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Phonetics & Phonology

Mike Davenport and S. J. Hannahs

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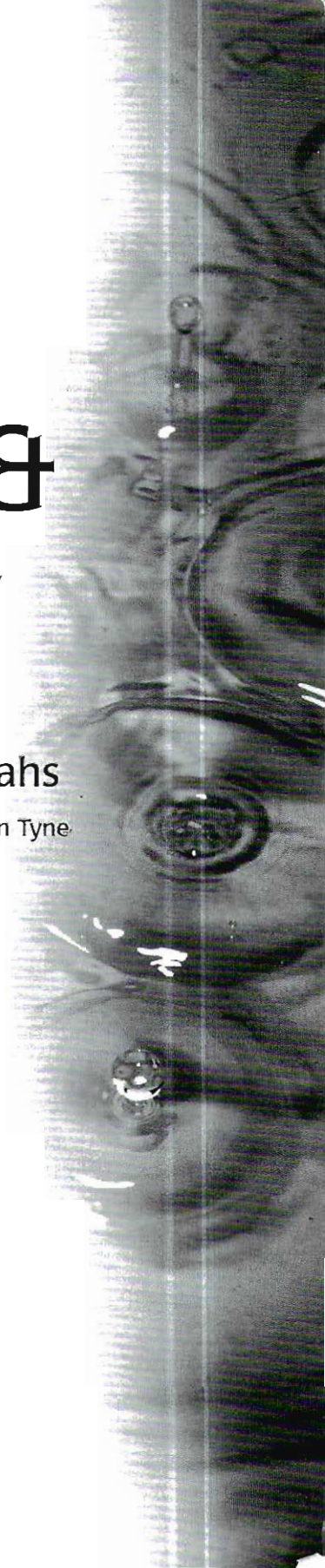
INTRODUCING
**Phonetics &
Phonology**

Mike Davenport and S. J. Hannahs

University of Durham and University of Newcastle upon Tyne

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for Lesley and Maggie

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Preface

This textbook is intended for the absolute beginner who has no previous knowledge of either linguistics in general or phonetics and phonology in particular. The aim of the text is to serve as an introduction first to the speech sounds of human languages – that is phonetics – and second to the basic notions behind the organisation of the sound systems of human languages – that is phonology. It is not intended to be a complete guide to phonetics nor a handbook of current phonological theory. Rather, its purpose is to enable the reader to approach more advanced treatments of both topics. As such, it is primarily intended for students beginning degrees in linguistics and/or English language.

The book consists of two parts. After looking briefly at phonetics and phonology and their place in the study of language, Chapters 2 through 6 examine the foundations of articulatory and acoustic phonetics. Chapters 7 through 11 deal with the basic principles of phonology. The final chapter of the book is intended as a pointer towards some further issues within contemporary phonology. While the treatment does not espouse any specific theoretical model, the general framework of the book is that of generative phonology and in the main the treatment deals with areas where there is some consensus among practising phonologists.

The primary source of data considered in the book is from varieties of English, particularly Received Pronunciation and General American. At the same time, however, aspects of the phonetics and phonology of other languages are also discussed. While a number of these languages may be unfamiliar to the reader, their inclusion is both justifiable and important. In the first place, English does not exemplify the full range of phonological processes that need to be considered and exemplified. Second, the principles of phonology discussed in the book are relevant to all human languages, not just English.

At the end of each chapter there is a short section suggesting further readings. With very few exceptions the suggested readings are secondary sources, typically intermediate and advanced textbooks. Primary literature has generally not been referred to since the intended readership is the beginning student.

Exercises are included at the end of Chapters 2 through 11. These are intended to consolidate the concepts introduced in each chapter and to afford the student the opportunity to apply the principles discussed. While no answers are provided, the data from a number of the exercises are given fuller accounts in later chapters.

As with any project of this sort, thanks are due to a number of colleagues, friends and students. In particular we'd like to thank Michael Mackert for his comments and critique. A number of other people have also given us the benefit of their comments and suggestions, including Maggie Tallerman, Lesley Davenport, Roger Maylor and Ian Turner. None of these people is to be blamed, individually or collectively, for any remaining shortcomings. Thanks also to generations of students at the universities of Durham, Delaware, Odense and Swarthmore College, without whom none of this would have been necessary!

Mike Davenport

S. J. Hannahs

Durham

March 1998

Preface to the second edition

Whilst maintaining the basic structure and order of presentation of the first edition, we have added a new chapter on the syllable, stress, tone and intonation, as well as adding or expanding sections in existing chapters, including a section on recent developments in phonological theory. We have also made numerous minor changes and corrections. We have been helped in this endeavour by many colleagues, students, reviewers and critics. For his specialist help on the anatomy of the vocal tract we'd like to express our thanks to James Cantrell. For help, encouragement, and apposite (and otherwise!) criticism we'd also like to thank (in alphabetical order): Loren Billings, David Deterding, Laura J. Downing, Jan van Eijk, Mária Gósy, András Kertész, Thomas Klein, Ken Lodge, Annalisa Zanola Macola, Donna Jo Napoli, Kathy Riley, Jürg Strässler, Maggie Tallerman, Larry Trask, and anonymous reviewers for Hodder Arnold. We'd also like to acknowledge the help (and considerable patience) of staff at Hodder Arnold: Eva Martinez, Lesley Riddle, Lucy Schiavone and Christina Wipf Perry. We apologise to anyone we've left out (and to anyone who didn't want to be included). None of these people can be assumed to agree with (all of) our assumptions or conclusions: nor (unfortunately) can they be held responsible for any remaining infelicities.

*Mike Davenport & S. J. Hannahs
Durham & Newcastle
December 2004*

THE INTERNATIONAL PHONETIC ALPHABET (revised to 1993, corrected 1996)

CONSONANTS (PULMONIC)

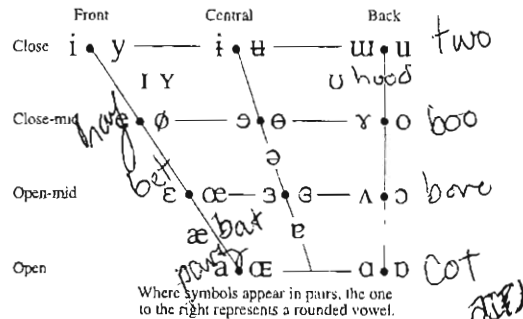
	Bilabial	Labiodental	Dental	Alveolar	Postalveolar	Retroflex	Palatal	Velar	Uvular	Pharyngeal	Glottal
Plosive	p b			t d		ʈ ɖ	c ɟ	k ɡ	q ɢ		ʔ
Nasal	m	ɱ		n		ɳ	ɲ	ŋ	ɴ		
Trill		ʙ		ʀ					ʀ		
Tap or Flap				ɾ		ɽ					
Fricative	ɸ β	f v	θ ð	s z	ʃ ʒ	ʂ ʐ	ç ʝ	x ɣ	χ ʁ	ħ ʕ	h ɦ
Lateral fricative				ɬ ɮ							
Approximant		ʋ		ɹ	ɻ	ɻ	j	ɰ			
Lateral approximant				l		ɭ	ʎ	ʟ			

Where symbols appear in pairs, the one to the right represents a voiced consonant. Shaded areas denote articulations judged impossible.

CONSONANTS (NON-PULMONIC)

Clicks	Voiced implosives	Ejectives
ʘ Bilabial	ɓ Bilabial	ʼ Examples
ǀ Dental	ɗ Dental/alveolar	ɓ' Bilabial
ǃ (Postalveolar)	ɟ Palatal	t' Dental/alveolar
ǁ Palatoalveolar	ɡ Velar	k' Velar
ǂ Alveolar lateral	ɠ Uvular	s' Alveolar fricative

VOWELS



OTHER SYMBOLS

ɱ Voiceless labial-velar fricative	ç ʒ Alveolo-palatal fricatives
w Voiced labial-velar approximant	ɭ Alveolar lateral flap
ɰ Voiced labial-palatal approximant	ɥ Simultaneous ʃ and x
ħ Voiceless epiglottal fricative	
ʕ Voiced epiglottal fricative	Africates and double articulations can be represented by two symbols joined by a tie bar if necessary
ʔ Epiglottal plosive	

kp ts

SUPRASEGMENTALS

- ˈ Primary stress
- ˌ Secondary stress
- ː Long e: founəˈtɪʃən
- ˑ Half-long eˑ
- ˚ Extra-short e˚
- ˘ Minor (foot) group
- ˗ˊ˗ Major (intonation) group
- Syllable break ji.ækt
- ◌◌◌ Linking (absence of a break)

hɪvəˈpɑːtɪ
pɑːtɪ
pɑːtɪ

DIACRITICS Diacritics may be placed above a symbol with a descender, e.g. ɲ̥

◌̥ Voiceless	◌̤ Breathy voiced	◌̦ Dental
◌̦ Voiced	◌̧ Creaky voiced	◌̨ Apical
◌̧ Aspirated	◌̨ Languidlabial	◌̩ Laminar
◌̨ More rounded	◌̩ Labialized	◌̪ Nasalized
◌̩ Less rounded	◌̪ Palatalized	◌̫ Nasal release
◌̪ Advanced	◌̫ Velarized	◌̬ Lateral release
◌̫ Retracted	◌̬ Pharyngealized	◌̭ No audible release
◌̬ Centralized	◌̭ Velarized or pharyngealized	
◌̭ Mid-centralized	◌̮ Raised	
◌̮ Syllabic	◌̯ Lowered	
◌̯ Non-syllabic	◌̰ Advanced Tongue Root	
◌̰ Rhoticity	◌̱ Retracted Tongue Root	

TONES AND WORD ACCENTS

LEVEL	CONTOUR
ē or ˥ Extra high	ē or ˩ Rising
é or ˥ High	ē or ˨ Falling
ē or ˨ Mid	˩ High rising
ē or ˩ Low	˨ Low rising
ē or ˩ Extra low	˩˩ Rising-falling
˩ Downstep	↗ Global rise
˩ Upstep	↘ Global fall

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CX
2/1

1 Introduction

This book is about the sounds we use when we speak (as opposed to the sounds we make when we're doing other things). It's also about the various kinds of relationship that exist between the sounds we use. That is, it's about 'phonetics' – the physical description of the actual sounds used in human languages – and it's about 'phonology' – the way the sounds we use are organised into patterns and systems. As speakers of a particular language (English, say, or Hindi or Gaelic or Mohawk) we obviously 'know' about the **phonetics** and **phonology** of our language, since we use our language all the time, and unless we are tired or not concentrating (or drunk) we do so without making errors. Furthermore, we always recognise when someone else (for example a non-native speaker) pronounces something incorrectly. But, equally obviously, this knowledge is not something we are conscious of; we can't usually express the knowledge we have of our language. One of the aims of this book is to examine some ways in which we can begin to express what native speakers know about the sound system of their language.

1.1 Phonetics and phonology

Ask most speakers of English how many vowel sounds the language has, and what answer will you get? Typically, unless the person asked has taken a course in phonetics and phonology, the answer will be something like 'five: A, E, I, O and U'. With a little thought, however, it's easy to see that this can't be right. Consider the words 'hat', 'hate' and 'hart': each of these is distinguished from the others in terms of the vowel sound between the 'h' and 't', yet each involves the vowel letter 'a'. When people answer that English has five vowels, they are thinking of English *spelling*, not the actual *sounds* of English. In fact, as we will see in Chapter 4, most kinds of English have between 16 and 20 different vowel sounds, but most speakers are completely unaware of this, despite constantly using them.

In a similar vein, consider the words 'tuck', 'stuck', 'cut' and 'duck'. The first three words each contain a sound represented in the spelling by the letter 't', and most speakers

of English would say that this 't' sound is the same in each of these words. The last word begins with a 'd' sound, and in this case speakers would say that this was a quite different sound to the 't' sounds.

An investigation of the physical properties of these sounds (their phonetics) reveals some interesting facts which do not quite match with the ideas of the native speaker. In the case of the 't' sounds we find that there are quite noticeable differences between the three. For most speakers of English, the 't' at the beginning of 'tuck' is accompanied by an audible outrush of air (a little like a very brief 'huh' sound), known as **aspiration**. There is no such outrush for the 't' in 'stuck', which actually sounds quite like the 'd' in 'duck'. And the 't' in 'cut' is different yet again: it may not involve any opening of the mouth, or it may be accompanied by, or even replaced by, a stoppage of the air in the throat, similar to a very quick cough-like sound, known as a 'glottal stop'. When we turn to the 'd' sound, the first thing to notice is that it is produced in a very similar way to the 't' sounds; for both 't' and 'd' we raise the front part of the tongue to the bony ridge behind the upper teeth to form a blockage to the passage of air out of the mouth. The difference between the sounds rests with the behaviour of what are known as the vocal cords (in the Adam's apple), which vibrate when we say 'd' and do not for 't'. (We shall have much more to say about this kind of thing in Chapters 2, 3, 4 and 5.)

That is, **phonetically** we have four closely related but slightly different sounds; but as far as the speaker is concerned, there are only two, quite different, sounds. The speaker is usually unaware of the differences between the 't' sounds, and equally unaware of the similarities between the 't' and 'd' sounds. This reflects the **phonological** status of the sounds: the 't' sounds behave in the same way as far as the system of English sounds is concerned, whereas the 't' and 'd' sounds behave quite differently. There is no contrast among the 't' sounds, but they as a group contrast with the 'd' sound. That is, we cannot distinguish between two different words in English by replacing one 't' sound with another 't' sound; having a 't' without aspiration (like the one in 'stuck') at the beginning of 'tuck' doesn't give us a different English word (it just gives us a slightly odd pronunciation of the *same* word, 'tuck'). Replacing the 't' with a 'd', on the other hand, clearly does result in a different English word: 'duck'.

So where phonetically there are four different sounds, phonologically there are only two contrasting elements, the 't' and the 'd'. When native speakers say that the 't's are the same, and the 'd' is different, they are reflecting their knowledge of the phonological system of English, that is, the underlying organisation of the sounds of the language.

In a certain respect phonetics and phonology deal with many of the same things since they both have to do with speech sounds of human language. To an extent they also share the same vocabulary (though the specific meanings of the words may differ). The difference between them will become clear as the book progresses, but it is useful to try to recognise the basic difference from the outset. **Phonetics** deals with speech sounds themselves, how they are made (**articulatory phonetics**), how they are perceived (**auditory phonetics**) and the physics involved (**acoustic phonetics**). **Phonology** deals with how these speech sounds are organised into systems for each individual language: for

example: how the sounds can be combined, the relations between them and how they affect each other.

Consider the word 'tlip'. Most native speakers of English would agree that this is clearly not a word of their language, but why not? We might think that there is a phonetic reason for this, for instance that it's 'impossible to pronounce'. If we found that there are no human languages with words beginning 'tl...', we might have some evidence for claiming that the combination of 't' followed by 'l' at the beginning of a word is impossible. Unfortunately for such a claim, there are human languages that happily combine 'tl' at the beginnings of words, e.g. Tlingit (spoken in Alaska), Navajo (spoken in Southwestern USA); indeed, the language name Tlingit itself begins with this sequence. So, if 'tl...' is phonetically possible, why doesn't English allow it? The reason is clearly not phonetic. It must therefore be a consequence of the way speech sounds are organised in English which doesn't permit 'tl...' to occur initially. Note that this sequence can occur in the middle of a word, e.g. 'atlas'. So, the reason English doesn't have words beginning with 'tl...' has nothing to do with the phonetics, since the combination is perfectly possible for a human being to pronounce, but it has to do with the systematic organisation of speech sounds in English, that is the phonology.

Above we noted that phonetics and phonology deal with many of the same things. In another very real sense, however, phonetics and phonology are only accidentally related. Most human languages use the voice and vocal apparatus as their primary means of expression. Yet there are fully fledged human languages which use a different means of expression, or 'modality'. Sign languages – for example British Sign Language, American Sign Language, Sign Language of the Netherlands and many others – primarily involve the use of manual rather than vocal gestures. Since these sign languages use modalities other than speaking and hearing to encode and decode human language, we need to keep phonetics – the surface manifestation of spoken language – separate from phonology – the abstract system organising the surface sounds and gestures. If we take this division seriously, and we have to on the evidence of sign language, we need to be careful to distinguish systematically between phonetics and phonology.

1.2 The generative enterprise

We have seen that we can make a distinction between on the one hand the surface, physical aspects of language – the sounds we use or, in the case of sign languages, the manual and facial gestures we use – and on the other hand the underlying, mental aspects that control this usage – the system of contrasting units of the phonology. This split between the two different levels is central to the theory of linguistics that underpins this book – a theory known as **Generative Grammar**. Generative grammar is particularly associated with the work of the American linguist Noam Chomsky, and can trace its current prominence to a series of books and articles by Chomsky and his followers in the 1950s and 1960s.

A couple of words are in order here about the terms 'generative' and 'grammar'. To take the second word first, 'grammar' is here used as a technical term. Outside linguistics,

'grammar' is used in a variety of different ways, often being concerned only with certain aspects of a language, such as the endings on nouns and verbs in a language like German. In generative linguistics, its meaning is something like 'the complete description of a language', that is, what the sounds are and how they combine, what the words are and how they combine, what the meanings of the words are, etc. The term 'generative' also has a specific meaning in linguistics. It does not mean 'concerning production or creation'; rather, adapting a usage from mathematics, it means 'specifying as allowable or not within the language'. A generative grammar consists of a set of formal statements which delimit all and only all the possible structures that are part of the language in question. That is, like a native speaker, the generative grammar must recognise those things which are allowable in the language and also those things which are *not* (hence the rather odd 'all and only all' in the preceding sentence).

The basic aim of a generative theory of linguistics is to represent in a formal way the tacit knowledge native speakers have of their language. This knowledge is termed **native speaker competence** – the idealised unconscious knowledge a speaker has of the organisation of his or her language. **Competence** can be distinguished from **performance** – the actual use of language. Performance is of less interest to generative linguists since all sorts of external, non-linguistic factors are involved when we actually use language – factors like how tired we are, how sober we are, who we are talking to, where we are doing the talking, what we are trying to achieve with what we are saying, etc. All these things affect the way we speak, but they are largely irrelevant to our knowledge of how our language is structured, and so are at best only peripheral to the core generative aim of characterising native speaker competence.

So what exactly are the kinds of things that we 'know' about our language? That is, what sort of things must a generative grammar account for? One important thing we know about languages is that they do indeed have structure: speaking a language involves much more than randomly combining bits of that language. If we take the English words 'the', 'a', 'dog', 'cat' and 'chased', native speakers know which combinations are permissible (the term is **grammatical**) and which are not (**ungrammatical**); so 'the dog chased a cat' or 'the cat chased a dog' are fine, but *'the cat dog a chased' or *'a chased dog cat the' are not (an asterisk before an example indicates that the example is judged to be ungrammatical by native speakers). So one of the things we know about our language is how to combine words together to form larger constructions like sentences. We also know about relationships that hold between words in such sentences; we know, for example, that in 'the dog chased a cat' the words 'the' and 'dog' form a unit, and are more closely related than say 'dog' and 'chased' in the same sentence. This type of knowledge is known as **syntactic knowledge**, and is the concern of that part of the grammar known as the **syntax**.

We also know about the internal make-up of words. In English a word like 'happy' can have its meaning changed by adding the element 'un' at the beginning, giving 'unhappy'. Or it could have its function in the sentence changed by adding 'ly' to the end, giving 'happily'. Indeed, it could have both at once, giving 'unhappily', and again, native speakers 'know' this and can recognise ungrammatical structures like *'lyhappyun' or

*‘happyunly’. In the same way, speakers recognise that adding ‘s’ to a word like ‘dog’ or ‘cat’ indicates that we are referring to more than one, and they know that this plural marker must be added at the end of the word, not the beginning. This type of knowledge about how words are formed is known as **morphology**, and is the concern of the morphological component of the grammar.

The grammar must also account for our knowledge about the meanings of words, how these meanings are related and how they can be combined to allow sentences to be interpreted. This is the concern of the **semantics**.

Finally, as we have seen in this chapter, we as native speakers have knowledge about the sounds of our language and how they are organised, that is, **phonological** knowledge. This is the concern of the **phonological component** of the grammar (and, of course, of this book).

So a full generative grammar must represent all of these areas of native speaker knowledge (syntactic, morphological, semantic and phonological). In each of these areas these are two types of knowledge native speakers have: that which is predictable, and that which is not. A generative grammar must therefore be able to characterise both these sorts of knowledge. As an example, it is not predictable that the word in English for a domesticated feline quadruped is ‘cat’; the relationship between the animal and the sequence of sounds we use to name it is arbitrary (if it wasn’t arbitrary then presumably all languages would have the same sequence of sounds for the animal). On the other hand, once we know what the sounds are, it *is* predictable that the first sound will be accompanied by the outrush of air known as aspiration that we discussed above, whereas the last sound will not. Our model of grammar must also make this distinction between the arbitrary and the predictable. This is done by putting all the arbitrary information in a part of the grammar known as the **lexicon** (which functions rather like a dictionary). The predictable facts are then expressed by formal statements known as rules, which act on the information stored in the lexicon.

So, to return to our feline quadruped, the lexicon would contain all the arbitrary facts about this word, including information on its syntactic class (that it is a noun), on its meaning (a domesticated feline quadruped!) and on its pronunciation (a ‘c’ sound followed by an ‘a’ sound followed by a ‘t’ sound). This information, known as a lexical entry, is then available to be acted upon by the various sets of rules in the components of the grammar. So, the syntactic rules might put the word in the noun slot in a structure like ‘the big NOUN’, the phonological rules would specify the actual pronunciation of each of the three sounds in the word, the semantic rules link the word to its meaning, etc. In this way, the grammar as a whole serves to ‘generate’ or specify allowable surface structures that the lexical entries can be part of, and can thus make judgements about what is or is not part of the language, in exactly the same way that a native speaker can. If faced with a structure like *‘the very cat dog’ the syntactic component of the grammar would reject this as ungrammatical because the word ‘cat’ (a noun) is occupying an adjective slot, not a noun slot: if faced with a pronunciation which involves the first sound of ‘cat’ being accompanied by a ‘glottal stop’ (see Section 3.1.5), the phonological component would

similarly reject this as ungrammatical, since this is not a characteristic of such sounds at the beginning of words in English. The rule components of the grammar thus serve to mediate between, or link, the two levels of structure: (1) the underlying, mental elements of the language (that is, linguistic structures in the speaker's mind which the speaker is not consciously aware of) and (2) the surface, physical realisations of these elements (that is, the actual sounds made by the speaker when uttering a word).

The nature of the organisation of the phonological component of a generative grammar is the concern of the second part of this book, Chapters 7 to 12. To begin with, however, we concentrate in Chapters 2 to 6 on the description, classification and physical characteristics of speech sounds, that is, phonetics.

Further reading

For general introductions to generative linguistic theory, including phonetics and phonology, see for example Fromkin, Rodman and Hyams (2002), Akmajian, Demers, Farmer and Harnish (2001), O'Grady, Dobrovolsky and Katamba (1997), Kuiper and Allan (1996), Napoli (1996).