

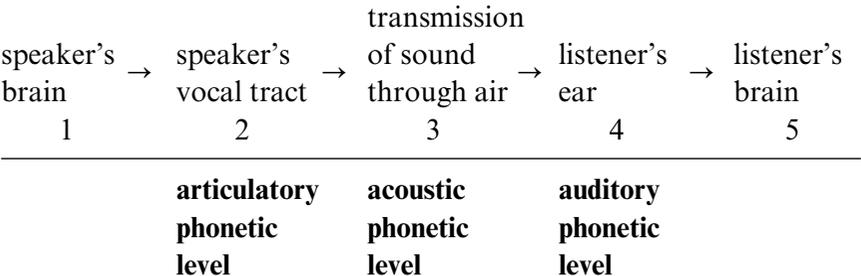
# 20 Further areas of study in phonetics and phonology

This chapter completes the course by looking at two further areas of study. Each is important in its own way, and each is an area on which students working at an advanced level in phonetics and phonology spend a considerable amount of time.

## 20.1 Laboratory phonetics

Experimental phonetics has been an important part of phonetics for most of the twentieth century, and experimental work in phonetics laboratories has produced many important discoveries about how speech is produced and perceived. Too often, however, this area of the subject has been regarded as a mysterious world where incomprehensible things are done with expensive equipment. This situation is changing rapidly, and one consequence of the easier availability of instrumental speech analysis techniques is that the fields of descriptive phonetics, pronunciation teaching and experimental phonetics have become much more closely linked. Computers and the software needed to analyse speech are becoming much cheaper, and the increasing accessibility of the internet is adding to the availability of suitable technology.

In explaining the subject matter of experimental phonetics it is helpful to start by looking at the **speech chain**, which may be diagrammed in simplified form like this:



With currently available technology we are not able to discover what goes on in detail in the brain when someone is speaking (Stage 1), although we can make informed guesses based on evidence such as speech errors (“slips of the tongue”), the effects on speech production of different sorts of brain damage and the evidence of brain scanning.

Much more is known about Stage 2, the articulatory aspect of speech production. Many special instruments have been developed to help us to find out about such things as the pressure of air in the lungs and the vocal tract, the flow of air out of the mouth and nose, the opening and closing of the vocal folds and of the soft palate, and the movement of articulators like the lips and the lower jaw. X-ray techniques were used extensively for examining the movements of articulators until the 1970s, and produced very important discoveries, but it later became clear that there were serious health risks in using normal radiographic and cineradiographic technology (in the early 1970s I received – at my own request – a large amount of radiation through cineradiographic recording of my larynx for my research, which I now find a little worrying!). Safer “microbeam” techniques with much lower doses of radiation were developed in the 1980s, but even those are now little used. Contact between the tongue and the palate can be measured electrically by means of **electropalatography** (EPG), where a piece of moulded plastic is fitted to the hard palate. This false palate is similar to the palate that holds false teeth for those who have them but, instead of having teeth, this palate contains small electrodes that can detect the contact of the tongue with the hard palate. This technique can reveal a great deal of interesting information about the working of the tongue during speech. Additionally, it is possible to detect the electrical activity that is produced when muscles contract, through **electromyography** (EMG), and we can thus observe the complex co-ordination of activity in the muscles controlling speech production. Although most of these techniques are expensive and difficult to use, it is possible that at least some of them may become more easily available. They can be very useful both for discovering in detail how English speakers produce their speech sounds, and for demonstrating to learners of English their pronunciation errors in a way that helps them to correct them. To give a simple example, recording the airflow from speakers’ mouths

can show how successfully they are producing the aspiration appropriate for syllable-initial **p**, **t** and **k**.

Stage 3, the transmission of sound waves through the air, is studied by **acoustic analysis**. Much has been discovered about the sounds of speech in this way. We can discover the physical events that produce the perceptual characteristics of speech sounds, including the **duration** of sounds or syllables (we often refer to duration as “length”), the **intensity** of different sounds (which is closely related to the loudness that we perceive), and the fundamental frequency of voiced sounds (which is closely related to pitch). Until recently, the acoustic analysis of speech was such a slow and laborious business that only small samples of speech could be analysed; however, developments in computer technology have made it possible to carry out analysis on a much larger scale. Software for acoustic analysis and spectrographic displays of speech is available at little or no cost via the internet, and it is now possible to get a computer to produce a simple phonetic transcription of what is said to it.

Computers can provide additional pronunciation training at times when a human teacher is not available, and can help children with hearing and speech disorders to improve their speech. Since (as mentioned above) it is possible to produce an accurate computer analysis of the fundamental frequency of speech, this can be displayed on a screen to help someone in practising the production of prosodic features of speech.

Finally, it is of great importance to discover more about how the listener’s brain identifies what it receives from the ear (Stages 4 and 5). Many experiments have shown how sensitive human beings are to very slight acoustic differences and how flexible they are in being able to adjust to very different speakers. We are also very strongly influenced by our expectations: if we have heard and understood half a sentence, it seems that our brain is already guessing at what the rest of it will be before it is heard, and is certainly not acting in a passive way like a simple machine. To help in discovering the organisation and the capabilities of our ability for perceiving speech, we need to be able to produce very small and finely-controlled differences in speech sounds. Experimental phonetics has made much use of speech produced through the technique of **speech synthesis**. The best speech synthesis is capable of producing speech of such high quality that

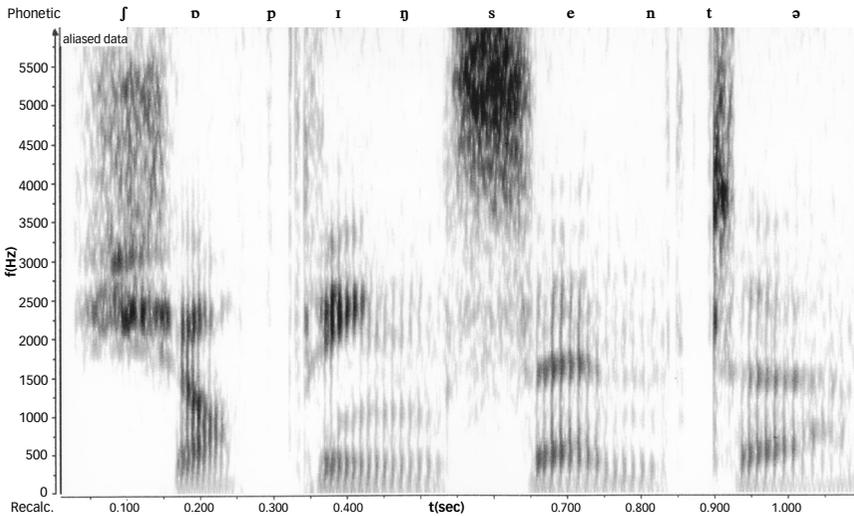


Fig. 15 Spectrogram of phrase 'shopping centre'

only an expert can distinguish it from a recording of a human being's speech; less sophisticated synthesisers are now often provided at no cost with ordinary personal computers. It is possible that synthetic speech may have a useful role to play in testing language learners' ability to perceive important segmental and suprasegmental distinctions in the language they are learning. We can also make many discoveries about perception by modifying and manipulating recordings of real speech. Tricks such as cutting sounds out of words, playing sounds backwards, lengthening or shortening syllables and modifying the intonation of a sentence are all relatively easy to do and can provide surprising results.

One of the major problems in the experimental study of speech is the enormous amount of **variability** found both within the speech of an individual and among different speakers. This means that if we study only one or two speakers, it is likely that our results will not be typical of other speakers. Much modern speech research makes use of collections of very large amounts of spoken data stored in digital form on computers in a form which allows the computer to search and process examples of particular types of phonetic data. Such collections are known as **speech databases**. Examples from my own research include searching for all fall-rise intonation patterns in six

hours of BBC speech (producing several thousand examples), and comparing the durations of different types of sound in a database comprising a number of different languages to look for cross-language differences and similarities.

## 20.2 The study of variety

The previous section ended with a brief introduction to the subject of variability in speech. One type of variability is seen in the differences among accents of English, and this is a subject that many students of English find interesting and wish to know more about. For a long time, the study of accents was part of the subject of **dialectology**, which aimed to identify all the ways in which a language differed from place to place. Dialectology in its traditional form is therefore principally interested in geographical differences; its best-known data-gathering technique was to send researchers (usually called “field-workers”) mainly into rural areas (where the speakers were believed to be less likely to have been influenced by other accents), to find elderly speakers (whose speech was believed to have been less influenced by other accents and to preserve older forms of the dialect) and to use lists of questions to find information about vocabulary and pronunciation, the questions being chosen to concentrate on items known to vary a lot from region to region. Surveys of this kind can provide the basis for many generalisations about geographical variation, but they have serious weaknesses.

Differences between accents are of two main sorts: **phonetic** and **phonological**. When two accents differ from each other only phonetically, we find the same set of phonemes in both accents, but some or all of the phonemes are realised differently. There may also be differences in stress or intonation, but not such as would cause a change in meaning. As an example of phonetic differences at the segmental level, it is said that Australian English has the same set of phonemes and phonemic contrasts as BBC pronunciation, yet Australian pronunciation is so different from that accent that it is easily recognised. A word of caution should be given here: it is all too easy to talk about such things as “Australian English”, “American English” and so on, and to ignore the variety that inevitably exists within a large community of speakers. Each individual’s speech is

different from any other's; it follows from this that no one speaker can be taken to represent a particular accent or dialect, and it also follows that the idea of a standard pronunciation is a convenient fiction, not a scientific fact.

Many accents of English also differ noticeably in intonation without the difference being such as would cause a difference in meaning; some Welsh accents, for example, have a tendency for unstressed syllables to be higher in pitch than stressed syllables. Such a difference is, again, a phonetic one. An example of a phonetic (non-phonological) difference in stress would be the stressing of the final syllable of verbs ending in '-ise' in some Scottish and Northern Irish accents (e.g. 'realise' **riə'laɪz**).

Phonological differences are of various types: again, we can divide these into segmental and suprasegmental. Within the area of segmental phonology the most obvious type of difference is where one accent has a different number of phonemes (and hence of phonemic contrasts) from another. Many speakers with Northern English accents, for example, do not have a contrast between **ʌ** and **ʊ**, so that 'luck' and 'look' are pronounced identically (both as **lʊk**); in the case of consonants, many accents do not have the phoneme **h**, so that there is no difference in pronunciation between 'art' and 'heart'. The phonemic system of such accents is therefore different from that of the BBC accent. On the other hand, some accents differ from others in having *more* phonemes and phonemic contrasts. For example, many Northern English accents have a long **eɪ** sound as the realisation of the phoneme symbolised **eɪ** in BBC (which is a simple phonetic difference); but in some Northern accents there is both an **eɪ** diphthong phoneme and also a contrasting long vowel phoneme that can be symbolised as **eː**. Words like 'eight' and 'reign' are pronounced **eɪt**, **reɪn**, while 'late', 'rain' (with no 'g' in the spelling) are pronounced **leɪt**, **reɪn**.

A more complicated kind of difference is where, without affecting the overall set of phonemes and contrasts, a phoneme has a distribution in one accent that is different from the same phoneme's distribution in another accent. The obvious example is **r**, which is restricted to occurring in pre-vocalic position in BBC pronunciation, but in many other accents is not restricted in this way. Another example is the occurrence of **j** between a consonant and **ʌ**, **ʊ** or **ʊə**;

in BBC pronunciation we can find the following: ‘pew’ **pju:**, ‘tune’ **tju:n**, ‘queue’ **kju:**. However, in many American accents and in some English accents of the South and East we find that, while ‘pew’ is pronounced **pju:** and ‘queue’ as **kju:**, ‘tune’ is pronounced **tu:n**; this absence of **j** is found after the other alveolar consonants, hence: ‘due’ **du:**; ‘new’ **nu:**.

We also find another kind of variation: in the example just given above, the occurrence of the phonemes being discussed is determined by their phonological context; however, sometimes the determining factor is lexical rather than phonological. For example, in many accents of the Midlands and North-Western England a particular set of words containing a vowel (represented by ‘o’ in the spelling) is pronounced as **ʌ** in BBC but as **ɒ** in these other accents; the list of words includes ‘one’, ‘none’, ‘nothing’, ‘tongue’, ‘mongrel’ and ‘constable’. One result of this difference is that such accents have different pronunciations for the two members of pairs of words that are pronounced identically (i.e. are homophones) in BBC, e.g. ‘won’ and ‘one’, ‘nun’ and ‘none’. For example, in my own pronunciation when I was young, I had **ɒ** instead of **ʌ** in these words, so that ‘won’ was pronounced **wɒn** and ‘one’ as **wɒn**, ‘nun’ as **nɒn** and ‘none’ as **nɒn**.

It would be satisfying to be able to list examples of phonological differences between accents in the area of stress and intonation but, unfortunately, straightforward examples are not available. We do not yet know enough about the phonological functions of stress and intonation, and not enough work has been done on comparing accents in terms of these factors. It will be necessary to show how one accent is able to make some difference in meaning with stress or intonation that another accent is unable to make. It is very probable that such differences do exist, and that they will in due course be identified by suitable research work.

It was mentioned earlier in this section that there were weaknesses in the description of accents in terms of geographical variation alone; the study of sociolinguistics has shown the importance of considering other sources of variation. We can find differences in pronunciation (as well as in other fields of linguistic analysis) resulting from various factors that we could call “static” influences including (in addition to geographical origin) one’s age and sex, social class, educational

background, occupation and personality. In addition, various situational factors influence pronunciation, such as the social relationship between speaker and hearer, whether one is speaking publicly or privately and the purposes for which one is using language. Some people (who usually turn out to do well in phonetic training) find that in speaking to someone with a different accent their pronunciation gets progressively more like that of the person they are speaking to, like a chameleon adapting its colour to its environment.

Among the situational factors influencing variation, it is possible to pick out some which could be described as stylistic, and many linguists have attempted to produce frameworks for the analysis of style in language. There is not space for us to consider this in detail, but we should note that, for foreign learners, a typical situation – regrettably, an almost inevitable one – is that they learn a style of pronunciation which could be described as careful and formal. Probably their teachers speak to them in this style, although what the learners are likely to encounter when they join in conversations with native speakers is what we have referred to previously as a “rapid, casual” style. An additional problem is that young foreign students tend to be taught the pronunciation of an older generation; even if they should learn to speak like young English people, it is likely that they will face the problem of being evaluated by examiners whose standard is that of an older generation.

Young children have an enviable ability to acquire the rapid, casual pronunciation of a language apparently without effort if they are provided with the necessary social contact with native speakers and meaningful communication situations. It has been claimed that adults can also “pick up” spoken language in this way (second language acquisition) better than by the traditional classroom approach (second language learning) if the conditions are similar to those experienced by young children. This is an attractive idea, but for most adults the goal of learning through communicating naturally in the language throughout the day will, sadly, never be a practical one. We have to continue to make use of something like formal classroom teaching because of the limited time and resources available.

It should now be clear that the pronunciation described in this course is only one of a vast number of possible varieties. The choice

of a slow, careful style is made for the sake of convenience and simplicity; learners of English need to be aware of the fact that this style is far from being the only one they will meet, and teachers of English to foreigners should do their best to expose their pupils to other varieties.

### **Notes on problems and further reading**

**20.1** There are few satisfactory books that explain the principles of experimental phonetics, in the sense of how to design and carry out experiments and to interpret the results in terms that are meaningful to other phoneticians. I would recommend Lass (1996), although some of it is difficult. There is a useful review of modern instrumental techniques in Ball and Code (1997) or, more briefly, in Chapter 12 of Ball and Rahilly (1999). A recent addition to the list is Hayward (2000).

There are some good books that explain the speech chain and the aspects of speech that are measurable. *The Speech Chain* by Denes and Pinson (1993) is clear and interesting. Basic introductions to acoustic phonetics are given in many phonetics textbooks including Ladefoged (1993), Clark and Yallop (1995) and Ball and Rahilly (1999). Fuller treatment is given in Johnson (1996), Borden and Harris (1994) and Lieberman and Blumstein (1988).

**20.2** On the study of accent variety, the list of references could become enormous. Those given in the section “Recommendations for general reading” (pp. 270) should be enough for most readers. The same is true for sociolinguistics, but I feel that any reading beyond basic introductory material ought to include some work by Labov, whose influence on the subject has been profound; see, for example, Labov (1972).

### **Note for teachers**

Audio Unit 20 is short and intensive. It is meant primarily to give a final reminder that English spoken at something like full conversational speed is very different from the slow, careful pronunciation of the early Audio Units. If there is time, students should now be encouraged to go back to some of the more difficult Audio Units

dealing with connected speech (say from Audio Unit 12 onwards, missing out Audio Unit 15); they will probably discover a lot of things they did not notice before.

### Written exercises

Phonological differences between accents are of various types. For each of the following sets of data, based on non-BBC accents, say what you can conclude about the phonology of that accent.

- |   |                        |                           |
|---|------------------------|---------------------------|
| 1 | 'sing' <b>sɪŋ</b>      | 'finger' <b>fɪŋgə</b>     |
|   | 'sung' <b>sʌŋ</b>      | 'running' <b>rʌnɪŋ</b>    |
|   | 'singing' <b>sɪŋɪŋ</b> | 'ring' <b>rɪŋ</b>         |
| 2 | 'day' <b>deɪ</b>       | 'you' <b>juː</b>          |
|   | 'buy' <b>baɪ</b>       | 'me' <b>miː</b>           |
|   | 'go' <b>gəʊ</b>        | 'more' <b>mɔː</b>         |
|   | 'now' <b>nəʊ</b>       | 'fur' <b>fɜː</b>          |
| 3 | 'mother' <b>mʌvə</b>   | 'father' <b>fɑːvə</b>     |
|   | 'think' <b>fɪŋk</b>    | 'breath' <b>bref</b>      |
|   | 'lip' <b>lɪp</b>       | 'pill' <b>pɪw</b>         |
|   | 'help' <b>ɛwp</b>      | 'hill' <b>ɪw</b>          |
| 4 | 'mother' <b>mʌðər</b>  | 'father' <b>fɑːðər</b>    |
|   | 'car' <b>kɑːr</b>      | 'cart' <b>kɑːrt</b>       |
|   | 'area' <b>ɛːriəl</b>   | 'aerial' <b>ɛːriəl</b>    |
|   | 'idea' <b>aɪdiəl</b>   | 'ideal' <b>aɪdiəl</b>     |
|   | 'India' <b>ɪndiəl</b>  | 'Norma' <b>nɔːrməl</b>    |
| 5 | 'cat' <b>kæt</b>       | 'plaster' <b>plɑːstər</b> |
|   | 'cart' <b>kɑːrt</b>    | 'grass' <b>grɑːs</b>      |
|   | 'calm' <b>kɑːm</b>     | 'gas' <b>gæs</b>          |