An Introduction to English Phonology

2nd edition

April McMahon

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Contents

To students

I became a linguist because of the first ever undergraduate course I took on the sounds of English. I was absolutely captivated by the idea of being able to write down precisely what someone was saying using the International Phonetic Alphabet; by understanding how speakers of the same language could sound so completely different from each other; and by the ways in which the sounds of English have changed over the centuries. In short, I rapidly found out as a student that I was a bit of a language geek, and sounds were easily the best bit.

Not all readers of this book, by any means, are going to end up as professional linguists (actually, that might come as a relief to some of you). However, I hope it will help you to get to grips with an aspect of studying English Language or Linguistics which not everyone finds all that approachable or appealing. You might be taking a course on English Phonetics and Phonology because it's part of the package for your degree and you don't have much option. Or you want to find out more about language, and the introductory course you are taking just happens to start out with sounds. Or you may want to specialise in speech and language therapy, or sociolinguistics, or language acquisition, but you jolly well have to learn some phonetics and phonology to get to the stuff you know you are going to like. Within linguistics, phonetics and phonology can have the reputation of being a bit scary. Phonetics and the International Phonetic Alphabet (IPA) can seem rather scientific and horribly precise, while phonology is sometimes perceived as too theoretical and remote from real life.

Whatever your motivation, and whatever your initial worries might be about embarking on a completely new topic of study, I hope this little book is going to be a useful support for your learning about the sounds of English. In fact, you already know more than you think you know. You will already be aware of how spoken language varies from one person to another, or one generation to another, from talking with your own friends and family. Speakers of English are perhaps particularly

prone to making judgements about each other based on what we sound like, and we are quite quick to decide where someone comes from (not just geographically, but socially) from the way they speak. As babies, we naturally babble all the sounds of the world's languages, narrowing that down over our first few years to just the sounds we hear in the languages around us. We turn out, then, to have a huge amount of tacit knowledge about sounds – that is, knowledge we don't know we have – before we even start studying phonetics and phonology.

Actually, that's where the trouble starts. It turns out to be quite a lot harder to make your subconscious knowledge conscious than to acquire a completely new skill from scratch. A lot of this book therefore focuses on unpacking your internal knowledge and figuring out how to describe and use it – which is why there are lots of examples, plus exercises and discussion points at the ends of the chapters. Some of this is quite practical and applied; and while we will concentrate on the sounds of English, you will also find you develop the basics for transcribing and describing the sounds of any language in the world – this is the basis of general phonetics. This book also introduces the main concepts of phonology, which is less about what we actually do with language in the world, when we speak or listen, and much more about the knowledge of language which we subconsciously carry about in our heads.

Because I know lots of readers will be learning phonetics and phonology as a means to an end, rather than necessarily as an end in itself, I am also unapologetic about using examples from sociolinguistics, different accents and different periods of English, because I am a historical linguist as well as a phonologist. Links between phonology and other subdisciplines within linguistics have also made their way into some of the exercises and topics for discussion at the ends of the chapters. Not all of these may be of interest to you, but I hope there will be something there that connects with your favourite topics, as well as straightforward exercises to support your learning. At the end of the book there's also a section guiding you through some of the exercises – though not all of them, as some will have many possible answers, depending on your own particular accent, and others are open questions for debate. There is also a quite detailed glossary with definitions of key topics and terms, which are in bold the first time they are introduced in the text. I hope you will find this useful for revision too, if you have exams or assignments.

You may find you are using this textbook as the week-by-week reading for a whole course, or that individual sections are recommended for extra reading. Either way, if you turn out to want to find out more, there are suggestions for more reading and resources at the ends of the chapters. At the very least, the first edition of the book has been

road-tested by a lot of students on different courses, and this second edition has been updated to be clearer and more helpful where feedback has suggested improvements. At best, I hope it will also give you some glimpses into why some of us are so fascinated by sounds and how we use them.

To colleagues

This textbook is designed for use on ten- or twelve-week introductory courses on English phonology of the sort taught in the first year of many English Language and Linguistics degrees. It has been a pleasure to find the first edition being used for such purposes around the world, but with student interests diversifying and first-year courses often becoming more general in coverage, it has been important to adjust this second edition accordingly. In particular, I have expanded the coverage of different accents so the book should also be usable on introductory courses which focus more on variation in English, albeit still with a significant emphasis on sounds. Based on what colleagues have reported about the first edition, the book seems to work well at a rate of a chapter a week. However, students may benefit from a little more time spent on Chapter 2, where some of the key theoretical concepts are introduced; and the chapters which have been expanded most for this second edition are Chapters 8 and 10, either or both of which could be divided across two weeks on a slightly longer course.

Students beginning English Language or Linguistics (especially, though not uniquely, as part of a more general programme of study) can struggle with phonetics and phonology. It is understandably challenging to see past the new symbols and terminology, and the apparent assumption that we can immediately become consciously aware of movements of the vocal organs which we have been making almost automatically for the last eighteen or more years. This book introduces the main units and concepts we require to describe speech sounds accurately, but it also attempts to show students why we need to know about phonetics and phonology, if we are interested in language and in our subconscious knowledge of it.

The structure of the book is admittedly slightly unusual: most textbooks for beginning students, even if they focus on English, tend to begin with an outline of elementary general phonetics, and introduce phonological concepts later. I have started the other way round: in a

book which is primarily intended as an introduction to phonology, it seems appropriate to begin with one of the major units of phonology, the phoneme. The idea of phonological contrast is a complex but necessary one, and students do seem to cope well with an introduction of this more abstract idea before they become embroiled in the details of phonetic consonant and vowel classification. When it comes to presenting those details, I have also chosen to use verbal descriptions rather than diagrams and pictures in most cases. There are two reasons for this. Firstly, students need to learn to use their own intuitions, and this is helped by encouraging them to introspect and think about their own vocal organs, rather than seeing disembodied pictures of structures which don't seem to belong to them at all. Secondly, I know from meeting fellow-sufferers that I am not the only person to find supposedly helpful cartoons and diagrams almost impossible to decipher, and to feel that the right word can be worth a thousand pictures. If students or teachers feel the visual centres of their brains are being insufficiently stimulated, many diagrams and photographs are available in the additional reading recommended at the end of each chapter.

In a textbook of this length, choices are also inevitable: mine are to concentrate on segmental phonology, with limited discussion of stress, syllables and intonation, though there is a whole new section on intonation in Chapter 10. The theoretical machinery introduced extends only to segments, features, basic syllabification and elementary realisation rules; issues of morphophonemics and rules versus constraints are mentioned only briefly. My hope is that a thorough grounding in the basics will help students approach more abstract theoretical and metatheoretical issues in more advanced courses with greater understanding of what the theories intend to do and to achieve, and with a better chance of evaluating competing models. Students will also have a clearer idea of where the theoretical machinery has come from, and of the historical development of their discipline. However, I have taken the view that an introduction of this sort is not the place to set out a stall for any particular theoretical approach.

The first edition of this book was developed when I was teaching at the University of Sheffield, and my warmest thanks for help and advice go to my students there (who were not necessarily aware that I was just as interested in their attitude to exercises and examples as in their answers), and to Heinz Giegerich and Andrew Linn (who were all too aware that their input was required, and withstood pestering with typical patience). The second edition has benefited from direct road-testing at the Universities of Edinburgh and Kent, and from constructive comments from a whole range of colleagues and students.

Particular thanks go to David Hornsby and Tamara Rathcke at Kent, but I am very grateful to everyone who has used the book and hope this new and updated edition will continue to be helpful to both new and experienced phonologists. Special thanks also to my family – my daughter was learning to talk when I was writing the first edition; she and my two sons have (unintentionally) provided many excellent examples for my teaching over the years; and all three of them and my husband continue to be almost unfailingly tolerant of my odd enthusiasm for the many and varied sounds of English.

1 Sounds, spellings and symbols

1.1 Phonetics and phonology

Although our species has the scientific name *Homo sapiens*, 'thinking human', it has often been suggested that an even more appropriate name would be *Homo loquens*, or 'speaking human'. Many species have sound-based signalling systems, and can communicate with other members of the same species on various topics of mutual interest, like approaching danger or where the next meal is coming from. Most humans (leaving aside for now native users of **sign languages**) also use sounds for linguistic signalling, but the structure of the human **vocal organs** allows a particularly wide range of sounds to be used, and they are also put together in an extraordinarily sophisticated way.

There are two subdisciplines in linguistics which deal with sound: namely, **phonetics** and **phonology**. To fulfil the aim of this book, which is to provide an outline of the sounds of various English **accents** and how those sounds combine and pattern together, we will need aspects of both. Phonetics provides objective ways of describing and analysing the range of sounds humans use in their languages. More specifically, **articulatory phonetics** identifies precisely which speech organs and muscles are involved in producing the different sounds of the world's languages. Those sounds are then transmitted from the speaker to the hearer, and **acoustic** and **auditory phonetics** focus on the physics of speech as it travels through the air in the form of **sound waves**, and the effect those waves have on a hearer's ears and brain. It follows that phonetics has strong associations with anatomy, physiology, physics and neurology.

However, although knowing what sounds we can, in principle, make and use is part of understanding what makes us human, each person grows up learning and speaking only a particular human language or languages, and each language makes use of only a subset of the full range of possible, producible and distinguishable sounds. When we turn to the characteristics of the English sound system that make it

specifically English, and different from French or Welsh or Quechua, we move into the domain of phonology, which is the language-specific selection and organisation of sounds to signal meanings. Phonologists are interested in the sound patterns of particular languages, and in what speakers and hearers need to know, and children need to learn, to be speakers of those languages: in that sense, it is close to psychology.

Our phonological knowledge is not something we can naturally access and talk about in detail, certainly not without guidance or teaching. We often have intuitions about language, without knowing where they come from or exactly how to express them – but they are based on internal knowledge we certainly do have, and which can be drawn out by asking the right questions. For instance, speakers of English will tend to agree that the word *snill* is a possible but non-existent word, whereas **fnill* is not possible (as the asterisk conventionally shows). In the usual linguistic terms, *snill* is an **accidental gap** in the English vocabulary, while **fnill* is a **systematic gap**, which is excluded because of the **rules** of the English sound system. English speakers are not consciously aware of those rules, and are highly unlikely to tell a linguist asking about those words that the absence of **fnill* reflects the unacceptability of word-initial **consonant** sequences, or **consonant clusters**, with [fn-] in English (note that square brackets appear round **phonetic transcriptions**, which use **International Phonetic Alphabet** (**IPA**) notation to write down sounds precisely). The more likely answer would be that *snill* 'sounds all right' (and if you're lucky, your informant will produce similar words like *skill*, *spill*, *sniff* or *snip* to back up her argument), but that **fnill* 'just sounds wrong'. It is the job of the phonologist to express generalisations of this sort in precise terms, and ideally to explain them: after all, just because knowledge is not conscious does not mean it is unreal, unimportant or not worth understanding.

To use an example from a different sort of physical activity, when you run downstairs, you don't consciously think 'left gluteus maximus, left foot, right arm; right gluteus maximus, right foot, left arm' on each pair of steps. In fact, you're unlikely to make any conscious decisions at all, below the level of wanting to go downstairs in the first place, and relatively few people will know the names of the muscles involved. Worse still, becoming consciously aware of the individual activities involved is quite likely to disrupt the overall process: think about what you're doing and you finish the descent nose-first.

All of this is very reminiscent of our everyday use of spoken language. We decide to speak, and what about, but the nuts and bolts of speech production are beyond our conscious reach; and thinking deliberately about what we are saying, and how we are saying it, is likely to

cause self-consciousness and hesitation, interrupting the flow of fluent speech rather than making us better at it. Both language and mobility (crawling, walking, running downstairs) emerge in developing children by similar combinations of mental and physical maturation, internal abilities, and input from the outside world. As we go along, what we have learned becomes easy, fluent and automatic; we become dimly aware of what complexity lies behind our actions only when we realise we have made a speech error, or see and hear a child struggling to say a word or take a step. Phonologists, like anatomists and physiologists, aim to help us understand the nature of that underlying complexity, and to describe fully and formally what we know in a particular domain, but don't know we know.

The relationship between phonetics and phonology is a complex one, but we might initially approach phonology as narrowed-down phonetics, linked in specific ways to meanings. Quite small babies, in the **babbling** phase, produce the whole range of possible human sounds, including some which they never hear from parents or siblings: a baby in an English-speaking environment will spontaneously make consonants which are not found in any European language, with their closest occurrence in an African language, say, or one from the Caucasus. However, that child will then naturally narrow down her range of sounds from the full human complement to only those found in the language(s) she is hearing and learning. Indeed, she is quite likely to claim, when later, at school, trying to learn another language with a different sound inventory, that she cannot possibly produce unfamiliar sounds she made perfectly naturally when only a few months old (so, lots of English speakers claim they can't produce the trilled or rolled 'r' sounds found in French, for example). Or within a language, subtle **instrumental analysis** of speech reveals that every **utterance** of the same word, even by the same speaker, will be a tiny fraction different from every other; yet hearers who share that language will effortlessly identify the same word in each case.

In this sense, phonetics supplies an embarrassment of riches, providing much more information than speakers seem to use or need: all those speakers, and every utterance different every time! Phonology, on the other hand, involves a reduction to the essential information, to what speakers and hearers think they are saying and hearing. The perspective shifts from more units to fewer, from huge variety to relative invariance, from absolutely concrete to relatively abstract; like comparing the particular rose I can see from my window, or roses generally in all their variety (old-fashioned, bushy, briar; scented or not; red, yellow, shocking pink), to The Rose, an almost ideal and abstract category to

which we can assign or refer the many different actual variants. A white dog-rose, a huge overblown pink cabbage rose and a new, genetically engineered variety can all be roses with no contradiction involved. Putting this back into linguistic terms, it's not just that I say *tomahto* and you say *tomayto*; it's that I say *tomahto* and *tomahto* and *tomahto*, and the three utterances are subtly different, but we both think I said the same thing three times.

1.2 Variation

The discussion so far may suggest a rather straightforward dichotomy: phonetics is **universal**, while phonology is **language-specific**. But things are not quite that simple.

First, phonologists also attempt to distinguish patterns which are characteristic of a single language and simply reflect its history (in other words, they got there more or less by accident), from others which have a more universal motivation. In the case of the absence of **fnill*, or more generally, the absence of word-initial [fn-] clusters, we are dealing with a fact of modern English. It is perfectly physically possible to produce this combination of sounds; there are words in many languages, including Norwegian *fnise* 'giggle' and *fnugg* 'speck', which begin with just that cluster. Indeed, that very sequence of sounds was quite normal at the beginnings of words in earlier periods of English – *sneeze*, for example, has the **Old English** ancestor *fnēsan*, while Old English *fnæd* meant 'hem, edge, fringe', but it is not part of the inventory of sound combinations which English speakers learn and use today. The same goes for other initial clusters, such as [kn-]: this, again, was common in Old English, as in *cnāwan* 'to know', and survives into modern English spelling as <kn->, though it is now simply pronounced [n] (note that triangle brackets enclose written forms). [kn-] is also perfectly normal in other languages, including German, where we find *Knabe* 'boy', *Knie* 'knee', spelled <Kn-> but pronounced as the cluster [kn-]. There are cases, then, when it just so happens that a particular sequence or pattern of sounds does not turn up in a specific language at a specific historical period – though it is fine for humans in general, and perfectly normal in other languages and at other times.

On the other hand, there are some tendencies which are natural, general and very hard to avoid. If you say the words *intemperate* and *incoherent* to yourself as naturally as you can, and concentrate on the first consonant written *n*, you may observe that this signals two different sounds. In *intemperate*, the front of your **tongue** moves up behind your top front teeth for the *n* and stays there for the *t*; but in *incoherent*,

you are producing the sound usually indicated by <-ing> in English spelling, with your tongue raised much further back in the mouth, since that's where it's going for the following [k] sound (spelled <c>). Processes of **assimilation** like this involve two sounds which are adjacent or at least close together in a word, becoming closer together or more alike in terms of pronunciation. This makes life easier for the speaker by reducing vocal tract gymnastics. Assimilation is an everyday occurrence in every human language, and it is particularly common for **nasal** sounds, like the ones spelled *n* here, to assimilate to following consonants. Explaining universal tendencies like this one will involve an alliance of phonology and phonetics: so phonologists are interested in universals too.

However, phonological differences also exist below the level of the language. Frequently, two people will think of themselves as speakers of the same language, but vary in their usage (sometimes you do say *tomayto*, while I say *tomahto*). This is not just an automatic, phonetic matter: in some cases, a single speaker will always use one variant, but in others, individuals will use different variants on different occasions. It also has nothing to do with the physical characteristics of the different speakers, or the different environments in which they may find themselves, although this was a common belief in the days before linguists adopted a rigorous scientific methodology. Thomas Low Nichols, a nineteenth-century commentator on American English, speculates that 'I know of no physiological reason why a Yankee should talk through his nose, unless he got in the habit of shutting his mouth to keep out the cold fogs and drizzling north-easters of Massachusetts Bay.' There is a natural tendency for geographically distant accents to become more different, simply because speakers who live far away have not tended to communicate with one another historically, so their ways of speaking drift apart; the same tendency has led the various Romance languages, such as Italian, Spanish, Romanian and French, to diverge from their common ancestor, Latin. In addition, speakers often wish, again subconsciously, to declare their allegiance to a particular area or social group by using language in the particular way that group uses it; these **accent differences** can be powerful social markers, on which we judge and are judged.

Furthermore, although there are agreed conventions which form the basis of the phonology of languages and of accents, those conventions can be subverted in various ways, just as in other areas of human behaviour. People change what they do, subtly or not so subtly, to suit the environment or the impression they want to make. In short, even phonologically speaking, there is more than one English – indeed, on

one level, there are as many Englishes as there are people who say they speak English. Providing an adequate and accurate phonological description is therefore a challenge: on the one hand, a single system for English would be too abstract and would conceal many meaningful differences between speakers; on the other, a speaker-by-speaker account would be too detailed, and would neglect what unifies speakers and allows them to recognise one another as using the same system. Linguists therefore tend to talk about varieties of a language – accents or **dialects**, whose speakers will typically share more features than two speakers of different varieties. Within an accent, there will still be **variation** depending on the speakers' physical characteristics, or geographical location, or because some speakers have adopted a new form or word or sound from another group or language.

In what follows, we will concentrate on a small number of varieties – Southern Standard British English; Scottish Standard English; General American, the most frequently encountered broadcasting variety in the United States; and New Zealand English. All of these are abstractions, and combine together a range of constantly shifting subvarieties and individual usages; but they are useful in illustrating the range of variation within English, and represent groupings recognisable to their speakers, providing a level of accuracy which a monolithic 'English' system could not. In later chapters, we will also introduce some World English varieties, notably Singaporean and Hong Kong English, which are influenced by other languages spoken natively in the same environment; and we will consider a newly emerging accent, Multicultural London English (MLE).

1.3 The International Phonetic Alphabet

So far, the examples given have been rather general ones, or have involved analogies from outside language. Giving more detailed examples demands a more specific vocabulary, and a notation system dedicated to the description of sounds. The English spelling system, although it is the system of transcription familiar to most speakers of English, is both too restrictive and too lenient to do the job.

Without a universal transcription system for phonetics and phonology, writing down the unfamiliar sounds of other languages presents an almost insuperable challenge. Take, for example, a sound which English speakers do use, but only **paralinguistically** (that is, for purposes outside the language system itself): namely, the 'tut-tut' sound. When we see 'tut-tut' written down, we do not think of a word with a specific meaning, but of a repeated clicking noise which signals some

sort of general disapproval. This description is hopelessly inadequate, however, for anyone else trying to recognise the sound in question, or to learn how to make it. In some languages, the 'tut-tut' **click** sound functions as a perfectly ordinary consonant, just like word-initial [b] in English *but* or [l] in *list*. However, hearing a native speaker use the 'tut-tut' click in a language where it is an ordinary consonant does not help us understand how the sound is made or how it compares with others either. Likewise, adopting the usual spelling from that language (assuming it is not one of the many without an **orthography**) might let us write the 'tut-tut' sound down; but this technique would not produce a universal system for writing sounds of the world's languages, since we would end up with a hotch-potch of symbols taken from the spelling systems of particular languages. There would be little consistency, and generalisation of such a system would be difficult, especially as spelling systems are often borrowed from one language into another, and they can be far from making perfect phonetic sense.

The situation is worse with 'exotic' sounds which do not happen to coincide even with those used paralinguistically in English: groping towards a description in ordinary English is far too vague to allow accurate reproduction of the sound in question; and indeed, such sounds tended by early commentators to be regarded as unstable or not quite proper. John Leighton Wilson, who published a brief description of the African language Grebo in 1838, had considerable difficulties with sounds which do not have an obvious English spelling, and tended to resolve this by simply not transcribing them at all. Thus, he notes that

> There is a consonant sound intermediate between b and p, which is omitted … with the expectation that it will, in the course of time, gradually conform to one or the other of the two sounds to which it seems allied.

Similarly, he observes 'a few words in the language so completely nasal that they cannot be properly spelled by any combination of letters whatever'.

It is for these reasons that the International Phonetic Alphabet was proposed in 1888; it has been under constant review ever since by the International Phonetic Association, and the latest revision dates from 2015. It is true that a certain amount of learning is required to become familiar with the conventions of the IPA and the characteristics of sounds underlying the notation, but once you know that 'tut-tut' is [ǀ], an **alveolar** click, it will always be possible to produce the relevant sound accurately, to write it down unambiguously and to recognise it in other languages.

Although a universal system of description and transcription might be desirable in principle, and even in practice when dealing with unfamiliar languages and sounds, readers of a book both in and on English might question the necessity of learning the IPA. However, precisely the same types of problems encountered above, in relation to sounds which are not part of the system of English, also appear in connection with the phonology of English, and some new ones besides.

First, there is considerable ambiguity in the English spelling system, and it works in both directions: many sounds to one spelling, and many spellings to one sound. The former situation results in 'eye-rhymes', or forms which look as if they ought to have the same pronunciation but don't. There are various doggerel poems about this sort of ambiguity (often written by non-native speakers who have struggled with the system): one begins by pointing out a set of eye-rhymes – 'I gather you already know, Of *plough* and *cough* and *through* and *dough*'. Those four words, which we might expect to rhyme on the basis of the spelling, in fact end in four quite different **vowels**, and *cough* has a final consonant too. On the other hand, *see*, *sea*, *people*, *amoeba* and *fiend* have the same long [iː] vowel but five different spellings.

Despite these multiple ambiguities, attempts are regularly made to indicate pronunciations using the spelling system. None is wholly successful, for a variety of different reasons. This lack of precision can be particularly frustrating for phonologists trying to discover characteristics of earlier stages of English. John Hart, a well-known sixteenth-century grammarian, gives many descriptions of the pronunciations of his time, but the lack of a standard transcription system hampers him (and us) when it comes to one of the major mysteries of English phonology at this period: namely, the sound of the vowel spelled *a*. Hart mentions this explicitly, and tells us that it is made 'with wyde opening of the mouthe, as when a man yawneth'; but does that mean a back vowel, the sort now found for Standard Southern British English speakers in *father*, or a front one, like the *father* vowel for New Zealanders or Australians? Similarly, Thomas Low Nichols, discussing mid-nineteenth-century American English, notes that 'It is certain that men open their mouths and broaden their speech as they go West, until on the Mississippi they will tell you "thar are heaps of bar [bear] over thar, whar I was raised".' Here we have two related difficulties: the nature of the *a* vowel and what the orthographic *r* means, if anything. Most British English speakers (those from Scotland, Northern Ireland and some areas of the West Country excepted) will pronounce [ɹ] only immediately before a vowel, so an [ɹ] sound would be evident in *very* [vɛɹɪ] or *car engine* [kɑɹɛnʤɪn], but the last sound of *car* pronounced in isolation is a vowel [ɑː]. It follows that a

London English speaker would naturally read the quote with [ɹ] at the end of the first *thar*, *bar* and *whar*, but not in the second *thar*, where the next word begins with a consonant. However, a Scot would produce [ɹ] in all these words, regardless of the following sound. Which is closer to what Thomas Low Nichols intended?

Orthographic *r* is still problematic today: when Michael Bateman, in a newspaper cookery column, writes that 'This cook, too, couldn't pronounce the word. It's not pah-eller; it's pie ey-yar,' he is producing a helpful guide for most English English speakers, who will understand that his 'transcription' of *paella* indicates a final vowel, since they would not pronounce [ɹ] in this context in English; but he is quite likely to confuse Scots or Americans, who would pronounce [ɹ] wherever *r* appears in English spelling, and may therefore get the mistaken idea that *paella* has a final [ɹ] in Spanish. In short, the fact that there are many different Englishes, and that each quite properly has its own phonological interpretations of the same spelling system (which, remember, is multiply ambiguous in the first place), means we encounter inevitable difficulties in trying to use spelling to give explicit information about sounds.

The same problems arise in a slightly different context when writers try to adapt the spelling system to indicate accent differences:

> 'Good flight?' asked Jessica at Christchurch Airport. I melodramatically bowed a depressurization-deaf ear towards her … before answering that it had been a little gruelling.
>
> 'You are a bit pale. But you'll still be able to get breakfast at the hotel … '
>
> What Jessica actually said was *git brikfist it the hitil.* The Kiwi accent is a vowel-vice voice, in which the *e* is squeezed to an *i*, the *a* elongated to an *ee.* A New Zealander, for example, writes with a *pin*, and signals agreement with the word *yis.*
>
> (Mark Lawson (1994), *The Battle for Room Service: Journeys to all the safe places*, London: Picador, p. 22)

Lawson succeeds in showing that a difference exists between New Zealand and English English, and provides a very rough approximation of that difference. However, anyone who has listened to New Zealand speakers will know that their pronunciation of *pen* is not identical to Standard Southern British English *pin*, as Lawson's notation would suggest; and readers who have not encountered the variety might arrive at a number of different interpretations of his comments that New Zealand vowels are 'squeezed' or 'elongated'. The National Centre for English Cultural Tradition in Sheffield has produced a list

of local phrases, again rendered in a modified version of English spelling: it includes *intitot* ('Isn't it hot?'), *eez gooinooam* ('he's going home') and *lerrus gerrus andzwesht* ('Let's get our hands washed'). Sometimes the modifications are obvious and easy to interpret; the lack of *h* in *intitot* suggests that no [h] is pronounced, and the substitution of *r* for *t* in *lerrus gerrus* signals the common northern English weakening of [t] to [r] between vowels. But why double *rr*? The double vowel letters in *gooinooam* presumably signal long vowels; but the *rr* in *lerrus* certainly does not mean a long consonant. Such lists are amusing when the reader knows the variety in question, but reading the list in a respectable imitation of an unfamiliar accent would be rather a hit and miss affair.

The same goes for dialect literature, even when there is an informally agreed set of emendations to the spelling system, as is perhaps the case for Scottish English. Tom Leonard's poem 'Unrelated Incidents (3)' begins:

> this is thi
> six a clock
> news thi
> man said n
> thi reason
> a talk wia
> BBC accent
> iz coz yi
> widny wahnt
> mi ti talk
> aboot thi
> trooth wia
> voice lik
> wanna yoo
> scruff.

Again, many of the alterations are entirely transparent for a reader who is familiar with Scottish English – *aboot* does sound like *a-boot* rather than having the **diphthong** usually found in Standard Southern British English *about*, where a diphthong is a vowel which changes in quality during its production, with different start and end points. Likewise, *widny* rather than *wouldn't* is both clear and accurate. However, not everything is so obvious. *Trooth* is written to match *aboot*, and the two words do have the same vowel in Scots – but the former is pronounced like its English English equivalent, whereas the latter is not; so we might ask, why alter both? *Thi* is consistently written for *the*, and there

is indeed a slight difference in those final vowels between the two varieties; but if we compare Tom Leonard with Mark Lawson, the impression given is that *thi* (= *the*) for a Scot sounds like *pin* (= *pen*) for a New Zealander, which is not the case at all.

In some cases of this type, there are attempts to introduce new symbols into the English spelling system to represent accent differences: one particularly common device is to use an apostrophe. This has become a fairly conventional and familiar device; but again, it turns out to be ambiguous. For instance, take the three phrases *I feel 'ot*, *She was waitin'* and *Give us the bu'er*. The first is perhaps the most straightforward: many speakers of non-standard varieties of English consistently drop their [h]s (and we all do, in pronouns under low **stress**, for instance, as in *What did he say*?, where [h] will be pronounced only in extraordinarily careful speech). In this case, then, the apostrophe means the standard [h] is omitted. This might, however, lead us to believe that an apostrophe always means that something is missing, relative to the standard pronunciation. Informal characterisations might support this **hypothesis**, since speakers producing forms like *waitin'* and *bu'er* are frequently described as 'dropping their gs' and 'dropping their ts' (or 'swallowing their ts') respectively: an article in *The Independent* of 28 June 2000 reports that 'the entire cast of *East Enders* … swallow their ts, ps and ks like true Glasgow speakers when using such words as "sta'ement" and "sea'belt"'. However, the phonetic facts suggest otherwise. Whereas *'ot* simply lacks an initial consonant, *waitin'* does not lack a final one: instead, the final [ŋ] of *waiting* has been replaced by [n] (recall the discussion of *incoherent* versus *intemperate* above). For most speakers, apart from some from the Midlands and north of England, there was no [g] to drop in the first place, simply one nasal in more formal circumstances, which shifts to another nasal in informal conversation. In *bu'er*, we also find one consonant, this time [t], being replaced by another, the **glottal stop**; but this time, the replacement is found in English only as an alternative for another sound. It has no independent orthographic representation, and is strongly associated with informal, non-standard and **stigmatised** usage.

If we are to consider these variants objectively, however, we need a system of notation which will allow us to observe them neutrally, providing transcriptions of each variety in its own terms: seeing the glottal stop as IPA [ʔ], which is a perfectly normal consonant in, say, Arabic, rather than regarding it as an unsymbolisable grunt or a debased form of another consonant, is more likely to allow us to analyse the facts of accent variation without seeing every departure from an idealised standard variety as requiring apology. The linguistic arbitrariness but

social grounding of such judgements is apparent from forms like *car park* – a standard Standard Southern British English pronunciation will have no [ɹ] in either word, and to a Scottish English speaker with both [ɹ]s invariably produced, there is certainly something missing; but you don't tend to see this represented as *ca' pa'k*, or hear southerners accused of 'swallowing their [r]s'.

For all these cases, what we need is a consistent, agreed system of transcription, so that we can assess the accent differences we find and compare them with confidence. Of course, no purely phonetic system is going to help with the meaning of items of vocabulary a reader has not met before – an IPA transcription will not tell you what a *hampot* is, or *glaur*, or a *beagie*, if you don't know. But at least you have the comfort of knowing how the locals pronounce it.

At the same time, this is an introductory text on English, and not a handbook of general phonetics, so for the most part, unless comparisons with other languages are important, only those sections of the IPA relevant to English sounds will be considered. We shall begin with consonants in Chapter 3 and move on to vowels, where most accent variation in English is concentrated. However, before introducing the IPA in detail, we must also confront a phonological issue. As we have already seen, native speakers of a language cannot always be relied upon to hear every theoretically discernible gradation of sound. In some cases, the IPA supplies alternative symbols in cases where speakers will be quite sure they are hearing the same thing; and this is not a universal limitation of human ears, but rather varies from language to language. To illustrate this, and to resolve the problem that sometimes speakers think they are hearing something quite different from what they objectively are hearing, we must introduce the concept of the **phoneme**.

Exercises and topics for discussion

1. If the International Phonetic Alphabet is meant to be universal, how can it make sense for there to have been regular revisions? Find out about the history of the IPA, and the reasons for some of the revisions that have been made in more recent versions.

2. Find some examples of English spelling being used to represent different accents of English (for example, in novels, poetry, or dialogue in plays). Using these data, work out when it is easier to interpret what sounds are actually intended, and when it is more difficult, and why.

Recommendations for reading

Comparisons of human and animal language are provided in Aitchison (2007) and there is relevant discussion in Pinker (1994). More detail on the debates about how humans became a linguistic species, and how we acquired the capacity to speak, is to be found in McMahon and McMahon (2012), and Deutscher (2006) provides a very accessible introduction to the mysteries of human language **acquisition**, evolution and change. For introductions to child language and language acquisition, see Saxton (2017) and Fletcher and MacWhinney (1996). Trudgill (2000a) is an accessible introduction to dialects and why they are important, although it is fairly narrowly focused on England (more reading on language variation will be suggested in later chapters). A detailed account of the history and usage of the IPA is provided in International Phonetic Association (1999), and further information is available at <https://www.internationalphoneticassociation.org/> (all websites last accessed 1 July 2019). You can download the IPA chart and IPA fonts from here; the latest major revision was in 2015 and charts are re-issued every year. You can find an interactive IPA chart with accessible pronunciations and descriptions, developed by Cambridge University Press in association with the Department of Linguistics, University of California, at <https://www.cambridge.org/fr/academic/textbooks/genetti/ipa-chart>.

If you do want to know what *hampot*, *glaur* and *beagie* mean, try the Scottish National Dictionary at <http://www.dsl.ac.uk/>. You can find out more about Scots at the Scots Language Centre (<https://www.scotslanguage.com>).

2 The phoneme: the same but different

2.1 Variation and when to ignore it

Recognising that two objects or concepts are 'the same but different' ought to present a major philosophical problem; the phrase itself seems self-contradictory. However, in practice, we categorise elements of our world in just this way on an everyday basis. A two-year-old can grasp the fact that his right shoe and left shoe are very similar but actually belong on different feet; and as adults, we have no difficulty in recognising that lemons and limes are different but both are citrus fruits, or that misery and happiness are different but are both emotions. This sort of hierarchical classification is central to the notion of the phoneme.

Humans excel at ignoring perceptible differences which are not relevant for particular purposes. To illustrate this, take a piece of paper and write your normal signature six times. There will certainly be minor differences between them but you will still easily recognise all those six signatures as yours, with the minor modifications detectable only by uncharacteristically close scrutiny. Perhaps more to the point, someone else, checking your signature against the one on your credit card, will also disregard those minor variants and recognise the general pattern as identifying you. There are exceptions, of course: some alterations are obvious and usually environmentally controlled, so if someone jolts your elbow or the paper slips, you apologise and sign again. On the whole, however, the human mind seems to abstract away from irrelevant, automatic variation and to focus on higher-level patterns, though we are typically unaware of that abstraction and of the complex processes underlying it. This relatively high tolerance for low-level variation explains why **speech recognition** or speech-to-text systems are still highly complex (though there has been significant progress in this field recently), and why they may require significant training for each potential user.

2.2 Conditioned variation in written language

Since we are more used to thinking explicitly about written language than about how we speak, one way of approaching this issue of abstraction is through our conscious knowledge of the rules of writing. When children learn to write, one aspect they have to master is the conventions governing the use of capital and lower-case letters. Children often tend to learn to write their name before anything else, and the first or initial letter of a proper name will be a capital. Children are also great generalisers, and indeed over-generalisers; for instance, the first words they learn often have a much wider range of meanings than their adult equivalents. Thus, for a one-year-old, *cat* may mean 'any animal' (whether real, toy or picture), *tractor* 'any vehicle' and *Daddy* 'any male adult'; these broad senses are later progressively narrowed down. This tendency to over-generalise means that children may at first try to write all words with initial capitals, until they are taught the accepted usage, which in modern English is for capitals to appear on proper names, *I*, and the first word in each sentence, and lower-case letters elsewhere, giving the prescribed patterns in (1).

(1) a. Anna *annA
Africa *africA
b. An apple for Anna
c. Give Anna an apple.

Precisely how the capital and lower-case letters are written by an individual is not relevant, as long as they are recognisable and consistently distinct from other letters – *an* needs to be distinguished from *on*, and *An* from *In*, but it does not especially matter whether we find a, *a* or ɑ for lower-case, and A, *A*, A or A for capital. It all depends on who we copy when we first learn, what our writing instruments and our grip on them are like or, typographically, which of the burgeoning range of fonts we fancy.

Again, we seem readily able to perceive that all these subtly different variants can be grouped into classes. There is a set of lower-case and a set of capital letters, and the rules governing their **distribution** (that is, where members of each set can turn up) relate to those classes as units, regardless of the particular form produced on a certain occasion of writing. Moreover, the lower-case and capital sets together belong to a single, higher-order unit: they are all forms, or **realisations**, of 'the letter a', an ideal and abstract unit to which we mentally compare and assign actual written forms. 'The letter a' never itself appears on paper, but it is conceptually real for us as users of the alphabet: this abstract

unit is a **grapheme**, symbolised by <a>; triangle brackets are conventionally used for spellings. The choice of symbol is purely conventional: since it is a conceptual unit, and since we do not know what units look like in the brain, we might as well use an arbitrary sign like <§>, or <✪>, or give it a name: <a> is Annie Apple in the children's Letterland series for beginning readers. However, it is convenient to use a form that looks like one of the actual realisations, or forms that appear in the real world, as this will help us to match up the abstract grapheme with the actual, concrete **graphs** which manifest it in actual writing.

The rules governing the distribution of <a> and other graphemes are not, however, absolute natural laws. Learning that proper names and sentences begin with capitals is appropriate for a child writing modern English but not for a child learning German, who would need to learn instead that all nouns (not just *Anna* and *Afrika* but also *Apfel* 'apple') always begin with a capital letter, as well as all sentences. A similar strong tendency is observable in earlier stages of English too, and although literary style is not absolutely consistent in this respect, there are many more capitals in the work of a poet like John Milton, for instance, than in written English today; see (2).

(2) Of Mans First Disobedience, and the Fruit
Of that Forbidden Tree, whose mortal taste
Brought Death into the World, and all our woe,
With loss of *Eden*, till one greater Man
Restore us, and regain the blissful Seat,
Sing Heav'nly Muse …
(Milton, *Paradise Lost*, Book 1, lines 1–6)

2.3 The phoneme

Children do not learn the rules of spoken language by explicit instruction, but rather by a combination of copying what they hear, and building up mental generalisations based on their experiences. Whether a child comes to speak and understand English or Spanish or Quechua (or all of them) will depend on the language or languages spoken around her; but linguists now understand a great deal about the stages through which language production and comprehension develop in infancy, regardless of the specific language(s) involved. Linguists usually refer to this process as acquisition rather than learning to indicate that there is more going on than repetition – there is a natural tendency for language to emerge in the same way as small children seem compelled to crawl, then walk. How much children are helped in this by some

internal structure in the brain dedicated to language acquisition, which is sometimes called a language acquisition device or language faculty, is still a matter of debate. In any case, the process is very different from the rather painstaking and highly conscious process which adults go through when they are trying to learn an additional language, or **L2**.

Although the type of learning is very different, however, aspects of spoken language show very strong similarities to the types of patterns outlined above for writing. Again, there are some differences between units that really matter because replacing one with another will cause a different meaning to be conveyed in the language in question: replace the initial sound [k] in *call* with [t] and you have *tall*, an entirely different English word. Correspondingly, English speakers perceive [k] and [t] as entirely separate sounds, and find them rather easy to distinguish.

In other cases, two sounds which phoneticians can equally easily tell apart will be regarded as the same by native speakers. For instance, say the phrase *kitchen cupboard* to yourself, and think about what you are doing when you produce the first sounds of the two words. Despite the difference in spelling (another case where orthography, as we also saw in the last chapter, is not an entirely reliable guide to the sounds of a language), native speakers will tend to think of those initial consonants as the same – both are [k]s. However, if you say the phrase several times, slowly and think uncharacteristically carefully about whether your **articulators** are doing the same at the beginning of both words, you will find that there is a discernible difference. For the first sounds in both *kitchen* and *cupboard*, your tongue will be raised towards the roof of your mouth. However, this raising happens further forward in *kitchen* than in *cupboard*, so the first sound in *kitchen* is fronter (with the articulatory action going on nearer the lips), and in *cupboard* the initial consonant is formed further back. For *kitchen*, your lips will be spread apart a little more too, while for *cupboard* your mouth will be more open. Unless you are from Australia or New Zealand (for reasons we shall discover in Chapter 8), this difference is even clearer from the phrase *car keys*, this time with the first word having the initial sound produced further back in the mouth, and the second further forward.

In IPA terms, these can be transcribed as [k], the *cupboard* sound, and [c], the *kitchen* one. However, in English [k] and [c] do not signal different meanings as [k] and [t] do in *call* versus *tall*; instead, we can always predict that [k] will appear before one set of vowels, which we call **back vowels**, like the [ʌ] of *cupboard* or the [ɑː] a Standard Southern British English speaker has in *car*, while [c] appears before front vowels, like the [ɪ] of *kitchen* or the [iː] in Standard Southern British English *keys*. Typically, speakers control predictable differences of this type

automatically and subconsciously, and sometimes resist any suggestion that the sounds involved, like [k] and [c] in English, are different at all, requiring uncharacteristically close and persistent listening, and indeed training, to tell the two apart. The difference between [k] and [c] in English is **redundant**; in phonological terms, this means that the difference arises automatically in different contexts but does not convey any new or different information.

Returning to our orthographic analogy, recall that every instance of a hand-written *a* or *A* will be different from every other instance, even produced by the same person. In just the same way, the same speaker producing the same words (say, multiple repetitions of *kitchen cupboard*) will produce minutely different instances of [k] and [c]. However, a hierarchical organisation of these variants can be made: in terms of spelling, we can characterise variants as belonging to the lower-case or capital set, and those in turn as realisations of the abstract grapheme <a>. The subclasses have a consistent and predictable distribution, with upper-case (or capital) at the beginnings of proper nouns and sentences, and lower-case (or small) everywhere else: we can say that this distribution is **rule-governed**. Similarly again, we can classify all the variants we hear as belonging to either fronter [c] or backer [k], although we are not, at least without a little phonetic consciousness-raising, aware of that difference in the way we are with *a* and *A*. Presumably the fact that we learn writing later, and with more explicit instruction, accounts for our higher level of awareness here.

In turn, [c] and [k], which native speakers regard as 'the same', are realisations of an abstract unit we call the phoneme (where the ending *-eme*, as in *grapheme*, means 'some abstract unit'). Phonemes are conventionally represented by IPA symbols, in this case /k/, but appear between slash brackets. As with graphemes, we could, in principle, use an abstract symbol for this abstract unit, say /§/, or /✪/, or give it a number or a name; but again, it is convenient and clear to use the same symbol as one of its realisations. Those realisations, here [k] and [c], are **allophones** of the phoneme /k/.

To qualify as allophones of the same phoneme, two (or more) **phones** – that is, sounds – must meet two criteria. First, their distribution must be predictable: we must be able to specify where one will turn up, and where the other; and those sets of contexts must not overlap. If this is true, the two phones are said to be in **complementary distribution**. Second, if one phone is exceptionally substituted for the other in the same context, that substitution must not lead to a meaning difference. Even if you say *kitchen cupboard* with the [k] first and the [c] second (and that won't be easy because you have been doing the opposite as

long as you have been speaking English – it will be even harder than trying to write at your normal speed while substituting small *a* for capital *A* and vice versa), another English speaker will notice only that there is something vaguely odd about your speech, if that. She may think you have an unfamiliar accent, but crucially, she will understand that you mean 'kitchen cupboard' and not something else. This would not be true where a realisation of one phoneme is replaced by a realisation of another: if the [k] allophone of /k/ is replaced by the [t] allophone of /t/, then *tall* will be understood instead of *call*.

Finally, just as orthographic rules can vary between languages and across time, so no two languages or periods will have exactly the same phonology. Although in English [k] and [c] are allophones of the same phoneme and are regarded as the same sound, in Hungarian they are different phonemes. We can test for this by looking for **minimal pairs**: that is, pairs of words differing in meaning, where the only difference in sound is that one has one of the two phones at issue where the other has the other (think of *tall* and *call*). In Hungarian, we find minimal pairs like *kuka* [kuka] 'dustbin' and *kutya* [kuca] 'dog'. It follows that [k] and [c] are not in complementary but in **contrastive distribution**; that interchanging them does make a meaning difference between words; and hence that [k] and [c] belong to different phonemes, /k/ and /c/ respectively, in Hungarian. Unsurprisingly, speakers of Hungarian find the difference between [k] and [c] glaringly obvious and would be extremely surprised to find that English speakers typically lump them together as 'the same' sound.

As for differences between periods of the same language, it is straightforward to demonstrate that modern English [f] and [v] contrast, or are in complementary distribution, since minimal pairs like *fat* [f] versus *vat* [v], *leaf* versus *leave*, or *safer* versus *saver* are easy to come by. The phoneme system of modern English therefore contains both /f/ and /v/. However, the situation was very different in Old English, which is the earliest recorded stage of the English language (from about AD 500 up to around AD 1100, when the **Middle English** period begins). Take a look at the Old English examples in (3):

(3) *Old English*

hla[v]ord <hlaford> 'lord'	heo[v]on <heofon> 'heaven'
æ[f]ter <æfter> 'after'	[f]isc <fisc> 'fish'
o[v]er <ofer> 'over'	
heal[f] <healf> 'half'	

Instead of minimal pairs, we find predictable, complementary distribution, with [v] appearing **medially**, between vowels, and [f] in other

positions. Consequently, [f] and [v] can be analysed as allophones of one single phoneme, which we might call /f/: Old English speakers would have regarded [f] and [v] as the same, just as modern English speakers think of [k] and [c] as the same sound. Later in the history of English, many words like *very*, *virtue* and *veal* were borrowed from French, bringing with them initial [v], which had not previously been found in English. The distribution of [f] and [v] therefore ceased to be complementary, since both phones could appear in word-initial position, creating minimal pairs like *very* and *ferry*, or *veal* and *feel*. In consequence, [v] stopped being an allophone of /f/ and became a phoneme in its own right, producing the opposition of /f/ (realised or pronounced as [f]) and /v/ (realised as [v]) which we find today.

2.4 Some further examples

The notion of the phoneme is a notoriously difficult one to come to terms with at first. This is not altogether surprising: it isn't every day that you are told you know a whole range of things you didn't know you knew, and moreover that this knowledge is probably structured as a set of mental units you didn't know you had. However, the fact that phonemes are so central to phonology means that it is well worth giving a few extra examples, to make the concept a little more familiar.

First, let us return to modern English /t/ and /k/, which we have already met in *tall* versus *call*; in fact, we can add *Paul* to make a minimal triplet, adding /p/ to our phoneme system. Now hold a piece of paper up in front of your mouth by the bottom of the sheet, so the top is free to flap about, and try saying *Paul*, *tall*, *call*. You will find that a little puff of air is released after the initial /p/, /t/ and /k/, making the paper move slightly: this is called **aspiration**, and is signalled in IPA transcription by adding a superscript [^{h}] after the symbol in question. This means that /p/, /t/ and /k/ have the allophones [p^{h}], [t^{h}] and [k^{h}] word-initially; the aspiration is most noticeable with [p^{h}], since it is articulated with the lips, nearest to where the air exits.

However, /p/, /t/ and /k/ really do have to be right at the beginning of the word for these allophones to appear. Try to make yourself aware of the initial aspiration in *pill*, *till* and *kill*; this time, you will again be producing [p^{h}] and [t^{h}], but the allophone of /k/ will be slightly different; the front vowel in *kill* conditions a fronter, aspirated [c^{h}]. If you add an initial [s] and do the piece of paper trick again, you will find that there is no discernible movement. After [s], we find plain, unaspirated allophones [p], [t] and [c] in *spill*, *still* and *skill* (and unaspirated [k] in *scold*, as opposed to [k^{h}] in *cold*, where /k/ is followed by a back vowel).

It follows that phonemes can have a whole range of allophones. Illustrating with just one phoneme, modern English /k/, we have now identified word-initial aspirated [kʰ] in *call*, *cold*; fronter, aspirated [cʰ] before front vowels, as in *kill*, *kitchen*; unaspirated [k] in *scold*; and unaspirated [c] in *skill*. That deals with the beginnings of words. At the ends, /k/ is very frequently accompanied by a partial glottal stop; this is known as **glottal reinforcement**, and the final sound in *back* is signalled in IPA terms as [ʔk]. When a following word begins with [g], for instance, this [ʔk] is sometimes replaced by a glottal stop, as in *back garden*, where you may perceive the [ʔ] allophone of /k/ as almost a pause before the [g]. **Glottalisation** of this kind is much more common for /t/: as we saw in the last chapter, glottal stops are increasingly found in many urban British English accents in forms like *sta̰tement*, *sea̰tbelt*, *bṵtter*, meaning that the glottal stop in English may be an allophone of both /k/ and /t/. We return to this issue of overlap between phonemes in Chapter 5.

For a final example, let us turn to a phoneme we have not considered before, namely /l/. /l/ has only two main allophones in English, depending on its position in the word (unless you speak some varieties of Irish or Welsh English, or Geordie, the variety spoken around Newcastle, in which case you have only the first realisation described below; conversely, some varieties of Scottish English have only the second allophone). If you say *lull*, or *lilt*, you will notice that the first *l* in each case is pronounced with the tip of your tongue up behind your top front teeth, while the second additionally has the tongue raised further back. This time the distribution of the allophones does not depend on the frontness or backness of the adjacent vowel, since *lull* has a back vowel, while *lilt* has a front one, but both have the fronter [l] first, and the backer [ɬ] second. In the case of /l/, what matters (roughly speaking; we will come up with a better generalisation in Chapter 9) is whether the /l/ precedes or follows the vowel in the word. If /l/ comes first, it is pronounced as '**clear**', fronter [l], as also in *clear*; and if the vowel comes first, /l/ is realised as '**dark**', more back [ɬ], as in *dull*. The two are obviously in complementary distribution, and hence can both straightforwardly be assigned to the same phoneme, /l/, in modern English.

We find a different story in Scots Gaelic, however, where minimal pairs can be found for the clear and dark variants. For instance, the words *baile* 'a town' and *balla* 'a wall' are pronounced identically, except for the clear [l] in *baile*, and the dark [ɬ] in *balla*. Whereas substituting clear for dark pronunciations, or vice versa, in English would be picked up by listeners as slightly, intangibly peculiar, for a Scots Gaelic

speaker the difference is both easily noticeable and meaningful, since a substitution will simply produce the wrong word. Again, we find that differences which in one language are automatic to the point of inaudibility without training, are highly salient and have important linguistic consequences in another.

2.5 The reality of the phoneme

We have already seen that the phoneme system of a speaker's native language, and specifically the difference between pairs of sounds which contrast and pairs which do not, strongly condition her perceptions: the early twentieth-century American linguist Edward Sapir concludes that 'What the native speaker hears is not phonetic elements but phonemes.' However, the phoneme is a psychologically real unit in other ways too, since it conditions not only what we hear, but also what we do.

First, alphabetic spelling systems are frequently based on the phonemes of a language There are various reported cases of linguists teaching variants of the IPA to speakers of languages which lacked orthographies, or spelling systems, because they had not previously been written down. Despite the linguists' efforts to provide inventories of symbols which covered all the phones of the language, speakers subsequently tended to make use of only one symbol per phoneme. In Old English, both [f] and [v], which were then in complementary distribution, were spelled <f>, whereas in modern English contrastive /f/ and /v/ typically correspond to <f> (or <ph>) versus <v>. Similarly, in Hungarian /k/ and /c/ are consistently distinguished as <k> and <ty>. Alphabets have several times been borrowed by speakers of one language from those of another, and been remodelled in some respects to fit the borrowing phoneme system better. So, the first letter of the Semitic alphabet represents the glottal stop, [ʔ], which is phonemically distinctive in Arabic, for example. However, when this alphabet was borrowed by the Greeks, that first letter, Greek alpha, was taken to represent the vowel which begins the word *alpha* itself. Although Greek speakers would commonly produce an initial glottal stop on a word like *alpha* (as would English speakers, especially when saying the word emphatically), they would not observe it or want to symbolise it, since [ʔ] is not a phoneme of Greek, so Greek speakers do not perceive it as a 'real' sound which deserves its own spelling. We should not, however, as we saw in the last chapter, assume that we can simply read the phoneme system off the spelling system, since there is not always a one-to-one correlation. Hence, English does have two orthographic symbols for

/k/, namely <k> and <c>, but these do not systematically signal two separate allophones: the spelling system simply has a redundant extra symbol here. Furthermore, some phonemes are spelled consistently but not with a single graph, so the phonemic difference between the English nasals /m/, /n/ and /ŋ/ in *ram*, *ran* and *rang*, is signalled orthographically by <m>, <n> and <ng> (or <nk> in *rank*).

More importantly, our native phoneme system tends to get in the way when we try to learn other languages. It is perhaps unsurprising that we should find it difficult at first to produce sounds which do not figure at all in our first language. However, it is just as difficult, and sometimes worse, to learn sounds which are phonemically contrastive in the language we are learning, but allophones of a single phoneme in our native system. For instance, there is no contrast between aspirated [tʰ] and unaspirated [t] in English; we can predict that the former appears only word- initially. In Chengtu Chinese, however, /t/ contrasts with /tʰ/, as we find minimal pairs like [tou] 'a unit of dry measure for grain' versus [tʰou] 'to tremble'; the same is true in Thai, where [tam] 'to pound' contrasts with [tʰam] 'to do', establishing a phonemic distinction of /t/ and /tʰ/. When a native English speaker tries to learn Chengtu Chinese, or Thai, she will find this distinction extremely awkward to replicate, despite the fact that she herself has always used both of these sounds.

The problem is that, whereas a totally new and unfamiliar sound simply has to be learned from scratch, an old sound in a new role requires further processes of adjustment: our English-speaking Thai learner has to suppress her instinctive and subconscious division of the aspirated and unaspirated sounds, and learn to produce both in the same context. In perceptual terms, it is again easier to hear a completely new sound, which will initially be extremely easy to perceive because of its very unfamiliarity, than to learn to distinguish two sounds which have conceptually been considered as one and the same. Conversely, Korean speakers, who have [r] and [l] as allophones of a single phoneme, with [r] produced between vowels and [l] everywhere else, will make errors in learning English. They will tend to find minimal pairs like *lot* and *rot* highly counterintuitive, and produce [l] at the beginning of both, but [r] medially in both *lolly* and *lorry*. A combination of unlearning and learning is needed to get those patterns right.

In Chapter 4, we shall return to phonemes and allophones, and develop more precise ways of stating exactly where each allophone occurs. First, however, we need some more phonetic detail on the consonants of English, and some more technical vocabulary to describe how they are produced.

Exercises and topics for discussion

1. Find some more examples of general categories (which don't really exist in the world), with specific instantiations or realisations (which do). These can be from language or elsewhere. If you are struggling to come up with a linguistic example, find out about the concept of hyponymy, and the relationship between hyponyms and superordinate terms. Does this help you understand the notion of the phoneme any better?

2. A learner of English as a second language has the following pronunciations (note that [ʃ] is the symbol for the first sound in *ship*, and [ð] for the first sound in *the*):

that [dat]	*dog* [dɒg]	*head* [hɛd]
leather [lɛðə]	*leader* [liðə]	
sing [ʃɪŋ]	*sat* [sat]	*loss* [lɒs]
fish [fɪʃ]	*miss* [mɪʃ]	*push* [pus]

How might you explain these non-native pronunciations? How do you think this learner would pronounce the bold-faced consonants in ***D**addy*, *ei**th**er*, *loa**th**e*; ***sh**ip*, *pa**ss***, *di**sh***, *u**sh**er*?

3. Do the following sounds contrast in English? Find minimal pairs to support your hypothesis, ideally for initial, medial and final position in the word. Where minimal pairs for all positions do not seem to be available, write a short statement of where the sound in question can and cannot be found.

[m n ŋ p b t d k g l r]

4. The Ministry for Education in a certain country whose language has, up to now, been unwritten has hired two foreign linguists to produce an orthography. Linguists A and B have suggested two rather different systems. Which one is most in line with the phonological structure of the language it is designed for? Why do you think the other linguist may have made different decisions?

Linguist A	*Linguist B*	*pronunciation*	*meaning*
bim	bim	[bim]	'rug'
bin	bin	[bin]	'head'
biŋ	bing	[biŋ]	'wheel'
zag	zak	[zak]	'parrot'
zib	zip	[zip]	'ostrich'
azaŋ	azang	[azaŋ]	'to speak'
obaz	obas	[obas]	'to throw'
ham	ham	[ham]	'egg'

mohiz	mohis	[mohis]	'to eat'
zigah	ziga	[zigah]	'to sing'
gig	gik	[gik]	'ant'
gah	ga	[gah]	'a song'
nagog	nagok	[nagok]	'to sting'
habiz	habis	[habis]	'to drink'

Recommendations for reading

Further discussion of phoneme analysis can be found in a number of recent textbooks on English phonology or phonology in general. Carr (2012) and Davenport and Hannahs (2010) provide brief, approachable outlines; Giegerich (1992) is written at a slightly higher level and also deals with more theoretical shortcomings of the phoneme. Students interested in writing systems, and in the history of writing, might consult Sampson (2015) or Coulmas (2012). Issues of language acquisition and the question of **innateness** are debated in Pinker (1994). You can find out more about Old English in Hogg and Alcorn (2012). For an accessible introduction to the issues around speech recognition, see The Economist Technology Quarterly, 'Language: Finding a Voice', January 2017. Available at: <http://www.economist.com/technology-quarterly/ 2017-05-01/language>.

3 Describing English consonants

3.1 What's inside a phonetic symbol?

So far, we have considered the IPA essentially as an alternative writing system, which allows us to express a larger range of sounds than the English spelling system would. However, looking only at those symbols as wholes might suggest that we are dealing with individual, self-contained units when we consider phonemes and allophones: each is like a locked black box labelled with an IPA symbol.

In fact, each IPA symbol is shorthand for a whole range of properties. Those properties explain how the particular **segment** being symbolised is pronounced; unpacking the black box for each sound reveals not a jumble, but an internal structure, and understanding that structure allows us to make comparisons with other sounds. When we know that [k], for instance, is a **voiceless velar plosive**, we can start to see what properties it shares with other sounds which might also be voiceless, or velar, or plosives; we can also see how it differs from other sounds which are not voiceless, or velar, or plosives. Furthermore, we shall see what properties are shared by different allophones of the same phoneme, which might allow them to be regarded as 'the same' by speakers of English: that is, we can work out what particular phonetic **features** speakers of English tend to ignore, and which they are aware of. Since this may be very different for speakers of other languages, unpacking IPA notation in this way also allows cross-linguistic comparisons to be made. In this chapter, we shall therefore consider a very basic set of phonetic features which enable us to describe the articulation of the consonants of English, and to assess their differences and similarities.

3.2 Consonant classification

A biologist looking at some particular creature wants to know various things about it, to work out where it should be placed in conventional

biological classification. Some properties are visible and therefore easy to work out, such as how many legs it has or whether it has fur, feathers or scales. In other cases, closer observation will be needed: tooth shape cannot usually be checked from a distance. Still other properties are behavioural, and our biologist might need to observe her creature over a longer period of time to figure out whether it lays eggs or bears live young, or what it eats.

The same goes for phonetic classification: some properties are straightforwardly observable when you look in a mirror, or can be figured out easily from feeling what your articulators are doing. Other features are harder to spot and need some extra training before you will become aware of them. Some features do not straightforwardly relate to a physical property at all, but are labels to distinguish two classes of sounds which behave differently phonologically. Furthermore, we also need to remember that phonemes are realised as various different allophones, so we must build up a picture of all the possible environments where that phoneme can occur and what happens there, to sort out how it behaves.

Biologists today are, of course, working within an agreed classification: when they observe a creature with particular physical traits, or particular behaviours, they can slot it into a framework of herbivores and carnivores; mammals, insects, birds and reptiles; vertebrates and invertebrates; and so on. This was not always the case, and our current hierarchical classification of species has developed from the work of Linnaeus in the eighteenth century. Fortunately, phoneticians and phonologists now also have a similar, generally agreed framework for classifying, comparing and describing sounds. For consonants, we need to know six things to arrive at a classification: in the rest of this chapter, we shall consider these six sets of properties in turn, and assess which English phonemes fit into each category. Vowel classification involves realisations of rather different features, and we return to this in Chapter 6: we are beginning with consonants because many of their properties are easier to ascertain from self-observation, and because the systems of consonant phonemes in different accents of English typically vary far less than the vowels.

3.3 The anatomy of a consonant

3.3.1 What is the airstream mechanism?

Speech is audible because the movements of articulators (to be discussed in subsequent sections) cause the air to vibrate, forming sound

waves which travel to the hearer's ears, and set up vibrations in the inner ear, which are then translated into sounds again by the brain. Since sound waves need air, it follows that articulatory vibrations will make sound waves only if there is a moving body of air available. **Airstreams** can be set in motion, or **initiated**, in three ways; however, only one is used in English, and indeed this particular airstream is found in every language of the world.

Essentially, speaking is modified breathing: it makes use of the resources involved in normal **respiration**, but in a more controlled way. When we are simply breathing quietly, the phases of breathing in and out last for approximately the same amount of time, and expiration is not under our physical control; it simply occurs as an automatic consequence of having breathed in. However, when we are speaking, the phase of breathing out is significantly longer, depending on the length of the utterance we want to produce. A network of muscles, like the **intercostal muscles** between our ribs, come into play to make breathing out smoother, more gradual and more controlled during speech, providing a regular and sustained flow of air which can then be modified by the articulators in various ways.

All the sounds of English, both consonants and vowels, are produced on this **pulmonic egressive** airstream, where the **initiator** is the lungs (= pulmonic) and the rest of the respiratory system, and the direction of airflow is outwards (= egressive): this is overwhelmingly the most common airstream mechanism in every language of the world. It can generally be taken for granted that the sounds under discussion below are pulmonic egressive, but you should remember to give that information in a complete description. For example, the **labial nasal** [m] (which, as we shall see, is produced using the lips – hence labial, and with airflow through the nose – hence nasal), is strictly a pulmonic egressive labial nasal.

It is possible to produce speech using a **pulmonic ingressive** airstream. No language seems to use this airstream regularly for particular sounds, although it has been reported in various cultures as a means of voice disguise: if you try to breathe in and speak at the same time, you will find that the pitch of your voice raises significantly.

There are two other airstreams which may be involved in speech, although even in languages where these are used, they will characterise only a few sounds, interpolated in a stream of pulmonic egressive speech. The first is the **glottalic** airstream mechanism, initiated by a movement of the **larynx**, which is where you can feel your 'Adam's apple' or 'voicebox' (technically, the larynx), protruding slightly about half-way up your throat. The larynx can move up or down, and the

glottalic airstream can therefore be either egressive (because air is being pushed out) or ingressive (when air is being pulled in), producing sounds known as **ejectives** and **implosives** respectively; none of these occurs in English. Finally, the 'tut-tut' click sound [ǀ] is produced on a **velaric** airstream, which operates only ingressively. When you make [ǀ], you can feel that the back of your tongue is pressed against the roof of your mouth, stopping air from moving any further back; a little air is then drawn into the mouth further forward, and the closure with the tongue is released to make a click. Neither the glottalic nor the velaric airstream provides airflow with the volume or controllability of the pulmonic system, which is why they tend to be used only for isolated sounds.

3.3.2 Voiced or voiceless?

A major division among speech sounds which is relevant for all languages is the dichotomy of **voiced** and **voiceless**. If you put your fingers on your 'Adam's apple' and produce a very long [zzzzzzz], you should feel vibration; this shows that [z] is a voiced sound. On the other hand, if you make a very long [sssssss], you will not feel the same sort of activity: [s] is a voiceless sound.

Pulmonic egressive air flows through the **trachea**, or windpipe, and up into the larynx, which is like a mobile little box suspended at the top of the trachea, acting to control the airway to and from the lungs, with the **epiglottis** above it protecting the lungs by stopping foreign bodies like food from dropping in. Stretched across the larynx from front to back are the **vocal folds**, or **vocal cords** (note that these are cords, rather than chords – they help us make sound, but not necessarily music). These can be pulled back and drawn apart, in which case they leave a space, the **glottis**, through which air can flow freely: this is the case for voiceless sounds like [s]. For voiced sounds, the vocal folds are drawn together, closing off the glottis; however, the pressure of air flowing from the lungs will cause the folds to part, and their essentially elastic nature will then force them together again. Repetitions of this cycle of opening and closing cause vibration, as for voiced sounds like [z]. The number of cycles of opening and closing per second will depend on the size of the vocal folds, and determines the pitch of the voice: hence, children's smaller, shorter vocal folds produce their higher voices.

Although sounds can be voiced in any position in the word, voicing is most obvious medially, between other voiced sounds: when there is an adjacent voiceless sound or pause, voicing will not last for so long

or be so strong. Consequently, although English has the minimal pairs *tip – dip*, *latter – ladder*, *bit – bid* for /t/ versus /d/, [d] is only voiced throughout its production in *ladder*, where it is medial and surrounded by voiced vowels. Word-initially, we are more likely to identify /t/ in *tip* by its aspiration (remember the piece of paper trick, demonstrating that /t/ is realised as aspirated [tʰ] in absolute word-initial position), and /d/ in *dip* by its lack of aspiration, than rely on voicing.

Voicelessness and voicing are the two main settings of **phonation**, or states of the glottis: for English at least, the only other relevant case, and again one which is used paralinguistically, is **whisper**. In whisper phonation, the vocal folds are close together but not closed; the reduced size of the glottis allows air to pass, but with some **turbulence**, which is heard as the characteristic hiss of whisper.

3.3.3 Oral or nasal?

The next major issue is where the pulmonic egressive airstream used in English goes. For most sounds, air passes from the lungs, up through a long tube composed of the trachea, or windpipe; the larynx; and the **pharynx**, which opens out into the back of the **oral cavity**. The air passes the various articulators in the mouth and exits at the lips; all these vocal organs are shown in Figure 3.1. However, for three English sounds, air passes through the **nasal cavity** instead.

The key to whether air can flow through the nose is the **velum**, or **soft palate**, which you can identify by curling the tip of your tongue up and running it back along the roof of your mouth until you feel the hard, bony palate giving way to something squashier. For **oral** sounds, the velum is raised and pushed against the back wall of the pharynx, cutting off access to the nose. However, for [m], [n] and [ŋ] in *ram*, *ran* and *rang*, the velum is lowered, so that air moving up from the lungs must flow through the nose. If you produce a long [s], you will be able to feel that air is passing only through your mouth; conversely, if you hum a long [m], you will notice that air continues to flow through your nose while your lips are pressed together, with that closure being released only at the end of the [m]. When someone suffering from a cold tells you 'I've got a cold id by dose' instead of 'I've got a cold in my nose', she is failing to produce [n] and [m] because soft tissue swelling blocks air access to the nose and perforce makes all sounds temporarily oral.

Nasal sounds, like [m] and [n], are produced with air only passing through the nasal cavity for at least part of their production. On the other hand, **nasalised** sounds, like the [ã] vowel in *can*, preceding a

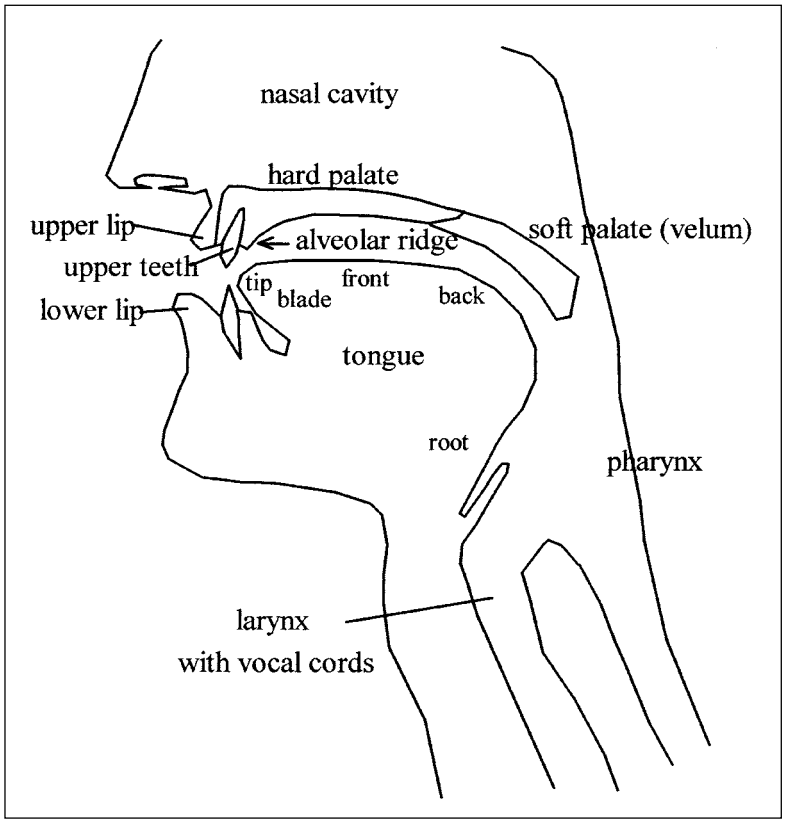


Figure 3.1 The vocal tract

nasal consonant, as opposed to the [a] vowel in *cat*, which precedes an oral one, are characterised by airflow through both nose and mouth simultaneously.

3.3.4 What is the manner of articulation?

To produce any consonant, an **active articulator**, usually located somewhere along the base of the vocal tract, moves towards a **passive articulator**, somewhere along the top, or the roof of the mouth. Where those articulators are determines the consonant's **place of articulation**, as we shall see in the next section. How close the active and passive articulators get determines the **manner of articulation**. There are three main manners of articulation, and one subsidiary case which, in a sense, is intermediate between the first two.

A. STOPS

If the active and passive articulators actually touch, stopping airflow through the oral cavity completely for a brief period, the sound articulated is a **stop**. If you put your lips together to produce [pʰ] *part*, and hold them in that position, you will feel the build-up of air which is then released when you move from the stop to the following vowel. Further back in the vocal tract, [tʰ] *tart* and [kʰ] *cart* are also stop sounds. More accurately, all these are plosives, the term for oral stops produced on a pulmonic egressive airstream, just as clicks are stops produced on a velaric ingressive airstream, for instance. Plosives may be voiceless, like [p], [t] and [k], or voiced, like their equivalents [b], [d] and [ɡ].

Since the definition of a stop involves the complete, transient obstruction of the *oral* cavity, it also includes nasal sounds, where airflow continues through the nose. English [m], [n] and [ŋ] are therefore nasal stops, although they are typically referred to simply as nasals, as there are no distinctive English nasals involving other manners of articulation. All these nasals are also voiced.

Finally, some varieties of English also have subtypes of stops known as **taps** or **trills**. While a plosive is characterised by a complete obstruction of oral airflow, followed generally by release of that airflow, a tap is a very quick, ballistic movement where the active articulator strikes a glancing blow against the passive one; interruption of the airstream is real, but extremely brief. Many Scots speakers have a tapped allophone [ɾ] of the phoneme /r/ between vowels, as in *arrow*, *very*; many American speakers have a similar tap as a realisation of /t/ in *butter*, *water*. Trills are repeated taps, where the active articulator vibrates against the passive one. Trilled [r] is now rather uncommon for speakers of English, although attempts at imitating Scots often involve furious rolling of [r]s; but there are still trilled realisations of /r/ in French, either alveolar (see below) [r] or uvular [ʀ].

B. FRICATIVES

During the production of a **fricative**, the active and passive articulators are brought close together, but not near enough to block the oral cavity totally. This **close approximation** of the articulators means that the air coming from the lungs has to squeeze through a narrow gap at high speed, creating turbulence, or local audible friction, which is heard as hissing for a voiceless fricative, and buzzing for a voiced one. English [f] *five* and [s] *size* are voiceless fricatives, while [v] *five* and [z] *size* are voiced.

The subclass of **affricates** consists of sounds which start as stops and end up as fricatives; but as we shall see in Chapter 5, they behave as

single, complex sounds rather than sequences. Stops generally involve quick release of their complete articulatory closure; if this release is slow, or delayed, however, the articulators will pass through a stage of close approximation appropriate for a fricative. The two relevant sounds for English are [tʃ], at the beginning and end of *church*, and its voiced equivalent [dʒ], found at the beginning and end of *judge*. If you pronounce these words extremely slowly, you should be able to identify the stop and fricative phases.

C. APPROXIMANTS

It is relatively easy to recognise a stop or fricative, and to diagnose the articulators involved, since these are either touching or so close that their location can be felt. In **approximants**, on the other hand, the active and passive articulator never become sufficiently close to create audible friction. Instead, the **open approximation** of the articulators alters the shape of the oral cavity and leads to the production of a particular sound quality.

There are four approximant consonant phonemes in English: /j/ *yes*, /w/ *wet*, /r/ *red* (which may have a tapped allophone for some speakers medially, but is typically pronounced as approximant [ɹ]) and /l/ *let*. All these approximants are voiced.

3.3.5 Is the airflow central or lateral?

This parameter is rather a minor one, since it distinguishes only one phoneme of English from all others. For almost all English consonants, the airflow through the oral cavity is **central**. Recall that fricatives, like [s] or [f], are produced with close approximation of the active and passive articulators; however, if you produce any fricative, you will feel that your articulators are actually pushed together quite tightly at the sides of the oral cavity, with the actual close approximation, and hence the narrow gap for airflow, left in the middle. The same is true for all the approximants except one: if you produce *rip* and *lip*, and focus on the initial consonants, you will notice that while the outgoing air for /r/, as usual, moves along the centre of the mouth, for /l/ it moves down the sides. If you find this difficult to feel, try making the related voiceless fricative sound found in Welsh names spelled with <ll>, like *Llewellyn*; because this is a fricative and involves close approximation of the articulators, the airflow is easier to observe. Alternatively, try making an [l] ingressively, pulling the air into your mouth instead of breathing it out, and feel the cold air moving inwards along the sides of your tongue. In English, both the clear and the dark allophones of /l/ (remember the

clear, fronter [l] at the beginning of *lull*, and the dark, more back [ɬ] at the end), and only these, have **lateral** airflow, and are known as lateral approximants.

Since the only case where the central versus lateral difference is distinctive in English involves /r/ and /l/, these should consistently be described as central and lateral respectively. Although, in a particularly thorough description, all other sounds (except nasals, which have no oral airflow at all) should be explicitly stated to be central, this definition will generally be understood rather than stated below, since the other English sounds do not contrast with lateral sounds of the same place and manner of articulation, meaning that confusion is highly unlikely.

3.3.6 What is the place of articulation?

As we have seen, the location of the active and passive articulators determines the place of articulation for a consonant. In English, consonants are produced at eight places of articulation. Since we have now covered all the other articulatory parameters required to describe consonants, introducing and defining these places will allow us to build up a complete consonant phoneme system for English. In the tables below, the phoneme or allophone in question is initial in the example word, unless another part of that word is in bold face.

A. BILABIAL

For a **bilabial** sound, the active articulator is the bottom lip, and the passive articulator is the top lip.

/p/	*pie*	voiceless bilabial plosive
/b/	*by*	voiced bilabial plosive
/m/	*my*	voiced bilabial nasal

There is at least one further English phoneme which, to an extent, fits under this heading: this is the approximant /w/ in *wet*. In producing [w], the lips are certainly approximated, though not enough to cause friction or obstruct the airflow, but you should be able to feel that the back of your tongue is also bunched up. This additional articulation takes place at the velum, so that [w] is not simply a labial sound, but a **labial–velar** one. In some accents of English, notably those spoken in Scotland and New Zealand, this /w/ contrasts with /ʍ/, the voiceless labial–velar fricative, which tends to occur in words spelled <wh->. If you have the same pronunciation for *witch* and *which*, or *Wales* and *whales*, then you have only /w/; if these are consistently different for you, then these minimal pairs establish a contrast of /w/ and /ʍ/.

/w/	*witch*	voiced labial–velar approximant
/ʍ/	*which*	voiceless labial–velar fricative

B. LABIO-DENTAL

For **labio-dental** sounds, the active articulator is again the bottom lip, but this time it moves up to the top front teeth. Note that these sounds are labio-dental, while /w/ and /ʍ/ are labial–velar, because in the first case, articulation takes place only at a single location, while in the second, there are two separate, simultaneous articulations.

/f/	*fat*	voiceless labio-dental fricative
/v/	*vat*	voiced labio-dental fricative

C. DENTAL

In most English sounds, and most speech sounds in general, the active articulator is part of the tongue; to avoid confusion, places of articulation where the tongue is involved are therefore generally called after the passive articulator. For the two **dental** fricatives, it follows that the passive articulator is the top front teeth; the active articulator is the tip of the tongue. The tongue itself is conventionally divided into the **tip** (the very front); the **blade** (just behind the tip, and lying opposite the alveolar ridge); the **front** (just behind the blade, and lying opposite the hard palate); the **back** (behind the front, and lying opposite the velum); and the **root** (right at the base, lying opposite the wall of the pharynx).

[θ]	*thigh*	voiceless dental fricative
[ð]	*thy*	voiced dental fricative

D. ALVEOLAR

Alveolar sounds are produced by the tip or blade of the tongue moving up towards the alveolar ridge, the bony protrusion you can feel if you curl your tongue back just behind your top front teeth.

/t/	*tie*	voiceless alveolar plosive
/d/	*die*	voiced alveolar plosive
/n/	*nigh*	voiced alveolar nasal
/s/	*sip*	voiceless alveolar fricative
/z/	*zip*	voiced alveolar fricative
/r/	*rip*	voiced alveolar central approximant
/l/	*lip*	voiced alveolar lateral approximant

The symbol /r/ is used for the phoneme here and throughout the book, primarily because it is typographically convenient; different realisations of /r/ are found throughout the English-speaking world,

however, and as we have seen, [r] itself, the voiced alveolar trill, is rather rare. The tapped realisation, [ɾ], is also alveolar; but another, even more common pronunciation is not. This is the voiced **retroflex** approximant, [ɹ], which is produced with the tip of the tongue curled back slightly behind the alveolar ridge; this is the most common realisation of /r/ for speakers of Southern Standard British English and General American.

E. POSTALVEOLAR

If you move your tongue tip back behind the alveolar ridge, you will feel the hard palate, which then, moving further back again, becomes the soft palate, or velum. **Postalveolar** sounds are produced with the blade of the tongue as the active articulator, and the adjoining parts of the alveolar ridge and the hard palate as the passive one. They include two fricatives, and the affricates introduced in the last section.

/ʃ/	*ship*	voiceless postalveolar fricative
/ʒ/	*beige*	voiced postalveolar fricative
/tʃ/	*chunk*	voiceless postalveolar affricate
/ʤ/	*junk*	voiced postalveolar affricate

F. PALATAL

Palatals are produced by the front of the tongue, which moves up towards the hard palate. We have so far encountered two palatal sounds: the approximant /j/ in *yes*, and the voiceless palatal stop [c] in *kitchen*. Recall, however, that [c] is the allophone of /k/ found before certain vowels; velar [k] appears elsewhere. There is a similar pattern for /g/, which has as allophones velar [g] in *garden* and palatal [ɟ] *give*. Since we are constructing a phoneme system here, these allophones are not included in the list.

/j/	*yes*	voiced palatal approximant

G. VELAR

For **velar** sounds, the active articulator is the back of the tongue, and the passive articulator is the velum, or soft palate. The labial–velar approximant and fricative /w/ and /ʍ/ are not included here, as they were discussed above with the bilabials; however, it should be remembered that these doubly articulated sounds strictly belong under both headings. Similarly, although the 'dark l' realisation, [ɬ], is also velar, it does not appear in the list below as it is an allophone of /l/.

There is a further accent difference involving velar sounds: in some varieties of English, notably Scottish ones, there is a voiceless velar

fricative, /x/: this is the sound at the end of Scots *loch*, which speakers of other accents typically replace with a [k].

/k/	*cot*	voiceless velar plosive
/ɡ/	*got*	voiced velar plosive
/ŋ/	*rang*	voiced velar nasal
/x/	*loch*	voiceless velar fricative

H. GLOTTAL

Glottal sounds are in the minority in articulatory terms, since they do not involve the tongue: instead, the articulators are the vocal folds, which constitute a place of articulation as well as having a crucial role in voicing. English has two glottal sounds. The first is allophonic – namely, the glottal stop, [ʔ], which appears as an intervocalic realisation of /t/ in many accents, as in *butter*. The glottal stop is technically voiceless, though in fact it could hardly be anything else, since when the vocal folds are pressed together to obstruct the airstream completely, as must be the case for a stop sound, air cannot simultaneously be passing through to cause vibration. The second, the voiceless glottal fricative [h], is a phoneme in its own right.

/h/	*high*	voiceless glottal fricative

Exercises

1. (a) Which of the following words begin with a voiceless fricative?
   hang dogs cut ship chip foot zip sit
   (b) Which of the following words begin with a voiced sound?
   nap jug knock lot pet jump fin
   (c) Which of the following words ends with a stop sound?
   nap hang jug nudge bet lamb lots
   (d) Which of the following words ends with an alveolar sound?
   pot sad boss lamb lamp size hen call
   (e) Which of the following words contain an approximant consonant?
   wash hall map sing sigh red yellow

2. (a) What do the initial consonants of these words have in common?
   wash let right yet wish rough
   (b) What do the final consonants of these words have in common?
   hop hot pass wish rough lock scratch
   (c) What do the initial consonants of these words have in common?
   fish ship zip sigh house view

3. How do the consonants at the end of the words in List A differ from those at the end of the words in List B?

	List A	*List B*
(a)	ham	top
	sin	lock
	sing	rot

If you say [sɪŋg], ignore the final [g] for this exercise.

(b)	place	lake
	lose	beg
	half	dot

(c)	dogs	rough
	hall	cats
	film	catch
	cold	help

4. Transcribe the words below – feel free to use just V for each vowel, if you prefer, as you have not yet been introduced to them in detail. Then write as full a description as you can of all the consonants in each word, in your accent. For instance, in *doze* [d] is a pulmonic egressive central voiced alveolar stop; [z] is a pulmonic egressive central voiced alveolar fricative. Remember to pay attention to the sounds, and not to the spelling.

psalm jester which climb heavy splint loch bought squelch

Recommendations for reading

Textbooks recommended in the last chapter are also relevant here. In addition, Ogden (2017) is an excellent introduction to the phonetics of English in particular. Zsiga (2013) gives an overview of phonetics and phonology for language in general, with some very useful material on acoustic phonetics, which is not dealt with here. Roach (2009) may be of special help to non-native speakers, and Catford (2002) and Ladefoged and Johnson (2014) are classic introductions to phonetics. The most comprehensive account of our current understanding of phonetics is still Laver (1994). References relating particularly to the IPA were given in Chapter 1.

4 Defining distributions: consonant allophones

4.1 Phonemes revisited

As we saw in Chapter 3, the two major criteria for establishing phonemic contrast are **predictability of occurrence** and **invariance of meaning**. That is to say, if we are dealing with two allophones of the same phoneme, the two must occur in non-overlapping (or mutually exclusive) sets of environments. Where you find one allophone, then, you can't find the other. Furthermore, there cannot be any minimal pairs, where substituting one of our focus sounds for the other in exactly the same context creates a difference in meaning. These two criteria establish conclusively that English [ɹ] and [l] belong to distinct phonemes: there are many minimal pairs, like *rip* and *lip*, *rot* and *lot*, *marrow* and *mallow*, so clearly the two phones do occur in the same contexts, and substituting one for the other does create a meaning difference. On the other hand, clear, alveolar [l] and dark, velar [ɬ] occur in predictably different environments: in Standard Southern British English, the clear, more front one appears word-initially or between vowels, as in *lip*, *lot*, *mallow*; and the dark, more back one word-finally or before a consonant, as in *pill*, *tall*, *halt*. Since there are no minimal pairs, and substituting one variant for the other will not make a meaning difference, [l] and [ɬ] are necessarily allophones of a single phoneme, /l/.

Equipped with the articulatory descriptions from the last chapter, we can now progress to a more detailed account of the distribution of allophones. In doing so, we will also discover that certain phonemes form groups, in that they have similar allophones in similar environments – so, they behave in similar ways. We must try to identify what members of such groups of phonemes have in common, to explain why they work together.

4.2 Making generalisations

In Chapter 2, several examples of allophonic variation were considered. In one case, we found that /k/ has two variant pronunciations: namely, velar [k] in *cupboard* and palatal [c] in *kitchen*. Another involved /p/, /t/ and /k/, which have aspirated allophones, with a perceptible release of air, in *pill*, *till* and *kill*, but unaspirated allophones in *spill*, *still* and *skill*, or *sip*, *sit* and *sick*.

However, providing a list of words where the relevant allophone appears is only our starting point. Phonologists are interested in generalisations about the language they are working on, and indeed in generalisations that hold for all languages, and generalisations are not best expressed simply through lists. Lists give us useful data as a starting point but they do not reveal the factors which the forms in the lists have in common, so they do not help us find explanations. Identifying these common factors will help us to understand why a particular allophone appears in that context and not elsewhere, and to predict what will happen in other words with a similar context.

As an example, recall the [c] and [k] allophones of /k/. English speakers (with the exception of New Zealanders and Australians) will have palatal and velar pronunciations distributed as in (1).

(1)	kitchen	[cɪtʃən]	keys	[ciːz]
	cupboard	[kʌbəd]	car	[kɑː]

If you were asked to predict the pronunciation of the initial sounds of *keep*, *cool*, *ceilidh* (for non-Scots, pronounced exactly like *Kayleigh*) and *koala*, you would not get very far by considering (1) as just two lists of words: how could you tell whether each of these examples fitted into the [c] list or the [k] list? The key is to consider what connects the words where each allophone appears: and the answer is that [c] appears before a front vowel (more detail on vowels is in Chapter 6), while [k] precedes a back vowel. It follows that ***k**eep* and ***c**eilidh* will also have [c], since the bold-faced vowels are front, while ***c**ool* and ***k**oala* will have [k], as the bold-faced vowels are back. Since front vowels are made roughly at the hard palate, and so is palatal [c], while back vowels are produced at the velum, as is velar [k], the pairs of vowels and consonants 'match'. It is extremely common for sounds to become more similar, or to **assimilate** to one another, in this sort of way. As the previous chapter showed, the vocal organs undergo very complex, coordinated movements during speech, and anything that simplifies the gymnastics involved while not jeopardising comprehension is understandably very welcome to speakers. Specifying what the different examples have in common therefore

allows us to understand the results we find, and make predictions about the behaviour of other forms with the same environment. And as we might expect, /g/, which matches /k/ in every respect except voicing, behaves in exactly the same way, being palatalised before the same set of vowels as /k/ in the same varieties.

In the case of /p/, /t/ and /k/ aspiration, the relevant **conditioning factor** is not the shape of an adjacent segment, but rather position in the word (more accurately, as we shall see in Chapter 9, in the **syllable**). What *pill*, *till* and *kill* have in common (along with *peel*, *pass*, *play*, *pretty* and many others) is that the /p/, /t/ or /k/ is right at the beginning of the word. In *spill*, *still*, *skill*, *sip*, *sit*, *sick* and many others, it is not right at the beginning of the word; either it is near the start, but another consonant precedes it, or it is word-final. We can test this hypothesis by finding lots of other examples where /p/, /t/ and /k/ appear word-initially and checking whether there is aspiration. So long as we keep finding aspirated allophones there, and nowhere else, our generalisation holds. If we find **counterexamples**, where either aspirated forms appear in other contexts, or word-initial allophones of /p/, /t/ or /k/ are not aspirated, we have to modify our generalisation to include them. After a while, when we keep finding data that agree with our observation and not finding data that disagree, we can feel more confident that our generalisation is the right one and regard our hypothesis as confirmed.

This is the scientific method – observe something; look at data; formulate a hypothesis to explain or account for your observation; and then test it to destruction by checking more data of different sorts so that you can confirm or disprove it. If you disprove your hypothesis, reformulate it to account for the exceptions, and try again. If it seems to be confirmed, don't get too confident: you will have to keep your eyes and ears open for different data that might disprove it after all. However, disproving a hypothesis isn't a failure in this method – it's actually a step forward because it is part of testing and refining our hypotheses to get closer to an explanation. And such explanations are the goal of phonologists, who want to understand not only what happens with sounds, but also why.

4.3 Making statements more precise

The next question is how we should express these generalisations or hypotheses. Having established that certain sounds are allophones of the same phoneme, and that they are in complementary distribution, we might write a statement like (2) to say what happens to the phoneme or phonemes in question, and where.

(2) a. /k/ and /g/ become [c] and [ɟ] when they are followed by a front vowel. They are pronounced as [k] and [g] in all other contexts.
b. /p/, /t/ and /k/ become [p^h], [t^h] and [k^h] at the very beginning of a word. After another consonant or at the end of a word, they are pronounced as [p], [t] and [k].

These statements express the main generalisation in each case. However, making a statement like this in normal English can be unclear and unwieldy, so phonologists typically use a more formal notation which helps us to work out exactly what is being said; it is easier that way to identify what a counterexample would be, and to see what predictions are being made. The English statement also does not tell us why /p/, /t/ and /k/ are affected, rather than just one or two of them; or why these three sounds should be the ones to behave similarly, rather than /p/, /s/ and /r/, for instance. Similarly, we cannot see what /k/ and /g/ have in common, or indeed what the resulting allophones have in common, simply by looking at the phoneme symbols (so far, these are still like locked boxes with phoneme symbols as labels, which we cannot see inside). In short, then, writing down what happens in normal English words tells us what happens but does not give us much of a clue about why.

Introducing the articulatory descriptions from Chapter 3 immediately makes our statements more adequate and more precise, as we can now express what particular sets of sounds have in common (3).

(3) a. Velar stops become palatal when they are followed by a front vowel. They are pronounced as velar in all other contexts.
b. Voiceless stops are aspirated at the very beginning of a word. After a consonant or at the end of a word, they are unaspirated.

We can take this one step further by regarding each of the articulatory descriptions as a **binary feature**. We have already seen that a sound is either voiced or voiceless, and these are opposites; similarly, a sound is either nasal or oral (not nasal). Instead of voiced and voiceless, or nasal and oral, we can then write [+ voice] and [– voice], and [+ nasal] and [– nasal]. This may seem like introducing needless complexity, but once you are used to the notation, it is much easier to compare these rather formal statements, and to see what the important aspects are.

These **distinctive features** allow each segment to be regarded as a simultaneously articulated set, or **matrix**, of binary features, as shown in (4).

(4)

/p/	/z/	/l/
– voice	+ voice	+ voice
– nasal	– nasal	– nasal
+ labial	– labial	– labial
– alveolar	+ alveolar	+ alveolar
+ stop	– stop	– stop
– fricative	+ fricative	– fricative
– approximant	– approximant	+ approximant
+ central	+ central	– central

These features, however, are not entirely satisfactory. They do describe phonetic characteristics of sounds; but we are trying to provide a phonological description, not a phonetic one, and one interesting phonological fact is that features and phonemes fall into classes. For instance, the matrices in (4) have to include values for all three of the features [stop], [fricative] and [approximant], despite the fact that any sound can be only one of these. Together, they provide a classification for manner of articulation; but (4) lists them all as if they were as independent as [nasal], [voice] and [alveolar]. You can have a voiced alveolar nasal (or a voiceless alveolar non-nasal) sound, so these features operate independently; but you can't have an approximant stop – there is no such thing. Similarly, in (4), values are given for [labial] and [alveolar], and we would have to add [labio-dental], [dental], [postalveolar], [palatal], [velar] and [glottal] for English alone; but again, it is simply not possible for a single consonant to be both labio-dental and velar, for instance, or both alveolar and labial. We are missing the generalisation that, together, this group of features makes up the dimension of place of articulation.

One possible way of overcoming this lack of economy in the feature system is to group sets of features together, and write **redundancy rules** to show which values can be predicted. Redundancy rules take the shape shown in (5).

(5)
[+ stop] → [– fricative, – approximant]
[+ fricative] → [– stop, – approximant]
[+ labial] → [– labio-dental, – dental, – alveolar, – palatal …]
[+ alveolar] → [– labial, – labio-dental, – dental, – palatal …]

The first rule says 'if a segment is a stop, it cannot also be either a fricative or an approximant'. All these redundancy rules are universal – that is, they hold for all human languages, and are, in a sense, statements of logical possibilities. Particular languages may also rule

out combinations of features which are theoretically possible, and which occur routinely in many other languages. Two language-specific redundancy rules for English are given in (6): the first tells us that English has no palatal nasal (although Italian and French do), and the second, that English has only lateral approximants (though Welsh, for instance, also has a lateral fricative). These redundancy rules cannot be written the other way around: it would not be accurate to say that non-palatals are all nasal in English (because [p], for example, is not palatal, but it isn't nasal either), or that all approximants are lateral (because [w], for example, is an approximant, but it is central rather than lateral).

(6) [+ nasal] → [– palatal]
[+ lateral] → [+ approximant]

While we should expect to have to state redundancy rules of the sort in (6), since these express quirks of particular languages, it seems unfortunate that our feature system is not structured in a way that automatically factors out the universal redundancies in (5). However, to produce a better phonological feature system, we first need to spell out what we want such a system to achieve.

4.4 A more economical feature system

Some requirements of a phonological feature system are as follows:

- The system should be relatively economical.
- It should enlighten us about which combinations of features can go together universally, and therefore which segments and segment-types are universally possible. That is, many universal redundancy rules of the sort in (5) should not have to be written explicitly, as they will follow from the feature system.
- It should allow us to group together those segments and segment-types which characteristically behave similarly in the world's languages.

Certain elementary phonetic features which we have already met can be adopted without further question into our revised system: for instance, [± oral], [± lateral] and [± voice] do correspond to binary oppositions, and help us to distinguish classes of consonants in English and other languages. The main problems involve place and manner of articulation.

Turning first to manner of articulation, we might initially wish any sensible feature system to distinguish vowels from consonants. This is a

division of which we are all intuitively aware, although that awareness may owe something to our knowledge of written as well as spoken language. Children learn early that, in the English alphabet, the vowel letters are <a e i o u>, though these, alone and in combination, can signal a much larger number of vowel sounds. When challenged to write a word 'without vowels', English speakers might respond with *spy* or *fly*, but not *type*, although the <y> in all three cases indicates the vowel [aɪ], while the <e> in *type* does not correspond to a vowel in speech (or, indeed, to anything at all). None the less, there is a general awareness that vowels and consonants form different categories integral to phonology and phonetics – an assumption central to the organisation of this book, where the two classes are introduced in different chapters.

This binary opposition between vowels and consonants is not entirely clear-cut. For instance, vowels are almost always voiced: it is highly unusual for languages to have phonemically voiceless vowels, and those that do always have voiced ones too. However, there are also consonants which are almost always voiced: this is true of nasals, and also of approximants (like English /j w l r/). We might say that these consonants are closer to vowels than stops and fricatives, which can be either voiced or voiceless, and indeed often occur in pairs distinguished only by [± voice] – think of English /p b/, /t d/, /k g/, /f v/, /s z/.

Similarly, vowels, as we shall see in Chapter 9, form the essential, central part of syllables: it is possible to have a syllable consisting only of a vowel, as in *I* (or *eye*), *a*, *oh*, but consonants appear at syllable **margins**, preceding or following vowels, as in *sigh*, *side*, *at*, *dough*. None the less, some consonants may become **syllabic** under certain circumstances. Nasals and approximants can be syllabic in English: for instance, in the second syllables of *button*, *bottom*, *little* (and *father*, for speakers who have an [ɹ] there), there is no vowel, only a syllabic consonant. You may think you are producing a vowel, probably partly because there is a vowel graph in the spelling; but, in fact, most speakers will move straight from one consonant to the next, although the syllabic consonant has its own phonetic character. In IPA notation, the property of being syllabic is signalled by a small vertical line under the consonant symbol, giving [bʌtn̩], [bɒtm̩], [lɪtl̩], [faðɹ̩]. It is not possible for oral stops and fricatives to become syllabic in this way: in *lifted*, or *horses*, there *must* be a vowel before the final [d] or [z].

This evidence seems to suggest that, on the one hand, we should distinguish all consonants from vowels. On the other hand, in many phonological processes in many different languages, the class of

stops and fricatives behaves differently from the class of vowels, nasals and approximant consonants, so that these two categories should be distinguishable too. Since these classifications cross-cut one another, it is clearly not possible to get the right results using a single binary feature, or indeed using any features proposed so far. For example, although we could describe the class of nasals, vowels and approximants as [– stop, – fricative], a negative definition of this kind does not really explain why they form a class, or what they have in common.

Many phonologists would use three features, the so-called **major class features**, to produce these classifications. First, we can distinguish consonants from vowels using the feature [± syllabic]; sounds which are [+ syllabic] form the core, or **nucleus**, of a syllable, while [– syllabic] sounds form syllable margins. Vowels are therefore [+ syllabic], and all consonants [– syllabic], though some consonants (like English /m n l r/) may have [+ syllabic] allophones in certain contexts, as we have seen. Second, the feature [± consonantal] distinguishes [+ consonantal] oral stops, fricatives, nasals and **liquids** (the cover term for /r/ and /l/ sounds), from [– consonantal] **glides** (like English /j/, /w/) and vowels. The crucial distinction here is an articulatory one: in [+ consonantal] sounds, the airflow is obstructed in the oral cavity, either being stopped completely or causing local audible friction. On the other hand, for [– consonantal] sounds, airflow is continuous and unimpeded (remember that, for nasal stops, although airflow continues uninterrupted through the nose, there is a complete closure in the oral cavity). Finally, [± sonorant] distinguishes nasals, vowels and all approximants from oral stops and fricatives; the former set, the **sonorants**, are characteristically voiced, while the latter, the **obstruents**, may be either voiced or voiceless.

As (7) shows, the combination of these three binary features actually distinguishes four major classes of segments.

(7)	All vowels	[+ syllabic, – consonantal, + sonorant]
	Glides (English /j w/)	[– syllabic, – consonantal, + sonorant]
	Liquids and nasals (sonorant consonants)	[– syllabic, + consonantal, + sonorant]
	Oral stops and fricatives (obstruent consonants)	[– syllabic, + consonantal, – sonorant]

However, we can produce further, flexible groupings, to reflect the fact that composite categories often behave in the same way phonologically. For example, vowels, nasals and all approximants are

[+ sonorant]; vowels and glides alone are [– consonantal]; and we can divide our earlier, intuitive classes of consonants and vowels using [± syllabic].

The introduction of these major class features resolves some of our earlier difficulties with manner of articulation, but we are still not able to distinguish stops from affricates or fricatives. To finish the job of accounting for manner, we must introduce two further features. The more important of these is [± continuant]. This feature separates the oral and nasal stops, which are [– continuant] and have airflow stopped in the oral tract, from all other sounds, which are [+ continuant] and have continuous oral airflow throughout their production. Second, the affricates /tʃ/ and /ʤ/ (which we have rather been ignoring up to now) can be classified as a subtype of oral plosive, or stop; but the complete articulatory closure, for these sounds only, is released more gradually than usual, so that the affricates incorporate a fricative phase. The affricates are generally described as [+ delayed release], while other stops are [– delayed release].

Despite these advances in dealing with manner of articulations, there remain problems with place. Recall that, if all places of articulation are stated independently, a consonant which is [+ alveolar] will also have to be listed as [– labial], [– dental], [– palatal], [– velar] and so on. To illustrate this problem, consider the different phonetic shapes of the prefix *un-* in (8).

(8)

unarmed	[n]
unpleasant	[m]
unfavourable	[ɱ]
unthinkable	[n̪]
unstable	[n]
uncomplicated	[ŋ]

The prefix consonant is always nasal, but its place of articulation alters depending on the following segment. Before a vowel or an alveolar consonant, like [s], the nasal is alveolar; before a bilabial consonant like [p], it is bilabial; before a labio-dental like [f], it is labio-dental [ɱ]; before a dental, it is dental [n̪]; and before a velar, in this case [k], it is also velar. We can write these generalisations as a series of **phonological rules**, as in (9). These rules have the same format as the redundancy rules proposed above, but instead of stating generalisations about necessary combinations of features, or excluded combinations, they summarise processes which take place in the structure of a particular language, in a certain context.

(9) $\begin{bmatrix} +\text{nasal} \\ +\text{alveolar} \\ -\text{labial} \\ -\text{dental} \\ -\text{velar} \end{bmatrix} \rightarrow \begin{bmatrix} -\text{alveolar} \\ +\text{labial} \end{bmatrix} / \underline{\quad} [+\text{labial}]$

$\begin{bmatrix} +\text{nasal} \\ +\text{alveolar} \\ -\text{dental} \\ -\text{labial} \\ -\text{velar} \end{bmatrix} \rightarrow \begin{bmatrix} -\text{alveolar} \\ +\text{dental} \end{bmatrix} / \underline{\quad} [+\text{dental}]$

$\begin{bmatrix} +\text{nasal} \\ +\text{alveolar} \\ -\text{velar} \\ -\text{labial} \\ -\text{dental} \end{bmatrix} \rightarrow \begin{bmatrix} -\text{alveolar} \\ +\text{velar} \end{bmatrix} / \underline{\quad} [+\text{velar}]$

… and so on

In these rules, the material furthest left is the **input** to the process, or what we start with: that is, nasals with different place features in each case. The arrow means 'becomes', or technically 'is rewritten as'; and there then follows a specification of the change that takes place. In (9), this always involves changing the place of articulation. Any feature which is not explicitly mentioned in the middle section of the statement is taken to be unchanged; so in the first rule, the consonant involved stays [+ nasal, – dental, – velar] because the rule does not say anything explicit about these features, but changes its values for [± alveolar] and [± labial]. The rest of the statement following the environment bar / (which can be paraphrased as 'in the following environment') specifies the context where this particular realisation appears. In (9), the environment always involves a following sound with a particular place of articulation: the underline signals where the input fits into the sequence. Bearing in mind the discussion of phonemes in Chapter 2, where these were defined as abstract, mental units which do not appear directly in the world, a realisation rule of this sort hypothesises which phoneme we have in our minds, and what determines the way it is realised or pronounced in actual speech, depending on the context it finds itself in.

The problem is that this system of features, with several different places of articulation, each expressed using a different feature, will lead to gross duplication in the statement of what is, in fact, a rather simple and straightforward generalisation: /n/ comes to share the place of

articulation of the following consonant. What seems to matter here is that the place of articulation of the **output** matches that of the **conditioning context**. If we were to regard all the place features as subdivisions of a higher-order feature 'place', we could state the whole rule as in (10).

(10) $\begin{bmatrix} + \text{ nasal} \\ + \text{ alveolar} \end{bmatrix} \rightarrow [\alpha \text{ place}] \quad /\_\_\_\_ [\alpha \text{ place}]$

This rule tells us that the place of articulation of the input consonant, an alveolar nasal, comes to match the place of the following segment, whatever that might be. The Greek letter variable means that whatever one value is, the other one will become the same. If the output and conditioning context also matched in voicing and nasality, for instance, further Greek letter variables could be introduced, so that the output and context would be specified as [α place, β voice, γ nasal]. A more advanced subpart of phonology, feature geometry, investigates which features might be characterised as variants of a superordinate feature like 'place' in this way.

Although recognising a superordinate 'place' feature allows an economical statement of this particular process, we also need a way of referring to each individual place of articulation: after all, not all consonants will always undergo all rules in the same way, and indeed the input of (10) is still restricted to the alveolar nasal. It seems we must reject features like [± alveolar], [± velar], and search again for a more economical, phonological feature set, which ideally should also help us group together those places of articulation which typically behave similarly cross-linguistically.

One commonly accepted solution involves the two features [± **anterior**] and [± **coronal**]. Anterior sounds are those where the passive articulator is the alveolar ridge or further forward; this includes labial, labio-dental, dental and alveolar sounds. [– anterior] sounds are produced further back in the vocal tract; for English, this will include postalveolar, palatal, velar and glottal sounds (and also, note, the labial–velars /w/ and /ʍ/). For coronal sounds, the active articulator is the tip, blade or front of the tongue, so include dental, alveolar, postalveolar and palatal consonants in English; conversely, [– coronal] sounds, such as labials, labio-dentals, labial–velars, velars and glottals, do not involve the front parts of the tongue. This system is undoubtedly economical, even though we require one further feature, [± strident], to distinguish fricatives like /s/ from /θ/: these will both be [– syllabic, + consonantal, – sonorant, + anterior, + coronal] in the feature system developed so far. **Strident** sounds in English are [f v s z ʃ ʒ tʃ dʒ].

Rule (11) applies these features to English [k] and [c]. Note that it is common practice to exclude features which are not absolutely necessary to distinguish the sound or sounds referred to from others in the language: thus, although the input /k/ is strictly also [– nasal, – lateral, – delayed release, – strident], these redundant feature values need not be included, as /k/ is already uniquely identified from the features given.

(11) $\begin{bmatrix} -\text{ syllabic} \\ +\text{ consonantal} \\ -\text{ sonorant} \\ -\text{ voice} \\ -\text{ continuant} \\ -\text{ anterior} \\ -\text{ coronal} \end{bmatrix} \rightarrow [+\text{ coronal}] \quad /\_\_\_\_\_ \text{ front vowel}$

Ideally, the explanation for the presence of a certain allophone in a certain context should be available in the rule itself. In (11), however, /k/ becomes [+ coronal] before a front vowel; but the connection between [coronal] and [front] is obscured by the different descriptions conventionally used for vowels and consonants. We return to vowel features in Chapters 6 and 7.

4.5 Natural classes

The major class features identify several categories of sounds which recur cross-linguistically in different phonological rules. Feature notation can also show why certain sounds behave similarly in similar contexts, within these larger classes. For instance, English /p/, /t/ and /k/ aspirate at the beginnings of words. All three may also be glottally reinforced at the ends of words. All three are unaspirated after /s/; and no other English phoneme has the same range of allophones, in the same environments. In feature terms, although /p/, /t/, /k/ differ in place of articulation, all three are obstruent consonants, and within this class, are [– voice, – nasal, – continuant]. A group of phonemes which show the same behaviour in the same contexts, and which share the same features, constitute a **natural class**. More formally, a natural class of phonemes can be identified using a smaller number of features than any individual member of that class. As (12) shows, the class of voiceless plosives, /p/, /t/ and /k/, can be defined uniquely using only three features. If we subtract one of the plosives, we need more features, since we must then specify the place of articulation, and the same is true in defining a single plosive unambiguously.

(12)

/p t k/	/p t/	/p/
– voice	– voice	– voice
– nasal	– nasal	– nasal
– continuant	– continuant	– continuant
	+ anterior	+ anterior
		– coronal

Phonological rules very typically affect natural classes of phonemes. For example, medial voicing of /f/ to [v] in Old English, discussed briefly in Chapter 2, affected not only that labial fricative, but also the other members of the voiceless fricative class, /s/ and /θ/. If we wrote a rule for /f/ alone, it would have to exclude the other voiceless fricatives, so that the input would have to include [+ anterior, – coronal]; however, the more general fricative voicing rule in (13) requires fewer features to characterise the input, as we would expect when a natural class is involved.

(13) [+ continuant, + consonantal, – voice] → [+ voice] / [+ voice] _____ [+ voice]

This rule also neatly captures the connection between the process and its conditioning context, and therefore shows the motivation for the development: the fricatives, which are generally voiceless, become voiced between voiced sounds. This will often mean between vowels, as in *heofon* 'heaven' and *hlaford* 'lord' ; but it may also mean between a vowel and a voiced consonant, as in *hæfde* 'had'. If voicing takes place between voiced sounds, instead of having to switch off vocal fold vibration for a single segment and then switch it back on again, the vocal folds can continue vibrating through the whole sequence. Voicing the fricative in this context is therefore another example of assimilation, where one sound is influenced by another close to it in the utterance.

4.6 A warning note on phonological rules

Paradoxically, phonological rules are *not* rules in one of the common, everyday English meanings of that word; they are not regulations, which spell out what *must* happen. Instead, they are formal descriptions of what *does* happen, for speakers of a particular variety of a particular language at a particular time. Some phonological rules may also state what *sometimes* happens, with the outcome depending on issues outside phonology and phonetics altogether. For example, if you say *hamster* slowly and carefully, it will sound like [hamstə] (or [hamstəɹ], depending on

whether you 'drop your [r]s' in this context or not: we return to this issue in Chapter 8, and to vowels in Chapters 6 and 7, so don't worry too much about the vowel symbols for now). If you say the word quickly several times, you will produce something closer to your normal, casual speech pronunciation, and it is highly likely that there will be an extra consonant in there, giving [hampstə] (or [hampstəɹ] instead. As the rate of speech increases, adjacent sounds influence one another even more because the same complex articulations are taking place in even less time. Here, the articulators are moving from a voiced nasal stop [m] to a voiceless alveolar fricative [s], so that almost every possible property has to change all at once (apart from the source and direction of the airstream, which all English sounds have in common anyway). In fast speech, not all these transitions may be perfectly coordinated: the extraneous [p] appears when the speaker has succeeded in switching off voicing, and raising the velum to cut off airflow through the nose, but has not yet shifted from stop to fricative, or from labial to alveolar. There is consequently a brief moment when the features appropriate for [p] are all in place, before the place and manner of articulation are also altered to produce the intended [s]. Listing the feature composition of [m], [p] and [s], as in (14), reveals that [p] shares half the features of each of [m] and [s], so it is entirely understandable that [p] should arise from this casual speech process.

(14)

[m]	[p]	[s]
+ voice	– voice	– voice
– continuant	–continuant	+ continuant
+ nasal	– nasal	– nasal
+ anterior	+ anterior	+ anterior
– coronal	– coronal	+ coronal

A very similar process arises in words like *mince* and *prince*, which can become **homophonous** (that is, identical in sound) to *mints* and *prints* in fast speech. Here, the transition is from [n], a voiced alveolar nasal stop, to [s], a voiceless alveolar oral fricative, and the half-way house is [t], which this time shares its place of articulation with both neighbours, but differs from [n] in voicing and nasality, and from [s] in manner of articulation. In both *hamster* and *mince/prince*, however, the casual speech process creating the extra medial plosive is an optional one. This does not mean that it is consciously controlled by the speaker, but the formality of the situation, the identity of the person you are talking to and even the topic of conversation can determine how likely these casual speech processes are. In a formal style – for instance, asking a question after a lecture or having a job interview – you are far more likely to

make a careful transition from nasal to fricative in words of this kind, while informal style – for instance, chatting to friends over a coffee – is much more conducive to intrusion of the 'extra' plosive. These issues of formality and social context, which are the domain of **sociolinguistics**, are not directly within the scope of phonetics and phonology, although they clearly influence speakers' phonetic and phonological behaviour.

If speakers of English keep pronouncing [hampstə] and [pɹɪnts] *prince* in sufficient numbers, and in enough contexts, these pronunciations may become the norm, extending even into formal circumstances, and being learned as the canonical pronunciation by children (this is exactly what has already happened in *bramble* and the name *Dempster*). Even now, children (and occasionally adults too) spell *hamster* as *hampster*, showing that they may believe this to be the 'correct' form. Developments from casual to formal pronunciation are one source of **language change**, and mean that phonological rules and systems can vary between languages and can change over time. For instance, as we saw earlier, modern English has a phonemic contrast between /f/ and /v/, but in Old English, [f] and [v] were allophones of a single phoneme, /f/.

No feature system is perfect; however carefully designed a system is, it will not in itself explain all the properties of a particular language, which may sometimes reflect quirks and idiosyncrasies that have arisen during the history of that system. Equally, some developments of one sound into another are perfectly natural in a particular context, but the feature system fails to express this transparently because it is so closely linked to articulation. Voiceless sonorants are rare simply because they are rather difficult to hear, and the best possible features, if they lack an acoustic aspect, will fail to reflect that fact. Just as we are all speakers and hearers, so sounds have both articulatory and acoustic components: sometimes one of these is relevant in determining allophonic variation, sometimes the other – and sometimes both. For instance, it is quite common cross-linguistically for labial sounds, like [p] or [f], to turn into velar ones, like [k] or [x], and vice versa: in words like *cough*, the <gh> originally signalled a velar fricative, [x], which has historically become [f]. In articulatory terms, labials and velars have little in common: indeed, they are produced almost at opposite ends of the vocal tract. We can at least use [– coronal] for the composite set of labials and velars, but this would also, counterfactually, include glottals; and in any case, negative definitions are of limited usefulness (why should two classes of consonants work together because both do *not* involve the front of the tongue?). However, acoustic analysis reveals a striking similarity in the profile of energy making up labials and velars, so that the two categories are heard as more similar than we might expect. In addition, the vowel

in *cough* is pronounced with rounded lips; if this lip-rounding is carried on just a little too long, so that it affects the following consonant, the articulators will also be in a position appropriate for [f]. In this case, articulatory and acoustic factors have worked together to change the [x] of earlier English to the [f] we find today. Most phonological feature systems are based uniquely either on articulatory or on acoustic factors; either way, we would miss part of the story in a case like this.

However, adopting a feature system of one sort or another is invaluable in formalising phonological rules; in sharpening up our thinking when formulating such rules; in seeing segments like [p] or [s] as shorthand for a bundle of properties, rather than as mysterious, self-contained units; and in trying to explain why certain sounds and groups of sounds behave in the way they do. Despite some limitations, the feature system outlined above will therefore be used in the rest of this book.

Exercises and topics for discussion

1. In Exercise 2 of Chapter 2, you were presented with the following pronunciations, from a learner of English as a second language:

that [dat]	dog [dɒg]	head [hɛd]
leather [lɛðə]	leader [liːðə]	
sing [ʃɪŋ]	sat [sat]	loss [lɒs]
fish [fɪʃ]	miss [mɪʃ]	push [pus]

Write rules accounting for the distribution of the allophones of /d/ (= [d] and [ð]), and /s/ (= [s] and [ʃ]), using binary features. Note that the symbol for a word boundary is #; so if a process takes place at the beginning of a word, we write / # _____as the environment, and likewise /_____# for the end.

2. The following data appeared in Exercise 4 of Chapter 2. State the distribution of the voiced and voiceless allophones of /b/, /z/ and /g/ as economically as possible. How many rules do you need?

pronunciation	*meaning*
[bim]	'rug'
[bin]	'head'
[zak]	'parrot'
[zip]	'ostrich'
[azaŋ]	'to speak'
[obas]	'to throw'
[mohis]	'to eat'
[zigah]	'to sing'

[gik]	'ant'
[gah]	'a song'
[nagok]	'to sting'
[habis]	'to drink'

3. Produce feature matrices, including *all* the features introduced in this chapter, for the following English sounds: /l r p d s θ ŋ ʤ w/.

4. In your matrices for Exercise 3, put brackets round the redundant features: that is, those which do not have to be included for the segment to be uniquely identified. In some cases, you may notice general patterns; if so, state these as redundancy rules.

5. In each of the following lists, the sounds involved constitute a natural class for English, except that there is one odd sound. Find the odd one out in each case, and define the natural class using features.

(a) [l ɹ b j w]
(b) [p g k ð d b t]
(c) [k n s t l d ɹ z]

6. Sequences of consonants, such as those at the beginning of *train*, *stray*, *fly*, are known as consonant clusters. In two-consonant clusters which have [s] as the first consonant, what can the second consonant be? Can these consonants be grouped into a natural class or several natural classes? In three-consonant clusters which have [s] as the first consonant, what can the second and third consonants be? Can these consonants be grouped into a natural class or several natural classes?

7. Find some definitions of explanation. What does it mean to explain something, and how does the scientific method help us test whether something is a good explanation?

Recommendations for reading

Giegerich (1992) provides a clear and detailed overview of distinctive features of the sort introduced here, with special emphasis on English. Consideration of features and feature theory, and the mechanics of rule-writing, is also included in most recent general textbooks on phonology, including Carr and Montreuil (2013), Hayes (2008), Odden (2013) and Zsiga (2013). Lass (1984) provides a particularly helpful critique of some elements of feature theory, including binarity and the emphasis on articulation. The features used here are ultimately derived from Chomsky and Halle (1968), although this is not an easy book for beginners and should be approached with caution!

5 Criteria for contrast: the phoneme system

5.1 Minimal pairs and beyond

The main business of the last chapter was the construction of rules stating allophonic distributions. These rules, in turn, were based on the identification of phonemes, for which we relied on the two fundamental tools of predictability of occurrence and invariance of meaning: if two sounds occur in non-overlapping, predictable sets of contexts, and if substituting one for the other does not make a semantic difference (that is, a difference in meaning), then those two sounds must necessarily be allophones of a single phoneme. On the other hand, if those two sounds can occur in the same environments, and exchanging them produces different words, they belong to different phonemes. This diagnosis is confirmed by the **commutation test**, which involves putting different sounds in a particular context, to see if minimal pairs result. An example for English consonants is given in (1).

(1) Context: *-at*

pat	/p/
bat	/b/
mat	/m/
fat	/f/
vat	/v/
that	/ð/
tat	/t/
sat	/s/
gnat	/n/
rat	/r/
chat	/tʃ/
cat	/k/
hat	/h/

Accidental gaps in the English vocabulary mean that no lexical item **jat*, or **lat*, or **dat* is available. However, minimal pairs can be found in slightly different contexts to establish /ʤ/, /l/, /d/ and so on as consonant phonemes of English: hence, we find *sip*, *zip*, *dip*, *tip*, *lip*, or *cot*, *dot*, *shot*, *jot*. Considering a range of contexts provides evidence for all the consonant phonemes of English, which are plotted on a chart in (2): the voiceless labial–velar and velar fricatives /ʍ/ and /x/ appear in brackets because they are found only in some varieties of English.

(2)

	labial	labio-dental	dental	alveolar	post alveolar	palatal	velar	glottal
plosive	p b			t d			k g	
nasal	m			n			ŋ	
affricate					tʃ ʤ			
fricative	(ʍ)	f v	θ ð	s z	ʃ ʒ		(x)	h
approximant	w			l r		j		

Minimal pairs and the commutation test alone will generally suffice to establish the members of a phoneme system: according to Charles Hockett, a mid-twentieth-century American linguist who was very influential in the development of phoneme theory, 'Minimal pairs are the analyst's delight, and he seeks them whenever there is any hope of finding them.' However, there are some circumstances where phonemes cannot be established by minimal pairs alone. To establish a phoneme, we may need additional, supplementary criteria; or we may have to invoke phonological units above and beyond the phoneme. In the sections below, we turn to these special cases, and also to a consideration of the phoneme system itself, and its relevance and reality for language users.

5.2 Phonetic similarity and defective distributions

5.2.1 Phonetic similarity

In the vast majority of cases, applying our phoneme tests will provide results which are in keeping with native speakers' intuitions about which sounds belong together. Very often, as we have seen, allophones of a single phoneme will not, in fact, be distinguishable for a native speaker at all, without a certain amount of phonetic training. However, there are some cases where sticking to those tests too rigidly can have quite the opposite consequence, coming up with results which do not agree with speakers' intuitions at all.

One of the best-known and most obvious examples of this kind in English involves [h] and [ŋ]. The minimal pairs in (1) above show that

[h] contrasts with a number of English consonant phonemes word-initially, but there is no minimal pair with [ŋ]. Conversely, in word-final position, it is straightforward to find contrasts for [ŋ], as in *rang*, *ran*, *ram*, *rat*, *rack*, *rag*, *rap*, *rash*, but there is no equivalent minimal pair with [h]. In the last chapter, we tried to go beyond just making lists of words when we observe particular phonological behaviour, to figure out what the underlying generalisation, or rule, might be. In this case, when we attempt to figure out a general pattern, we note that [h] appears only before a stressed vowel, at the beginning of a stressed syllable (see Chapter 9), as in *hat*, *ahead*, *apprehensive*, *vehicular*. If you compare *vehicular* with *vehicle*, both have <h> appearing in the spelling, but there is a [h] sound in the first word and not in the second. This is a good test case for our generalisation because the stress in *vehicular* falls on the second vowel, and [h] does appear; whereas in *vehicle* it falls on the first vowel, before the <h>, and there is no [h]. On the other hand, [ŋ] is not permissible syllable-initially: it can appear only at the end of a syllable, either alone, as in *rang*, *hanger*, or before a velar plosive, either [k] or [g], as in *rink*, *stinker*, *finger*, *stronger*.

What this means, in purely technical terms, is that [h] and [ŋ] are in complementary distribution. One appears only syllable-initially, while the other never does; and in consequence, there is no possible minimal pair which will distinguish the two. If we take only predictability of occurrence and invariance of meaning into account, we will be forced into setting up a phoneme which we might symbolise as /ɧ/, which is realised as [h] in one set of environments, and [ŋ] in another.

It is not going to be easy to convince native speakers of English that this is the right solution. Previously in this book, we have identified cases where native speakers have to work hard on bringing previously subconscious intuitions to the surface. That is not the problem here – instead, our intuitions suggest strongly that [h] and [ŋ] are entirely separate and unrelated, and are really bad candidates to be allophones of the same phoneme. There is some evidence in favour of that view, too. First, although we have seen that the English spelling system is not absolutely and reliably phonemic, different spellings are never consistently used for different allophones of a single phoneme, as would be the case for [h] <h> and [ŋ] <ng> / <nk>. Second, native speakers can easily tell the two sounds apart, which would not be true, for instance, of clear and dark variants of /l/, or aspirated and unaspirated allophones of /p/.

Our core criteria for allophony, predictability of occurrence and invariance of meaning, very generally give the right results, so it is probably unwise to reject them because of one exceptional case, or

indeed to mess about with them much. However, we can add a further condition on determining allophony, which applies both to the 'normal' cases and to the situation of [h] and [ŋ].

In brief, this additional criterion for allophony states that all the allophones of a phoneme must be **phonetically similar**. Using distinctive features allows this rather vague notion to be quantified, but there is still no straightforward equation for determining what counts as sufficiently phonetically similar and what does not. We cannot draw a dividing line which will be universally applicable: for instance, requiring that the allophones of a single phoneme must be different by no more than three features (or some other specific number). However, we might at least hypothesise that two sounds are highly unlikely to be allophones of the same phoneme if the number of contrasting feature values is higher than the number of shared ones. For [h] and [ŋ], this produces an unambiguous result: both are consonants but there the similarity ends. [h] is a voiceless fricative, while [ŋ] is a voiced stop; [h] is oral, while [ŋ] is nasal; [h] is glottal, while [ŋ] is velar; [h] is an obstruent, while [ŋ] is a sonorant. On almost every parameter which could distinguish the two, they are in fact distinct. Rather than setting up a single phoneme with two such bizarrely different realisations, invoking **phonetic similarity** allows us to justify regarding /h/ and /ŋ/ as distinct phonemes, despite the lack of minimal pairs.

Phonetic similarity also helps in cases where a single allophone could theoretically be assigned to more than one possible phoneme, a situation commonly encountered when members of a natural class of phonemes undergo the same rule. For instance, we have seen that in Old English, the voiceless fricatives /f θ s/ became voiced between voiced sounds. It follows that all the voiced fricative allophones were in complementary distribution with all the voiceless ones, since [v ð z] could appear only between voiced sounds, and [f θ s] could appear only elsewhere. Purely on the grounds of predictability of occurrence and invariance of meaning, there is no guidance on which of these we should assign to which phoneme: in theory we could set up one phoneme with allophones [f] and [z], a second with [θ] and [v], and a third with [s] and [ð], if all that matters is for one allophone to be voiceless and the other to be voiced. We might also feel that this solution would make Old English speakers turn in their graves: their intuitions are highly likely to have favoured grouping the two labial sounds together, the two dentals and the two alveolars. Again, this intuitive solution is supported by a requirement of phonetic similarity, this time involving the assignment of the two most similar allophones, those sharing a place of articulation, to a single phoneme in each case. In modern English, a precisely similar

problem and solution arise with the voiceless stop phonemes and their aspirated and unaspirated allophones.

5.2.2 Defective distribution

Of course, if /h/ and /ŋ/ were entirely normal phonemes, we would not have got into the problematic situation of regarding them as potential realisations of the same phoneme in the first place. In the normal case, we would expect some realisation of every phoneme in a language to appear in every possible environment: initially, medially and finally in the word, and also before and after other consonants in clusters. There are, however, two types of exception to this sweeping generalisation.

First, there are the **phonotactic constraints** of a language, which spell out which combinations of sounds are permissible. In English, as we saw in the exercises to the last chapter, only rather few three-consonant clusters are allowed, and the first consonant in the sequence must always be /s/. Nasal stops in English can cluster only with oral stops sharing the same place of articulation (unless the oral stop marks the past tense, as in *harmed*); hence *lamp*, *clamber*, *plant*, *land*, *rink*, *finger* are fine in English, but not **lamk*, **lanp*, *[laŋt]. Even more specifically, /v/ and /m/ cannot be the first member of *any* initial consonant cluster, although both can occur on their own initially, medially and finally. As for /h/, it never clusters at all (although, again, this was possible in Old English, where there are forms like *hring* 'ring', *hwæl* 'whale', where linguists believe the orthographic <h> was most plausibly pronounced as [h]). Phonotactic statements of this kind restrict the length and composition of permissible clusters, on a language-specific (and period-specific) basis. By definition, because this can vary across time and between languages, it is not about what combinations of sounds it is physically possible for us to pronounce, but what a specific language system allows.

Second, some phonemes have **defective distributions**: they not only are restricted in the combinations of consonants they can participate in, but are simply absent from some positions in the word or syllable. English /h/ and /ŋ/ both fall into this category, since the former is available only syllable-initially, and the latter only syllable-finally. It is because those defective distributions are mutually exclusive that English [h] and [ŋ] are in complementary distribution.

Phonemes with defective distributions like this are relatively rare. Sometimes, their defectiveness follows from their historical development: [ŋ] is derived historically from a sequence of [nk] or [ng], where the nasal assimilated to the place of articulation of the following consonant; and since initial clusters of nasal plus stop are not permissible

either in earlier English or today, [ŋ] was never allowed word-initially. Similarly, a chain of sound changes leading to the weakening and loss of /h/ before consonants and word-finally has left it 'stranded' only syllable-initially before a stressed vowel; the acoustic properties of [h] also make it particularly difficult to hear except in this context. We find another case of defective distribution in **non-rhotic** varieties of English, where /r/ is pronounced before a vowel, but not before a consonant or a pause, meaning that [ɹ] appears in *red*, *bread*, *very*, but not in *dark*, *car*.

Often, though not always, defectively distributed phonemes are relatively new arrivals. For instance, the newest member of the English consonant system is probably /ʒ/, which developed in Middle and Early Modern English from sequences of [zj] in *measure*, *treasure*, and from French loans such as *rouge*, *beige*: the [zj] sequence does not appear word-initially, and although French does allow [ʒ] here, as in *jamais* 'never', no words with that structure happen to have been borrowed into English, leading to an apparent prohibition on word-initial English [ʒ], which is really accidental and may change in time (as suggested by recent loans like *gîte*).

5.3 Free variation

The previous section dealt with an exception to the criterion of predictability of occurrence: two sounds which are in complementary distribution are normally assigned to a single phoneme, but where this would conflict with phonetic similarity (and with native speakers' intuitions), it is appropriate to set up two distinct phonemes. It is then important for us to seek an alternative explanation for the complementarity, and often that will involve defective distribution. In this section, we turn to an exception to the other main criterion for allophony, invariance of meaning.

When one sound is substituted for another and no meaning difference arises, we are usually dealing with two allophones of the same phoneme. An English speaker who produces a dark [ɬ] in initial position may be regarded as having an unfamiliar accent or some sort of minor speech impediment, but there is little danger that *light* pronounced with initial [ɬ] is going to be mistaken for another word entirely.

However, there is sometimes more than one possible pronunciation in the same word or context; this is known as **free variation**, and raises two possible theoretical problems. First, we require complementary distribution to allow us to assign two sounds to a single phoneme; and yet a speaker of Scottish English, for example, may sometimes produce a tapped allophone of /r/ in *very*, and on other occasions,

an approximant. There are no possible minimal pairs for tapped [ɾ] versus approximant [ɹ]. In addition, an allophonic rule can be written to capture the normal state of affairs, specifying that the tap appears intervocalically, as in *very*, and the approximant word-initially and word-finally. Where we find apparent exceptions, they are usually sociolinguistically motivated: perhaps the Scot is talking to an English English speaker, who will typically not use the tap, and is subconsciously accommodating her speech towards that of her **interlocutor**; perhaps she is trying to sound less like a Scot or less like her mother; perhaps she is in a very formal situation, where more 'standard' pronunciations are favoured. Clearly, such **stylistic variation** is not free in sociolinguistic terms, though it is known as free variation phonologically because there is no watertight phonological or phonetic context determining the appearance of one allophone rather than the other. The variable appearance of a glottal stop [ʔ] or [t] medially in *butter*, for instance, would fall into the same category, and the frequency of occurrence of the two variants would be subject to explanation in the same sociolinguistic terms.

The second type of free variation is the converse of the first and potentially more problematic. Here, instead of finding two allophones of a single phoneme in the same context, violating complementary distribution, we see two sounds which, on other criteria, belong to different phonemes, failing to make the meaning difference we expect. Sometimes the difference can be explained in geographical terms: for instance, Standard Southern British English speakers say *tomahto* and North American speakers typically say *tomayto*, producing the same lexical item with consistently different vowels. Those two vowels, [ɑ] and [eɪ] respectively, none the less contrast for speakers of both accents, although, as we shall see in more detail in the next three chapters, they appear in different sets of words. For example, a Standard Southern British English speaker will have a relevant minimal pair in *grass* [gɹɑːs] and *grace* [gɹeɪs]. On the other hand, a General American speaker will have [æ] in *grass* – but in that accent we can still establish the same phonemic contrast using different minimal pairs, such as *lot* [lɑt] and *late* [leɪt], or *odd* [ɑːd] and *aid* [eɪd].The two different pronunciations of *tomato* are therefore simply characteristic of speakers from different areas, and do not tell us anything about the different phonological systems of those accents (though they might suggest some particular areas for us to test in figuring out which phonemes speakers of those different accents are likely to have).

In other cases, the same speaker uses different phonemes in the same word on different occasions of utterance. Some speakers consist-

ently pronounce *economic* with the [ɛ] of *elephant*, and others with the [i] of *eat*; but many more produce sometimes one, and sometimes the other. And yet there are plenty of minimal pairs to establish a contrast between /ɛ/ in *pet*, *hell* or *bed*, and /i/ in *peat*, *heal* or *bead*, outside that single problematic lexical item. The same is true for *either* and *neither*, which some speakers produce with [i], others with the [aɪ] of *high*, and still others with variation between the two. Again, there is no question that /i/ and /aɪ/ constitute different phonemes, with minimal pairs including *he* and *high*, *heed* and *hide*, or *steal* and *stile*. This is theoretically problematic: two sounds which, on all other criteria, belong to different phonemes are none the less found in the same context without making a meaning difference, directly contravening invariance of meaning. However, such examples tend to be few and far between, and involve only single lexical items; and again, the explanation is typically sociolinguistic. These pronunciations often develop in different geographical areas, then one spreads into the territory of the other. One variant may become stigmatised and the other fashionable; but this stylistic variation can disappear over time, leaving two rather neutral alternatives. In such cases, the resulting variation can be truly free; but as long as the phonemes involved can be identified on the basis of minimal pairs elsewhere, these can simply be regarded as one-off exceptions. They are parallel to cases where a speaker stores two words, from the same historical source but each now appropriate in a different dialect, like the Scot who uses *kirk* with fellow Scots, but otherwise *church*; or indeed, to the use of historically unrelated synonyms like *sofa* and *settee*.

5.4 Neutralisation

This second type of free variation can also be seen as constituting the tip of a much larger theoretical iceberg. In the [ɛ]*conomic* – [i]*conomic* cases, two otherwise contrastive sounds are both possible in a single word. The contrast between two phonemes may also be interrupted more systematically, in a particular phonological context; in this case, rather than the two phonemes being equally possible alternatives, we find some form intermediate between the two.

One example involves the voiceless and voiced English plosives. These seem to contrast in all possible positions in the word: minimal pairs can be found for /t/ and /d/ initially, as in *till* versus *dill*; medially, in *matter* versus *madder*; finally, as in *lit* versus *lid*; and in consonant clusters, as in *trill*, *font* versus *drill*, *fond* – and the same is true for the labial and velar plosives. However, no contrast is possible in an initial cluster, after /s/: *spill*, *still* and *skill* are perfectly normal English words, but there

is no **sbill*, **sdill* or **sgill*. This phenomenon is known as **neutralisation** because the otherwise robust and regular contrast between two sets of phonemes is neutralised, or suspended, in a particular context – in this case, after /s/.

In fact, matters are slightly more complicated yet. Although the spelling might suggest that the sounds found after /s/ are realisations of the voiceless stops, we have already seen that, in one crucial respect, they do not behave as we would expect voiceless stops to behave at the beginning of a word: that is, they are not aspirated. On the other hand, they do not behave like realisations of /b d ɡ/ either, since they are not voiced. That is to say, the whatever-it-is that appears after /s/ has something in common with both /p/ and /b/, or /t/ and /d/, or /k/ and /ɡ/, being an oral plosive of a particular place of articulation. But in another sense, it is neither one nor the other, since it lacks aspiration, which is the distinctive phonetic characteristic of an initial voiceless stop, and it also lacks voicing, the main signature of an initial voiced one.

There are two further pieces of evidence, one practical and the other theoretical, in support of the in-between status of the sounds following /s/. If a recording is made of *spill*, *still*, *skill*, then the [s] is erased, and the remaining portion is played to native speakers of English, they find it difficult to tell whether the words are *pill*, *till*, *kill*, or *bill*, *dill*, *gill*. Furthermore, we might argue that a /t/ is a /t/ precisely because it contrasts with /d/ – phonemes are defined by the other phonemes in the system they belong to. To take an analogy, again from written English, children learning to write often have difficulty in placing the loop for a <b> right at the base of the upstroke, and it sometimes appears a little higher than in adult writing – which is fine, as long as it doesn't migrate so high as to be mistaken for a <p>, where the loop is meant to appear at the top. What matters is maintaining distinctness between the two; and the same is true in speech, where a realisation of /d/, for instance, can be more or less voiced in different circumstances, as long as it does not become confused with realisations of /t/. In a case where the two cannot possibly contrast, as after /s/ in English, /t/ cannot be defined as it normally is, precisely because, here alone, it does not contrast with /d/. It follows again that the voiceless, unaspirated sound after /s/ in *still* cannot be a normal allophone of /t/.

Phonologists call the unit found in a position of neutralisation an **archiphoneme**. The archiphoneme is symbolised by a capital letter, and is composed of all the properties which the neutralised phonemes have in common, but not the properties which typically distinguish them, as shown in (3).

(3) /T/

$$\begin{bmatrix} +\text{ oral} \\ +\text{ stop} \\ +\text{ alveolar} \\ 0\text{ voice} \end{bmatrix}$$

The archiphoneme /T/ is proposed where the normal opposition between /t/ and /d/ is suspended, so neither /t/ nor /d/ is a possibility. /T/ is an intermediate form, sharing the feature values common to /t/ and /d/, but with no value possible for voicing, since there is no contrast of voiced and voiceless in this context. Neutralisation is therefore the defective distribution of a class of phonemes, involving a particular phonological context (rather than a single word, as in the *either/neither* case).

There are many other cases of neutralisation in English, but for the time being, we shall consider only one. In many varieties of English, the normal contrasts between vowels break down before /r/. To take one example, British English speakers will tend to maintain a three-way contrast of *Mary*, *merry* and *marry*, whereas many speakers of General American suspend the usual contrast of /eɪ/, /ɛ/ and /æ/, as established by minimal triplets like *sail*, *sell* and *Sal* or *pain*, *pen* and *pan*, in this environment, making *Mary*, *merry* and *marry* **homophones**. Although the vowel found here often sounds like [ɛ], this cannot be regarded as a normal realisation of /ɛ/, since /ɛ/ is a phoneme which contrasts with /eɪ/ and /æ/, and that contrast is not possible here. We can, then, set up an archiphoneme /E/ in just those cases before /r/, again signalling that a contrast otherwise found in all environments fails to manifest itself in this particular context.

5.5 Phonology and morphology

The archiphoneme is useful in signalling cases where oppositions are suspended, but has two problems. First, a representation like /mEri/ is three ways ambiguous for a General American speaker, since it could be *Mary*, *merry* or *marry*: this might, in fact, be quite appropriate because the three sound the same at the phonetic level, but it would be helpful to have a way of identifying, somewhere in the phonology, just which is which. Second, in some cases that look rather like neutralisation, the archiphoneme cannot really be invoked. For instance, the English regular plural ending on nouns is marked by an <s> spelling, which means more than one thing phonologically: in *cats*, *caps*, *chiefs*, where the final sound of the **stem** is voiceless, the plural **suffix** is realised as voiceless [s]; in *dogs*, *heads*, *pans*, *hooves*, *dolls*, *eyes*, where the final sound

of the stem is voiced, the plural suffix is also voiced [z]; and finally, in cases where the stem ends in a sibilant – namely, [s z ʃ ʒ tʃ ʤ] – a vowel is inserted for reasons of ease of articulation, since sequences of two sibilants are not allowed in English, giving *horses*, *bushes*, *churches* with [əz] (or [ɪz]). This might, on the face of it, seem to be a purely phonetic matter, involving assimilation of the plural ending to the last segment of the stem, but there is more to it than that. If voicing assimilation were necessary in final clusters, forms like *hence*, *false*, *loss* would not be possible words of English, since they involve final sequences of a voiced consonant or vowel, followed by voiceless [s]. What matters, in the plural cases, is what that final sound is doing: the cases where it is functioning as a suffix indicating plurality behave differently from those in which it is part of the stem.

Similarly, singular and plural noun forms like *leaf – leaves*, *hoof – hooves*, *knife – knives* might initially appear to represent a case of neutralisation, where the usual contrast between /f/ and /v/ is suspended before /z/ (recall that this <s> is pronounced as a voiced sound). However, whatever is going on here cannot be ascribed straightforwardly to the phonetic context, since there are also cases, as in (4), where either the singular and plural both have voiceless fricatives, or both have voiced ones.

(4) chief – chiefs roof – roofs
hive – hives stove – stoves

Neutralisation always involves a *regular* suspension of contrast in a particular phonetic context. Here, we are dealing with an **alternation** between two phonemes, /f/ and /v/, in a particular grammatical context. *Leaf* has a final /f/, and *leaves* a medial /v/ – there is no intermediate, archiphonemic form here. The determining factor is neither phonetic nor phonological: it is simply a fact about certain English nouns (including *leaf*, *hoof*, *knife*, *life*, *wife*, but excluding *chief*, *roof*, *hive*, *stove*) that they have /f/ in some forms, notably the singular, and /v/ in others, notably the plural.

Such alternation between phonemes, depending on grammatical facts, is very common. For instance, before certain suffixes, the shape of the final consonant of a stem may change: hence /k/, /s/ and /ʃ/, otherwise three distinct phonemes as in *kin*, *sin* and *shin*, occur predictably depending on whether the stem *electric* stands alone, or has a following suffix – see (5). Similar alternations in (5) involve *president* and other words derived from it. English speakers can perfectly well pronounce [k] before the sound sequence [ɪti], as in *kitty*, or [t] before [i], as in *pretty* or *Betty* : the fact that these sounds do not appear in *electricity* or

presidency, where we find [s] instead, reflects the function of *-ity* and *-y* as suffixes in those cases.

(5)

electri[k]	electri[s]ity	electri[ʃ]ian
presiden[t]	presiden[s]y	presiden[ʃ]ial

5.6 Rules and constraints

Most interactions of phonology with **morphology**, the part of linguistics which studies how words are made up of meaningful units, like stems and suffixes, are beyond the scope of this book, although the overlap between the two areas, commonly known as **morphophonemics**, has been extremely important in the development of phonological theory since the 1960s. Indeed, the difference between phonetically conditioned allophony and neutralisation, which involve only phonetics and phonology, and cases where we also need to invoke morphological issues, is central to one of the most important current debates in phonology.

In the last chapter, generalisations about the distribution of allophones were stated in terms of rules, the assumption being that children learn these rules as they learn their native language, and start to see that forms fall into principled categories and behave according to regular patterns. Rule-based theories also include **constraints** – static, universal or language-specific statements of possibility in terms of segment shapes or combinations: these include both the redundancy rules discussed in Chapter 4, and phonotactic constraints. However, since the mid-1990s, an alternative approach has developed, as part of the phonological theory called **Optimality Theory**. Phonologists working in Optimality Theory do not write rules; they express *all* phonological generalisations using constraints. Instead of saying that a particular underlying or starting form changes into something else in a particular environment, which is what rules do, constraints set out what must happen, or what cannot happen, as in the examples in (6), which express regularities we have already identified for English.

(6)

ASPIRATION:	Voiceless stops are aspirated syllable-initially
*s [b d g]	There are no sequences of [s] plus a voiced stop

In most versions of Optimality Theory, all the constraints are assumed to be universal and **innate**: children are born with the constraints already in place, so all they have to do is work out how important each constraint is in the structure of the language they are learning, and produce a ranking accordingly. For an English-learning child, the

two constraints in (6) must be quite important because it is true that voiceless stops *are* aspirated at the beginnings of syllables, and there *are* no sequences of [s] plus a voiced stop; consequently, we conclude that English speakers must rank these two constraints high. However, for children learning a language *without* aspiration, or *with* clusters of [s] plus voiced stop, these constraints will not predict or match the linguistic facts they hear; they must therefore be ranked low down in the list, so they have no obvious effect. On the other hand, a child learning German, say, would have to pay special attention to a constraint banning voiced stops from the ends of words, since this is a position of neutralisation in German, permitting only voiceless stops; but a child learning English will rank that constraint very low, as words like *hand*, *lob*, *fog* show that this constraint does not surface in the phonetic facts of English.

Constraints of this sort seem to work quite well when we are dealing only with phonetic and phonological factors, and may be appropriate alternatives to rules in the clearly conditioned types of allophonic variation we have considered, and for neutralisation. However, they are not quite so helpful when it comes to the interaction of morphology and phonology, where alternations often are not clearly universally motivated, but involve facts about the structure and lexical items of that specific language alone. Analysing such cases using Optimality Theory may require a highly complex system of constraints, as we will have to accept that all the possible constraints for anything that could ever happen in any language are already there in every child's brain at birth. These issues are likely to lead to further debate in phonology in future years.

5.7 The phoneme system

The introduction of features reveals phonemes, not as the ultimate, smallest unit of the phonology, but as cover-symbols for a range of properties (remember our analogy of a phoneme being a black box labelled with an IPA symbol – to understand more about it, we need to be able to see the contents). However, it also permits a higher-level perspective, exploring natural classes, and the motivation for similar patterns of behaviour in groups of phonemes. These groupings can also be considered at the level of the phoneme system as a whole.

Just as the phoneme, although an abstract unit, seems to have some degree of reality for native speakers and to shape their perceptions, so the phoneme system, at an even higher level of abstraction, also reflects

speakers' intuitions and may shape the historical development of a language.

For one thing, setting out a phoneme system can be extremely helpful to a phonologist in deciding which phonemes to propose for particular groups of allophones, and in checking that her decisions accord with native speakers' intuitions. For instance, some phonologists consider the English velar nasal as a phonemic sequence of /ŋg/ and /nk/, as it certainly was historically, even in cases where no [g] or [k] now appears phonetically: hence, *hang* would be analysed as /haŋg/, with the alveolar nasal having a velar allophone before velar plosives, and the velar plosive subsequently being deleted after a velar nasal at the ends of syllables. However, native speakers find the three nasals [m], [n] and [ŋ] easy to distinguish, although they may well not easily perceive cases which are more clearly allophones of /n/, such as the labiodental nasal [ɱ] in *unfortunate*. Their perception of /ŋ/ as separate from /n/ may be encouraged by the shape of the stop system in general, where voiced and voiceless plosives and a distinctive nasal stop go together at the labial /b p m/ and alveolar /d t n/ places of articulation, with /g k ŋ/ providing a parallel set of velars.

Similarly, consider the English affricates [tʃ] and [ʤ], in *church* and *judge*. These could be phonemicised either as single units (albeit single units with two phases: recall that affricates have a stop phase, followed by a brief fricative phase as the stop is gradually released), or as clusters of consonants. In deciding which option to adopt, phonologists try to establish how the affricates behave. Do they follow the pattern of single phonemes in English, or do they act like clusters? In English, initial clusters of plosive plus fricative are extremely rare, and tend to be restricted to words obviously borrowed from other languages, like *psittacosis* or *dvandva* (the latter a Sanskrit term for a type of **compound word**). However, the affricates occur quite freely both initially and finally (where such clusters are more common), making them seem less like clusters and more like single units. Phonetically, affricates are also typically shorter than a sequence of stop plus fricative, so that in *why choose*, the fricative component in particular is significantly shorter than in *white shoes* (say them to yourself if you are not convinced about this). If the voiceless affricate were aspirated word-initially, or glottally reinforced word-finally, there would be additional good reasons for seeing this as essentially a stop, rather than a sequence.

Phoneme systems often seem to have the shape they do for essentially phonetic reasons. For instance, if there are too many distinctive sounds with similar features, they are likely to be misperceived, and may gradually merge historically: there is a general tendency for

languages to have a reasonable margin of safety between sounds, so that words can be kept apart without the sort of effort which is inconsistent with fast, casual speech. Recall the discussion above of distinguishing <p> and <b> in writing, where there is a certain amount of tolerance built into the system concerning the placement of the loop; this would not be maintained if an intermediate symbol, <Þ>, was introduced. Similarly, it is possible to keep the allophones of labial, alveolar and velar stops distinct because there is a considerable amount of phonetic space between them in terms of articulation; in English, palatal allophones of /k ɡ/, or dental allophones of /t d/ do not interfere with the realisations of any other stops. The story would be different if English also had contrastive palatal and dental stops.

As well as being determined by the need for reasonable margins of error, so that processes of assimilation, for instance, can take place without encroaching too greatly on the territory of adjacent phonemes, systems also seem to favour symmetry. Thus, English has pairs of contrastive voiced and voiceless stops at the labial, alveolar and velar places of articulation. If gaps arise in systems of this kind, they are very commonly filled by change in the language or by borrowing: the Old Irish stop system had a /b/ but no /p/, and /p/ was borrowed from Latin. In the case of the English fricatives, when voiced /v ð z/ came to contrast with pre-existing /f θ s/ in Middle English, there was no voiced counterpart for either /ʃ/ or /h/. However, /ʒ/ has subsequently been introduced by simplification of the [zj] cluster and in loans from French, while /h/ is increasingly marginal, appearing only syllable-initially; indeed, in some accents, like Cockney, it is routinely dropped in that position too, and might be said to be absent from the system altogether. Looking at phoneme systems may perhaps help phonologists identify weak spots in the language which are likely targets for later changes, as well as exemplifying some of the general principles native speakers pay attention to when learning and using their language.

Exercises and topics for discussion

1. Find minimal pairs for the largest number of English consonant phonemes you can, in initial, medial and final positions in the word. Which list is longest? Note cases where you encounter defective distributions.

2. The 'liquid' consonants – namely, /r/ and /l/ – devoice in English after voiceless consonants, giving [pl̥eɪ] *play*, [tɹ̥eɪ] *tray*.

(a) Of the allophones [ɹ], [ɹ̥], [l] and [l̥], which are in complementary distribution?

(b) Which pairs of allophones would you assign to which phoneme, and how would you justify this decision?
(c) Write the allophonic rule determining the distribution of voiced and devoiced liquids.

3. Choose a nursery rhyme or short poem. Transcribe it (that is, write it out in IPA notation) as accurately as you can for your own accent, using V for vowels because you have not met these in enough detail yet, but giving as much detail on consonant allophones as you can.

4. Why do native English speakers have such difficulties in pronouncing surnames like Nguyen (a Vietnamese name, but now very common in Australia) and forenames like Ngaio or Ngaire (from Maori; the latter is sometimes anglicised as Nyree)? Find out what you can about these names, and how they are / should be pronounced. What does this tell us phonologically?

5. Find out what you can about the new(ish) English word *zhuzh*. What does it mean? Why are there doubts about how you spell it? And why is it important phonologically?

6. In many (especially, but not only, urban) varieties of non-standard British English, the following pattern of distribution occurs for the voiceless plosives.

pill [pʰɪl]	spill [spɪl]	lip [lɪʔ]
till [tʰɪl]	still [stɪl]	lit [lɪʔ]
kill [kʰɪl]	skill [skɪl]	lick [lɪʔ]

How can we describe the situation in word-final position phonologically? What symbol(s) might we choose to represent the unit(s) found here, and why? What would the most appropriate feature specification of the final unit of [lɪʔ] be?

Recommendations for reading

Difficulties with the phoneme, and issues of neutralisation and morphophonemics, are discussed in Giegerich (1992), Zsiga (2013) and Lass (1984). Archangeli and Langendoen (1997) is an accessible general introduction to Optimality Theory; Kager (2011) gives a more detailed account. Gussenhoven and Jacobs (2017) is a recent textbook on phonology written from an Optimality Theoretic point of view.

6 Describing vowels

6.1 Vowels versus consonants

Several examples in the last chapter involved vowels. For instance, we have encountered allophonic variation for vowels as well as consonants, with /æ/ becoming nasalised [æ̃] before the final nasal consonant in *can*, but staying oral before the oral plosive at the end of *cat*. We found that there is free variation for some speakers between [i] and [ɛ] in *economic*, but that these two vowels none the less contrast, as shown by minimal pairs like *peat* – *pet* or *heal* – *hell*. We also saw that the usual contrast of /eɪ/, /ɛ/ and /æ/ is neutralised before /r/ for many General American speakers, who pronounce *Mary*, *merry* and *marry* homophonously. It follows that the central ideas of phonemic contrast, with minimal pairs determining the members of the phoneme system, and rules showing allophonic variation in different contexts, apply equally to vowels and to consonants; free variation, phonetic similarity and neutralisation affect both classes of sounds too. A more detailed demonstration of these issues for vowels, and the establishment of vowel phoneme systems for different varieties of English, will be the focus of Chapters 7 and 8.

However, when we turn to the physical description of actual vowel sounds, it is not possible simply to reuse the parameters and features already introduced for consonants. (That would be brilliant because you would already have learned them all. Sorry.) Of course, vowels and consonants are all speech sounds, and in English at least, they are all produced using the same pulmonic egressive airstream. In almost all other respects, however, the features which allow us to classify and understand consonants are less than helpful in distinguishing between vowels.

In Chapter 3, six articulatory parameters were introduced: knowing the value for each of these allowed us to describe English consonants unambiguously, and would extend to further consonants found in other

languages. To describe a consonant in articulatory terms, we needed to know the airstream mechanism involved; the state of the glottis, determining whether the sound is voiced or voiceless; the position of the velum, which either allows or stops airflow through the nose, making the consonant nasal or oral; the manner of articulation – namely, stop, affricate, fricative or approximant; whether airflow is central or lateral; and finally, the place of articulation, and consequently the identity and position of the active and passive articulators.

Unfortunately, almost none of these helps us in classifying vowels. All vowels, universally, are produced on a pulmonic egressive airstream, with central airflow: there is no contrast between central and lateral vowels. It is possible, but rare, for vowels to be voiceless or nasal; in English, however, all vowel phonemes are voiced and oral, and voiceless and nasal allophones appear only in very specific circumstances, as we shall see later. Vowels are all continuants: that is, airflow through the oral tract is not significantly obstructed during their production, so they are all approximants on the consonant manner classification: there are no stop, fricative or affricate vowels. Finally, although we shall distinguish between vowels in terms of place of articulation, the range of options is much more restricted than for consonants, where places from labial to glottal are distinguished in English alone. All vowels are produced in a very limited **vowel space** in the centre of the oral tract, roughly between palatal and velar in consonantal terms. Not only is the space for making vowels more restricted, but their place of articulation will also be much more difficult to ascertain from self-observation, since the tongue never moves close enough to the roof of the mouth in vowel production to make its position easy to feel.

It follows that an adequate vowel classification requires new features and descriptive parameters which are better designed to capture the ways in which vowels *do* vary. This kind of situation, where two classes of objects or concepts share some essential unity but need different descriptors, is not unique to vowels and consonants. For instance, plants and animals are both categories of living things; they both populate the world widely, and are mutually necessary in terms of their complementary roles in gas exchange, for instance. They both require the same basic nutrients, operate according to the same chemical principles, and have common structures, including identical cell types. However, there is just as little point in classifying plants according to whether or not they are mammals, or have feathers, or are carnivores or herbivores, as there is in categorising animals as being evergreen or dropping their leaves, bearing cones or flowers, or producing fruit or not. At that lower

classificatory level, it is simply necessary to recognise the divergence of the two categories by using different distinguishing features. Equally, vowels and consonants are both speech sounds, and are both necessary for language, since they play complementary roles in structuring syllables and words. Both are formed by modifications of a moving airstream, carried out by the actions of the vocal folds and articulatory organs. However, below this very general, common level, consonants and vowels operate as different sets, and to allow us to produce as precise and insightful a classification of each set as possible, they must be described in different terms.

6.2 The anatomy of a vowel

In classifying vowels, we need not indicate airstream mechanism, since it will always be pulmonic egressive, and we can generally assume that vowels are all voiced and oral; allophonic exceptions will be discussed in Chapter 7. To describe vowels adequately and accurately, we then need to consider three different parameters, all of which can be seen as modifications of the place or manner of articulation continua for consonants: as we shall see, these are **height**, **frontness** and **rounding**. Additionally, vowels may be long or short (long ones are marked with a following [ː] below), and **monophthongs** or diphthongs. The examples in the sections below will be from Standard Southern British English (SSBE; sometimes called Received Pronunciation, or RP) and General American (GA), the most widely spoken variety of English in the United States, excluding the southern states and the eastern seaboard, especially Boston, New England and New York City. SSBE and GA are generally thought of by English and American speakers respectively as not having any strong regional marking, and both are varieties highly likely to be heard in broadcasting: for instance, in reading the television or radio news. Further accents will be introduced in Chapters 7 and 8.

6.2.1 The front–back dimension

Front vowels are produced with the front of the tongue raised towards the hard palate (although not raised enough, remember, to obstruct the airflow and cause local friction; vowels are approximants). The vowels in (1) are front. These could, in principle, equally be described as palatal, and this might be helpful in making phonological rules transparent: recall that in Chapter 4, the rule palatalising velar /k ɡ/ before front vowels in *kitchen*, *key*, *give*, *geese* looked rather perplexing, as

the relationship between palatal and front was not obvious. However, calling front vowels palatal would be misleading, since frontness covers a larger area than [palatal], as we shall see below; and it contrasts with completely different alternatives – namely, central and back – rather than labial, alveolar, dental, velar and so on.

(1) *Front vowels*

	SSBE	GA
kit	ɪ	ɪ
dress	ɛ	ɛ
trap	a	æ
fleece	iː	iː
face	eɪ	eɪ

Conversely, back vowels have the back of the tongue raised, towards the soft palate or velum. The vowels in (2) are back.

(2) *Back vowels*

	SSBE	GA
lot	ɒ	ɑː
foot	ʊ	ʊ
palm	ɑː	ɑː
thought	ɔː	ɔː
goat	oʊ	oː
goose	uː	uː

There is also a class of vowels between front and back: these are known as **central** vowels, and involve a raising of the body of the tongue towards the area where the hard and soft palate join. Central vowels are exemplified in (3). The most common of these in English, [ə], is known as **schwa**, and only appears in unstressed syllables.

(3) *Central vowels*

	SSBE	GA
about	ə	ə
nurse	ɜː	ɜr
strut	ʌ	ʌ

6.2.2 The high–low dimension

High vowels have the tongue raised most towards the roof of the mouth; if the raising was significantly greater, then friction would be produced, making a fricative consonant, not a vowel. The high vowels from the last section are in (4).

(4) *High vowels*

	SSBE	GA
kit	ɪ	ɪ
fleece	iː	iː
foot	ʊ	ʊ
goose	uː	uː

Low vowels are those where the tongue is not raised at all, but rather lowered from its resting position: when you produce a low vowel, you will be able to feel your mouth opening and your jaw dropping, even if it is not very easy to figure out quite what your tongue is doing. Low vowels are given in (5). Note that when there is a gap for one particular variety in the tables below, this means the usual vowel for speakers of that variety in that word does not have the characteristic being exemplified in the table – so speakers of SSBE do say the word *lot*, but do not typically pronounce it with a low vowel.

(5) *Low vowels*

	SSBE	GA
trap	a	æ
lot		ɑː
palm	ɑː	ɑː

Again, there is a further class intermediate between high and low, namely, the **mid** vowels, shown in (6). These can, if necessary, be further subclassified as high mid (like the *face* and *goat* vowels) or low mid (like the *dress*, *thought*, *strut* vowels), depending on whether they are nearer the high end of the scale or nearer the low end.

(6) *Mid vowels*

	SSBE	GA
face	eɪ	eɪ
goat	oʊ	oː
dress	ɛ	ɛ
lot	ɒ	
thought	ɔː	ɔː
about	ə	ə
nurse	ɜː	ɜr
strut	ʌ	ʌ

6.2.3 Lip position

In the high back [uː] vowel of *goose*, there is tongue raising in the region of the soft palate, but in addition, the lips are **rounded**. Vowels in any of

the previous categories may be either rounded, where the lips are protruded forwards, or unrounded, where the lips may be either in a neutral position, or sometimes slightly spread (as for a high front vowel, like [iː] *fleece*). However, it is overwhelmingly more common cross- linguistically for back vowels to be rounded than for front ones, and for high vowels to be rounded than low ones; this is borne out in English, as you can see in (7).

(7) *Rounded vowels*

	SSBE	GA
lot	ɒ	
foot	ʊ	ʊ
thought	ɔː	ɔː
goat	oʊ	oː
goose	uː	uː

6.2.4 Length

Using these three dimensions of frontness, height and rounding, we can now define the vowel in *fleece* as high, front and unrounded; that in *goose* as high, back and rounded; and the unstressed vowel of *a*bout, schwa, as mid, central and unrounded. However, our elementary descriptions would class the *kit* vowel as high, front and unrounded, and the *foot* vowel as high, back and rounded; these labels make them indistinguishable from the clearly different vowels of *fleece* and *goose* respectively. SSBE and GA speakers very readily perceive the *fleece* and *kit* vowels, and the *goose* and *foot* vowels, as different; and there are plenty of minimal pairs to support a phoneme distinction, as in *peat – pit*, *leap – lip*, *Luke – look*, *fool – full*. This distinction usually involves vowel length: in SSBE and GA, the vowels in (8) are consistently produced as longer than those in (9).

(8) *Long vowels*

	SSBE	GA
fleece	iː	iː
goose	uː	uː
goat		oː
thought	ɔː	ɔː
palm	ɑː	ɑː
lot		ɑː
nurse	ɜː	ɜr

(9) *Short vowels*

	SSBE	GA
kit	ɪ	ɪ
dress	ɛ	ɛ
trap	a	æ
lot	ɒ	
foot	ʊ	ʊ
about	ə	ə
strut	ʌ	ʌ

This is not to say, however, that the *only* difference between [iː] and [ɪ], or [uː] and [ʊ], is one of length: the quantity difference goes along with a difference in quality. [iː] is higher and fronter than [ɪ]; [uː] is higher and backer than [ʊ]; and similarly, [ɑː] in *palm* is lower and backer than the corresponding short [a] in *trap*. In general, long vowels in English are more peripheral, or articulated in a more extreme and definite way, than their short counterparts. Some phonologists use a feature [± **tense**] rather than length to express this difference, with the long, more peripheral vowels being [+ tense], and the short, more centralised ones being [– tense], or **lax**.

6.2.5 Monophthongs and diphthongs

Most of the vowels we have considered so far have been monophthongs, in which the quality of the vowel stays fairly consistent from the beginning of its production to the end. However, there are also several diphthongs in English. Diphthongs change in quality during their production, and are typically transcribed with one starting point and a quite different end point; as might be expected from this description, diphthongs are typically long vowels. In English, all diphthongs have the first element as longer and more prominent than the second, and are known as **falling** diphthongs. Three diphthongs are found very generally in accents of English, and are shown in (10).

(10) *Diphthongs (i)*

	SSBE	GA
price	aɪ	aɪ
mouth	aʊ	aʊ
choice	ɔɪ	ɔɪ

The long high-mid front and back vowels in *face* and *goat* are also characteristically diphthongal in SSBE, as is the *face* vowel in GA; see (11).

(11) *Diphthongs (ii)*

	SSBE	GA
face	eɪ	eɪ
goat	oʊ	oː

Finally, SSBE has a third set of diphthongs, which are known as the **centring diphthongs**, as they all have the mid central vowel schwa as the second element. These centring diphthongs developed historically before /r/, which was then lost following vowels in the ancestor of SSBE; they consequently appear mainly where there is an <r> in the spelling, although they have now been generalised to some other words, like *idea*.

GA speakers have a diphthong in *idea*, but still pronounce the historical [ɹ] in *near*, *square*, *force*, *cure* and therefore lack centring diphthongs in these words (see (12)).

(12) *Centring diphthongs*

	SSBE	GA
near	ɪə	ir
square	ɛə	ɛr
force	ɔə/ɔː	oːr
cure	ʊə	ʊr

6.3 Vowel classification

The labels outlined in the previous section are helpful, but may leave questions unresolved when used in comparisons between different languages or different accents of the same language. Thus, French [uː] in *rouge* is very close in quality to English [uː] in *goose*, but not identical; the French vowel is a little more peripheral, slightly higher and more back. Similarly, [oː] in *rose* for a GA speaker is slightly lower and more centralised than 'the same' vowel for a speaker of Scottish English. None of the descriptors introduced so far would allow us to make these distinctions clear, since in the systems of the languages or accents concerned, both members of each of these pairs of vowels would, quite appropriately, be described as long, high, back and rounded, or long, high-mid, back and rounded respectively.

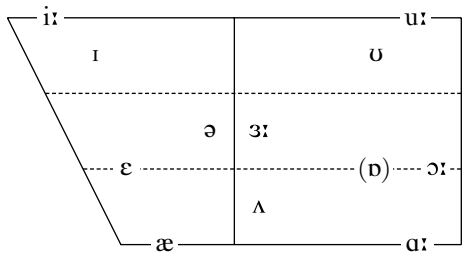
Furthermore, a classification of this sort, based essentially on articulation, is arguably less appropriate for vowels than for consonants. In uttering a vowel, the important thing is to produce a particular sort of auditory impression, so that someone listening understands which vowel in the system you are aiming at, but it does not especially matter which articulatory strategies you use to convey that

auditory impression. If you were asked to produce an [uː] but not allowed to round your lips, then with a certain amount of practice you could make at least something very similar; and yet it would not be a rounded vowel in the articulatory sense, although you would have modified the shape of your vocal tract to make it sound like one. This is not possible with most consonants, where the auditory impression depends on the particular articulators used, and how close they get, not just the overall shape of the vocal tract and the effect that has on a passing airstream. It is true that the whole oral tract is a continuum, but it is easier to see the places for consonants as definite 'stopping-off places' along that continuum, helped by the fact that most consonants are obstruents, and we can feel which articulators are involved.

One possible solution is to abandon an articulatory approach to vowel classification altogether and turn instead to an analysis of the speech wave itself, but acoustic phonetics is beyond the scope of this book. In any case, it is true that most speakers of particular accents or even languages will produce certain vowels in an articulatorily similar fashion. For comparative purposes, what we need is an approach which allows vowel qualities to be expressed as relative rather than absolute values.

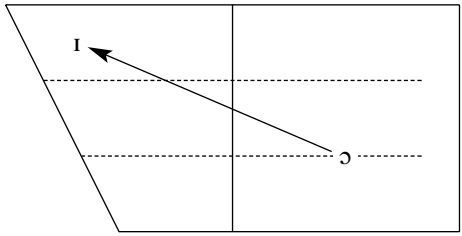
We can achieve this comparative perspective by plotting vowels on a diagram rather than simply defining them as isolated sounds. The diagram conventionally used for this purpose is known as the **vowel quadrilateral**, and is an idealised representation of the vowel space, roughly between palatal and velar, where vowels can be produced in the vocal tract. The left edge corresponds to the palatal area, and hence to front vowels, and the right edge to the velar area, and back vowels. The top line extends slightly further than the bottom one because there is physically more space along the roof of the mouth than along the base. Finally, the chart is conventionally divided into six sectors, allowing high, high-mid, low-mid and low vowels to be plotted, as well as front, central and back ones. There is no way of reading information on rounding directly from the vowel quadrilateral, so that vowels are typically plotted using an IPA symbol rather than a dot; it is essential to learn these IPA symbols to see which refer to rounded, and which to unrounded vowels. The SSBE and GA monophthongs discussed in Section 6.2 are plotted in (13); the monophthongs of the two accents are similar enough to include on a single chart, although the [ɒ] vowel is bracketed, since it occurs in SSBE but not in GA, where words like *lot* have low [ɑː] instead.

(13) *SSBE and GA monophthongs*



Diphthongs are not really well suited to description in terms of the labels introduced above, since they are essentially trajectories of articulation starting at one point and moving to another; in this respect, they are parallel to affricate consonants. Saying that [ɔɪ] in *noise*, for instance, is a low-mid back rounded vowel followed by a high front unrounded vowel would not distinguish it from a sequence of vowels in different syllables or even different words; but the diphthong in *noise* is clearly different from the sequence of independent vowels in *law is*. Using the vowel quadrilateral, we can plot the changes in pronunciation involved in the production of a diphthong using arrows, as in (14). Plotting several diphthongs in this way can lead to a very messy chart, but it is none the less helpful in clarifying exactly how a particular diphthong is composed, and what its starting and stopping points are; and the notation reminds us that a symbolic representation like [ɔɪ] is actually shorthand for a gradual articulatory and auditory movement.

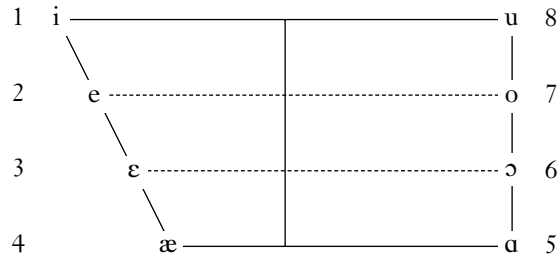
(14)



However, plotting vowels on the quadrilateral is reliable only if the person doing the plotting is quite confident about the quality she is hearing, and this can be difficult to judge without a good deal of experience, especially if a non-native accent or language is being described. To provide a universal frame of reference for such

situations, phoneticians often work with an idealised set of vowels known as the **Cardinal Vowels**. For our purposes, we need introduce only the primary cardinals, which are conventionally numbered 1–8. Cardinal Vowel 1 is produced by raising and fronting the tongue as much as possible; any further, and a palatal fricative would result. This vowel is like a very extreme form of English [iː] in *fleece*. Its opposite, in a sense, is Cardinal Vowel 5, the lowest, backest vowel that can be produced without turning into a fricative; this is like a lower, backer version of SSBE [ɑː] in *palm*. Between these two fixed points, organised equidistantly around the very edges of the vowel quadrilateral, are the other six primary Cardinal Vowels, as shown in (15). Cardinal 8 is like English [uː] in *goose*, but again higher and backer; similarly, Cardinals 3, 4 and 6 can be compared with the vowels of English *dress*, *trap* and *thought*, albeit more extreme in articulation. Finally, Cardinals 2 and 7 are, as we shall see in Chapters 7 and 8, like the monophthongal pronunciations of a Scottish English speaker in words like *day*, *go*. The steps between Cardinals 1–4 and 5–8 should be articulatorily and acoustically equidistant, and lip rounding also increases from Cardinals 6, through 7, to 8.

(15) *The Primary Cardinal Vowels*



In truth, the only way of learning the Cardinal Vowels properly, and ensuring that they can act as a fixed set of reference points as they were designed to do, is to learn them from someone who already knows the system, and do a considerable amount of practice; Daniel Jones, who invented the Cardinal Vowel system, wrote that 'The values of cardinal vowels cannot be learnt from written descriptions; they should be learnt by oral instruction from a teacher who knows them.' For the moment, what matters is to have an idea of what the Cardinal Vowels are, and what the theoretical justification for such a system is, in terms of describing the vowels of an unfamiliar language, or giving a principled account of the differences between the vowels of English and some other language, or between different accents of English. We turn

to such differences, as well as a more detailed outline of English vowel phonemes and allophones, in the next two chapters.

Exercises

1. (a) Which of the following words contain a rounded vowel?
   put seek hook grew grey hoe hold
   (b) Which of the following words contains a front vowel?
   see seat met tap throw tape through
   (c) Which of the following words contain a high vowel?
   see seat steak throw list lost through
   (d) Which of the following words contain a central vowel?
   about put luck hit purse father kept
   (e) Which of the following words contain a high back vowel?
   put love hit heat luck look food

2. (a) What do the vowels in these words have in common?
   bet hair rose post love purse mate
   (b) What do the vowels in these words have in common?
   see leap weird pit fiend miss crypt
   (c) What do the vowels in these words have in common?
   height boy try noise loud crowd fine
   (d) What do the vowels in these words have in common?
   flea rude piece flu stew leave sees

3. Make vowel quadrilateral diagrams for all the diphthongs of SSBE, showing the position of the first and second elements and drawing lines and arrows connecting them.

4. Give as detailed a description as you can of the vowels in the following words:

   father leaving hear thoroughly fast haste lookalike sausage ooze

Recommendations for reading

The reading recommended in Chapter 3 is equally suitable for this chapter, although you will wish to concentrate this time on chapters and sections relating to vowels rather than consonants. Links to a very comprehensive selection of phonetics and phonology online resources can be found at <https://users.castle.unc.edu/~jlsmith/phonetics-resources.html>, which is maintained by Jennifer Smith at the University of North Carolina. You can listen to a recording of Daniel Jones himself saying the eight Primary Cardinal Vowels

at <http://audiufon.hum.uu.nl/sounds/1to8fall.wav>. Sound changes, and their contribution to the present-day structure of the language, have been mentioned several times above and in earlier chapters: if you are interested in language change, you might like to consult Campbell (2013) or Trask (2015).

7 Vowel phonemes

7.1 The same but different again

As we saw in the last chapter, most of the features which work well in classifying and describing consonants are entirely inappropriate for vowels, while vowels vary in dimensions (such as tongue height) which are not relevant for consonants. However, when we turn to the criteria for establishing phonemes, and the exceptions to these reviewed in Chapters 2 and 5, it turns out that vowels and consonants behave very similarly indeed. The sections below therefore fulfil a dual role of providing more information about vowels, while allowing some revision of notions like complementary distribution, allophonic rules, free variation, neutralisation and phonetic similarity, which were first introduced mainly in connection with consonants.

7.2 Establishing vowel contrasts

7.2.1 Minimal pairs

Minimal pairs and the commutation test are the main tools available to the phonologist in ascertaining phonemic contrast among both consonants and vowels. A minimal pair list for SSBE vowels appears in (1).

(1) *Vowel minimal pairs*

bit	/ɪ/
bet	/ɛ/
bat	/æ/
but	/ʌ/
beat	/iː/
bait	/eɪ/
Bart	/ɑː/
boat	/oʊ/

bought	/ɔː/
boot	/uː/
bite	/aɪ/
bout	/aʊ/
sherbet	/ə/
Bert	/ɜː/

The list above provides evidence for almost all phonemically contrastive vowels of SSBE, with a very small number of exceptions. Since schwa appears only in unstressed syllables, where most of the other vowels cannot appear, we must make do with near-minimal comparisons in this case, contrasting the second, unstressed syllable of *sherbet* with the various stressed syllables in (1). The short vowels /ʊ/ and /ɒ/, and the centring diphthongs, which were listed as SSBE vowels in the last chapter, do not appear in the selected context /b-t/; but the additional data in (2) show that /ʊ/ and /ɒ/ on the one hand, and the three centring diphthongs on the other, contrast both with one another and with representative members of the list in (1). Phonemic contrast is a transitive relationship, meaning that if phoneme *a* contrasts with phoneme *b*, and phoneme *b* contrasts with phoneme *c*, then phonemes *a* and *c* also contrast: this means that if a contrast can be established between one of the 'left-out' vowels and any vowel in (1), then that vowel can be taken as contrasting with all the vowels in (1).

(2) pit /ɪ/ put /ʊ/ pot /ɒ/ peat /iː/ etc.
leer /ɪə/ lair /ɛə/ lure /ʊə/ lore /ɔː/

Sets of minimal pairs like this may work very well for one accent, but not for another. Some disparities of this sort were discussed in earlier chapters; for instance, minimal pairs like *lock* /k/ versus *loch* /x/, or *witch* /w/ versus *which* /ʍ/ will be relevant for many Scottish speakers in establishing the voiceless velar and labial–velar fricative phonemes, but both members of the pairs will have /k/ and /w/ respectively in many other accents of English. Although this was a rather minor issue for consonants, it is much more important in discussing vowel phoneme systems, since, as we shall see in Chapter 8, most accent variation in English involves vowels.

7.2.2 Standard Lexical Sets

The oppositions established for SSBE in (1) and (2) cannot, then, be transferred automatically to other accents. For instance, GA has no centring diphthong phonemes; *leer*, *lair* and *lure* have the /iː/, /eɪ/ and /uː/

vowels of *beat*, *bait* and *boot*, followed in each case by /r/. GA also lacks the /ɒ/ vowel of SSBE *pot*; but we cannot assume that all the words with /ɒ/ in SSBE have a single, different phoneme in GA. On the contrary, some words, like *lot*, *pot*, *sock*, *possible* have GA /ɑː/ (as also in *palm*, *father*, *Bart, far* in both accents); but others, including *cloth*, *cough*, *cross*, *long* have GA /ɔː/ (as also in *thought*, *sauce*, *north*, *war* in both accents).

It follows that lists of minimal pairs are suitable when our goal is to establish a phoneme system for a single accent, but they may not be the best option when we are more interested in comparing different accents. An alternative is to use a system introduced by John Wells (see 'Recommendations for reading'), involving **Standard Lexical Sets**, as shown in (3). The key word for each standard lexical set appears conventionally in capital letters, and is shorthand for a whole list of other words sharing the same vowel, although the precise vowel they do share may vary from accent to accent.

(3) *Standard Lexical Sets*

SSBE	GA	Set number	Keyword
ɪ	ɪ	1	KIT
ɛ	ɛ	2	DRESS
a	æ	3	TRAP
ɒ	ɑː	4	LOT
ʌ	ʌ	5	STRUT
ʊ	ʊ	6	FOOT
ɑː	æ	7	BATH
ɒ	ɔː	8	CLOTH
ɜː	ɜ	9	NURSE
iː	iː	10	FLEECE
eɪ	eɪ	11	FACE
ɑː	ɑː	12	PALM
ɔː	ɔː	13	THOUGHT
oʊ	oː	14	GOAT
uː	uː	15	GOOSE
aɪ	aɪ	16	PRICE
ɔɪ	ɔɪ	17	CHOICE
aʊ	aʊ	18	MOUTH
ɪə	ir	19	NEAR
ɛə	eɪr	20	SQUARE
ɑː	ɑr	21	START
ɔː	ɔr	22	NORTH
ɔː	or	23	FORCE
ʊə	ur	24	CURE

ɪ	i	25	HAPPY
ə	ər	26	LETTER
ə	ə	27	COMMA

These lexical sets allow comparison between accents to be made much more straightforwardly: we can now ask which vowel speakers of a particular accent have in the KIT set, or whether they have the same vowel in NORTH and FORCE (as SSBE does) or two different vowels (as GA does). We could add that many speakers of Northern English English will have /ʊ/ in STRUT as well as FOOT, and /a/ in BATH as well as TRAP, pinpointing two of the differences most commonly noted between north and south. The point of the Standard Lexical Sets is not to show that oppositions exist in all these contexts: in fact, there may be no accent of English which contrasts twenty-seven phonemically different vowels in the twenty-seven lexical sets (or even twenty-four, for the stressed vowels). Instead, the aim is to allow differences between accents (and sometimes between speakers of the same accent, perhaps in different generations, or even within the same speaker's repertoire in different styles) to be identified and discussed.

More detail on accent variation will be given in the next chapter. For the moment, to illustrate the usefulness of the Standard Lexical Sets, the vowels of two further accents are given in (4). Standard Scottish English (or SSE) is the Scottish equivalent of SSBE: a relatively unlocalised, socially prestigious accent. Many Scots have SSE as a native variety; many others use it in formal situations, and it is widely heard in the media, in education and in the Scottish Parliament. It is to be contrasted with Scots, sometimes called 'broad Scots', a divergent range of non-standard Scottish dialects which differ from English Standard English not only in phonetics and phonology, but also in vocabulary and grammar. (Scots, on the other hand, may be an independent language, albeit closely related to English.) The final example is New Zealand English, a relatively recent variety which shares some characteristics with the other extra-territorial Englishes spoken in Australia and South Africa, but also has some distinctive characteristics of its own: notably, the fact that schwa appears in stressed position, in the KIT lexical set.

(4)

SSE	NZE	Set number	Keyword
ɪ	ə	1	KIT
ɛ	e	2	DRESS
a	ɛ	3	TRAP
ɒ	ɒ	4	LOT
ʌ	ʌ	5	STRUT

u	ʊ	6	FOOT
a	aː	7	BATH
ɒ	ɒ	8	CLOTH
ʌr	ɜː	9	NURSE
i	ɪi	10	FLEECe
e	ɛɪ	11	FACE
a	aː	12	PALM
ɒ	ɔː	13	THOUGHT
o	əu	14	GOAT
u	ɨʉː	15	GOOSE
ʌɪ	aɪ	16	PRICE
ɔɪ	ɔɪ	17	CHOICE
ʌʊ	aʊ	18	MOUTH
ir	iə	19	NEAR
er	eə	20	SQUARE
ar	aː	21	START
ɒr	ɔː	22	NORTH
or	ɔː	23	FORCE
ur	uə	24	CURE
i	i	25	HAPPY
ər	ə	26	LETTER
ʌ	ə	27	COMMA

A number of differences between these accents, and between each of them and SSBE or GA, can be read off these lists. For instance, SSE does not contrast the TRAP and PALM vowels, so that *Sam* and *psalm*, which are minimal pairs for all the other varieties considered so far, are homophonous for Scottish speakers, both having short low front /a/. In NZE, *Sam* and *psalm* do form a minimal pair, but not with low short front /a/ or /æ/ versus low long back /ɑː/: instead, in NZE we find mid short front /ɛ/ in *Sam* as opposed to low long front /aː/ in *psalm*. Both the TRAP and DRESS vowels in NZE are higher than those of SSBE or GA, while the long vowels of FLEECE, FACE, GOAT and GOOSE are very characteristically diphthongs.

Recall, however, that phonemes are abstract units, and thus could potentially be symbolised using any IPA, or indeed any other character. The symbols chosen for particular phonemes in the lists above are not the only possibilities; they reflect a choice made by a particular phonologist. I have elected to use a symbol for each phoneme, in each accent, which corresponds to one of the main allophones of that phoneme: that is, in many cases, speakers of the accent in question will actually pronounce the symbol given in the list, with its normal IPA value.

Thus, NZE speakers will often say [ɛ] in *trap*, and [e] in *dress*, and will typically have a diphthongal pronunciation of *fleece*, *goose*, *goat* and *face*, with rather centralised vowels in GOOSE words, so there is a match with the symbol for the phoneme I have chosen to use in the list.

However, for some phonologists the symbols used in (4) would not be the most obvious choices. This highlights a decision phonologists must make in establishing a phoneme system. On the one hand, we may wish our phonemes to 'feel' fairly concrete, reflecting quite closely what speakers actually do in at least some of their everyday pronunciations; this is the choice made here. It follows that there will be significant symbol differences between the vowel systems of different accents. On the other hand, some phonologists feel it is more important to reflect the fact that English is a single language, and believe that speakers must have common mental representations to allow them to understand one another, even if they speak with rather different accents. In that case, common phoneme symbols might be chosen across the whole of the language. For instance, instead of using /ɪi/ for FLEECE in NZE, we would select /iː/, stressing that this is the same phoneme as in SSBE or GA, although there would then have to be an allophonic rule to say that this phoneme is very typically diphthongised for most New Zealanders.

The second solution has the advantage of stressing the common features speakers of English might share, at least in terms of mental representations, although they may sound very different in actual conversation. It therefore maintains a strong difference between abstract phonology and concrete phonetics: the /a/ phoneme in TRAP would be low [a] for SSBE, but low mid [ɛ] for NZE, while the /ɛ/ phoneme of DRESS would be high mid [e] for NZE, and low mid [ɛ] in all the other accents we have examined, meaning that phonemes potentially have very different realisations, and the same realisation can belong to different phonemes in different accents.

At this point, we do not know enough about how speakers store and process their language mentally to prove which is the most appropriate solution, but it is worth asking how speakers would learn a very abstract system, which does not reflect the phonetic qualities they hear around them during language acquisition. If a New Zealander pronounces the FLEECE vowel as a diphthong, and hears NZE or Australian English (which also tends to have a diphthong here) much more often than British or American accents, why would such a speaker assume this vowel phoneme should be stored as anything other than a diphthong? And why should the 'right' value for the phoneme correspond to what is pronounced in British or American English, rather than in New Zealand or Australia? The decision between representations which are close to

phonetic reality, but with considerable accent variation, and potentially rather messy systems, or rather abstract phonemes, with streamlined and economical systems unifying the speakers of different varieties, must be confronted whenever we move away from surface phonetics and into phonology. In this book, I shall continue to use phoneme symbols which correspond to major allophones of those phonemes in the accent concerned, but other, more abstract alternatives can be found in the recommended further reading.

7.3 Vowel features and allophonic rules

Once phonemic contrasts have been established for the accent in question, and the appropriate representation for each phoneme has been selected, the realisations of those phonemes must be determined and rules written to describe allophonic variation. Again, features and rule notation can be used to formalise these statements. We saw in Chapter 4 that vowels are [+ syllabic, – consonantal, + sonorant, + voice, – nasal]. To distinguish English vowels appropriately, we also require the features [± high], [± mid] for the dimension of tongue height; [± front], [± back] for place of articulation; and [± round]. These give the illustrative matrix in (5).

(5)

	[high]	[mid]	[front]	[back]	[round]
[i]	+	–	+	–	–
[e]	+	+	+	–	–
[ɛ]	–	+	+	–	–
[a]	–	–	+	–	–
[u]	+	–	–	+	+
[o]	+	+	–	+	+
[ɔ]	–	+	–	+	+
[ɑ]	–	–	–	+	–
[ə]	–	+	–	–	–

These features can distinguish four contrastive degrees of vowel height, and three degrees of frontness, which allows all varieties of English to be described. However, /iː/ and /ɪ/, and /uː/ and /ʊ/, will be identical in this matrix. In SSBE and GA, the former in each pair is typically long, and the latter short; and long vowels are also articulated more extremely, or more peripherally than corresponding short ones: the long high front vowel is higher and fronter than the short high front vowel, while the long high back vowel is higher and backer than its short counterpart. The question is whether we regard this as primarily

a quality or a quantity difference. If we take quality as primary, we can regard /i/, /u/, /ɑ/, /ɔ/ as [+ tense], or more peripheral, and simply write a redundancy rule to say that all tense vowels are phonetically long. On the other hand, we could do the opposite and take length as the important factor, so these vowels are long /iː/, /uː/, /ɑː/ and /ɔː/, and redundantly also more peripheral.

For most accents of English, we could choose either solution, although most phonologists would select either length or tenseness as relevant at the phoneme level, with the other simply following automatically, to minimise redundancy in the system. However, in SSE and Scots dialects, it matters which we choose. This is because vowels in Scottish accents (and some related Northern Irish accents) are unique among varieties of English in one respect: we can predict where vowels are phonetically long, and where they are phonetically short. Vowels become long before /r v ð z ʒ/ and at the end of a word, but they are short everywhere else, as shown in (6).

(6) *The Scottish Vowel Length Rule*

/i/	[i]	beat	wreath	leaf	bean
	[iː]	beer	wreathe	leave	agree
/o/	[o]	boat	close (Adj)	foal	ode
	[oː]	bow	close (V)	four	owe

/ɪ/, /ɛ/ and /ʌ/, which are short and lax in other accents, do not lengthen in any circumstances. In SSE and Scots, then, we can define the two classes of phonemic vowels as lax (the three which never lengthen) and tense (the others, which are sometimes long and sometimes short, in predictably different environments). It is possible to predict length from [± tense], but not the other way around. The allophonic rule involved will then state that tense vowels lengthen before /r/, before a voiced fricative or before a word boundary (that is, in word-final position), to account for the data in (6).

Other allophonic rules are more general. For instance, in all varieties of English, vowels become nasalised immediately before nasal consonants; the velum lowers in anticipation of the forthcoming nasal, and allows air to flow through the nasal as well as the oral cavity during the production of the vowel. If you produce *cat* and *can*, then regardless of whether your vowel is front or back, there will be a slight difference in quality due to nasalisation in the second case; you may hear this as a slight lowering of the pitch. This rule is shown in (7); note that the symbol V here means 'any vowel'.

(7) V → [+ nasal] / ___ [+ nasal]

Just as for consonants, then, some allophonic rules specifying the realisations of vowel phonemes are found very generally in English (and may, in fact, as in the case of the nasalisation process in (7), reflect universal phonetic tendencies); others, like the Scottish Vowel Length Rule, are peculiar to certain accents.

7.4 Phonetic similarity and defective distribution

Just as we saw for consonants in Chapter 5, phonetic similarity can help us decide which vowel allophones to assign to which phonemes, and defective distributions hinder our decision-making. For instance, schwa in accents other than NZE is confined to unstressed positions, and therefore does not, strictly speaking, contrast with most other vowels. Its defective distribution means it could be regarded as the unstressed allophone of almost any other vowel phoneme. So, schwa appears in the unstressed syllables of *about*, *father*, *fathom*, *sherbet*, *pompous*; but which vowel phoneme is involved in each case? Since speakers do not tend to produce vowels other than schwa in any of these forms, even when speaking rather carefully, it is difficult to say. We could say that there is wholesale neutralisation of vowel phonemes in unstressed syllables; alternatively, because speakers of English can hear the difference between schwa and other vowels quite reliably, and seem to regard schwa as a distinct vowel, the best solution might be to accept that schwa is a phoneme of English in its own right, albeit with a defective distribution. Again, as with consonants, defective distributions often result from language change. For instance, spelling evidence from Old English indicates that a much wider range of vowels was probably found in unstressed syllables in that period; these have gradually merged into schwa during the history of English. Similarly, the centring diphthongs of SSBE are generally found where there is an <r> in the spelling, and where other accents, like SSE and GA, have combinations of a vowel found elsewhere in the system, plus [ɹ]. Historically, all varieties of English followed the SSE / GA pattern; but accents like SSBE lost [ɹ] in certain contexts, with a related change in the realisation of vowels producing the centring diphthongs.

Turning to phonetic similarity, it will again help to resolve situations where one allophone could potentially belong to more than one phoneme, although phonologists (and native speakers) apply this criterion so automatically as to scarcely justify making it an explicit step in phonemic analysis. In the case of vowel nasalisation before nasals, for instance, there is a situation of complementary distribution between ALL nasalised allophones on the one hand, since these can appear only adjacent to a nasal consonant, and ALL oral allophones on the other. It is

theoretically possible that [uː] and [ĩː], or [ɛ] and [õ] might be assigned to the same phoneme, if we took only complementary distribution into account. However, since the members of these vowel pairs differ from one another with respect to more features than simply [nasal], notably in terms of frontness; and since there are alternative pairings available – namely, [iː] and [ĩː], or [ʊ] and [õ], where nasalisation is the only difference at issue – these minimally different, more phonetically similar pairings will be used in establishing which two realisations belong to each phoneme.

7.5 Free variation, neutralisation and morphophonemics

Some examples involving free variation between vowel phonemes were reviewed in Chapter 5: for instance, *economic* can be pronounced, for the same speaker, with the DRESS vowel on some occasions and the FLEECE vowel on others. Although this conflicts with the requirement that different phonemes should not be substitutable without causing a change in meaning to be conveyed, such a marginal case involving only a single lexical item should not be allowed to compromise the general distinction between /ɛ/ and /iː/, given the significant number of minimal pairs which do establish the contrast between them.

Free variation also occurs between allophones of a single phoneme. This again correlates with sociolinguistic rather than linguistic conditioning. For instance, in NZE some speakers produce /ɜː/, the NURSE vowel, with lip-rounding, more significantly so in informal circumstances. Similarly, New Yorkers may produce the FLEECE and GOOSE vowels as monophthongs in formal situations, but prefer diphthongs in casual speech; and the quality of the diphthongs varies too, with [ɪi], [ʊu] being more common for middle-class speakers, but more central first elements, and hence a greater distance between the two parts of the diphthongs, for working-class speakers. Some cases of free variation reflect language change in progress: so, in SSBE, older speakers may still produce centring diphthongs in CURE and SQUARE words, while younger ones almost invariably smooth these diphthongs out and produce monophthongal [ɔː], [ɛː]. Younger speakers might use the pronunciations more typical of the older generation when they are talking to older relatives or in formal circumstances.

Cases of neutralisation tend not to be subject to sociolinguistic influence in this way, but rather reflect a tendency for certain, otherwise contrastive, sets or pairs of vowels to fall together with a single realisation in a particular phonological context. In the last chapter, we saw that the DRESS, TRAP and SQUARE vowels are neutralised for many GA speak-

ers before /r/, so that *merry*, *marry* and *Mary* become homophonous: in this context, rather than the usual /ɛ/, /æ/, /eɪ/ opposition, we might propose an archiphoneme /E/, realised as [ɛ]. Neutralisations of this sort are extremely common for English vowels. To take just two further examples, speakers from the southern states of the USA have a neutralisation of the KIT and DRESS vowels before /n/, so that *pin* and *pen* are homophonous; and for many speakers of SSE and Scots, the opposition between the KIT and STRUT vowels is suspended before /r/, so that *fir* and *fur* are both pronounced with [ʌ].

However, whereas suspension of contrast takes place in a particular phonological context, and will affect all lexical items with that context, in other cases we are dealing with an interaction of morphology and phonology; here, we cannot invoke neutralisation. For instance, the discussion of the Scottish Vowel Length Rule above does not quite tell the full story, since we also find alternations of long and short vowels in the cases in (8).

(8)

Short	*Long*
greed	agreed
brood	brewed
bonus	slowness
typing	tie-pin

From the Scottish Vowel Length Rule examples considered earlier, we concluded that vowel length is not contrastive in SSE and Scots, since it was possible to predict that long vowels appear before certain consonants or at the end of a word, while short ones appear elsewhere. However, the data in (8) appear, on purely phonological grounds, to constitute minimal pairs for short and long vowels. In fact, what seems to matter is the structure of the words concerned. The vowels in the 'Long' column of may not look as if they are word-final but in a sense they are: they precede the inflectional ending [d] marking past tense; or precede the suffix *-ness*; or appear at the end of the first element of a compound, which is a word in its own right, as in *tie*. This is not true for the 'Short' column, where the words are not separable in this way. The Scottish Vowel Length Rule must therefore be rewritten to take account of the morphological structure of words: it operates before /r/ and voiced fricatives, at the end of a word, and also at the end of a **morpheme**, or meaningful unit within the word; in the cases in (8), the affected vowel is at the end of a stem.

In other cases, different vowel phonemes alternate with one another before particular suffixes, as we found for consonants in Chapter 5 where the final [k] of *electric* became [s] or [ʃ] before certain suffixes, as

in *electricity* and *electrician*. One of the best-known cases in English, and one which affects all varieties, involves pairs of words like those in (9).

(9)			
	divine – divinity	line – linear	/aɪ – /ɪ/
	serene – serenity	supreme – supremacy	/iː/ – /ɛ/
	sane – sanity	explain – explanatory	/eɪ/ – /æ/

These Vowel Shift alternations (so-called because the patterns reflect the operation of a sound change called the **Great Vowel Shift** several hundred years ago) involve pairs of phonemes which very clearly contrast in English: namely, the members of the PRICE and KIT, FLEECE and DRESS, and FACE and TRAP pairs of Standard Lexical Sets. Minimal pairs are common for all of these (take *type* and *tip*, *peat* and *pet*, *lake* and *lack*, for instance). However, the presence of each member of these pairs can be predicted in certain contexts only; and native speakers tend to regard the pairs involved, such as *divine* and *divinity*, as related forms of the same word. This is not neutralisation because the context involved is not specifically phonetic or phonological: it is morphological. That is, what matters is not the length of the word, or the segment following the vowel in question, but the presence or absence of one of a particular set of suffixes. In **underived** forms (that is, those with no suffix at all) we find the tense or long vowel, here /aɪ/, /iː/ or /eɪ/; in **derived forms**, however, with a suffix like *-ity*, *-ar*, *-acy*, *-ation*, a corresponding lax or short vowel /ɪ/, /ɛ/ or /æ/ appears instead. This alternation is a property of the lexical item concerned; vowel changes typically appear when certain suffixes are added, but there are exceptions like *obese*, with /iː/ in the underived stem, and the same vowel (rather than the /ɛ/ we might predict) in *obesity*, regardless of the presence of the suffix *-ity*. Opting out in this way does not seem to be a possibility in cases of neutralisation, but is quite common in cases of morphophonemics, or the interaction between phonology and morphology.

To put it another way, not all alternations involving morphology are completely **productive**. Some are: in such cases, every single relevant word of English obeys the regularity involved (so, all those nouns which form their plural using a *-s* suffix will have this pronounced as [s] after a voiceless final sound in the stem, [z] after a voiced one, and [ɪz] after a sibilant; not only this, but any new nouns which are borrowed into English from other languages, or just made up, will also follow this pattern). Others are fairly regular, but not entirely so: this goes for the Vowel Shift cases above. And yet others are not regular at all, but are simply properties of individual lexical items which children

or second-language learners have to learn as such. The fact that *teach* has the past tense *taught* is an idiosyncrasy of modern English which has to be mastered; but although knowing this relationship will help a learner of English to use *teach* and *taught* appropriately, it will not help when it comes to learning other verbs, because *preach* does not have the past tense **praught*, and *caught* does not have the present tense **ceach*. Knowing where we should draw the line between extremely regular cases which clearly involve exceptionless rules or generalisations, fairly regular ones which may be stated as rules with exceptions, and one-off (or several-off) cases where there is no rule at all but a good deal of rote-learning, is one of the major challenges of **morphophonology**. The only comfort is that native speakers, at least during acquisition and sometimes later too, find it just as much of a challenge, as amply demonstrated by over-generalisations like past-tense *swang* from *swing* (on the pattern of *swim – swam*) or past-tense [trɛt] from *treat* (on the pattern of *meet – met*).

Exercises and topics for discussion

1. Make phonemic transcriptions for the following words, for (a) SSBE, (b) GA, (c) SSE and (d) NZE.
   water grass righteousness holiday pilchard following northeast spoonful

2. Write rules for the following processes:
   (a) Front rounded vowels become unrounded before velars
   (b) Vowels devoice before voiceless consonants
   (c) /iː uː ɪ ʊ/ become /eː oː ɛ ɒ/ after clusters of two consonants, the second of which is a nasal
   (d) /ɑː ɔː/ become /uː/ before palatal consonants or at the beginnings of words.

3. Go back to the nursery rhyme or short poem you transcribed in the exercises to Chapter 5. Now, instead of using V for all vowels, transcribe the vowels using the reference accent (from SSBE, GA, SSE and NZE) with which you are most familiar, or which is closest to your own.

4. Make a list of the Standard Lexical Sets, and write down which vowel phoneme you have in each of the twenty-seven cases. Which vowel symbols have you chosen to symbolise each phoneme, and why?

5. In the Standard Lexical Sets in exercise (4), are there cases where your pronunciation varies depending on the context: for instance, between formal and more casual conversations, or according to who you are speaking to? What sorts of differences arise in these different styles?

Compare and discuss with some other English speakers who have different accents to see what similarities and differences you identify – this will be good preparation for the next chapter.

Recommendations for reading

The general phonology textbooks recommended for Chapter 5 are also relevant here. The standard lexical set approach is set out in detail in Wells (1982), which also provides a wealth of information on varieties of English; you can find some additional resources and listen to some of the reference accents at <https://www.phon.ucl.ac.uk/home/wells/accentsanddialects/>. More detail on the linguistic situation in Scotland and the varieties spoken there can be found in Jones (1997) and Millar (2018). Hay, Maclagan and Gordon (2008) provide an excellent introduction to New Zealand English. Wolfram and Ward (2006) is a collection of very accessible introductions to varieties of American English, which covers, as the volume's subtitle promises, 'how dialects differ from coast to coast'.

8 Variation between accents

8.1 The importance of accent

Every speaker of English has a particular system of his or her own, known by linguists as that individual's **idiolect**. However, considering language only at the idiolectal level might produce extremely thorough and detailed descriptions, but would give rather little insight into why individuals speak in the way they do, or why some speakers sound more alike, and others very different, from one another. To understand this, we must identify higher-level groupings, and investigate geographical and social accents. That is to say, individuals adopt a particular mode of speech (or, more accurately, move along a continuum of modes of speech), depending on who they want to identify with, who they are talking to, and what impression they want to make.

Not all these 'decisions' are conscious, of course. Small children learn to speak as their immediate family members do; but quite soon, their peer group at school (even nursery) becomes at least equally important, and may provide rather different linguistic models. Later, older children, then television presenters, social media influencers, actors or sporting heroes may become role models, leading to further modifications in accent. Consequently, age-related differences appear in all varieties; some will be transient, as a particular TV show falls out of fashion and the words or pronunciations borrowed from it disappear; others will become entrenched in young people's language, and may persist into adulthood, providing the patterns children learn from in turn, and becoming entirely standard forms for the next generation.

This flexibility, and the associated facts of variation and gradual change, mean that phonologists face a Catch-22 situation. On the one hand, describing idiolects will give seriously limited information, since it will not reveal the groups an individual belongs to, or the dynamics of those groups. On the other hand, we must take care that the groups we propose are not described at too abstract a level. Any description of 'an

accent' is necessarily an idealisation, since no two speakers will use precisely the same system in precisely the same way: our physical idiosyncrasies, different backgrounds, and different preferences and aspirations will see to that. None the less, two speakers of, say, Scottish Standard English, or New Zealand English, will have a common core of features, which allows them to be grouped together by speakers of the same accent, by speakers of other accents, and by phonologists. Not everyone is equally adept at making these identifications, of course. Speakers of other varieties may succeed in placing accents only within a very general geographical area: thus, a speaker of GA may have difficulty in distinguishing a Scottish from an Irish speaker, while conversely, a Scot may confuse Americans and Canadians. Within groups, however, much more subtle distinctions are perceived and have geographical or social meaning: hence, one speaker of SSE may identify another as coming from Glasgow rather than Edinburgh, and perhaps even from a particular area of the city, and may well base assumptions to do with social class and level of education on those linguistic factors.

Accent is clearly extremely important, as one of the major tools we use in drawing inferences about our fellow humans, and in projecting particular images of ourselves. Phonologists should, then, be able to do as speakers do, in identifying and classifying accents, but with a more technical rather than emotional classification of the differences and similarities between them. An accent, in phonological terms, is an idealised system which speakers of that variety share. Although slight differences in its use may be apparent, both between and within individuals, its speakers will still share more in common with one another, and with that idealised accent system, than with speakers of any other idealised accent system. **Standard** accents should also be described in just the same way as **non-standard** ones, as they provide just the same sort of social and geographical information about their users: that is, although it is quite common for speakers of a standard accent, such as SSBE in the south of England, to claim that they have no accent, other speakers (and phonologists) know different.

A more detailed appreciation of the cues speakers attend to in different accents, which features are most useful to them in recognising and identifying an accent, and the social judgements they make on that basis, are matters for sociolinguistics and **dialectology** rather than phonology. The main contribution a phonologist can make is to produce a classification of types of differences between accents, which can then be used in distinguishing any set of systems; that is the goal of this chapter. However, we shall return later to consider some recently developing accents, and to the contributions of **language contact**

in some of those cases, which takes us back into sociolinguistics and language change in progress.

In the next three sections, we shall introduce a three-way classification of accent differences, and illustrate these using examples involving both consonants and vowels. First, the phoneme systems of two accents may vary, so different phonemic oppositions can be established for them: these are **systemic differences**. Second, the same phonemes may have different allophones: these are **realisational differences**. Finally, there are **distributional differences**, whereby the same lexical item may contain different phonemes in two different varieties; or alternatively, the same phoneme may demonstrate a phonological restriction on its distribution in one variety but not another.

8.2 Systemic differences

The first and most obvious difference between accents is the systemic type, where a phoneme opposition is present in one variety but absent in another. Consonantal examples in English are relatively rare – in other words, most accents of English share the same consonantal phoneme inventory. As we have already seen, some varieties of English, notably SSE, Scots and NZE, have a contrast between /w/ and /ʍ/, as evidenced by minimal pairs like *Wales* and *whales*, or *witch* and *which*. Similarly, SSE and Scots have the voiceless velar fricative /x/, which contrasts with /k/ – for instance, in *loch* versus *lock* – but which is absent from other accents. NZE speakers will therefore tend to have one more phoneme, and Scots and SSE speakers two more, than the norm for accents of English.

Conversely, some accents have fewer consonant phonemes than most accents of English. For instance, in Cockney and various other inner-city English accents, [h]-dropping is so common, and so unrestricted in terms of formality of speech, that we might regard /h/ as having disappeared from the system altogether. This is also true for some varieties of Jamaican English. In many parts of the West Indies, notably the Bahamas and Bermuda, there is no contrast between /v/ and /w/, with either [w] or a voiced bilabial fricative [β] being used for both, meaning that /v/ is absent from the phonemic and phonetic systems. The same contrast is typically missing in Indian English, but the opposition is resolved in a rather different direction, with the labio-dental approximant [ʋ] very frequently being used for the initial sound of *wine* and *vine*, or *west* and *vest*. Again, there is only a single consonant phoneme in this case in Indian English, while other accents typically have a contrast between two.

The number of accent differences involving vowels, and the extent of variation in that domain, are very significantly greater than in the case of consonants for systemic, realisational and distributional differences. This probably reflects the fact that the vowel systems of all English varieties are relatively large, so that a considerable number of vowels occupy a rather restricted articulatory and perceptual space; in consequence, whenever and wherever one vowel changes, it is highly likely to start to encroach on the 'territory' of some adjacent vowel. It follows that a development beginning as a fairly minor change in the pronunciation of a single vowel will readily have a knock-on effect on other vowels in the system, so that accent differences in this area rapidly snowball. In addition, as we saw in earlier chapters, the phonetics of vowels is a very fluid area, with each dimension of vowel classification forming a continuum, so that small shifts in pronunciation are extremely common, and variation between accents, especially when speakers of those accents are not in day-to-day communication with each other, develops easily.

Systemic differences in the case of vowel phonemes can be read easily from lists of Standard Lexical Sets and the systems plotted from these on vowel quadrilaterals. If, for the moment, we stick to the four reference accents introduced in the last chapter – namely, SSBE, GA, SSE and NZE – we can see that SSBE has the largest number of oppositions, with the others each lacking some of these. Comparing GA to SSBE, we find that GA lacks /ɒ/, so that LOT words are produced with /ɑː/, as are PALM words, while CLOTH has the /ɔː/ of THOUGHT. In this respect, SSBE is 'old-fashioned': it maintains the ancestral state shared by the two accents. However, in GA, realisations of the earlier /ɒ/ have changed their quality and merged, or become identical with the realisations of either /ɑː/ or /ɔː/. GA also lacks the centring diphthongs of SSBE, so that NEAR, SQUARE, CURE share the vowels of FLEECE, FACE, GOOSE respectively, but since GA is **rhotic** (that is, has an allophone of /r/ pronounced wherever there is an <r> in the spelling), the former lexical sets also have a realisation of /r/, while the latter do not. In this case, however, the historical innovation has been in SSBE. At the time of the initial settlement of British immigrants in North America, most varieties of English were rhotic, as GA still is, but the ancestor of SSBE has subsequently become non-rhotic. The loss of /r/ before a consonant or a pause in SSBE has had various repercussions on the vowel system: most notably, the development of the centring diphthongs.

In systemic terms, NZE lacks only one of the oppositions found in SSBE – namely, that between /ɪ/ and /ə/; in NZE, both KIT and LETTER words have schwa. There are more differences in symbols between the SSBE and NZE lexical set lists in Chapter 7; but these typically reflect

realisational, and sometimes distributional, rather than systemic differences, as we shall see in the next two sections. That is to say, I have chosen to represent the vowel of NZE TRAP as /ɛ/ and DRESS as /e/, FLEECE as /ɪi/ and FACE as /ɛɪ/, to highlight the typical realisational differences between the two accents. However, in phonemic terms, the TRAP and DRESS vowels, and the FLEECE and FACE vowels, still contrast in NZE, just as they do in SSBE. That is, the pairs of vowel phonemes in (1) are equivalent: they are symbolised differently because they are very generally pronounced differently (and we could equally well have chosen the same phonemic symbols in each case, to emphasise this parity, at the cost of a slightly more abstract system for NZE; see the discussion in Section 7.2.2 above), but the members of the pairs are doing the same job of distinguishing Standard Lexical Sets in the different accents.

(1)

SSBE	NZE	
ɛ	e	DRESS
æ	ɛ	TRAP
iː	ɪi	FLEECE
eɪ	ɛɪ	FACE

When we turn to SSE, however, we find a considerably reduced system relative to SSBE. As we might expect, given that SSE is rhotic, it lacks the centring diphthongs, so that NEAR, SQUARE, CURE share the vowels of FLEECE, FACE, GOOSE, though the former will have a final [ɹ] following the vowel. SSE also typically lacks the /ɜː/ vowel of NURSE, with [ʌɹ] appearing here instead; so the NURSE and STRUT sets share the same vowel. Leaving aside vowels before /r/, however, there are three main oppositions in SSBE which are not part of the SSE system, as shown in (2).

(2)

SSBE	SSE	
a	a	TRAP
ɑː	a	PALM
ɒ	ɒ	LOT
ɔː	ɒ	THOUGHT
ʊ	u	FOOT
uː	u	GOOSE

Each of these three contrasting pairs of vowel phonemes in SSBE corresponds to a single phoneme in SSE. While *Sam – psalm*, *cot – caught* and *pull – pool* are minimal pairs in SSBE, establishing the oppositions between /a/ and /ɑː/, /ɒ/ and /ɔː/, and /ʊ/ and /uː/ respectively, for

SSE speakers the members of each pair will be homophonous. There is no vowel quality difference; and the Scottish Vowel Length Rule, which makes vowel length predictable for SSE and Scots, means there is no contrastive vowel quantity either. There is some variation in SSE in this respect: speakers who have more contact with SSBE, or who identify in some way with English English, may have some or all of these oppositions in their speech. If an SSE speaker has only one of these contrasts, it is highly likely to be /a/ – /ɑ/; if /ʊ/ and /u/ are contrasted, we can predict that the /ɒ/ – /ɔ/ and /a/ – /ɑ/ pairs also form part of the system.

Of course, such systemic differences are not restricted to the reference accents surveyed above and in Chapter 7. For instance, within British English, many accents of the north of England and north Midlands fail to contrast /ʊ/ and /ʌ/, so that *put* and *putt*, or *book* and *buck* all have /ʊ/. In some parts of the western United States, speakers typically lack the /ɑː/ – /ɔː/ opposition found in GA, so they have /ɑː/ in both *cot* and *caught*. Other varieties of English have an even more extreme reduction of the vowel system relative to SSBE. These accents typically began life as second language varieties of English: that is, they were, at least initially, learned by native speakers of languages other than English, although they may subsequently have become official language varieties in particular territories, and be spoken natively by more recent generations. Inevitably, these varieties have been influenced by the native languages of their speakers, showing that language contact can also be a powerful motivating force in accent variation.

One case involves Singapore English. Singapore became a British colony in 1819, and English was introduced to a population of native speakers of Chinese (today, principally Mandarin), Malay, Tamil and a number of other languages. English has been the primary medium of education since 1987, and at least a third of the population mainly use English at home, so that Singapore English is becoming established as a native variety. Its structure, however, shows significant influence from other languages, and most Singaporeans can guess the ethnic background of another Singaporean speaker from hearing just a short amount of their conversational English. As with many accents, there is a continuum of variation in Singapore English, so that non-native speakers are likely to have pronunciations more distant from, say, SSBE: thus, while a native Singapore English speaker will say [mail] 'mile', a second-language speaker who is much more influenced by his native language may say [mʌʊ]. Individual speakers often switch, depending on who they are talking to, between more standard Singapore English and colloquial Singapore English, or 'Singlish'. Increasingly, younger

speakers of Singapore English are also looking to American rather than British English as a reference variety, so that further change in the system is likely. The system presented as Singapore English (SgE) in (3) is characteristic of native or near-native speakers. Note that SgE has no contrastive differences of vowel length.

(3)

SSBE	SgE	Set number	Keyword
ɪ	i	1	KIT
ɛ	ɛ	2	DRESS
a	ɛ	3	TRAP
ɒ	ɔ	4	LOT
ʌ	ʌ	5	STRUT
ʊ	u	6	FOOT
ɑː	ʌ	7	BATH
ɒ	ɔ	8	CLOTH
ɜː	ə	9	NURSE
iː	i	10	FLEECE
eɪ	e	11	FACE
ɑː	ʌ	12	PALM
ɔː	ɔ	13	THOUGHT
oʊ	o	14	GOAT
uː	u	15	GOOSE
aɪ	ai	16	PRICE
ɔː	ɔi	17	CHOICE
aʊ	au	18	MOUTH
ɪə	iə	19	NEAR
ɛə	ɛ	20	SQUARE
ɑː	ʌ	21	START
ɔː	ɔ	22	NORTH
ɔː	o	23	FORCE
ʊə	ɔ	24	CURE
ɪ	i	25	HAPPY
ə	ə	26	LETTER
ə	ə	27	COMMA

It is sometimes suggested that an extra Standard Lexical Set should be recognised (let's call it set 28, POOR) because, in Singapore English, words like *poor*, *sure*, *tour* have a diphthong /uə/, as opposed to /ɔ/ in *cure* and *pure*. However, as (3) shows, the typical pattern is for vowel oppositions found in SSBE to be absent from SgE. Sometimes, this seems to reflect influence from other languages spoken natively in Singapore. For example, neither Malay nor Hokkien Chinese has any

low back vowels, and where we would find a low back vowel in SSBE in BATH, PALM, START, we find instead the same /ʌ/ as in STRUT words. Likewise, neither Malay nor Hokkien has /a/, and both DRESS and TRAP words in SgE have the higher /ɛ/. In fact, the nearest vowel in the vowel quadrilateral in both Hokkien and Malay is the even higher /e/, and SgE does raise /ɛ/ to [e] before plosives and affricates, as in *head*, *neck*, *edge*. What we find here, and in many other contact situations, is not a direct copying of features from another language into the local variety of English, but a less direct influence which none the less shapes the system and its phonetic realisations.

8.3 Realisational differences

In the second type of accent difference, part of the system of phonemes may be the same for two or more accents, but the realisations of that phoneme or set of phonemes will vary. For instance, in SSBE, SSE and GA, /l/ has two main allophones, being clear, or alveolar, [l] before a stressed vowel, as in *light*, *clear*, but dark, velarised [ɫ] after a stressed vowel, as in *dull*, *hill*. This distribution of allophones is not the only possibility in English, however. In some accents, /l/ is always realised as clear; this is true, for instance, of Tyneside English (or 'Geordie'), Welsh English, and some South African varieties. On the other hand, in Australia and New Zealand, /l/ is consistently pronounced dark; and indeed, realisations may be **pharyngeal** rather than velar, or in other words, pronounced with a restriction even further back in the vocal tract. In London English, there is a further allophone of /l/: namely, a vocalised (or vowel-like) realisation finally or before a consonant: in *sell*, *tall*, *people*, *help*, /l/ is typically realised as a high or high mid back vowel like [ʊ] or [o]. For younger speakers, **/l/-vocalisation** is also taking hold in medial position, in words like *million*; and the process is also spreading beyond London, as part of the shift towards so-called 'Estuary English', a mixture of SSBE and London English which is arguably becoming a new standard for young people, especially in urban centres in the south of England.

The other English liquid consonant, /r/, also provides plenty of scope for realisational differences. /r/ is typically an alveolar or slightly retroflex approximant for SSBE and GA, but at least in medial position, is frequently realised as an alveolar tap in SSE (the tap is also a common realisation in South African English). In some parts of the north of England, notably in Northumberland and County Durham, a voiced uvular fricative [ʁ] is quite commonly found, although this may be receding gradually.

In other areas of northern England, this time notably Yorkshire, Tyneside and Liverpool, [ɹ] appears as an allophone of /t/, typically between vowels and across a word-boundary, as in *not on* [nɒɹɒn], *lot of laughs* [lɒɹə …], *get a job* [gɛɹə …]. In Merseyside, voiceless stops are very generally realised as fricatives or affricates in word-final position, so that *cake*, *luck*, *bike* will be [keɪx], [lʊx], [baɪx]. Whereas in Scots and SSE the appearance of [x] in *loch* constitutes a systemic difference, as there are minimal pairs establishing an opposition of /x/ and /k/, in Liverpool the velar fricative is clearly an allophone of /k/, so that the accent difference between, say, SSBE and Merseyside English in this respect is realisational but not systemic.

Turning to vowels, one particularly salient example involves the FACE and GOAT vowels, which, in SSBE, NZE and Australian English, are pronounced consistently as diphthongs. In GA, the FACE vowel is diphthongal, while the GOAT vowel may be a monophthong; and in SSE and SgE, both are monophthongal, with the predominant allophones being high-mid [e] and [o] in both accents. The NURSE vowel in SSBE is mid central [ɜː]; the same phoneme in NZE is very generally rounded, while in SgE it is typically raised to high-mid back unrounded [ɤ], or high back unrounded [ɯ] (not entirely surprisingly, Hokkien has [ɤ], Malay has both [ɤ] and [ɯ], but both lack [ɜ]).

Sometimes, although these realisational differences have no direct impact on the phoneme system itself, they do lead to neutralisations of otherwise consistent contrasts. For instance, we saw in the last section that SgE speakers raise /ɛ/ to [e] before plosives and affricates; the monophthongal pronunciation of /e/ as [e] in FACE words, and the lack of any systematic vowel-length distinction in SgE means that the contrast of /ɛ/ and /e/ is suspended in this context, leading to identical pronunciations of *bread* and *braid*, or *wreck* and *rake*. It is also possible for realisational differences in vowels to lead to allophonic differences in consonants. For instance, right at the beginning of this book, we identified an allophonic difference between velar [k] and palatal [c], with the latter appearing adjacent to a front vowel. In SSBE, SSE and GA, this will mean that velar realisations will be produced in *cupboard* and *car*, palatals in *kitchen* and *keys*. However, the distribution differs in other varieties of English, depending on their typical realisations of the FLEECE and KIT vowels. In NZE, FLEECE has a high front diphthong, so that *keys* will still have [c]; but no fronting will take place in *kitchen*, since the KIT set in NZE has central [ə]. On the other hand, in Australian English, KIT has a rather high, front [i] vowel so that *kitchen* will certainly attract a palatal [c]; but in some varieties at least, the diphthong in *keys* is central [əɪ], which will therefore favour a velar allophone of /k/.

8.4 Distributional differences

Distributional differences fall into two subclasses. First, there are differences in **lexical incidence**: certain individual lexical items will simply have one vowel phoneme in some accents, and another in others. For example, British English speakers are quick to comment on American English /aʊ/ in *route*, or /ɛ/ in *lever*; Americans find British English /ruːt/ and /liːvə(ɹ)/ equally odd. Some Northern English English speakers have /uː/ rather than /ʊ/ in *look* and other <oo> words; and it is fairly well known in Britain that words containing /ɑː/ vary in English English, with *grass*, *dance*, *bath*, for instance, having /a/ for many northern speakers, but /ɑː/ in the south, though both varieties have /ɑː/ in *palm*. Similarly, in SSE, *weasel* has /w/, and *whelk* /ʍ/; but in Borders Scots, where these phonemes also contrast, and where indeed most of the same minimal pairs (like *Wales* and *whales*, *witch* and *which*) work equally well, the lexical distribution in these two words is reversed, with /ʍ/ in *weasel* and /w/ in *whelk*.

On the other hand, a difference in the distribution of two phonemes may depend on the phonological context rather than having to be learned as an idiosyncrasy of individual lexical items. For instance, in GA there is a very productive restriction on the consonant /j/ when it occurs before /uː/. Whereas, in most British English, [j] surfaces in *muse*, *use*, *fuse*, *view*, *duke*, *tube*, *new*, *assume*, in GA it appears only in the first four examples, and not in the cases where the /uː/ vowel is preceded by an alveolar consonant. There is also, as we have seen, a very clear division between rhotic accents of English, where /r/ can occur in all possible positions in the word (so [ɹ], or the appropriate realisation for the accent in question, will surface in *red*, *bread*, *very*, *beer*, *beard*, *beer is*), and non-rhotic ones, where /r/ is permissible only between vowels (and will therefore be pronounced in *red*, *bread*, *very*, *beer is*, but not the other cases).

Again, vowels follow the same patterns. For instance, in many varieties of English, schwa is available only in unstressed positions, in *about*, *father*, *letter*; in NZE, however, its range is wider, since it appears also in stressed syllables, in the KIT lexical set. Similarly, in some varieties, words like *happy* have a tense /i/ vowel in the second, unstressed syllable; this is true for Tyneside English, SSE, GA and NZE. In SSBE, however, only lax vowels are permitted in unstressed syllables, so that /ɪ/ appears in *happy* instead. Not all these distributional restrictions have to do with stress; some are the result of other developments in the consonant or vowel systems. For instance, the presence of the centring diphthongs before historical /r/ in SSBE (and other non-rhotic accents)

means that non-low monophthongs cannot appear in this context. On the other hand, in rhotic accents like SSE and GA, there are no centring diphthongs, and the non-low monophthongs consequently have a broader range, with the same vowel appearing in FLEECE and NEAR, FACE and SQUARE, GOOSE and CURE.

In defining how accents differ, then, we must consider all three types of variation: systemic, realisational and distributional. Although some of these (notably the systemic type) may seem more important to a phonologist, since they involve differences in the phoneme system, we must remember that one of the phonologist's tasks is to determine what speakers of a language know, and how their knowledge is structured. It follows that we must be able to deal with the lower-level realisational and distributional differences too, since these are often precisely the points native speakers notice in assessing differences between their own accent and another variety of English. In any case, all of these types of variation will work together in distinguishing the phonological systems of different accents, and as we have seen, variation at one level very frequently has further implications for other areas of the phonology.

8.5 New accents – language contact and World Englishes

As we saw in the case of SgE, varieties of English often emerge in so-called L2 contexts – where they are primarily learned and spoken as second or other languages. Such varieties are then acquired and spoken as first or **L1** languages, and settle around a series of norms which will typically be shared by at least most of their speakers on most occasions. This is why we can set out a list of typical SgE vowels in the Standard Lexical Sets, for example – more often than not, native speakers will share this system, though there is likely to be some variation, depending on their family language background, and the style of speech.

SgE is not the only variety to have emerged in an L2 context, by any means. Hong Kong, which is now a Special Administrative Region of the People's Republic of China, was under British rule from 1842 until 1997. Some 95 per cent of the resident population is ethnic Chinese, and while Cantonese, English and Putonghua (spoken Mandarin) are the three official languages of Hong Kong, about 89 per cent are Cantonese speakers. There are some clear influences of Cantonese on Hong Kong English: for example, Cantonese does not allow consonant clusters at the beginning of a syllable (for more on syllables, see the next chapter), and Hong Kong English speakers frequently simplify initial clusters (*primary* [paɪmri], *places* [peɪsɛz]). However, when we turn to the vowel system, we find that Hong Kong speakers are just as likely to have

features in common with SSBE than to evidence a transfer of features from Chinese. For example, while SgE has [ʌ] in STRUT, BATH, PALM and START words, Hong Kong English shares this vowel for STRUT, but has [ɑː] in BATH, PALM and START. Speakers in similar contact situations do not always form their sound systems in the same ways. As English comes into contact with more and more languages world-wide, either face to face or online, we are likely to see increasing evidence of direct or indirect influence on varieties of English from other languages. More **World Englishes** are emerging, as English has moved beyond its earlier heartlands to be used as a second language or **lingua franca**, either officially or for particular social interactions. Through studying these varied contexts, phonologists and **variationists** will understand more about what is possible and what is most likely in contact situations.

However, sociolinguists and dialectologists have also identified a new trend, often in cities, where languages which have been spoken there for a long time are developing new varieties in multilingual, often working-class localities. The emergence of these varieties is often driven by younger speakers. Perhaps the best known of these new **multiethnolects** is Multicultural London English, or MLE, which is likely to have been developing only since the early 1980s.

The term 'multiethnolect' signals that these varieties (a **lect** is simply a variety of a language, whether it is found in a specific social, geographical or stylistic context) are arising in the increasingly multiethnic, diverse communities within our cities. Children who are either born into or move into these communities may well have parents who do not speak the primary or official language of the area – English, in London – and might not have many models of native speakers to learn from. Consequently, speakers of English as a second language all end up learning from one another, in cases of group second-language acquisition. Within friendship groups of first- and second-language speakers, from mixed ethnicities and backgrounds, sound changes can then begin, and spread into the native English-speaking populations. Some of these changes, partly because of their strong association with young speakers who are still experimenting with language and building their adult systems, will be transient and disappear again. However, others will become established and form part of the norms for speakers of MLE.

It follows that MLE is definitely a contact variety, or at least a product of a contact situation – although this is very clearly not a straightforward case of features being copied or borrowed from one language into another. Instead, there are many languages involved, and a pool of available features from which some are selected. Linguists working on MLE often prefer to talk about it as a developing repertoire

of features, rather than a set and defined system. However, that development does take place in a particular direction, leading to a characteristic new accent which is the normal way of speaking for many, especially younger, speakers now; and it is a very recognisable variety. Jenny Cheshire, Paul Kerswill and their colleagues, the main team who have pioneered work on MLE, say that

> The English of inner city London has changed dramatically during the last fifty years or so. In the East End, the traditional working class dialect once characterised as 'Cockney' has been replaced by what the media describe as 'Jafaican', a term that encapsulates lay perceptions that 'it sounds black'. (Cheshire et al. 2013: 68)

This goes along with descriptions of younger speakers from London, regardless of their ethnicity, as having a 'blaccent'; and there are also lexical items which do seem to show influence from Afro-Caribbean sources, including Jamaican Patois.

Kerswill, Cheshire and colleagues investigated adolescent speakers in Havering and Hackney. Their outer-city Havering speakers were all white and monolingual in English; in inner-city Hackney, the population was more diverse, with half coming from families of British origin who had lived in the area for at least two generations, and the other half being children or grandchildren of ethnically diverse immigrant families.

In both Hackney and Havering, young speakers frequently demonstrated TH-fronting (where *tooth* is pronounced with a final labio-dental [f] rather than dental [θ], and *thirst* and *first* therefore become homophonous); /l/-vocalisation, with a [ʊ] or [w] realisation of /l/ finally in *all*, *hill*, and sometimes medially in *million*, *building*, and GOOSE-fronting, with a typically fronted realisation of /u:/.

However, in Hackney, there were other realisational tendencies which were not found in Havering. Notably, FACE words often had a monophthong [e] or a diphthong like [eɪ] with a much shorter transition, whereas speakers in Havering more commonly used a Cockney-like diphthong [æɪ]. Hackney adolescents typically pronounced GOAT words with a raised, back diphthong [oʊ], again with a shorter transition (a tendency to be closer to monophthongal, or with less of a difference between the two elements of the diphthong). On the other hand, young speakers in Havering more commonly used a fronted diphthong [əʏ]. Young Hackney speakers also tended to back velar /k/ to pharyngeal [q] before low back vowels, and to produce unstressed schwa in the indefinite article *a* and definite article *the*, even when they precede a vowel – so *a apple* rather than *an apple*, and *the* [ə] *end* rather than *the* [i]

end. This change in the pronunciation of the article, and the changes in GOAT and FACE diphthongs, are certainly spreading and becoming more common. While there is great variability, there are also common factors; interestingly, in a later study by Kerswill, Cheshire and their team, listeners from London could not reliably tell speakers' ethnicity when they used MLE, which is therefore becoming an ethnically neutral variety. This is quite unlike the situation reported for Singapore in the previous section, where ethnicity can be identified quickly from quite a short burst of conversational SgE.

MLE, then, involves a complex and highly dynamic contact situation, with speakers of many languages interacting – in the Hackney study, more than ninety-five languages were spoken natively by schoolchildren. This creates a substantial pool of linguistic features which can be selected as part of the developing variety, though there is still a great deal of work to be done to identify the factors determining which features speakers choose to fish out of that pool of variation, and why.

In some other examples of emergent varieties, there is also language contact, but with a much more restricted repertoire of languages involved. This is the case in the United States for Chicano English, which is typically spoken by people of Mexican ethnic origin in California and the Southwest. It started out among English-learning immigrants who spoke only Spanish, but across generations, a community speaking both English and Spanish began to stabilise, with its own variety of English, sharing norms and features. This means Chicano English can now be spoken, and is spoken, by people who speak no Spanish; and it is by no means the same as having a Spanish accent.

Many of the differences from other varieties of English are in stress and **intonation** (to which we turn in the final two chapters of this book), but there are also some segmental differences, often showing the influence of Spanish. For example, Chicano English less often has a reduced vowel like schwa in unstressed syllables than the English of 'Anglo' speakers, who often have reduced [tə] for *to*, whereas Chicano speakers will typically retain [tʰu]. The suffix *-ing* in *working* will usually have [ɪ] for an Anglo speaker, but tense [i] in Chicano English, with a vowel more common in Spanish. This use of [i] rather than [ɪ], even in stressed syllables like *king*, may well be spreading to Anglo speakers in California now too.

Many of these emergent or relatively recent varieties of English are clearly developing in situations of language contact. As people become more mobile, it is not surprising that we share features of our language with one another. As the ways in which we interact grow and change, so

that younger speakers in particular are influenced by music, videos on the internet, and virtual friendship groups across previously unthinkable geographical distances, the ways in which our languages and varieties influence one another can only become more varied, complex – and fascinating for phonologists.

Exercises and topics for discussion

1. Plot your vowel system on a vowel quadrilateral. (You may wish to use one diagram for monophthongs, and one for diphthongs; or even more than one for diphthongs if you have a system with a large number of these.)

2. What is your phonemic consonant system? Provide minimal pairs to establish the contrasts involved. Pay particular attention to whether your accent is rhotic or non-rhotic, and whether your system includes /ʍ/ and /x/ or not. Do any of the consonant phonemes of SSBE fail to contrast in your accent? Why might this be?

3. Many speakers of English in England have a process called 'TH-fronting'. Instead of dental fricatives, these speakers often (especially in less formal settings) pronounce labio-dental ones, so *thing* has initial [f] rather than [θ], and *bother* has medial [v] not [ð]. First, find out what you can about TH-fronting, and assess whether it is a systemic, realisational or distributional difference. Then, consider my middle son, Fergus, who went through several years of highly consistent TH-fronting in early adolescence. His sister used to wind him up by calling him *Thergus*. What was she doing, and why did it make linguistic sense?

4. Set out the differences between your variety, for both vowel and consonant systems, and (a) SSBE, (b) GA, (c) SSE, (d) NZE, (e) SgE. In each case, classify the discrepancies as systemic, realisational or distributional. If you are a non-native speaker of English, or bilingual in English and another language, can you identify aspects of your native language(s) which might be responsible for some of the differences you have identified?

5. Paul Kerswill and Eivind Torgersen (2017) say of Multicultural London English 'it is actually hard to talk of it as a variety, since it contains a broad range of variation'. Find out more about MLE, using the resources at the end of the chapter, and plot the vowel system using either a Standard Lexical Sets approach, or vowel quadrilaterals (or, indeed, both). Is it sensible to talk and think about shared systems in this

way when there is so much variation? Do our phonological practices of identifying vowel systems, and using phoneme notation and lexical sets, suggest there is homogeneity when there really isn't, and sideline variation when it is actually more important? On the other hand, if we focus only on individuals, how can we capture the fact that some speakers have more in common than others?

Recommendations for reading

Giegerich (1992) provides phonological analyses of some of the varieties discussed here; characteristics of an overlapping set of accents are also discussed in Carr (2012). Some of the data discussed here come from Wells (1982), which covers a fairly complete range of varieties of English, but with understandably less on recently emerging varieties. Trudgill (2000a) provides more detail on the dialects of England in particular, and Wolfram and Schilling-Estes (1996) on American English. Beal (2010) focuses on regional varieties in England, and asks whether differences between accents and dialects are dying out.

The SgE material is mainly from Deterding (2007), and the Hong Kong information from Setter, Wong and Chan (2010). Both these books are in the 'Dialects of English' series from Edinburgh University Press, which showcases a range of varieties from around the English-speaking world: each volume contains a chapter on phonology, with an outline of the vowels in the Wells Standard Lexical Sets.

Information on Chicano English can be found in Fought's general introductory chapter in Wolfram and Ward (2006), with much more detail in Fought (2003) and Mendoza-Denton (2008) – there are interesting questions about the renaming of related varieties as Chicano, Hispanic or Latino English(es). You could also look at <https://www.pdx.edu/multicultural-topics-communication-sciences-disorders/chicano-english> or <https://www.pbs.org/speak/seatosea/americanvarieties/chicano/> for an interview with Carmen Fought.

MLE, as an emergent variety, is not typically covered in textbooks yet, so for further information you will generally have to access online resources or look at research results (such as Cheshire et al. 2011, Cheshire et al. 2013 or Kerswill and Torgersen (2017). The Databank of Spoken English (<https://www.qmul.ac.uk/sllf/linguistics/research/socio/english-language-teaching/databank-of-spoken-english/>) includes recordings of MLE speakers and transcripts with features of interest pointed out, though be aware that the focus is mainly on grammatical rather than phonological structures. The Linguistics Research Digest also includes a series of linked blogs about

MLE, written by members of the research team who have done most work on the variety, including Jenny Cheshire, Paul Kerswill and Sue Fox (<https://linguistics-research-digest.blogspot.com/2011/11/multicultural-london-english-part-1.html>). There is a huge amount of information and material available, including both recordings of many different accents and conversations about language, in the British Library Sounds archive (<https://sounds.bl.uk>).

There are lots of introductions to sociolinguistics and dialectology – for sociolinguistics, you could try Trudgill (2000b) or Meyerhoff (2018), and for dialectology, Chambers and Trudgill (1998). Thomason (2001) and Lim and Ansaldo (2015) provide introductions to the topical and fast-moving area of contact linguistics.

9 Syllables

9.1 Phonology above the segment

At the end of the last chapter, we returned to the central issue, and the central task for phonologists, of assessing what speakers know about the structure of their language. In this book so far, we have concentrated on this knowledge, and the speech production that reflects it, at the level of the segment and below. That is, we have discussed vowels and consonants, the features of which they are composed, and the judgements speakers make about them. However, as we shall see in this chapter and the next, speakers' behaviour and intuitions also indicate the presence of phonological organisation at a series of higher levels, above the single segment. Vowels and consonants are not just strung together haphazardly into long, unstructured strands: instead, they form a series of larger units with their own internal structure and distribution, governed by their own rules.

The first and smallest of these superordinate units, the syllable, will be the main focus of this chapter. Recognising and understanding syllables helps us state some phonological processes (for example, involving English /l/ and the aspiration of voiceless plosives) more accurately and succinctly. As we shall see in Chapter 10, the syllable and the next unit, the **foot**, are also crucial in analysing and determining the position of stress within each word. Finally, in whole utterances consisting of a sentence or more, phonological processes may apply between words, and rhythm and intonation produce the overall melody of longer stretches of speech.

9.2 The syllable

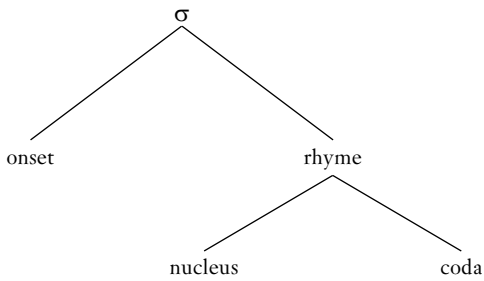
Speakers certainly have an intuitive notion of how many syllables each word contains: for instance, speakers of English would generally agree that *meadow*, *dangerous* and *antidisestablishmentarianism* (allegedly

the longest word in the language) have two, three and twelve syllables respectively. It is less easy for speakers to reflect consciously on the internal structure of syllables, or to decide where one stops and the next starts; but a wide variety of cross-linguistic studies have helped phonologists construct a universal template for the syllable, within which particular languages select certain options. The internal structure of the syllable, and evidence for its subparts from a range of English phonological processes, will be the topic of this chapter.

9.3 Constituents of the syllable

The universal syllable template accepted by most phonologists is given in (1). Note that small sigma (σ) is shorthand for 'syllable'; capital sigma (Σ), as we shall see later, is used to symbolise the foot (which is a larger unit, extending from the beginning of a stressed syllable to the start of the next stressed syllable – more on feet in Chapter 10).

(1)



The only compulsory part of the syllable, and hence its **head**, or most important, defining unit, is the nucleus. This will generally contain a vowel (and recall that vowels are [+syllabic]): indeed, the syllable *I*, or the first syllable of *about*, consist only of a nucleus. If no vowel is available, certain consonants can become nuclear and play the part of a vowel. In English, this is true of /l/, /m/, /n/ and /r/ in rhotic accents: that is, the sonorant consonants, in natural class terms. Each of the words *bottle*, *bottom*, *button*, *butter* has two syllables, and in each case, the second syllable consists only of nuclear, or syllabic [l̩], [m̩], [n̩] and [ɹ̩].

Both the **onset** and the **coda** are optional constituents, and each, if filled, will contain one or more consonants. In English, *be* has an onset but no coda; *eat* has a coda but no onset; and *beat* has both. Recognising the difference between the nucleus, which is primarily the domain of vowels, and the onset and coda, where we find consonants, also casts some light on the relationship between the high vowels /i u/ and the

glides /j w/. Phonetically, it is very hard to detect any systematic difference between [i] and [j], or [u] and [w] respectively; however, we can now say that [i] and [u] are [+syllabic], while the glides are [–syllabic], so that in *ye*, [j] is in the onset and [iː] in the nucleus; similarly, in *woo*, [w] is an onset consonant and [uː] a nuclear vowel. Clearly, [j] and [iː] are extremely similar phonetically; furthermore, since distinguishing syllable peaks, or nuclei, from margins allows us to predict where each will occur, they are in complementary distribution (and the same is true of [w] and [uː]). Technically, this could make [j] and [iː], and [w] and [uː], allophones of a single phoneme, with their distribution determined by position in the syllable – though to assess whether this is the most appropriate analysis, we would need to find ways of assessing whether it matches speakers' intuitions about what counts as 'the same'.

9.4 The grammar of syllables: patterns of acceptability

Patterns of permissibility vary in terms of filling these constituents of the syllable. In some languages, like Arabic, every syllable must have an onset; if a word without an onset in one syllable is borrowed from another language, for instance, a glottal stop [ʔ] will be inserted to meet that requirement. Conversely, in Hawaiian, no codas are allowed, so that coda consonants in loanwords will be deleted, or have an extra, following vowel introduced, so the consonant becomes an onset and therefore legal. However, there do not seem to be any languages which either insist on codas or rule out onsets. The universal, basic syllable type is therefore CV, where C means 'some consonant or another' and V means 'some vowel or another': all known languages allow this, whether they have other, more complex, syllable types in addition or not.

9.4.1 Phonotactic constraints

Even languages like English, which allow both onsets and codas, have restrictions on the permissible contents of those slots: these restrictions are known as phonotactic constraints. In particular, English allows **clusters** of two or three consonants in both onsets and codas; some languages have more complex cluster types, others only CC, and perhaps in the onset only. Some restrictions on the composition of clusters reflect structural idiosyncrasies of English; these include the examples in (2).

(2) In a CCC onset, C1 must be /s/.
/ŋ/ does not appear in onsets.
/v ð z ʒ/ do not form part of onset clusters.

/t d θ/ plus /l/ do not form permissible onset clusters.
/h/ does not appear in codas.
Coda clusters of nasal plus oral stop are acceptable only if the two stops share the same place of articulation.
/lg/ is not a permissible coda cluster.

9.4.2 The Sonority Sequencing Generalisation

However, some other restrictions on possible clusters are not specific to English; instead, they reflect universal prohibitions or requirements. The most notable phonological principle which comes into play here is known as the **Sonority Sequencing Generalisation**, and governs the shape of both onsets and codas. **Sonority** is related to the difference between sonorants (sounds which are typically voiced, like approximants, nasal stops and vowels) and obstruents (oral stops and fricatives, which may be either voiced or voiceless). Sonorants are more sonorous (believe it or not): that is, their acoustic properties give them greater carrying power. If you stood at the front of a large room and said one sound as clearly as you could, a listener at the back would be much more likely to be able to identify a highly sonorous sound like [ɑ] than a sound at the other end of the sonority range, such as [t].

Our knowledge of acoustic phonetics and other aspects of sound behaviour can be combined to produce a sonority scale like the one given in (3). Here, the most sonorous sounds appear at the top, and the least sonorous at the bottom. Some English examples are given for each category.

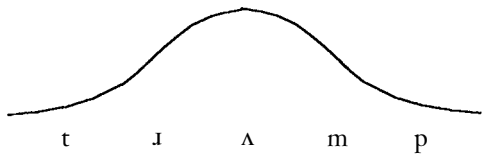
(3)

Low vowels	[ɑ æ] …
High vowels	[i u] …
Glides	[j w]
Liquids	[l ɹ]
Nasals	[m n ŋ]
Voiced fricatives	[v z] …
Voiceless fricatives	[f s] …
Voiced plosives	[b d g]
Voiceless plosives	[p t k]

Natural classes of sounds which function together in phonological processes are often composed of single or adjacent levels on the sonority hierarchy. For instance, English liquids and nasals can be syllabic, and these are the closest consonants to the vowel series (with the exception of the glides; and as we have seen already, we might say that [j w] do have syllabic counterparts – namely, the high vowels).

The general rule expressed by the Sonority Sequencing Generalisation is that syllables should show the sonority curve in (4).

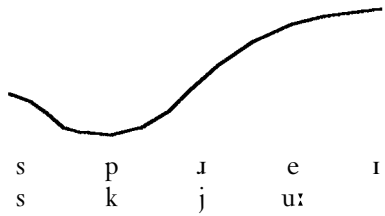
(4)



The nucleus constitutes the sonority peak of the syllable, with sonority decreasing gradually towards the margins. In syllables like *trump*, *prance*, *plant*, the outermost consonants, at the beginning of the onset and the end of the coda, are at the bottom end of the sonority scale, while less marginal consonants, adjacent to the vowel, are higher up the scale, and therefore closer to the vowel in their sonority value. Lack of adherence to the Sonority Sequencing Generalisation therefore rules out onsets like *[lp], *[jm], *[ɹg], although onsets with the same segments in the opposite order are found in *play*, *muse*, *grey*. Similarly, universal sonority restrictions mean English lacks *[pm], *[kl], *[mr] codas, although again clusters with the opposite order, which do show descending sonority, are attested in *lamp*, *silk*, *harm* (the last in rhotic accents only).

Like many rules, the Sonority Sequencing Generalisation has an exception, and this involves the behaviour of /s/. The onset clusters in *spray*, *skew* have the sonority profile in (5).

(5)



That is, the marginal consonant [s] has a higher sonority value than the adjacent voiceless plosive: yet there can be no question of drawing a syllable boundary here and recognising two syllables within the same word, as [s] is not one of the English consonants which can become nuclear or syllabic. The equivalent problem arises in codas. We would normally use a sonority pattern like the one in (6a) to tell us that a syllable division should be made, giving two syllables in *little*, but one in *lilt*. However, codas with both orders of clusters involving [s] are possible, as in *apse* and *asp*, or *axe* and *ask*; and the same sonority pattern in (6b)

must be analysed, contrary to the Sonority Sequencing Generalisation, as corresponding to a single syllable.

(6)

(a) l ɪ t ɪ *little* (two syllables)

(b) f ɒ k s *fox* (one syllable)

These exceptions are at least not random: cross-linguistically, violations of the Sonority Sequencing Generalisation always seem to involve coronal consonants (those produced using the tongue tip or blade, and typically alveolars), and especially /s/. Such consonants seem to behave exceptionally in a number of ways, and have to be excluded from various phonological generalisations, though it is not yet quite clear why.

9.5 Justifying the constituents

9.5.1 Syllable-based processes

Recognising the syllable as a phonological unit, and moreover a unit with the internal structure hypothesised in (1), allows us to write improved versions of some phonological rules introduced in previous chapters. Sometimes, what determines or conditions a phonological process or change is simply the nature of an adjacent segment. We can think of this as a sort of pattern-matching process: for example, we have seen that the nasal of the prefix *in-* assimilates to a following consonant, and that sounds frequently become voiced between other voiced segments. However, in other cases, it is the position of a sound within the syllable that dictates or influences its phonetic shape. In turn, improvements in our statement of phonological rules may help justify or validate the constituents we have proposed for the syllable.

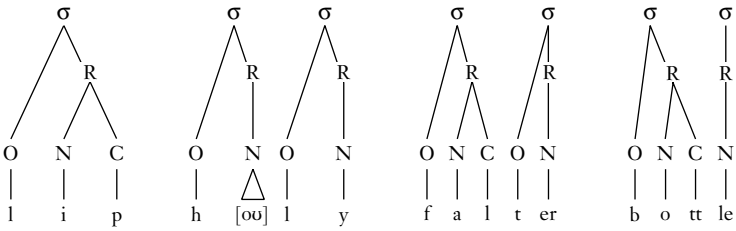
First, the notion of the syllable in general, and the onset constituent in particular, helps us to state the environment for aspiration of voiceless stops more accurately. Our current, rather informal, version predicts aspiration in absolute word-initial position; as we already know,

/p t k/ surface as aspirated in *pill*, *till*, *kill*, but not when preceded by /s/ in *spill*, *still*, *skill*. However, this is not the whole story, since we can also observe aspiration in *repair*, *return*, *record*, though not in *respond*, *disturb*, *discard*. In these examples, the voiceless stops are medial, not initial in the word; but in *repair*, *return*, *record*, they are the sole constituents of the onset for syllable two, and therefore initial in that syllable. As for *respond*, *disturb*, *discard*, here also /p t k/ are part of the onset, but this time preceded by /s/; and since a preceding /s/ inhibits aspiration in onsets word-initially, we should not be surprised that the same pattern is found in onsets word-medially. In short, aspiration of voiceless stops takes place, not at the beginning of the word, but at the beginning of the onset.

Similar support can be found for the second major constituent of the syllable: namely, the **rhyme**. As we have seen already, many varieties of English have two main allophones of /l/, clear or alveolar [l] and dark, velarised [ɬ], and these are in complementary distribution. However, stating the nature of this complementarity is not entirely straightforward. In earlier chapters, the rule for velarisation of /l/ was informally stated as taking place after the vowel in a word, giving the correct results for *clear* (with clear [l]) versus *hill* (with dark [ɬ]), for instance. This works well enough when we are dealing only with word-initial versus word-final clusters, but it leaves a grey area in word-medial position, where we find dark [ɬ] in *falter*, *hilltop*, but clear [l] in *holy*, *hilly*. Again, this is resolvable if we state the rule in terms of the syllable: clear [l] appears in onset position, and dark [ɬ] in the coda.

In fact, this process provides evidence not only for the contrast between onset and coda position, but for the superordinate rhyme constituent, which consists of the nucleus plus the optional coda. In cases of consonant syllabification, where /l/ (or another sonorant consonant) comes to play the role of a vowel and therefore occupies the nuclear position, as in *bottle*, *little*, we find the dark allophone. /l/-velarisation, then, takes place in syllable rhymes, as shown in (7).

(7)



9.5.2 Onset Maximalism

Of course, this rule (and, similarly, the earlier reformulation of aspiration in syllable terms) will work appropriately only if we know exactly where the different syllables and syllable constituents are. We have to be sure that we are drawing the boundaries between syllables, and therefore determining what consonants are in the coda of an earlier syllable, and which in the onset of a later one, in the right way. We have already noted that the Sonority Sequencing Generalisation provides one guide to drawing syllable boundaries; leaving aside the exceptional case of /s/ in clusters, we find that legal syllables exhibit a sonority profile which ascends from the left-hand margin of the onset, up to a sonority peak in the nucleus, and subsequently descends to the right-hand margin of the coda, as shown in (4) above. However, there is another, equally important, principle governing syllable division: namely, **Onset Maximalism** (also known as **Initial Maximalism**), which is set out in (8).

(8) *Onset Maximalism*
Where there is a choice, always assign as many consonants as possible to the onset, and as few as possible to the coda. However, remember that every word must also consist of a sequence of well-formed syllables.

Onset Maximalism tells us that, in a word like *leader*, the medial /d/ must belong to the second syllable, where it can be located in the onset, rather than the first, where it would have to be assigned to the less favoured coda. This is a permissible analysis because both [liː] and [də(ɹ)] are well-formed syllables of English: think of *lea*, or *Lee*, and the first syllable of *dirty*, or *Derwent*. The same goes for a word like *oyster*, where both parts of the medial /st/ cluster belong to the onset of the second syllable, leaving the initial diphthong to form a syllable on its own. There are many monosyllabic words with initial /st/, like *stop*, *start*, *stitch*, *stoop*, and if /st/ make a well-formed onset word-initially, then they can combine to make a well-formed onset word-medially, too.

We can use the same sort of argument to account for the alternation between dark [ɬ] in *hill* and clear [l] in *hilly*. Since *hill* has only a single syllable and, moreover, has a vowel occupying the nuclear slot, the /l/ must necessarily be in the coda, and therefore is realised as, or surfaces as, dark. However, in *hilly*, there are two syllables, and Onset Maximalism means /l/ must be in the onset of the second, where it automatically surfaces as clear. This kind of alternation, where the form that surfaces depends on its position in the syllable, is quite common in English and other languages. For instance, in non-rhotic accents of

English, /r/ has two realisations: namely, [ɹ] in onsets, and zero in codas. It surfaces in *red*, *bread*, *very*, but not in *car*, *park*. Again, as with the alternation between clear and dark variants of /l/, we find that the addition of suffixes can change the situation: so, for instance, *star* has no final consonant for non-rhotic speakers, but there is a medial [ɹ] in *starry*, where the /r/ constitutes the onset of the second syllable. It also follows that syllable boundaries will not always coincide with morpheme boundaries, or boundaries between meaningful units: in *starry*, the two morphemes are *star*, the stem, and *-y*, the suffix, but the syllables are divided as *sta.rry* (note that a dot signals a syllable boundary). As we shall see in more detail in the next chapter, similar alternations arise across word boundaries in connected speech: thus, although *car* has no final [ɹ], and the same is true of *car keys*, where the second word begins with a consonant, in *car engine* the second word begins with a vowel. That following vowel allows the /r/ to be allocated to the onset of the next syllable, where it duly surfaces as [ɹ]. As far as native speakers' knowledge goes, there are two ways of analysing this. We could assume that speakers store *car* mentally as /kɑr/, and delete the /r/ before a consonant or pause. Alternatively, the entry in the mental lexicon or dictionary might be /kɑ/, with [ɹ] being inserted before vowels. Choices of this kind, and their implications, are vitally important for phonologists. To test out our phonological theories, we need to consider as many data as possible, and figure out whether our theoretical assumptions are consistent with what we observe. Better still, we really want our hypotheses to extend to cases we have not yet observed, and predict correctly what we find in new situations or different contexts. Testing theories against observed reality, and also in terms of prediction and explanation, helps phonologists to validate, disprove or revise their theoretical models and ultimately to understand more about what speakers do, and why.

In that spirit of testing our assumptions and hypotheses, let us turn to a word like *falter*, with a different medial cluster. In this case, we cannot straightforwardly assign the medial /lt/ to the second syllable. The Sonority Sequencing Generalisation would allow the syllable boundary to follow /lt/ (compare *fault*, a well-formed monosyllabic word), but Onset Maximalism forces the /t/ at least into the onset of the next syllable. The syllable boundary cannot, however, precede the /l/ because /lt/ is not a possible word-initial cluster in English, and it consequently cannot be a word-internal, syllable-initial cluster either. On the other hand, in *bottle*, our immediate reaction might be to proposed *bo.ttle*, which fits both the Sonority Sequencing Generalisation and Onset Maximalism. However, we then face a problem with the first syllable, which would, on this analysis, consist only of /bɒ/; and, as we

shall see in Chapter 10, a single short vowel cannot make up the rhyme of a stressed syllable. The first syllable clearly needs a coda; but *bott.le* is not quite right either because that analysis does not fit with speaker intuitions and behaviour. If you ask native speakers to check syllable boundaries by saying each syllable in the word twice, they will typically say *bot-bot-tle-tle*, which seems to suggest that the /t/ is allocated to both syllables at the same time. The same is true of other words with the same problematic structure, like *syllable* in fact, which comes out as *syl-syl-la-la-ble-ble*; it may not be coincidental that these are written with double medial consonants. The usual solution here is to analyse the /t/ of *bottle* as **ambisyllabic**: that is, as belonging simultaneously in both the coda of the first syllable and the onset of the second. This does not conflict with either the Sonority Sequencing Generalisation or Onset Maximalism, but also accords with native speakers' intuitions and the stress patterns of English.

9.5.3 Literary applications of syllable constituents

Recognising the onset and rhyme not only allows us to write more accurate versions of our phonological rules, and to understand alternations between sounds which arise when we add an affix or combine words into longer strings, thus creating different syllabifications. These two constituents are also integral parts of two rather different literary traditions. In **alliterative** poetry, the important constituent is the onset, which must be identical in several words in a single line (and often, the more the better). An example from the Scots poetic tradition appears in (9); this is a short excerpt from the late fifteenth- or early sixteenth-century 'Flyting of Dunbar and Kennedie'. A flyting is essentially a long string of insults, here hurled by each of the poets named in the title at the other, in turn. The use of **alliteration**, which is clear even from the two lines given, extends throughout the fairly lengthy poem.

(9) Conspiratour, cursit cocatrice, hell caa (caa = crow)
Turk, trumpour, traitour, tyran intemperate …

It is clear that almost all of the words in the first line begin with <c> /k/, and those in the second with <t> /t/. In some cases, here *cocatrice*, *intemperate*, the alliterating sound may appear in word-internal onset positions too, so this is not just about the consonant being in absolute word-initial position. More obviously, or at least more familiarly, the rhyme of the syllable determines poetic **rhyme**: for a perfect rhyme, the nucleus and coda (if any) must be exactly the same, though whether there is an onset or not, or what it is, does not matter. That is, *meet*

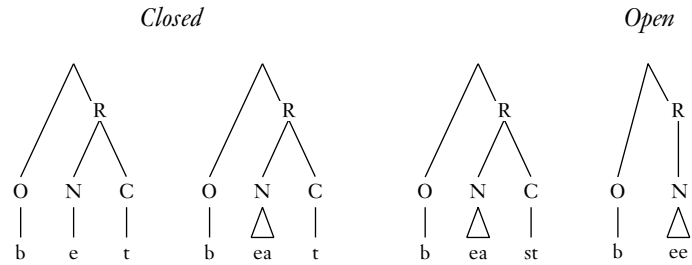
rhymes with *eat*, and with *beat*, and with *sweet* ; but it does not rhyme with *might* or *mate*, where the nucleus is different; or with *bee*, where there is no coda; or with *leek* or *beast*, where there is a coda, but not one consisting of the single consonant /t/.

9.5.4 Syllable weight

There is one further aspect of syllable structure which provides evidence for the syllable-internal structure set out above. Here again, as in the case of poetic rhyme, the nucleus and coda seem to work together, but the onset does not contribute at all.

In fact, there are two further subdivisions of syllable type, and both depend on the structure of the rhyme. First, syllables may be **closed** or **open**: a closed syllable has a coda (any coda), while in an open syllable, the rhyme consists of a nucleus alone, as shown in (10). It does not matter, for these calculations, whether the nucleus and coda are **simple**, containing a single element, or **branching**, containing more than one: a branching nucleus would have a long vowel or diphthong, while a branching coda would contain a consonant cluster.

(10)



There is a second, related distinction between **light** and **heavy** syllables. A light syllable contains only a short vowel in the rhyme, with no coda, as in the first syllable of *potato*, *report*, *about*. Although the first two cases have onsets and the third does not, all these initial syllables are still light, because onsets are entirely irrelevant to the calculation of syllable **weight**. If a syllable has a complex rhyme, then it is heavy; and complexity can be achieved in two different ways. First, a heavy syllable may have a short vowel, but one or more coda consonants, as in *bet*, *best*. Second, it may have a branching nucleus, consisting of a long vowel or diphthong; such a syllable will be heavy whether it also has a filled coda, as in *beast*, *bite*, or not, as in *bee*, *by*.

As we shall see in detail in the next chapter, syllable weight is a major factor in determining the position of stress in a word: essentially,

no stressed syllable in English may be light. This means that no lexical word, or full word, of English can consist of a short vowel alone, with or without an onset, since such words, including nouns, verbs and adjectives, must be able to bear stress: thus, we have *be*, *say*, *loss*, but not *[bɪ], *[sɛ], *[lɒ]. On the other hand, function words like the indefinite article *a*, or the pronunciation [tə] for the preposition *to*, which are part of the grammatical structure of sentences and are characteristically unstressed, can be light. In cases where these do attract stress, they have special pronunciations [eɪ] and [tuː], where the vowel is long, the nucleus branches, and the syllable is therefore heavy.

There is one set of cases where a conflict arises between syllable weight on the one hand, and the guidelines for the placement of syllable boundaries on the other: we have already encountered this in the discussion of *bottle* above. In most cases, these two aspects of syllable structure work together. For instance, *potato*, *report*, *about* each have a consonant which could form either the coda of the first syllable, or the onset of the second. Onset Maximalism would force the second analysis, placing the first [t] of *potato*, the [p] of *report* and the [b] of *about* in onset position in the second syllable of each word; this is supported by the evidence of aspiration in the first two cases. The first syllable of each word is therefore light; and since all three of these initial syllables are unstressed, this is unproblematic. Similarly, in words like *penny*, *follow*, *camera*, *apple*, Onset Maximalism would argue for the syllabifications *pe.nny*, *fo.llow*, *ca.me.ra*, and *a.pple*. However, in these cases, the initial syllable is stressed, in direct contradiction of the pervasive English rule which states that no stressed syllable may be light. In these cases, rather than overruling Onset Maximalism completely, we can regard the problematic medial consonant as ambisyllabic, or belonging simultaneously in the coda of the first syllable and the onset of the second. It therefore contributes to the weight of the initial, stressed syllable, but its phonetic realisation will typically reflect the fact that it is also in the onset of the second syllable. Consequently, as we saw earlier, the /l/ in *billy*, *follow* appears as clear, as befits an onset consonant, while /r/ in *carry* is realised as [ɹ], its usual value in onset position, rather than being unpronounced, its usual fate in codas.

Exercises and topics for discussion

1. Mark the syllable boundaries in the following words. In each case, what led to your decision in placing the boundary there? You should

consider the contribution of the Sonority Sequencing Generalisation, Onset Maximalism and syllable weight.

danger, *unstable*, *anxious*, *discipline*, *narrow*, *beyond*, *bottle*, *bottling*

2. Draw syllable trees for each of the words from Exercise 1. In each case, and for each syllable, mark the onset, rhyme, nucleus and coda; indicate whether any of these constituents branch; and note any cases of ambisyllabicity.

3. Make a list of all the two-consonant clusters which are ruled out by the Sonority Sequencing Generalisation in (a) onset and (b) coda position. For each one, try to think of an apparent exception in word-medial position, where, in fact, the first consonant of the apparent 'cluster' belongs in the coda of syllable one, and the second in the onset of syllable two. For example, sonority rules out final [kn]; an apparent (but not real) exception would be *acknowledge*.

4. Make a list of at least five consonant clusters which are ruled out either by the Sonority Sequencing Generalisation, or by the phonotactic rules of English, but for which you can find actual exceptions which do contain these clusters. These may be recent loanwords or foreign names. For example, English does not generally allow /ʃ/ in onset clusters, but a number of borrowings from Yiddish, like /ʃtʊm/, /ʃtɪk/, do have these clusters.

5. Find out what you can about the words *orange* and *apron*. Where do these words come from, and how did they get into English? Why in particular do we have *orange* and *apron* rather than *norange* and *napron*? And why do we have both *Ed* and *Ned* as short for *Edward*? What does all this tell us about syllables, and about the sorts of evidence phonologists might use in building hypotheses and theories about them?

Recommendations for reading

Carr (2012), Giegerich (1992) and Hogg and McCully (1987) all discuss the phonology of the syllable in much more detail than is possible in this chapter. Information on the syllable from a phonetic point of view can be found in Catford (2002), Ladefoged and Johnson (2014) and Couper-Kuhlen (1986).

10 The word and above

10.1 Phonological units above the syllable

Native speakers who are not linguists may be slightly surprised by the discovery, discussed in the last chapter, that they can count syllables and determine the boundaries between them. However, they will typically be much more consciously aware of the word as a linguistic unit, probably because words are meaningful units. Moreover, in a highly literate society, we are familiar with orthographic words, which conveniently appear with white space on each side. Individual spoken or written words can also appear in isolation: three of the four conversational turns in (1) consist, entirely appropriately and comprehensibly, of single words.

(1) A: Did you find a babysitter?
B: Yes.
A: Who?
B: Denise.

However, words, like other linguistic units, are not entirely straightforward and uncontentious for native speakers or for linguists. In particular, there are cases where it is difficult to determine how many words we are dealing with. For example, is *washing-machine* one word or two? Is it easier or more difficult to decide if we write it as *washing machine*, without the hyphen? And if we conclude that this is two words, then where does that leave *teapot*, where two acceptable independent words seem to make up one larger one? It seems that compounds like this take some time to become accepted in the speech community as single words: for a while, they appear as two written words, though signalling one distinct concept semantically (thus, a *washing-machine* washes clothes, not dishes, for which we have *dishwashers*; nor does it wash cars, which go through a *carwash*). As compounds are encountered more commonly, they begin to be written with a hyphen, which ultimately

drops to leave a single orthographic word – although speakers may think of a compound as a single word before this stage is reached.

Conversely, although *didn't*, *can't* or *it's* appear as single written words, speakers will tend to regard these as sequences of two words, contracted by the deletion of a vowel, as signalled by the apostrophe. So, *it's* (in *It's Saturday*) is a short form of *it is*, and therefore in a sense two words, as distinct from *its* (in *The cat ate its dinner*), which is a single word however you look at it. Mind you, the apostrophe itself is not trouble-free, and there is a good deal of confusion about when to use one and when not to. One sort of extraneous apostrophe even has its own name, with so-called greengrocers' apostrophes appearing in straightforward plural forms which are neither possessives nor contracted forms. For example, it is quite common to see on signs in shop windows forms like *Taxi's*, *Price's slashed* or *Carrot's £1 a kilo* (hence the greengrocers; and note the playful use of *greengrocers apostrophe's* in some of the discussions of this phenomenon).

For phonological purposes, we can simply note these tricky exceptional cases, and accept that native speakers typically have a good intuitive idea of what a word is (although this is an issue of considerable interest to morphologists, so we can leave the rest of the worrying on this subject to them). What we are interested in are the phonological properties of words, and the most important of these, in English at least, is stress. As we shall see, although each word has its own characteristic stress pattern when uttered in isolation, words are generally produced in strings, combining into phrases and whole sentences; phonological processes also operate at these higher levels. First, the position of stress on the isolated word may change when that word forms part of a larger unit; and second, some segmental processes, affecting vowels or consonants, may also apply between words.

10.2 Stress

10.2.1 The phonetic characteristics of stress

Native speakers of English are intuitively aware that certain syllables in each word, and one syllable in particular, will be more phonetically prominent than others. In *father*, the first syllable seems stronger than the second; in *about*, it is the other way around; and in *syllable*, the first syllable stands out from the rest. These more prominent syllables are stressed; and stress is a **culminative** property, signalled by a number of subsidiary phonetic factors, which work together to pick out a stressed syllable from the unstressed ones which surround it. There are three

important factors which combine to signal stress. First, the vowels of stressed syllables are produced with higher **fundamental frequency**: that is, the vocal folds vibrate more quickly, and this is heard as higher pitch. Second, the duration of stressed syllables is greater, and they are perceived as longer. Third, stressed syllables are produced with greater intensity, and are thus heard as louder than adjacent unstressed syllables. In addition, stress has effects on vowel quality, in that vowels often reduce to schwa under low stress. To take our earlier examples of *father*, *about* and *syllable*, the stressed syllables have the full vowels [ɑː], [aʊ] and [ɪ] respectively, but the unstressed ones typically have schwa; we do not say [sɪlæbɛl], for instance, but [sɪləbəl] (or [sɪləbl̩]).

The interaction of these phonetic factors produces an effect which is clearly audible but crucially relative: that is, we cannot distinguish a stressed from an unstressed syllable if each is spoken in isolation, but only by comparing the syllables of a word, or a longer string, to see which are picked out as more prominent. Indeed, within the word, there can be more than one level of stress. Some words have only stressed versus unstressed syllables, as in *father*, *about* and *syllable*. However, in *entertainment*, the first and the third syllables bear some degree of stress. Both have full vowels [ɛ] and [eɪ], as opposed to the unstressed second and fourth syllables with schwa, but the third syllable is more stressed than the first. Phonologists distinguish **primary stress** (the main stress in the word, on the third syllable of *entertainment*) from **secondary stress** (a lesser degree of stress elsewhere, here initially). Special IPA diacritic marks are placed at the beginning of the relevant syllable to indicate primary and secondary stress, as in *entertainment* [ˌɛntəˈteɪnmənt], *about* [əˈbaʊt] and *father* [ˈfɑːðə]. The difference between secondary stress and no stress is clear in a pair like *raider* [ˈɹeɪdə(ɹ)], where the second syllable is unstressed and has schwa, versus *radar* [ˈɹeɪˌdɑ(ɹ)], where both syllables have full vowels and some degree of stress, although in both words the first syllable is more stressed than the second.

10.2.2 Predicting stress placement

The languages of the world fall into two broad classes in terms of stress position. In **fixed-stress languages**, primary stress always (or virtually always) falls on one particular syllable; thus, in Scots Gaelic, main stress is consistently initial, except in some English loanwords, such as *buntata* 'potato', where stress stays on the syllable it occupies in the source language (here, the second). Similarly, stress in Swahili consistently falls on the penultimate syllable of the word. On the other hand, languages may

have **free stress**, as in Russian; here, words which differ semantically may be identical in terms of phonological segments, and differ only in the position of stress, as in Russian *'muka* 'torment' versus *mu'ka* 'flour'.

This division into fixed- and free-stress languages is relevant to phonologists because it has a bearing on how children learning the language, and adults using it, are hypothesised to deal with stress. In a fixed-stress language, we can assume that children will learn relatively quickly and easily that stress placement is predictable, and will formulate a rule to that effect. If they encounter exceptions to the rule, they may over-generalise the regular pattern, and have to unlearn it in just those cases, so that a child acquiring Scots Gaelic may well produce *'buntata* temporarily for English-influenced *bun'tata*. This is precisely like the situation with other regular linguistic processes, like the regular morphological plural rule adding *-s* to nouns, which children typically over-generalise to give *oxes*, *mouses*, *tooths* at an early stage, before learning the appropriate form of these **irregular** nouns individually. In free-stress languages, on the other hand, part of language acquisition involves learning that the position of stress is not predictable, but instead has to be memorised as part of the configuration of each individual word, along with the particular combination of vowels and consonants that make it up. There are no stress rules in completely free-stress languages: instead, speakers are assumed to have a mental representation of each word with stress marked on it.

English does not fall fully within either class: it is neither a wholly fixed-stress, nor a wholly free-stress language. This is, in large part, a result of its peculiar history. English inherited from Germanic a system with fixed stress falling on the first syllable of the stem, but it has subsequently been strongly influenced by Latin, French and other Romance languages because of the sheer number of words it has borrowed. It has therefore ended up with a mixture of the Germanic and Romance stress systems. On the one hand, there are pairs of words which contrast only by virtue of the position of stress, such as *con'vert*, *pro'duce* (verb) versus *'convert*, *'produce* (noun). This initially makes English look like a free-stress language, like Russian, but turns out to reflect the fact that such stress rules as English has, vary depending on the lexical class of the word they are applying to.

On the other hand, there are some general rules, as in (2), which do allow stress placement to be predicted in many English words.

(2) a. Noun Rule: stress the penultimate syllable if heavy. If the penultimate syllable is light, stress the antepenult.
a.'ro.ma a.'gen.da 'di.sci.pline

b. Verb Rule: stress the final syllable if heavy. If the final syllable is light, stress the penultimate syllable.
o.'bey u.'surp a.'tone 'ta.lly 'hu.rry

These stress rules depend crucially on the weight of the syllable: recall from the last chapter that a syllable will be heavy if it has a branching rhyme, composed of either a long vowel or diphthong (with or without a coda), or a short vowel with a coda. A syllable with a short vowel and no coda will be light. As (2a) shows, English nouns typically have stress on the penultimate syllable, so long as that syllable is heavy, which it is in *aroma* (with a long [oː] vowel or a diphthong [oʊ] depending on your accent), and in *agenda*, where the relevant vowel is short [ɛ], but followed by a consonant, [n]; this must be in the coda of syllable two rather than the onset of syllable three, since there are no *[nd] initial clusters in English. However, in *discipline*, the penultimate syllable is light [sɪ]; the following [pl] consonants can both be in the onset of the third syllable, since there are initial clusters of this type in *play*, *plant*, *plastic* and so on. Since [sɪ] has only a short vowel and no coda consonants, it fails to attract stress by the Noun Rule, and the stress instead falls on the previous, initial syllable.

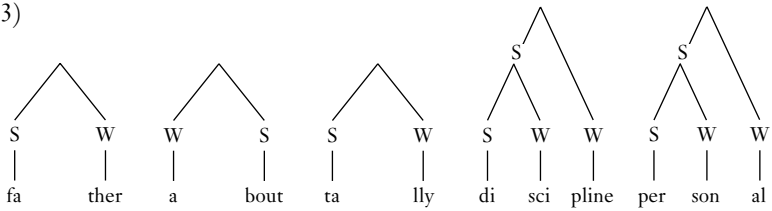
A similar pattern can be found for verbs, but with stress falling consistently one syllable further to the right. That is, the Verb Rule preferentially stresses final syllables, so long as these are heavy. So, *obey* (with a final long vowel or diphthong) has final stress, as do *usurp* (having a final syllable [ɜːp] for SSBE, with a long vowel and a coda consonant, and [ʌɹp] for SSE, for instance, with a short vowel and two coda consonants) and *atone* (with a long vowel or diphthong plus a consonant in the coda). However, both *tally* and *hurry* have final light syllables, in each case consisting only of a short vowel in the rhyme. It follows that these cannot attract stress, which again falls in these cases one syllable further left.

These stress rules are effective in accounting for stress placement in many English nouns and verbs, and for native speakers' actions in determining stress placement on borrowed words, which are very frequently altered to conform to the English patterns. However, there are still many exceptions. A noun like *spaghetti*, for instance, ought, by the Noun Rule, to have antepenultimate stress, giving *'spaghetti*, since the penultimate syllable [gɛ] is light; in fact, stress falls on the penultimate syllable, following the original, Italian pattern – in English, the <tt> is, of course, pronounced as a single [t], not as two [t]s or a long or **geminate** [t]. Although the Noun Rule stresses penultimate or antepenultimate syllables, nouns like *machine*, *police*, *report*, *balloon* in fact have

final stress. There are also cases where the stress could, in principle, appear anywhere: in *catamaran*, for instance, the stress pattern is actually *ˈcatamaˌran*, with primary stress on the first syllable and secondary stress on the final one, again in contradiction of the Noun Rule, which would predict *caˈtamaran* (as in *DeˈcameronI*), with antepenultimate stress as the penult is light. There is equally no good reason why we should not find *ˌcataˈmaran* (as in *ˌAldeˈbaran*), while another logical possibility, *ˌcatamaˈran*, has a pattern more commonly found in phrases, such as *ˌflash in theˈpan* or *ˌDesperateˈDan*. It seems that the Noun Rule and Verb Rule are misnomers; these are not really rules, though they do identify discernible tendencies.

Leaving aside the question of predictability, we can certainly describe the position of stress on particular words accurately and clearly using tree diagrams. In these diagrams, which form part of a theory called Metrical Phonology, each syllable is labelled either S or W: and because stress, as we saw above, is not an absolute but a relative property of syllables, these labels do not mean 'Strong' and 'Weak', but 'Stronger than an adjacent W' and 'Weaker than an adjacent S' respectively. Some illustrative trees are shown in (3).

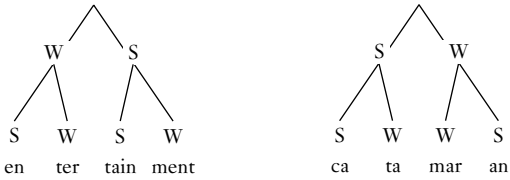
(3)



Trees of this sort allow us to compare different words at a glance and tell whether their prominence patterns, and thus the position(s) of stress, are the same or not; from (3), we can see that *father* and *tally* share the same stress pattern, though *about* has the relative prominence of its two syllables reversed. This is particularly important for longer words with more syllables, where prominence patterns are naturally more complex; so, (3) also shows that *discipline* and *personal* have the same stress patterns. Note that, even in longer words, metrical trees can branch only in a binary way: that is, each higher S or W node can branch only into two lower-level constituents, never more. This is straightforward enough for disyllabic words like *father*, *about* and *tally*, but in *discipline* and *personal*, tree construction involves two steps. Initially, the first two nodes are put together; then the higher-level S node these form is, in turn, combined with the leftover W syllable, to form another binary unit. This kind of pattern can be repeated in even longer words.

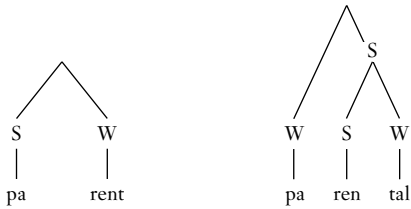
In cases involving both primary and secondary stresses, these trees are particularly helpful: (4) clearly shows the different patterns for *entertainment* and *catamaran*. In particular, the trees allow us to identify the main stress of each word easily, which will always be on the syllable dominated by nodes marked S all the way up the tree.

(4)



Finally, metrical trees are useful in displaying the stress patterns of related words. In English, as in many other languages, stress interacts with the morphology, so that the addition of particular suffixes causes stress to shift, or to appear on different syllables in related words. Most suffixes are **stress-neutral**, and do not affect stress placement at all: for instance, if we add *-ise* to *'atom*, the result is *'atomise*; similarly, adding *-ly* to *'happy* or *'grumpy* produces *'happily*, *'grumpily*, with stress remaining on the first syllable. However, there are two other classes of suffixes which do influence stress placement. The first are **stress-attracting** suffixes, which themselves take the main stress in a morphologically complex word: for example, adding *-ette* to *'kitchen*, or *-ese* to *'mother*, produces *ˌkitchen'ette*, *ˌmother'ese*. Other suffixes, notably *-ic*, *-ity* and adjective-forming *-al*, do not become stressed themselves, but cause the stress on the stem to which they attach to retract one syllable to the right, so that *'atom*, *e'lectric* and *'parent* become *a'tomic*, *elec'tricity* and *pa'rental*. The varying stress patterns of related words like *parent* and *parental* can very straightforwardly be compared using tree diagrams, as in (5).

(5)



There is one final category of word with its own characteristic stress pattern. In English compounds, which are composed morphologically of two independent words but signal a single concept, stress is characteristically on the first element, distinguishing the compounds *'greenhouse*

and *ˈblackbird* from the phrases *a ˌgreen ˈhouse*, *a ˌblack ˈbird*. Semantically, too, the difference is obvious: there can be brown blackbirds (female blackbirds are brown), or blue greenhouses, but *The ˌgreen ˈhouse is blue* is semantically ill-formed. In phrases, the adjectives *black* and *green* are directly descriptive of the noun, and have to be interpreted that way; on the other hand, the meaning of compounds is not determined compositionally, by simply adding together the meanings of the component parts, so that *greenhouse* signals a particular concept, with no particular specification of colour. Stress is clearly crucial in marking this difference between compounds and phrases; in noting it, however, we are already moving beyond the word, and into the domain of even larger phonological units.

10.3 The foot

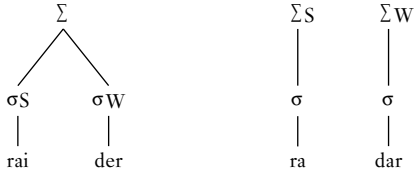
So far we have been assuming that syllables group into words, with some words being composed of only a single syllable. Strictly, however, the word is not a phonological unit, but a morphological and syntactic one; and as we shall see in the next section, phonological processes are no great respecters of word boundaries, operating between words just as well as within them. The next biggest phonological unit above the syllable is the foot.

The normally accepted definition is that each phonological foot starts with a stressed syllable (though we shall encounter an apparent exception below), and continues up to, but not including, the next stressed syllable. This means that *cat in a hat* consists of two feet, the first containing *cat in a*, and the second, *hat*. Although *cat flap* consists of only two words (or indeed one, if we agree this is a compound), as opposed to four in *cat in a hat*, it also consists of two feet, this time one for each syllable, since both *cat* and *flap* bear some degree of stress. Indeed, because English is a **stress-timed** language, allowing approximately the same amount of time to produce each foot (as opposed to **syllable-timed** languages, like French, which devote about the same amount of time to each syllable, regardless of stress), *cat in a hat* and *cat flap* will have much the same phonetic duration. The same goes for *the cat sat on the mat*, with rather few unstressed syllables between the stressed ones, and *as snug as a bug in a rug*, with a regular pattern of two unstressed syllables to each stress. This **isochrony** of feet, whereby feet last for much the same time, regardless of the number of syllables in them, is responsible for the characteristic rhythm of English.

Like syllables, feet can also be contrasted as stronger and weaker. Sometimes, there will be more than one foot to the word; for instance,

as we saw earlier, a word like *'raider*, with primary stress on the first syllable and no stress on the second, can be opposed to *'ra¸dar*, with primary versus secondary stress. It is not possible to capture this distinction using only syllable-based trees, since both *raider* and *radar* have a stronger first syllable and a weaker second syllable. However, these two W nodes are to be interpreted in two different ways: namely, as indicating no stress in *raider*, but secondary stress in *radar*. To clarify the difference, we must recognise the foot. *Raider* then has a single foot, while *radar* has two, the first S and the second W. Recall that small sigma (σ) indicates a syllable; capital sigma (Σ) is a foot.

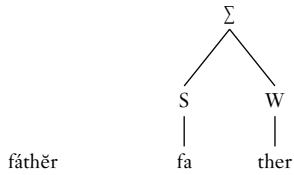
(6)



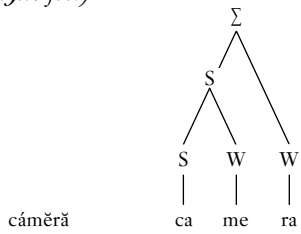
In other cases, the same number of feet may be spread over more than one word, so that *'cat ¸flap* has two feet, related as S versus W, while *¸cat in a 'hat* also has two feet, although here the first foot is more extensive, including *in a* as well as *cat*, and the prominence relationship of W S reflects the fact that *cat flap* is a compound bearing initial primary stress, while *cat in a hat* is a phrase, with main stress towards the end.

Feet can also be classified into types, three of which are shown in (7). The **iambic** type, structured W S, contradicts the claim above that all feet begin with a stressed syllable. In fact, however, at the connected speech level, the first, unstressed syllable in such cases will typically become realigned, attaching to the preceding foot. So, in *cup of tea*, the weak syllable *of* will be more closely associated with the preceding stronger syllable, with which it then forms a **trochaic** foot, than with the following one, as evidenced by the common contraction *cuppa* for *cup of*.

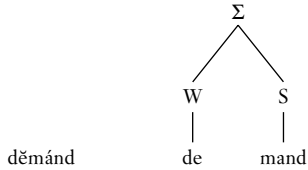
(7) *Trochee (trochaic foot)*



Dactyl (dactylic foot)



Iamb (iambic foot)



These foot types are important in scansion, or analysing verse. For example, the blank verse of Shakespeare's plays involves iambic pentameters: each line has five iambic feet, as shown in the metre of two lines from *The Merchant of Venice* (8).

(8) Thĕ quálíty´ ŏf mércў ís nŏt stráined
Ít dróppĕth ás thĕ géntlĕ ráin frŏm héaven

To take a less exalted example, (9) shows two lines with rather different metrical structure. The first consists of two dactyls and a final 'degenerate' foot composed of a single stressed syllable. Note that a foot of this kind, like *dock* here, or any monosyllabic word like *bit*, *cat* in normal conversation, cannot really be labelled as S or W: since stress is relational, it requires comparison with surrounding feet. The second line is again made up of iambic feet.

(9) Híckŏrў díckŏrў dóck
Thĕ móuse răn úp thĕ clóck.

Finally (taking another nursery rhyme, since these often have particularly clear and simple metre), a line like *Márў, Márў quíte cŏntrárў* is composed of four trochaic feet.

Poetry also provides an excellent illustration of the English preference for alternating stress. It does not especially matter whether we have sequences of SWSWSWSW or SWWSWWSWWSWW; what does matter is avoiding either **lapses**, where too many unstressed syllables intervene between stresses, or **clashes**, where stresses are adjacent, with no unstressed syllables in between at all. The English process of

Iambic Reversal seems designed precisely to avoid stress clashes of this kind. It affects combinations of words which would, in isolation, have final stress on the first word, and initial stress on the second. For instance, (10) shows that the **citation forms** (that is, the formal speech pronunciation of a word alone, rather than in a phrase) of *thirteen* and *champagne* have final stress.

(10) A: How many people turned up?
B: ˌThir'teen.
A: What are you drinking?
B: ˌCham'pagne.

However, when final-stressed words like *thirteen* and *champagne* form phrases with initial-stressed ones like *players* or *cocktails*, the stress on the first word in each phrase moves to the left, so that in *'thirˌteen players* and *'chamˌpagne 'cocktails*, both words have initial stress. This is clearly related to the preference of English speakers for **eurhythmic** alternation of stronger and weaker syllables, as illustrated in (11).

(11)

W S	S W		S W	S W
thirteen	players	→	thirteen	players
W S	S W		S W	S W
champagne	cocktails	→	champagne	cocktails

If these words retained their normal stress pattern once embedded in the phrases, we would find clashing sequences of WSSW, as shown on the left of (11), in violation of eurhythmy; consequently, the prominence pattern of the first word is reversed, changing from an iamb to a trochee – hence the name Iambic Reversal. The result is a sequence of two trochaic feet, giving SWSW and ideal stress alternation.

It is also possible, however, for the normal stress patterns of words to be disrupted and rearranged in an altogether less regular and predictable way, reflecting the fact that stress not only is a phonological feature, but also can be used by speakers to emphasise a particular word or syllable. If one speaker mishears or fails to hear another, an answer may involve stressing both syllables in a word, in violation of eurhythmy: so, the question *What did you say?* may quite appropriately elicit the response *'thir'teen.* Similarly, although phrases typically have final stress, a speaker emphasising the fact that we are talking about cats, not dogs, may well produce the pattern *a 'cat in a 'hat*, rather than *a ˌcat in a 'hat.* These adjustments to stress position interact with intonation, the characteristic prominence patterns of whole utterances in a language, in highly complex and fluid ways. We turn to an outline of intonation in

section 10.5 below, but first return to segmental phonology in phrases and words.

10.4 Segmental phonology of the phrase and word

10.4.1 Phrase-level processes

Although the main focus of this chapter has inevitably been on stress and prominence, this is not the only phonological characteristic of the word and phrase levels. As we have already seen, segments may be affected by those adjacent to them. While many of the examples we have considered throughout the book involve adjacent segments within the word, it is equally possible for segments in different words to become adjacent when those independent words are combined into utterances. Vowels and consonants at the beginnings and ends of words may therefore influence, or be influenced by, those which belong to adjacent words.

The bulk of these segmental phonological processes are characteristic of fast and casual speech, and are often referred to as **Connected Speech Processes** (CSPs for short). These generally involve either assimilations (whereby two adjacent sounds become more similar in quality, as the articulations used to produce them become more similar) or reductions; both these process types are natural consequences of talking more quickly and perhaps less carefully. Most CSPs are also optional, and will tend to be suspended or at least occur less frequently in more formal situations and in slower speech. To take just two examples, when two adjacent words have final and initial stops, these typically come to share the same place of articulation, so that *sit close* will tend to have medial [kk], and *odd message* [bm]. Function words like *he*, *than*, *you*, *my* also frequently reduce to [ɪ], [ðən] (or even [ən]), [jə], [mə]ː all these component processes, notably loss of consonants (in *he*, *than*), shortening of vowels (in *he* again), and reduction of vowels to schwa (in *than*, *you*, *my*) as a result of loss of stress, are segmental weakenings.

Speaking quickly and informally will also tend to cut the duration of unstressed vowels in full lexical words like nouns, verbs and adjectives, with a concomitant effect on their quality. In words like *deduce*, *profound*, *connect*, the first syllable in careful speech may contain a full vowel, [i], [oʊ] or [ɒ] respectively, but in faster speech and more relaxed circumstances, these are highly likely to be reduced to schwa. Work by Fry in 1947 reported that nearly 11 per cent of vowel phonemes in English consisted of /ə/, with its nearest rival, at 8 per cent, being /ɪ/, the other vowel frequently found in unstressed syllables. To put this in perspective, all other vowels in the survey fell below 3 per cent. This indicates

clearly how common unstressed syllables were in 1947, and they are not likely to have reduced in frequency since. In some cases, however, vowels not only reduce in fast speech, but they are deleted. A word like *connect*, in connected speech, could be pronounced either as [kənɛkt] or [knɛkt]; and in cases like this one, and *potato* [pteɪtoʊ], the result actually violates the phonotactics of English, since *[kn] and *[pt] are not permissible clusters.

Such processes do not always affect vowels, however: sometimes both vowels and consonants are elided in fast speech, so that whole syllables may vanish when we compare the citation forms of words like *February*, *veterinary* with their fast speech equivalents, [fɛbɹi], [vɛʔnɹi]. Note also [ʔ] for /t/ in the second example; reduction of a stop to a glottal stop, or indeed to a fricative, is another example of **lenition** or weakening. Moreover, phonological reductions and assimilations across word boundaries typically affect consonants rather than vowels. For example, at the phrase level, word-final /s/ followed by word-initial /j/ often combine to produce [ʃ], so that *race you* is often [ɹeɪʃə], not the citation form [ɹeɪs ju]. In this case, a very similar process also takes place word-internally, resulting in medial [ʃ] in *racial*; but again, typically, these word-internal cases are not so clearly optional, and [ɹeɪsjəl] would tend to be seen as old-fashioned or an example of a speaker trying too hard to speak 'correctly'.

Another very common process applying between words is [ɹ]**-intrusion** in non-rhotic accents of English, where [ɹ] appears between [ɑ], [ɔ] or [ə] and another following vowel, although there is no <r> in the spelling and no **etymological** /r/ in the word concerned. For instance, the name of a tennis tournament, the *Stella Artois event*, will typically be pronounced in casual speech as [ðəstɛləɹɑːtwɑːɹəvɛnt], with **intrusive** [ɹ] after both cases of <a>; and similarly, we find well-known examples like *the idea is* [ðiaɪdiəɹɪz] and *law and order* [lɔːɹənɔːdə]. Again, this process also takes place within words, as in *sheep baa*[ɹ]*ing, draw*[ɹ]*ing, magenta*[ɹ]*ish.* This might, on the face of it, seem a rather unusual fast speech process, since it involves the addition of a segment; but producing two vowels side by side appears to be rather difficult for speakers, and an intrusive consonant may allow more fluid and less hesitant speech. Many of these processes therefore have a similar rationale, in making life easier for speakers, and allowing speech tempo to be kept consistently fast.

10.4.2 Word-internal morphophonological processes

There is a further and somewhat different class of segmental phonological processes. In contrast to the CSPs discussed above, these do not

apply across word boundaries, but rather are confined within words, where they tend to take place in response to the addition of a particular suffix – generally, those suffixes identified as causing stress retraction in 10.2.2.

Forms with these suffixes are also prone to odd and irregular segmental processes. For instance, when the suffix-*ity* is added to *electric*, the final [k] of *electric* becomes [s] in *electricity*. The same suffix may also alter the stem vowel: when *-ity* is added to *divine*, *sane*, *serene*, the long stressed vowels of the stems are shortened in *divinity*, *sanity*, *serenity*. These changes are unlike CSPs, in that it is often hard to see why they take place where they do: while a fast speech reduction or assimilation is generally a response to speed of speech, and involves ease of articulation pressures, the word-internal type typically creates an alternation between two independent phonemes, not directly motivated by the phonological context (as in the /k/ and /s/ of *electric – electricity*). Even where there does seem to be a reduction, as in the shortening of the stressed vowel in *divine* to *divinity* on the addition of the *-ity* suffix, it is not obvious why this particular suffix should have this effect; and it cannot be ascribed to speed of speech, since these **morphophonological** processes are obligatory, regardless of speed of speech or sociolinguistic factors: hence, the citation forms of *electricity*, *divinity* will also show these changes.

Although the affixes which provoke these segmental changes generally also influence the position of stress, this is not always the case. For instance, adding the past tense marker *-t* or *-d* to irregular verbs like *keep – kept*, *sleep – slept*, *leap – leapt* obviously has no effect on stress, as these are monosyllabic forms where the stress can go only in one place. However, adding the suffix still seems to cause a categorical shortening of the stem vowel. One of the most important jobs for phonologists, bearing in mind the focus discussed throughout this book on what speakers know about their language, and what they must be assumed to do in order to learn, produce and understand it, is to work out where to draw the line between productive processes which speakers apply regularly and which they will generalise to new forms in the language, and fossilised processes which might have started out as regular phonetic developments, perhaps CSPs, in the history of the language, but which are now simply associated with individual words or small groups of words. That is, perfectly natural phonetic processes may, in time, become less transparent and less regular. In the case of *keep – kept*, or *divine – divinity*, we must ask ourselves whether the processes of vowel shortening, which perhaps were regular and phonetically motivated centuries ago, are still part of native speakers' active knowledge

of English, and still involve those speakers in actual processes of adding suffixes and shortening vowels. Alternatively, children acquiring English today might learn that words like *keep* and *divine* have related but different forms which are stored separately and produced on appropriate syntactic occasions. Since phonology, like all other areas of language, is consistently undergoing change and development, with new processes constantly arising and different accents diverging, our only definite conclusion can be that today's CSPs will present tomorrow's phonologists with exactly the same problem.

10.5 Intonation

The various segmental processes discussed in the previous section take place at word, foot or phrase level, when morphemes or lexical items are concatenated or strung together into larger units. Turning back to **prosody**, or **suprasegmental phonology**, we have seen that lexical items do not always retain the stress pattern they show in isolation or citation form, into connected speech. However, we have not yet considered suprasegmental phonology above the phrase level; so, we now turn to our last topic, the study of intonation, or the prominence patterns of whole utterances.

Intonation is the way our voices fall and rise in pitch throughout whole sentences or utterances, and here again phonology interacts with other levels of grammar, such as **syntax** and **semantics**. Different intonation patterns or 'tunes' are associated with different meanings or utterance types. Because these 'tunes' or patterns of prominence, rhythm and pitch interact closely with stress, the same phonetic signals are involved in hearing and analysing both stress and intonation. We hear fundamental frequency variation, or the speed at which the vocal folds vibrate, as changes in pitch; and these are combined with differences in loudness / intensity and duration.

Intonation is complicated partly because it is perhaps the area of phonology where there is least agreement about exactly how we represent what we are saying and hearing. All phonologists would use the IPA, and pretty much all would invoke similar systems of features to help us understand what goes on within segments (though the feature systems might differ a bit around the margins). The systems of notation we have used for stress and for syllables and feet are also well understood and generally accepted. In the case of intonation, however, some phonologists would analyse intonation 'tunes' as essentially a continuous and variable pitch contour. Others would hypothesise an underlying, mental sequence of high and low tones, which, in actual speech, are joined

together to create something more continuous and variable. Notation and terminology are still quite unsettled and fluid. In this chapter, we will therefore focus more on the functions of intonation, with a little discussion of variation, but not introduce any particular theoretical apparatus for describing it more precisely.

We can start by observing that there are typical 'tunes' in each language associated with different utterance types, like statements and questions. In English, for instance, questions typically have raised pitch towards the end of the sentence, while statements have a pitch shift downwards instead – compare *What's for dinner?* with *We're having salad.* Some of these patterns are very basic and, indeed, close to being universal: surveys suggest that upwards of 85 per cent of languages have rising intonation associated with questions, so there is something highly natural about this. It also resembles what our primate relatives do in their own vocal systems; Jane Goodall, in her pioneering work on chimpanzees, identifies an 'inquiring pant hoot' call with a clear rise in pitch, which travelling chimpanzees use to figure out if there are any other chimpanzees within hearing range. Psycholinguists have shown that very small babies can discriminate their parents' language from an unfamiliar language on the basis of prosodic patterns; and small children can mimic adult pitch patterns long before they have command of the segmental phonology of their native language(s). Intonation patterns are also quite challenging for second language learners to master fully, especially if they are learning as adults; so, it is possible for someone to have virtually 'perfect', native-speaker-like segmental phonology but to be identifiable as a non-native speaker because there is just something not quite right about her intonation. In short, intonation and prosodic patterns are acquired early, and seem very deeply embedded in human language; they are very interesting for some of the big questions about innateness in human language, and the interface between what is universal as opposed to language-specific.

Intonation can also do important work which is much more clearly language-specific, by signalling different possible interpretations of the same string of words. In languages like English, where there is not much morphology to indicate the syntactic roles in a sentence (like what is the subject and what is the object, or who did what to whom), we need to rely on different linguistic means, such as prosody.

Take a sentence (with thanks to Francis Nolan for the example) like *While eating my dog my cat and I watched television.* There are two possible interpretations of this same string of words, which we would usually signal in writing using punctuation, such as commas. On one interpretation, everyone is eating and watching television together (*While eating,*

my dog, my cat and I watched television). On the other interpretation, my cat and I are watching television while we eat my dog (*While eating my dog, my cat and I watched television*). Those orthographic commas are the equivalent of what we do with pitch and rhythm and intonation in spoken English – speakers use mini-pauses, and falls in pitch, to indicate boundaries between constituents of the syntactic structure. In turn, these help our listeners to figure out what meaning we intend to convey, or what the underlying semantic structures are. When we see a complex sentence with no punctuation, or when we hear a synthesised utterance like *While eating my dog my cat and I watched television* with the prosodic signals removed, speakers tend to struggle to interpret it. They often show what is known by psycholinguists as **garden path** behaviour, beginning to build an interpretation as they move through the sentence and then thinking no, wait, that can't possibly be right – in this case, when they get to *While eating my dog* … Going up the garden path in this way, and having then to backtrack, go back down and build a different interpretation, can be avoided by having and attending to prosodic clues.

As usual, things are actually rather more complicated than this on the phonetic ground. There may be a normal relationship between an intonation pattern and an utterance type, like a question or a statement, but there is, by no means, an exceptionless mapping from syntax to intonation. Speakers can also use stress and intonation to signal their attitude to what they are saying. To take a monosyllabic word, *No* spoken with slightly dropping pitch signals neutral agreement, but it may also be produced with rising pitch to signal surprise (*No! Really?*), or indeed with rising, falling and rising intonation, all squashed on to the same syllable, to show that the speaker is unsure or doubtful. Earlier, we looked at the statement *We're having salad* and the question *What's for dinner?*, and suggested that, ordinarily, the former will have falling intonation and the latter, rising. However, it is perfectly feasible to have rising intonation in *We're having salad*, converting it into a question by purely phonological means, without adjusting the syntax at all (*We're having salad? Again?*). Conversely, stress and intonation can interact, so *What's for dinner?* stays a question, but not a neutral one asking for information; a speaker saying *WHAT'S for dinner?* is clearly conveying an emotional response by putting the additional prominence on the first word and not the last. It follows that intonation also has a discourse function and can vary to signal the speaker's attitude or emotional state, rather than being linked consistently with the syntax.

Intonation is also subject to change over time, and can vary between accents of the same language, both geographically and

sociolinguistically. Informal descriptions of different accents often demonstrate an awareness of intonational variation, like the common characterisation of Northern Irish English as having 'all the sentences going up at the end', or of some varieties as having a 'sing-song' quality. Sometimes contact is involved: for example, Fought (2003) suggests that some aspects of Chicano English intonation lie between Anglo English and Mexican Spanish. For example, in American English dialects, typically, a high pitch followed by a fall to low pitch in *He's a good student*… produces a very strong expectation of a following *but* …, indicating doubt or an inconclusive attitude. However, in Mexican Spanish and in Chicano English, this sort of pattern is quite standard for the very end of an utterance, simply as a declarative or statement, and with no implications of doubt at all. In SgE, Deterding (2007) describes a trend for heavy stress or emphasis on a final pronoun, which would be unusual in most other varieties of English – see (12) for two examples from his speakers.

(12) a. er that is one reason why I want to subscribe to THEM …
b. my new nephew, he's only two months old, so I guess I will, my free time I'll I'll I'll … try to look after HIM, yah, play with HIM lah, mmm…

Both Fought and Deterding observe, however, that there has been relatively little research on intonational variation in English, so that much of the information we have is still anecdotal or specific to individual case-studies. One case which has been more intensively researched is the phenomenon of **uptalk** (or High Rising Tone / High Rising Terminal), whereby declarative statements are pronounced with an intonation pattern more characteristic of questions. Most speakers of English do this on occasion, often as a strategy to signal politeness through not appearing too assertive – so, if I am introducing myself to the receptionist at the dentist, I might say *I have an appointment for a check-up?*, with a final question-like rise, even though I know full well that I do have such an appointment, and would take issue if the receptionist told me I didn't. However, this intonation on syntactic statements in casual conversation, and particularly in story-telling contexts, is increasingly common in American and Canadian English, and, for example, among younger women in many British English varieties.

There are many different hypotheses about why this should be the case. Some focus on whether female speakers are more likely to signal uncertainty or deference through their speech, sometimes as a means of group inclusion or seeking consensus or approval. There are equally many suggestions about where uptalk may have originated,

from California 'Valley Girl' speech to Australian English, with the influence of Australian television soaps like *Neighbours* being a favourite popular candidate for its spread. The fact that uptalk is fairly easy to observe and describe, unlike many segmental phonological differences between accents, has made it a lively topic of discussion, though we certainly need more research on intonational variation and agreement on ways of analysing and representing it phonologically, before we can expect a definitive account. What is clear, is that questions of how speakers learn their sound systems, what phonological behaviour might tell us about language in the brain, and what factors affect phonological variation and change, will continue to fascinate both linguists and 'ordinary' speakers, and provide plentiful topics for future research and debate.

Exercises and topics for discussion

1. Look back at the English stress rules presented in (2). Consider the adjectives *lovely*, *beautiful*, *surreal*, *scarlet*, *noisy*, *sensible*. On the basis of these forms, do you think adjectives typically follow the Noun Rule or the Verb Rule? Is there a single, general pattern for adjectives at all?

2. Draw metrical S W trees for the following words:

person, personal, personality, elephant, peninsula, disentanglement

In each case, make sure that the syllable which carries main stress is dominated by S all the way up the tree.

3. Find examples of English words which consist of the following foot structures:

one iamb
one trochee
one dactyl
one iamb followed by one trochee
one dactyl followed by one trochee

4. Find some examples of poems which contain mainly iambic, trochaic and dactylic feet. Make a metrical analysis of several lines from each, using diacritics like *cát* over a stressed syllable, and *ŏf* over an unstressed one, to show what the foot structure is.

5. Find out what you can about either uptalk, or another type of intonational variation between accents of English. How are these variants described phonologically, and what kinds of explanations can you identify for their introduction and spread, or conversely for their increasing restriction and loss?

6. Transcribe the following utterances in citation form and as appropriate for faster, more casual speech. In each case, say what Connected Speech Processes you might expect to find in the second rendition:

I expect he has gone to meet her
Helen had a banana and a bread cake

Recommendations for reading

Carr (2012), Giegerich (1992) and Roach (2009) all provide further information on the complexities of English stress, while Couper-Kuhlen (1986), Cruttenden (1997) and Roach (2009) give detailed descriptions of English intonation and its analysis. Wells (2006) is a practically focused introduction to English intonation which might be particularly helpful to non-native speakers. A more theoretical approach to intonation is reported in Ladd (1996). Hirst and De Cristo (1998) contains outline theoretical descriptions of the intonation systems of twenty languages, but is quite advanced. You can find recordings and discussions of speakers of nine urban varieties of English in the British Isles, and links to other projects using this IViE corpus, at <http://www.phon.ox.ac.uk/files/apps/IViE/>. The difference between phonological processes which interact with morphology and those which are closer to phonetics forms the basis of Lexical Phonology; Kaisse and Shaw (1995) provide a helpful outline of this model.

Glossary

accent
– varieties of a language which differ primarily in their phonetics and phonology. Accents can be defined geographically or sociolinguistically; they can also be **standard** (the more 'educated' variety of an area, acceptable in more formal circumstances) or **non-standard**. Non-standard accents would typically be commented on negatively in the media, and associated with people who are thought of as less educated or as coming from less favourable social circumstances.

accent differences
– phonologists typically classify accent differences into three types. **Systemic** differences occur when one accent has a contrast between phonemes which does not exist in another. **Distributional** differences are found when two accents have the same phoneme, but it can occur in different places. A **realisational** difference involves the same phoneme in both accents, but with different allophones or realisations.

accidental gap
– a word which just happens not to occur in a particular language; so, *snill* is not a word of English (at the moment), but it would be a permissible word in terms of its phonological shape.

acoustic (phonetics) – see **phonetics**

acquisition
– the natural and potentially somewhat instinctively guided emergence of a child's first or native language(s). Typically, language acquisition will take place at much the same age and pace, following the same developmental milestones, for most children.

active (articulator) – see **articulator**

affricate
– a single, complex sound which starts as a stop and finishes as a fricative. Essentially, the release phase of the stop is slow, or delayed, so that the sound passes through an audible fricative phase.

airstream
– for speech sounds to be audible, an airstream must be initiated, then modified by the articulators. The most common (indeed, universal) airstream is **pulmonic**, with the lungs as the initiator; pulmonic sounds are always **egressive**, or produced with the air flowing outwards, though it is physically possible to produce sounds on a pulmonic **ingressive** airstream. **Glottalic** sounds, where the initiator is the **larynx**, can be either egressive (**ejectives**) or ingressive (**implosives**). The **velaric** airstream involves a small body of air set in motion backwards by a closure at the velum, and produces only ingressive sounds called **clicks**.

alliteration
– a linguistic device often used in poetry, where the onsets of a series of syllables have to be the same in a line or sequence of lines (so there might be lots of initial /t/s, for example, or /l/s).

allophone
– a realisation or real-world pronunciation of a phoneme (for example, clear [l] and dark [ɬ] are both allophones of /l/ in many varieties of English). To qualify as allophones of the same phoneme, two or more phones must be in **complementary distribution**: that is, they must appear in predictably distinct environments, and substituting one for another must not create a difference in meaning. Allophones of a single phoneme must also be reasonably similar phonetically.

alternation
– a relationship between two distinct phonemes, whereby they appear in different grammatical contexts. For example, /f/ and /v/ contrast in English, but in certain nouns they alternate, with /f/ in the singular and /v/ in the plural (*leaf – leaves*, *knife – knives*).

alveolar (ridge)
– the bony ridge along the roof of the mouth which you can feel by moving your tongue tip backwards from the top front teeth towards the hard palate. This is the place of articulation for alveolar sounds like [s z] in English.

ambisyllabic
– an ambisyllabic consonant is one which belongs simultaneously to the coda of one syllable and the onset of the following syllable (like the [t] in English *bottle*).

anterior
– sounds which have the passive articulator as the alveolar ridge or further forward are anterior; these tend to behave as a class of sounds in phonological rules or processes.

approximant
– any sound which is produced with open approximation between the articulators (where they are not close enough together to create local audible friction).

approximation
– the degree of closeness between the active and passive articulators during the production of a sound. The articulators can be in contact; or in **close approximation** (which produces local audible friction, as in a fricative sound); or in **open approximation** (where they are less close together, as for the liquids and glides in English).

archiphoneme
– a phonological unit proposed in cases where two or more phonemes, which are usually contrastive, collapse into a single or intermediate form in a specific phonological context. For example, in many American accents, the DRESS, TRAP and SQUARE vowels are neutralised before /r/, so *merry*, *marry* and *Mary* sound the same and are analysed with a common archiphonemic vowel.

articulator
– the specific vocal organs which move together into contact, or into close or open approximation to produce a particular sound. The one moving is the **active articulator** (often but not always a part of the tongue), while the one it moves towards is the **passive articulator**.

articulatory (phonetics) – see **phonetics**

aspiration
– the small, audible puff of air after some allophones of voiceless oral stops or plosives, such as realisations of English /p t k/ in absolute word-initial position (but not following /s/).

assimilation
– the process whereby two sounds close together in an utterance become more similar in their phonetic quality, or one sound is

influenced by another; for example, vowels often become nasalised before nasal consonants.

auditory (**phonetics**) – see **phonetics**

babbling
– the stage of early first language acquisition when babies or small children spontaneously produce the whole range of possible human linguistic sounds, including some they will not hear from their caregivers or other speakers of the languages around them.

back (**of tongue**) – see **tongue**

back (**vowel**) – see **vowel**

bilabial
– a sound where the articulators are the lips; examples are English /p b m/.

binary feature
– phonologists try to account for patterns of sounds, and for the fact that some groups of sounds persistently behave in similar ways, by proposing that each phoneme has an internal structure of **distinctive features**. These are typically analysed as binary, with a + and – value, so that [+ voice] sounds are characterised by vibration of the vocal folds, while [– voice] sounds are not.

blade (**of tongue**) – see **tongue**

branching (**of syllable constituents**)
– constituents within a syllable can either be **simple**, or composed of a single element, or **complex**, where there is more than one element and the constituent branches. For example, in *lamp* the coda has two consonants, /m/ and /p/, and therefore branches, whereas in *lap* the coda is simple or non-branching with only one consonant /p/.

Cardinal Vowels
– vowels are highly variable in natural languages, so to help learn and transcribe vowels, phoneticians often work with an idealised set of Cardinal Vowels, equally distributed around the periphery of the **vowel space**. The Cardinal Vowels were invented by Daniel Jones, and ideally need to be learned from someone who already knows them.

central
– **central airflow** moves along the midline or centre of the oral cavity; in English, all sounds but /l/ are central. **Central vowels** are those which are intermediate between front and back.

centring (diphthong) – see **diphthong**

citation form
– the form of a word which would be characteristic of formal situations and careful speech, with no connected speech processes.

clash, stress
– a situation where two stressed syllables are adjacent, with no unstressed syllables in between. This situation is often disfavoured (in both speech and poetry), and can be resolved by processes like **Iambic Reversal**.

click
– a stop sound produced on a velaric ingressive airstream.

clear – see **l**

close (approximation) – see **approximation**

closed (syllable) – see **syllable**

coda
– an optional constituent of a syllable, following the nucleus within the rhyme, and composed of one or more consonants. *Hay* has an onset and nucleus but no coda; *hate* also has a coda including /t/; and *haste* has a complex, branching coda with both /s/ and /t/.

commutation test
– a test for phonemic contrast which involves putting different sounds in the same phonological context, to assess whether there are minimal pairs. In English, we can check which consonants can precede *–at* to find *pat*, *bat*, *that*, *sat*, for example.

complementary distribution
– two phones or sounds which are in complementary distribution cannot appear in the same phonological context; their appearance is predictable, and where one can occur, the other cannot. Sounds in complementary distribution do not contrast with one another and may be allophones of the same phoneme.

complex – see **branching**

compound (word)
– a complex word made up of two or more independent words, such as *teapot* (*tea*+*pot*).

conditioning factor / context
– the location where a phonological rule or process takes effect, and / or the reason why that process happens. For example, in English, nasalisation in vowels is conditioned by a following nasal consonant; this is a kind of assimilation, or matching of feature values.

Connected Speech Processes
– phonological processes (often involving weakening or lenition, reduction or assimilation) which occur more frequently in more relaxed and less formal situations, and / or faster speech.

consonant
– a speech sound which typically appears at the margins of syllables, in the onset or coda. Consonants vary, and can therefore be classified, according to the airstream mechanism; voicing; place and manner of articulation; and whether the airflow is oral or nasal, and central or lateral.

consonant cluster
– a sequence of two or more consonants in the onset (*flat*) or coda (*elf*) of a syllable.

constraint
– a rule or statement saying what happens, or what must not happen, in a particular context. **Optimality Theory** is a phonological model using constraints rather than rules. Instead of saying that a phoneme turns into a particular allophone in a particular context (for example, vowels start off as oral, but nasalise before nasals), Optimality Theory postulates a constraint to say that nasal vowels must precede nasals, or alternatively, that oral vowels are not permitted before nasals.

contact, language
– strictly speaking, contact takes place between speakers and not between languages (which are abstract systems); when speakers of different languages or varieties interact, one of those systems can influence the other. An individual speaker who is learning a second or subsequent language may also show some influence of their native language on the one they are learning. This influence does not always involve direct borrowing of an item or process from one language or variety into another; the effects of contact can be far more subtle.

context – see **conditioning factor**

contrastive distribution
– two **phones** or sounds which are in contrastive distribution can appear in the same phonological context. It is usually possible to find minimal pairs to show that substituting one for the other makes a meaning difference, so they belong to different phonemes.

coronal
– sounds where the active articulator is the tip, blade or front of the tongue are coronal; these tend to behave as a class of sounds in phonological rules or processes.

counterexample
– phonologists look for patterns in data, and try to figure out rules or generalisations to explain what they find. An example which does not conform to the rules is a counterexample. So, if we hypothesised that a particular consonant could not occur in clusters and then found an example of it in a cluster, that would be a counterexample, and would either invalidate our generalisation or need a specific explanation.

culminative
– a culminative property, like stress, does not have a single phonetic signature, but a culmination or piling up of a series of different phonetic signals together. In the case of stress, pitch, duration and intensity are all characteristic of stressed syllables, usually at the same time.

dactylic – see **foot**

dark – see **l**

defective distribution
– a phoneme may be absent from particular positions in the word or syllable (for example, English [ŋ] does not appear in onsets, though the other nasals do). Defective distributions of this sort are quite rare, and may result from the historical development of a phoneme, or show it is a relatively recent borrowing.

dental
– dental sounds have the tip of the tongue as the active articulator, and the top front teeth as the passive articulator, like English [θ ð].

derivation / derived form
– derived forms are formed from existing words, often by adding a prefix or suffix (so, *unhappy* and *happiness* are derived from *happy*).

dialect
– a form of a language characteristic of a specific geographical area or social group. Dialects vary not just in their sounds (like **accents**), but also in lexis / vocabulary and grammar.

dialectology
– the branch of linguistics devoted to the study of **dialects**.

diphthong
– a vowel which changes in quality during its production, with two distinguishable phases, although it functions in the word and syllable as a single segment. Diphthongs can be **falling** (when the second element is lower than the first); **rising** (when the second element is higher than the first); or **centring** (when the second element is a central vowel such as **schwa**).

distribution
– the locations in the word or syllable where a phoneme or allophone can appear.

distributional (differences) – see **accent differences**

egressive – see **airstream**

ejective
– a stop sound produced on a glottalic egressive airstream.

epiglottis
– a flap at the top of the **larynx**, which protects the lungs by stopping foreign bodies like food from dropping in.

etymology
– the study of the history of words, and changes in their meaning over time.

eurhythmy
– the regular alternation of stressed and unstressed syllables, without lapses or clashes.

falling (diphthong) – see **diphthong**

features, distinctive
– phonological units which are hypothesised to make up the internal structure of **phonemes**, describing their internal properties and helping to explain phonological behaviour.

fixed-stress languages – see **stress**

foot
– a unit extending from the beginning of one stressed syllable to the beginning of the next stressed syllable. Different configurations of syllables make up **dactylic** (S-W-W), **trochaic** (S-W) and **iambic** (W-S) feet (see Section 10.2.2), which are important in analysing verse.

free-stress languages – see **stress**

free variation
– two sounds which usually contrast may appear in the same word or position (so, some people say [ɛ]*conomic*, others say [i]*conomic*). Free variation can also cover cases where one speaker varies between pronunciations according to stylistic factors: for example, using a glottal stop or voiceless alveolar stop [t], depending on formality. This sort of case is phonologically free but obviously governed by sociolinguistic factors.

fricative
– a sound produced with the active and passive articulators brought sufficiently close together to cause local, audible friction.

front (**of tongue**) – see **tongue**

front (**vowel**) – see **vowel**

fundamental frequency
– the rate at which the **vocal folds** vibrate during voicing; it is heard as **pitch**, with faster vibration equating to higher pitch.

garden path
– in psycholinguistics, a situation where a listener starts to analyse an utterance, then realises this is not appropriate, and has to stop and go back to try a different interpretation.

geminate
– a long consonant (often known as a double consonant), which functions as a single segment, rather than a consonant cluster. English does not have geminate consonants phonologically, but at word boundaries the same effect can be heard: for example, with a long [f] in *half finished*.

glides
– a cover term for the class including English /j/ and /w/, which often behave as a class phonologically. A subclass of particularly vowel-like approximants, as opposed to the **liquids**.

glottal
– a sound produced at the **glottis**, with the **vocal folds** as the articulators.

glottal reinforcement – see **glottalisation**

glottal stop
– a voiceless plosive where the vocal folds are the articulators.

glottalic – see **airstream**

glottalisation
– replacement of a voiceless plosive by a glottal stop; or **glottal reinforcement**, where a voiceless plosive is accompanied by a partial glottal stop (typically, in English, at the ends of words).

glottis
– the gap between the vocal folds in the larynx, through which air flows as part of the pulmonic airstream. During voicing, the vocal folds move to obstruct the glottis.

graph
– a symbol in a spelling system or **orthography**, such as the letters of the English alphabet.

grapheme
– an abstract unit in a spelling system or **orthography**, which is realised by different possible **graphs** (so we recognise 'the letter <a>' but write it in different styles).

Great Vowel Shift
– a large-scale sound change in the history of English, which affected many long vowels and diphthongs.

hard palate – see **palate**

head
– the most important or prominent, and usually compulsory, part of a linguistic unit. For the **syllable**, the head is the **nucleus**.

heavy (syllable) – see **syllable**

height (of vowels) – see **vowel**

homophones / homophonous
– words which sound the same, though they mean different things and may be spelled differently (like English *pair*, *pare*, *pear*).

hypothesis
– a proposal made to try to explain or account for patterns in data.

iambic – see **foot**

Iambic Reversal
– a phonological process in English which swaps the position of stress between syllables to resolve or avoid stress **clashes**.

idiolect
– the speech repertoire of an individual; a single person's accent / dialect, with all the variants used systematically on different occasions.

implosive
– a stop sound produced on a glottalic ingressive airstream.

ingressive – see **airstream**

Initial Maximalism – see **Onset Maximalism**

initiation (of airstream); initiator
– movement of air is required for audible speech to be produced. The initiator is the organ or physical system which sets the air in motion.

innate / innateness
– many linguists believe that certain aspects of language, or at least the drive to acquire language, are inherent in our species, so we are all born with them rather than having to learn everything from scratch. This would account for the speed and similarity with which human children acquire their native language(s) across cultures without explicit teaching, just as they spontaneously start to crawl or walk.

input
– the starting point for a phonological rule or process, which then applies to transform it into the **output**.

instrumental analysis (of speech)
– the use of machines and computers to analyse speech: for example, by giving a visual representation of sound waves.

intercostal muscles
– the muscles between the ribs, which are important in respiration or normal breathing, and for inflating and deflating the lungs as part of the pulmonic airstream mechanism.

interlocutor
– someone who is part of a conversation.

International Phonetic Alphabet
– a system of transcribing speech sounds which allows them to be written down unambiguously, understood and repeated by other linguists, and compared across languages.

intonation
– the 'tune' of speech in a language; the characteristic prominence patterns of whole utterances.

intrusive /r/
– a phonological phenomenon in non-rhotic accents of English, where an added or intrusive [r] sound appears between vowels in cases where there is no <r> in the spelling, and where rhotic speakers would not have an [r] – as in 'the idea[r] is' or 'banana[r]y'.

invariance of meaning
– one criterion for allophony. If two sounds are **allophones** of a single **phoneme**, substituting one for the other will not produce a meaning difference (though it might sound odd to other native speakers).

irregular
– irregular words do not follow the usual, regular patterns of morphology. For example, *ox* does not take the regular -(*e*)*s* ending to form the plural, but instead becomes *oxen*.

isochrony
– a tendency for each foot to take about the same time to say, regardless of how many syllables it contains.

l – clear
– the light, or clear, allophone of English /l/ is alveolar, and is found in syllable **onsets**.

l – dark
– the dark allophone of English /l/ is velar or pharyngeal, and is found in syllable **codas**.

l – vocalisation
– the realisation of /l/ as a vowel or a [w] glide word-finally or medially, as in *pool*, *million*.

L1
– a person's first or native language. Of course, an individual may acquire more than one native language in parallel, depending on

their home and community linguistic circumstances; that person would then be bilingual or multilingual.

L2
– a person's second language, usually learned later and often through more formal tuition.

labial
– a sound with the lips involved in articulation.

labial–velar
– a doubly articulated sound with two points of articulation, one at the lips, and another at the soft palate, as in English [w].

labio-dental
– a sound where the active articulator is the bottom lip, and the passive articulator is the top front teeth, as in English [f v].

language change
– changes in the structure of a language between generations, often because speakers adopt and prefer a particular form and older forms gradually die out. At the stage when there is still variation but one variant seems to be spreading, linguists talk about language change in progress.

language-specific
– structures or features which occur in a particular language, rather than being **universal** properties of all languages (so all human languages have vowels and consonants, but English has its own specific system of particular vowels and consonants).

lapse, stress
– a string of adjacent unstressed syllables, with no stressed syllables in between. This situation is often disfavoured (in both speech and poetry), and can be resolved by rhythmic processes shifting stress.

larynx
– a box-like structure in the trachea, or windpipe, which can move up and down; in the larynx are the vocal folds and the glottis, so it is important in voicing and also for the glottalic airstream mechanism.

lateral
– lateral airflow moves along the sides of the oral cavity, with the articulators in contact or approximated in the centre; in English, the only lateral is /l/, and all other sounds are central.

lax (vowel) – see **vowel**

lect
– a term for any variety of a language, neutral between accent, dialect, and geographical, social or stylistic variation.

lenition
– the weakening of a sound – for example, from a stop to a fricative, or a fricative to an approximant – often found in fast or casual speech processes, or in sound change.

lexical incidence
– a situation where an individual word has different phonemes in different varieties of a language – for example, American English speakers have /aʊ/ in *route*, and British English speakers have /u/.

light (syllable) – see **syllable**

lingua franca
– a language used as the common means of communication in a community where several native languages are spoken. It may be the native language of one group, or be brought in from elsewhere (like Latin in many areas of Europe in the Middle Ages).

liquids
– a cover term for the class including English /r/ and /l/, which often behave as a class phonologically. A subclass of approximants, as opposed to the **glides**.

long (vowel) – see **vowel**

low (vowel) – see **vowel**

major class features
– a small group of **distinctive features** which allow us to distinguish four important sets of sounds – the **vowels**, **glides**, **sonorants** and **obstruents**.

manner (of articulation)
– the closeness of the **active** and **passive articulators** during the production of a sound. Articulators may be in contact, producing a **stop**; in close approximation for a **fricative**; and in open approximation for other types of sound.

margin (of syllable)
– the optional constituents at the edges of syllables, on either side of the nucleus, where consonants typically appear.

matrix (of features)
– the simultaneously articulated set of distinctive features which make up a sound (or class of sounds); these are usually represented in large square brackets.

medial
– in the middle of a word (often between vowels); contrasts with **initial** and **final** in describing distributions of sounds.

mid (vowel) – see **vowel**

Middle English
– the period of the history of English after Old English, from about AD 1100 to 1500.

minimal pair
– two words differentiated by just a single sound, like *hot* and *lot*, which establish those elements as contrastive and therefore as phonemes of the language (here /h/ versus /l/).

monophthong
– a vowel which maintains the same quality throughout its production.

morpheme
– the smallest meaningful unit of a language, which cannot be divided up further (so *happiness* consists of two morphemes, *happy* and *–ness*). Morphemes are abstract units like phonemes, and are realised by words and parts of words in actual language.

morphology
– the study of the structure of words, and of parts of words, such as stems, prefixes and suffixes.

morphophonemics / morphophonology
– the interaction between phonology and morphology; adding a suffix, for example, can affect the position of stress (*atom* versus *atomic*) or the shape of the stem (*divine* versus *divinity*).

multiethnolect
– a variety of a language arising in a multiethnic, diverse community with many population groups and languages.

nasal
– a sound with air flowing through the nasal cavity rather than the oral cavity during its production.

nasal cavity
– a space filled with air, above and behind the nose. When the **velum** or **soft palate** is lowered during speech, air can flow out through the nasal cavity, through the fossae (the two parts of the nose, divided by the septum), and out through the nostrils, producing a **nasal** or **nasalised** sound.

nasalised
– a sound produced with air flowing through both the oral and nasal cavities at the same time. In English, vowels are commonly somewhat nasalised before a nasal consonant.

natural class
– a set of sounds which persistently behave similarly, and are affected in the same way by phonological rules. A **distinctive feature** system should ideally be able to describe a natural class using fewer features than for any single member of the class.

neutralisation
– a situation when a normally robust contrast between two phonemes or classes of phonemes is suspended, or fails to occur, in a particular phonological context.

non-rhotic
– those accents of English where /r/ is only realised or pronounced before a vowel, not everywhere there is an <r> in the spelling.

non-standard (accent) – see **accent**

nucleus
– the obligatory, central constituent or **head** of a **syllable**, usually containing a vowel (though occasionally some consonants may become **syllabic** and appear in the nucleus instead).

obstruent
– oral stops and fricatives, produced with at least close approximation between the articulators, which can be voiced or voiceless.

Old English
– the earliest period in the history of English, from about AD 500 to AD 1100.

onset
– an optional constituent of a syllable, preceding the rhyme, and composed of one or more consonants. *At* has no onset; *sat* has an onset

including /s/; and *spat* has a complex, branching onset with both /s/ and /p/.

Onset Maximalism (or **Initial Maximalism**)
– the generalisation that, when figuring out where syllable boundaries are, the most possible consonants should be assigned to the onset, and the fewest possible to the coda.

open (**approximation**) – see **approximation**

open (**syllable**) – see **syllable**

Optimality Theory
– a model of phonological theory which claims that phonological patterns result from innate, universal **constraints** setting out what must or must not happen; different language-specific patterns reflect different orders of importance among these constraints.

oral
– a sound with air flowing through the oral cavity rather than the nasal cavity during its production.

oral cavity
– the air-filled space between the lips and the larynx (essentially, the mouth), containing the articulators, through which air flows outwards for pulmonic egressive sounds.

orthography
– a writing or spelling system; the conventions followed in writing down a language.

output
– the end point of a phonological rule or process, which applies to transform it from the **input**.

palatal
– palatal sounds have the front of the tongue as the active articulator, and the hard palate as the passive articulator, like English [j].

palate
– the roof of the mouth, which separates the oral and nasal cavities. Further forward towards the alveolar ridge is the **hard palate**; further back is the **soft palate** or **velum**, which can lower to allow airflow through the nasal cavity.

palatoalveolar – see **postalveolar**

paralinguistic
– ways of modifying meaning or conveying emotion through vocal communication, which does not use words or the phonemes of a language.

passive (**articulator**) – see **articulator**

pharyngeal
– sounds made with the root of the tongue as the active articulator, and the back wall of the **pharynx** as the passive articulator.

pharynx
– the cavity above the larynx, opening out into the oral and nasal cavities.

phonation (also **voicing**)
– **voicing** and **voicelessness** are the two most common settings of phonation, or states of the **glottis**, depending on whether the **vocal folds** are approximated or not. Many linguists, however, use the term phonation as equivalent to voicing – when the vocal folds are pulled together to close the glottis, but are repeatedly forced open by the passage of air from the lungs, causing vibration.

phone
– an actual sound.

phoneme
– a hypothetical, abstract, segment-sized unit of sound. Substituting one phoneme for another (or strictly, an allophone of one phoneme for an allophone of another) will usually make a meaning difference and be noticed by native speakers.

phonetic similarity
– one criterion for assigning allophones to a single phoneme is that the allophones must be phonetically similar (though it is hard to specify precisely how similar they need to be).

phonetic transcription
– a system of writing down speech sounds unambiguously, so they can be understood and reproduced by other linguists. The most commonly accepted system of phonetic transcription is the **International Phonetic Alphabet**.

phonetics
– the study of the sounds of human speech. There are different branches of phonetics: **articulatory** phonetics concerns sound production;

acoustic phonetics looks at the physical properties of sound waves; and **auditory** phonetics involves how sounds are heard.

phonology
– the analysis of the sound systems of human languages, and patterns of sound behaviour, often involving hypotheses about how speakers analyse sounds and store them in the brain.

phonotactic constraints
– the rules determining what combinations of sounds are permissible in a language or variety: for example, in consonant clusters.

pitch – see **fundamental frequency**

place (**of articulation**)
– the location of the **active** and **passive articulators** in the production of a sound. Conventionally, the place is labelled according to the passive articulator, partly because so many sounds have the active articulator as part of the tongue. Alveolar consonants, then, involve the tip of the tongue moving towards the alveolar ridge; velar consonants involve the back of the tongue moving towards the velum. Place is less specific for **vowels**, as all vowels are produced between palatal and velar, with this **vowel space** usually being divided into **front**, **central** and **back**.

plosive (also **stop**)
– a consonantal sound articulated with complete closure between the active and passive articulators, so the airstream is briefly completely obstructed.

postalveolar
– postalveolar or **palatoalveolar** sounds have the blade of the tongue as the active articulator, and the junction between the alveolar ridge and hard palate as the passive articulator, as for English [ʃ ʒ].

predictability of occurrence
– one of the key criteria for identifying sounds as allophones of a single phoneme; each must appear in a defined and separate set of contexts.

primary (**stress**) – see **stress**

prosody (also **suprasegmental phonology**)
– patterns of sound in a language or across languages above the level of single segments like vowels or consonants, involving stress, rhythm and intonation in syllables, words and longer utterances.

productive
– a **regular** process which will usually apply. For example, adding a suffix *-s* to make the plural of a noun in English is productive, and will usually apply to new words that are borrowed or created. Productive processes can still have exceptions; these are **irregular** forms (like *oxen*, *feet*).

pulmonic – see **airstream**

realisation
– a concrete form of an abstract unit, which actually occurs in the world and can be observed and measured. **Phonemes** are realised by actual sounds, or **phones**, which we can hear, transcribe and analyse.

realisational (differences) – see **accent differences**

redundant / redundancy rule
– a feature which can be predicted from other features is redundant and does not need to be spelled out separately. Redundancy rules can be used to specify which properties of sounds follow from others: for instance, all stops and fricatives in English are central; all vowels are voiced.

regular – see **productive**

respiration
– normal breathing, which is modified for speech.

retroflex
– retroflex sounds are produced with the tongue tip as the active articulator, curled back slightly behind the alveolar ridge. Many English accents have a retroflex realisation of /r/.

rhotic
– those accents of English where /r/ is realised or pronounced everywhere there is an <r> in the spelling, not just before a vowel as in non-rhotic accents.

rhyme (as constituent of syllable)
– syllables consist of the (optional) **onset** plus the rhyme. In turn, the rhyme contains the **nucleus**, which is obligatory, and the **coda**, if there is one.

rhyme (in poetry)
– for a perfect rhyme in poetry, the **nucleus** and **coda** of the final syllables of the rhyming words must be exactly the same.

rising (**diphthong**) – see **diphthong**

root (**of tongue**) – see **tongue**

rounding (**of vowels**) – see **vowel**

rule, phonological
– a formal way of stating the regularities of pattern, or generalisations, which occur in a sound system.

rule-governed
– a regular pattern, involving consistent behaviour of a segment or class of segments in a specified context, which can be written as a rule or generalisation.

schwa
– a term often used for the short, unstressed, mid central vowel right in the middle of the vowel quadrilateral. Schwa is the vowel sound in the first syllable of *about*.

secondary (**stress**) – see **stress**

segment
– a vowel or consonant; the smallest discrete unit of speech.

segmental phonology
– Segmental phonology considers how vowels and consonants behave, how they are composed and how they influence one another.

semantics
– the branch of linguistics which studies meaning.

short (**vowel**) – see **vowel**

sign languages
– human languages which use a visual–manual rather than a vocal–auditory modality. Although sign languages are not based on sounds, linguists can analyse their components and patterns phonologically in a corresponding way.

simple (**of syllable constituents**)
– within the syllable, units like the rhyme, onset and coda can **branch** into multiple units, or have only a single component; in the latter case, they are **simple** or **non-branching**.

sociolinguistics
– the study of the relationship between language and society, which often involves language variation according to societal factors.

sonorant
– the class of sounds which are characteristically voiced, including nasals, vowels and approximants.

sonority
– the carrying power of a sound. Phonologists place sounds on a **sonority scale** with low vowels at the top and voiceless plosives at the bottom; more sonorous sounds are most likely to be part of the nucleus of a syllable, and less sonorous sounds appear nearest the margins.

Sonority Sequencing Generalisation
– the generalisation specifying that syllables typically follow a sonority curve, with the most sonorous sounds at the centre, in the nucleus, and sonority declining towards the margins.

sound waves
– physical analysis of the properties of speech sounds shows that sound waves travel through the air from the speaker to the hearer, with particular effects on the hearer's ears and brain. The properties of these sound waves are analysed in **acoustic** and **auditory phonetics** (see **phonetics**).

speech recognition
– speech-to-text systems, or computer programs designed to analyse speech and reconstruct the intended words and message. Work is also going on to develop text-to-speech systems, where a user can type in words and naturalistic speech can be synthesised. Both technologies are developing fast but there is a long way to go.

standard (accent) – see **accent**

Standard Lexical Sets
– a system of key words developed by J. C. Wells, where each key word is shorthand for a whole set of lexical items sharing the same vowel, though the precise vowel they do share can vary from accent to accent. This is a useful tool in comparing accents of English.

stem
– the central, meaningful part of a word, to which suffixes and prefixes can be added to modify the meaning either lexically or grammatically (so *friend* is a stem, and we can add the derivational prefix or suffix *un–* or *–ship* to give *unfriend* or *friendship*; or the inflectional suffix*–s* to make the noun plural).

stigmatised
– some sounds, or even whole accents (and, likewise, other non-phonological linguistic elements like particular words) may be looked down on by speakers who associate them with social factors which they disapprove of. As far as linguists are concerned, no vowel, for example, is better or worse than any other. (See also **accent**.)

stop – see **plosive**

stress
– a culminative feature of syllables, signalled by pitch, duration and intensity all working together to make stressed syllables more prominent. Some stressed syllables are more stressed than others, so phonologists typically recognise **primary** and **secondary stress**, as well as **unstressed** syllables. Stress can be **fixed** (assigned by rule to a specific syllable in each word) or **free** (where it has to be learned as an unpredictable property of each word) in different languages.

stress-attracting – see **suffix**

stress-neutral – see **suffix**

stress-timed
– in a stress-timed language, each **foot** takes about the same amount of time to say, regardless of how many syllables it contains; in a **syllable-timed** language, each **syllable** occupies about the same amount of time, regardless of stress.

strident
– strident fricatives and affricates like [f s] tend to be more emphatic and easier to hear than non-strident ones like [θ].

stylistic variation
– speakers may use different linguistic variants depending on style: for example, whether they are in a formal or informal setting.

suffix
– an ending added to a word, either as part of inflection (changing the grammatical meaning, like plural *-s*) or derivation (creating a new word, like *-ness* in *happiness*). Suffixes in English can be **stress-attracting** and take on stress themselves, like *-ette* in *kitchenette*; may cause stress to shift within the stem, like *-ic* in *atomic*; or, most often, may be **stress-neutral** (adding *-ly* to *happy* does not affect stress position on the stem).

suprasegmental phonology – see **prosody**

syllabic (consonant)
– a consonant which may take the place of a vowel in the **nucleus** of a syllable; nasals and liquids may become syllabic in English.

syllable
– a phonological unit between the segment and the word, including an obligatory **nucleus** and optional **onset** and **coda**, which is relevant for the analysis of stress and rhythm. Syllables may be **open** or **closed** (the latter include an onset), and **heavy** (if the rhyme branches) or **light**, and these characteristics are relevant to their phonological behaviour.

syllable-timed
– in a syllable-timed language, each **syllable** occupies about the same amount of time, regardless of stress; in a stress-timed language, each **foot** takes about the same amount of time to say, regardless of how many syllables it contains.

syntax
– the branch of linguistics studying the principles which govern sentence structure in a language and across languages, and the permissible combination and order of words and phrases.

systematic gap
– a form or class of forms absent from a language because a particular pattern of sounds is not permissible. For example, there just happens not to be a word *snill* in English (this is an **accidental gap**), but **fnill* is a systematic gap because [fn] is not an acceptable English consonant cluster.

systemic (differences) – see **accent differences**

tap
– a subtype of stop sound, where the active articulator strikes the passive one quickly in passing, so interruption of the airflow is only very brief.

tense (vowel) – see **vowel**

tip (of tongue) – see **tongue**

tongue
– a muscular organ in the oral cavity which is important for chewing, swallowing and taste, and also a very important articulator in human speech. In classifying place of articulation, the tongue is conventionally divided into the **tip**, **blade**, **front**, **back** and **root**, each of

which usually works with different passive articulators in sound production.

trachea
– the windpipe; a cartilaginous tube which connects the pharynx and larynx to the lungs, and through which air flows in normal respiration and for speech.

trill
– a subtype of stop sound, where the active articulator vibrates against the passive one in very quick, repeated taps.

trochaic – see **foot**

turbulence
– changes in pressure or velocity: for instance, associated with air squeezing through the narrowed gap created by close approximation of articulation, which will change the characteristics of the **airstream** and which we hear as local audible friction.

underived– see **derivation**

universal
– structures or features which occur in all human languages, rather than being **language-specific** (so all languages have vowels and consonants, but English has its own system of particular vowels and consonants).

unrounded (**vowel**) – see **vowel**

uptalk
– the tendency for some English speakers to use a high rising terminal, with pitch rising at the end of declarative sentences, an intonation pattern usually associated with questions.

utterance
– what someone says in spoken language. This can be a single word, or a whole sentence or more. Our actual utterances are often not full sentences because speakers start and stop, change direction or get distracted, so it is important to have a term for what is actually said, regardless of structure.

variation / variationist
– different speakers, or indeed the same speaker, may say 'the same thing' in a variety of ways. This can depend on linguistic, stylistic or social context and characteristics. Variationist linguistics seeks to identify and understand these differential usages.

velar
– velar sounds have the back of the tongue as the active articulator, and the soft palate or velum as the passive articulator, as in English [k g].

velaric – see **airstream**

velum (also **soft palate**)
– part of the roof of the mouth, which separates the oral and nasal cavities. Further forward towards the alveolar ridge is the **hard palate**; further back is the **soft palate** or velum, which can lower to allow airflow through the nasal cavity.

vocal folds (also **vocal cords**)
– folds of tissue in the larynx, which are approximated to close the glottis and obstruct airflow in the production of voiced sounds or for a glottal stop.

vocal organs (see also **articulators**)
– the physical structures, located between the lips and the larynx, which move together into contact, or into close or open approximation to produce a particular sound.

vocalisation – see **l**

voiced
– a sound produced when the vocal folds are drawn together to close the glottis, but repeatedly parted by airflow outwards from the lungs, causing vibration.

voicing – see **phonation**

voiceless
– a sound produced with the vocal folds apart, allowing unimpeded airflow through the glottis.

vowel
– a characteristically voiced, pulmonic egressive, continuant speech sound produced with open approximation, which typically forms the nucleus of a syllable. Vowels are produced in a relatively restricted vowel space roughly between palatal (**front** vowels) and velar (**back** vowels) in consonantal terms, with **central** vowels in between. **High** vowels have a greater degree of approximation between the articulators, though never sufficiently close approximation to create local audible friction; **mid** and **low** vowels have progressively less approximation and more mouth-opening. The lips may also be **rounded** or **unrounded**. Vowels can also be described as **long** or

short, and this correlates (though not perfectly) with the phonological properties of **tense** and **lax**. Tense vowels are articulated in a more extreme and peripheral way than lax ones.

vowel quadrilateral
– an idealised representation of the vowel space in the form of a diagram, on which vowels can be plotted using IPA symbols, and potentially arrows for movement in the case of diphthongs, to help phonologists understand their differences and relationships.

vowel space
– the relatively restricted area of the vocal tract in which vowels are produced, roughly between palatal and velar in terms of consonant classification.

weight – see **syllable, heavy / light**

whisper
– a state of the glottis which is used **paralinguistically** but not phonemically in languages; the vocal folds are somewhat approximated but not closed, so air can pass but with a little local turbulence. This is heard as the characteristic 'hiss' of whisper.

World Englishes
– emergent varieties of English in many different sociolinguistic contexts around the world. Also known as International or Global Englishes, these developing varieties are increasingly important for phonologists and sociolinguists, and are a fascinating outcome of our increasingly integrated and multiethnic, multilingual world.

Discussion of the exercises

These notes give model answers, or at least possible answers, for some of the more practical and straightforward exercises. There are not notes for absolutely every one, partly because you are sometimes asked to come up with examples from your own variety, or there are many possible options, or you are being asked to find out about a topic for discussion.

Chapter 2

1. Explaining these pronunciations involves two steps: first, figure out what the relevant environments are; and second, try to work out why the learner is producing these pronunciations in those environments. In terms of environments, [d] appears word-initially and word-finally, and [ð] medially, between vowels; [ʃ] appears before or after an [ɪ] vowel, and [s] next to other vowels. Since we know the speaker in this case is a learner of English, our first attempt at explanation might involve the patterns of her native language: we can hypothesise that, in that language, [d] and [ð] are allophones of a single phoneme, and likewise [ʃ] and [s] are allophones of a single phoneme, with a distribution like the one our learner imposes on English.

Predicted pronunciations would be: *Daddy* [daði]; *either* [ð]; *loathe* [d]; *ship* [ʃ]; *pass* [s]; *dish* [ʃ]; *usher* [s].

2. One list of minimal pairs for initial position would be *my – nigh – pie – buy – tie – die – guy – lie – rye*. You can add *me – key* in a slightly different context. You should be able to produce similar lists medially and finally; what you won't find are cases of initial [ŋ] or, for some speakers at least, final [r].

3. The main point here is that some pairs of sounds are in complementary distribution in this language: notably, voiced and voiceless pairs of sounds ([g] – [k], [b] – [p], [z] – [s]) do not contrast, since the

voiced one appears initially and medially, and the voiceless one finally. Linguist A has noticed this, and uses a single symbol for each pair; Linguist B uses different graphs. Linguist A also uses a single symbol for [ŋ], which is a single consonant in this language, and represents [h] with <h> each time it is pronounced. Linguist B uses <ng> for [ŋ], making it look like two consonants, and has no symbol for [h] word-finally. In short, A is using a system designed for this particular language; B is following English patterns, and is probably a native speaker of English.

Chapter 3

1. (a) hang, ship, foot, sit
   (b) nap, jug, knock, lot, jump
   (c) nap, hang, jug, bet, lamb
   (d) pot, sad, boss, size, hen, call
   (e) wash, hall, red, yellow

2. (a) They are all approximant consonants.
   (b) They are all voiceless.
   (c) They are all fricatives.

3. (a) A: nasal and voiced B: oral and voiceless
   (b) A: fricatives B: plosives
   (c) A: voiced B: voiceless

4. Note that ALL these consonants are pulmonic and egressive, and all are central except for [l].

[sɑːm]	voiceless alveolar fricative; voiced bilabial nasal stop
[ʤɛstə]	voiced postalveolar affricate; voiceless alveolar fricative; voiceless alveolar plosive; and for some speakers, a final [r] = voiced alveolar central approximant
[wɪtʃ] or [ʍɪtʃ]	voiced labial–velar approximant or voiceless labial–velar fricative; voiceless postalveolar affricate
[klaɪm]	voiceless velar plosive; voiced alveolar lateral approximant; voiced bilabial nasal stop
[hɛvi]	voiceless glottal fricative; voiced labio-dental fricative
[splɪnt]	voiceless alveolar fricative; voiceless bilabial plosive; voiced alveolar lateral approximant; voiced alveolar nasal stop; voiceless alveolar plosive

[lɒk] or [lɒx]	voiced alveolar lateral approximant; voiceless velar fricative or voiceless velar fricative
[bɔt] or [bɔːt]	voiced bilabial plosive; voiceless alveolar plosive
[skwɛltʃ]	voiceless alveolar plosive; voiceless velar plosive; voiced labial–velar approximant; voiced alveolar lateral approximant; voiceless postalveolar affricate.

Chapter 4

1. These rules are written to say that /d/ becomes [ð] between vowels, and /s/ becomes [ʃ] either before or after [ɪ]. You may, if you wish, also write a rule to say explicitly where [d] and [s] appear (for example, [d] occurs word-initially and word-finally).

$$\begin{bmatrix} +\text{voice} \\ +\text{consonantal} \\ -\text{sonorant} \\ +\text{anterior} \\ +\text{coronal} \\ -\text{continuant} \end{bmatrix} \rightarrow [+\text{continuant}] \,/\, \text{vowel} \_\_\_\_ \text{vowel}$$

$$\begin{bmatrix} -\text{voice} \\ +\text{consonantal} \\ -\text{sonorant} \\ +\text{anterior} \\ +\text{coronal} \\ +\text{continuant} \end{bmatrix} \rightarrow [-\text{anterior}] \,/\, \left\{ \begin{array}{l} \_\_\_\_\ [\text{ɪ}] \\ [\text{ɪ}]\ \_\_\_\_ \end{array} \right\}$$

2. You need a single rule to say that voiced obstruents (you needn't specify the place or whether these are continuants, to cover all the sounds involved) become voiceless at the ends of words:

$$\begin{bmatrix} +\text{voice} \\ +\text{consonantal} \\ -\text{sonorant} \end{bmatrix} \rightarrow [-\text{voice}] \,/\, \_\_\_\_\#$$

3. /l/ is [–syllabic, +consonantal, +sonorant, +continuant, +voice, +lateral, –nasal, +anterior, +coronal, –delayed release, –strident]
   /r/ is [–syllabic, +consonantal, +sonorant, +continuant, +voice, –lateral, –nasal, +anterior, +coronal, –delayed release, –strident]

/p/ is [–syllabic, +consonantal, –sonorant, –continuant, –voice, –lateral, –nasal, +anterior, –coronal, –delayed release, –strident]
/d/ is [–syllabic, +consonantal, –sonorant, –continuant, +voice, –lateral, –nasal, +anterior, +coronal, –delayed release, –strident]
/s/ is [–syllabic, +consonantal, –sonorant, +continuant, –voice, –lateral, –nasal, +anterior, +coronal, –delayed release, +strident]
/θ/ is [–syllabic, +consonantal, –sonorant, +continuant, –voice, –lateral, –nasal, +anterior, +coronal, –delayed release, –strident]
/ŋ/ is [–syllabic, +consonantal, +sonorant, –continuant, +voice, –lateral, +nasal, –anterior, –coronal, –delayed release, –strident]
/ʤ/ is [–syllabic, +consonantal, –sonorant, –continuant, +voice, –lateral, –nasal, +anterior, +coronal, +delayed release, +strident]
/w/ is [–syllabic, –consonantal, +sonorant, +continuant, +voice, –lateral, –nasal, +anterior, –coronal, –delayed release, –strident]

4. Redundant features are:
/l/ everything except [+lateral] –/l/ is the only English lateral
/r/ [–syllabic, +continuant, +voice, –nasal, –delayed release, –strident]
/p/ [–syllabic, –lateral, –nasal, –delayed release, –strident]
/d/ [–syllabic, –lateral, –nasal, –strident]
/s/ [–syllabic, –lateral, –nasal, –delayed release]
/θ/ [–syllabic, –lateral, –nasal, –delayed release]
/ŋ/ everything except [+nasal, –anterior, –coronal]
/ʤ/ everything except [+voice, +delayed release]
/w/ [–syllabic, +continuant, +voice, –nasal, –delayed release, –strident]

5. (a) the odd one out is [b]; the class is [– syllabic, + sonorant, – nasal]
(b) the odd one out is [ð]; the class is [– nasal, – continuant]
(c) the odd one out is [k]; the class is [+ anterior, + coronal, – delayed release]

6. In two-consonant clusters with [s] as the first consonant, the second may be a voiceless stop; a liquid; a nasal; a glide. The natural classes are

[– voice, – nasal, – continuant] for the voiceless stops, and [– syllabic, + sonorant] for the others.

In three-consonant clusters with [s] as the first consonant, the second must be a voiceless stop (see above), and the third a liquid or glide (= [– syllabic, + sonorant, – nasal]).

Chapter 5

1. You should be producing lists like the one in Exercise 2, Chapter 2. Defective distributions will involve initial [h], final [ŋ], and final [r] if you are a speaker of a non-rhotic accent.

2. (a) Using only the criteria of predictability of occurrence and invariance of meaning, [ɹ] is in complementary distribution with both [ɹ̥] and [l̥], and [l] with both [ɹ̥] and [l̥].
   (b) The usual decision would be to assign [ɹ] and [ɹ̥] to /r/, and [l] and [l̥] to /l/, on the grounds of phonetic similarity.
   (c) $\begin{bmatrix} -\text{syllabic} \\ +\text{sonorant} \\ -\text{nasal} \end{bmatrix} \rightarrow$ [–voice] / [–voice] ____

3. In word-final position, the usual three-way contrast of the voiceless stops is neutralised, and all three are realised by the glottal stop. It would be appropriate to recognise an archiphoneme here; we could use the symbol /P/, /T/ or /K/. Since the three voiceless stop phonemes /p/, /t/ and /k/ are usually distinguished by their place of articulation, the archiphoneme would be specified as [– voice, – nasal, – continuant] (the feature values the voiceless stops share), but would have no value for [anterior] or [coronal].

Chapter 6

1. (a) put, hook, grew, hoe, hold
   (b) see, seat, met, tap, tape
   (c) see, seat, list, through
   (d) about, luck, purse, father (second syllable)
   (e) put, look, food

2. (a) they are all mid vowels
   (b) they are all high front vowels
   (c) they are all diphthongs
   (d) they are all long, high vowels

3. The diagrams here will follow the pattern of (6.15). For /aɪ/, /aʊ/, the arrow will start at low central, and move up to either high front or high back. For /eɪ, /oʊ/, the end points are the same, but the start points are high-mid front and high-mid back respectively. Centring diphthongs will all end at schwa.

4. *father* long low back unrounded; short mid central unrounded
leaving long high front unrounded; short high front unrounded
hear centring diphthong; first element is short high front unrounded, second is short mid central unrounded. Speakers of rhotic varieties will have a long high front unrounded monophthong (plus [r]).
thoroughly short low-mid central unrounded; short mid central unrounded; short high front unrounded
fast long low back unrounded; for northern speakers, front rather than back
haste diphthong, with first element high-mid front unrounded, and second element high front unrounded; or high-mid front unrounded monophthong
lookalike short high back rounded; short mid central unrounded; diphthong, with first element low central unrounded, and second element high front unrounded
sausage short low-mid back rounded; short mid central unrounded
ooze long high back rounded.

Chapter 7

1.	SSBE	GA	SSE	NZE
water	/wɔːtə/	/wɔːtər/	/wɒtər/	/wɔːtə/
grass	/grɑːs/	/græs/	/gras/	/graːs/
righteousness	/raɪtʃəsnɛs/	/raɪtʃəsnɛs/	/rʌɪtʃəsnɛs/	/raɪtʃəsnes/
holiday	/hɒlɪdeɪ/	/hɑːlɪdeɪ/	/hɒlɪde/	/hɒlədɛɪ/
pilchard	/pɪltʃɜd/	/pɪltʃɜrd/	/pɪltʃʌrd/	/pəltʃɜd/
following	/fɒloʊɪŋ/	/fɑloʊɪŋ/	/fɒloɪŋ/	/fɒləuɪŋ/
northeast	/nɔːθiːst/	/nɔrθiːst/	/nɒrθist/	/nɔːθɪist/
spoonful	/spuːnfʊl/	/spuːnfʊl/	/spunful/	/spəunfʊl/

2. (a) $\begin{bmatrix} +\text{syllabic} \\ +\text{front} \\ +\text{round} \end{bmatrix} \rightarrow [-\text{round}] \; / \_\_\_\_ \begin{bmatrix} -\text{syllabic} \\ -\text{anterior} \\ -\text{coronal} \end{bmatrix}$

(b) $\begin{bmatrix} +\text{syllabic} \\ -\text{consonant} \\ +\text{sonorant} \end{bmatrix} \rightarrow [-\text{voice}] \; / \; \underline{\quad} \; \begin{bmatrix} -\text{syllabic} \\ -\text{voice} \end{bmatrix}$

(c) $\begin{bmatrix} +\text{syllabic} \\ +\text{high} \\ -\text{mid} \end{bmatrix} \rightarrow [+\text{mid}] \; / \; [-\text{syllabic}] \; \begin{bmatrix} -\text{syllabic} \\ +\text{nasal} \end{bmatrix} \_\_$

(d) $\begin{bmatrix} +\text{syllabic} \\ -\text{high} \\ -\text{mid} \\ +\text{back} \end{bmatrix} \rightarrow \begin{bmatrix} +\text{high} \\ +\text{round} \end{bmatrix} / \left\{ \begin{array}{ll} \#\underline{\quad} & \\ \underline{\quad} & \begin{bmatrix} -\text{syllabic} \\ -\text{anterior} \\ +\text{coronal} \end{bmatrix} \end{array} \right\}$

3. and 4. These exercises depend on your accent, so no answers can be provided. In deciding which symbols to use, you should consult tables (3) and (4) in Chapter 7, and may find it helpful to talk through your reasoning with fellow-students who have both similar and different accents.

Chapter 8

All the exercises in this chapter have a wide range of possible answers, depending on your particular accent. The advice for Exercises 3 and 4 in Chapter 7 above may again be helpful in approaching these tasks. Before you begin, you should be sure that you are confident about the differences between systemic, realisational and distributional variation.

Chapter 9

1. *dan.ger* — Onset Maximalism might suggest *da.nger*, but there are no *[ndʒ] initial clusters in English.

un.sta.ble — [st] is a permissible initial cluster; *[nst] is not, so the syllable division must be between [n] and [s]. However, note that [s] is higher in sonority than [t], so there is a violation of the Sonority Sequencing Generalisation. In the third syllable, [l] is the nucleus (or, for speakers who have a schwa vowel in this syllable, the coda).

an[k.ʃ]*ious* — Final [ŋk] is common in English (*thank*, *sink* …), but not initial *[kʃ].

discipline — On the grounds of Onset Maximalism, the syllabification should be *di.sci.pline*, but then the first two

syllables would be light, and the first is stressed. There is therefore likely to be ambisyllabicity between the first and second syllables, giving *dis.sci.pline.*

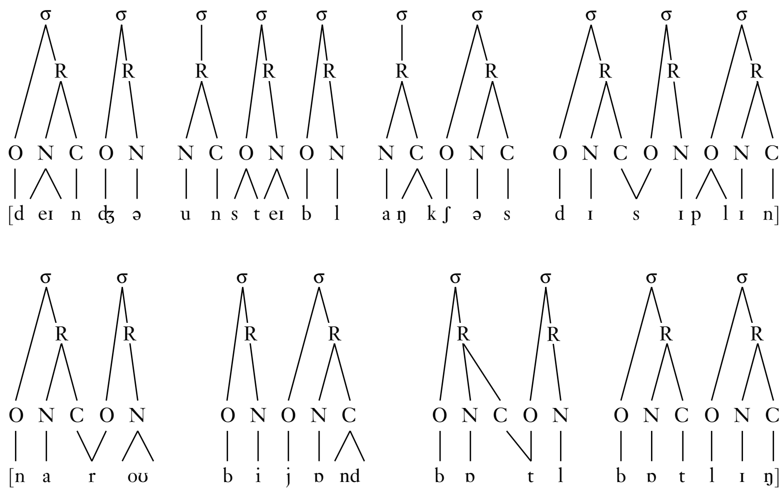
nar.row Another case of ambisyllabicity.

be.yond Here, the first syllable is unstressed and can be light; the glide [j] can therefore be in the onset of the second syllable only, prioritising Onset Maximalism.

bot.tle Another case of ambisyllabicity. It is true that there are no cases of onset *[tl-] clusters in English; but note that the syllabic [l] here is in the nucleus rather than the onset, so that Onset Maximalism can be maintained.

bott.ling Here, the [l] is in the onset, since a vowel follows; and in this case therefore, the prohibition on onset *[tl] clusters means the [t] is in the coda of the first syllable only.

2.



3. In this exercise, try to avoid making random lists of consonant clusters you can think of, and concentrate on narrowing down the possibilities using natural classes. For instance, in onset position, sonority rules out cases of liquids plus voiceless stops, so although [pl], [pr] are allowed, there are no initial clusters *[lp], *[rp], *[lt], *[rt], *[lk], *[rk]. Apparent medial exceptions would be *wallpaper*, *warpaint*, *alter*, *porter*, *alcohol*, *arcadia.* If the order voiceless stop plus liquid is permissible in onsets, it follows that this order must be ruled out in codas – and,

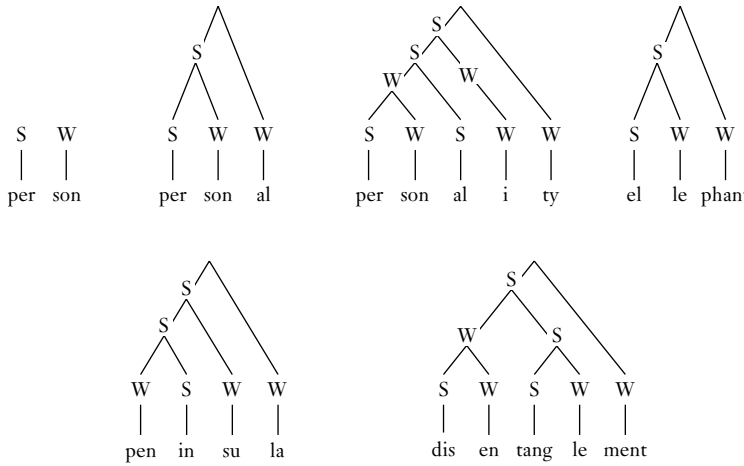
indeed, in English we find coda [lp], [lt], [lk], for instance, in *pulp*, *halt*, *milk*, but not *[pl], *[tl], *[kl], with ascending sonority; apparent medial exceptions are *apply*, *Atlantic*, *acclimatise*.

4. Again, these are just some indicative examples. English phonotactics generally forbid sequences of voiceless stop plus voiceless fricative, so *[ps] in onsets, but none the less we have *psittacosis*, *psyche*; similarly *[ts], but *tsetse* (fly). Likewise, English has no onsets with *[vl], but note the Russian name *Vlad*.

Chapter 10

1. There is no absolutely clear preference for the noun or the verb pattern in the adjectives in the list, although most can be interpreted as following the Noun Rule. *Surreal* seems to follow the Verb Rule, since it has final stress, which is not characteristic of nouns (leaving, for example, *machine*, *police* aside). However, *beautiful*, *scarlet* clearly follow the Noun Rule; both have heavy final syllables, so if following the verb pattern, they should carry final stress. *Sensible* probably falls into the same category. *Lovely* and *noisy* could follow either pattern, since their final syllables are short, meaning that stress would retract to the penultimate syllable in a verb, while the penult is the target for noun stress anyway. Can you think of other adjectives which might settle the issue?

2.



3. one iamb – *suppose*, *believe*, *machine*
one trochee – *letter*, *open*, *answer*

one dactyl – *cinema*, *enemy*, *quality*
iamb plus trochee –these would be candidates for stress clashes, since the iamb has final stress, and the trochee, initial stress: the closest we can get would be compounds like *belief system*, *advance warning*
dactyl plus trochee – *phantasmagoric*, *paediatrician*, *multiplication*

4. The analysis here will depend very much on the poems you choose, and on how regular the rhythm is in each case. The brief examples worked out in the text should help; and you might find it useful to think initially what a rhythm made up of a sequence of each foot type in isolation would sound like.

5. Citation forms (for SSBE – other accents will vary):

[aɪ ɛkspɛkt hiː haz gɒn tu miːt həː]
[hɛlən had ə bənɑːnə and ə bɹɛd keɪk]

Fast speech forms:
[aspɛktɪzgɒntəmiːtə]
[hɛlənadəbnɑːnəɹənəbɹɛgkeɪk]

Note multiple reduction of vowels to schwa; assimilation of place of articulation of the first stop to the second in the middle of *bread cake*; intrusive [r]; reduction of *he has* to *he's*; dropping of [h] in *had*, *her* and *he*.

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