María de los Ángeles Gómez González and Teresa Sánchez Roura
English Pronunciation for Speakers of Spanish

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From Theory to Practice

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All the listening material accompanying this book, whether **audio exercises** or **audio illustrations**, is available in the companion website of this book, EPSS Multimedia Lab (http://www.usc.es/multimlab/index.html).

You can visit the Lab for your own choice of audio exercises as you proceed through the material in the book. Audio illustrations (listed below) are marked where relevant throughout the book with the icon 🎧 and a reference number, so that 🎧 AI 1.3 means 'Audio Illustration 3 in Chapter 1'. You can easily find and listen to them in the EPSS Multimedia Lab under the "Audio Illustrations" tab in the main menu.

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List of Abbreviations and Phonetic Symbols

Abbreviations	Meaning
af	after/following
bf	before/followed by
C	consonant
CV	Cardinal Vowel
CVS	Cardinal Vowel Scale
dB	decibel(s)
EFL	English as a Foreign Language
EPD	(Cambridge) English Pronunciation Dictionary
F	formant(s)
F_0	fundamental frequency
F_1	first formant
F_2	second formant
Fr	French
GA	General American
Hz	Hertz
IPA	International Phonetic Alphabet
Lat	Latin
L1	First language
L2	Second language
LPD	Longman Pronunciation Dictionary
msecs	milliseconds
n	noun
NLM	Native Language Magnet
NP	normal pronunciation
NRP	non-regional pronunciation
OBR	openness, backness and lip rounding
OLD	Oxford Learner's Dictionary
PAM	Perceptual Assimilation Model
pl	plural
post-alv	post-alveolar
PSp	Peninsular Spanish
PresE	Present-day English

RP	Received Pronunciation
SFS	Speech Filing System
SID	Speech Internet Dictionary
sg	singular
Sp	Spanish
SR	Speech Recognition
SSBE	Standard Southern British English
SSE	Standard Scottish English
SSLE	Spanish-speaking learners of English
usu	usually
V	vowel
v	verb
VT	Vocal tract

Phonetic Symbols	**Meaning**	**Examples**
a	Cardinal Vowel no. 4 (open front unrounded)	First element of the RP diphthong /aɪ/ <i> in *idle* [ˈaɪdl̩]
ɐ	near-open central vowel	Scottish English pronunciation of the vowels in *bud* or *putt*
æ	raised open front vowel	<a> in *cat* [kæt]
ɑ	Cardinal Vowel no. 5 (open back unrounded)	Fr *pas* 'but'
ɑː	long open back unrounded vowel	<ar> in *card* [kɑːd]
ɒ	Cardinal Vowel no. 13 (open back rounded)	<o> in *pot* [pɒt]
b	voiced bilabial plosive	<b> in *bib* [bɪb]
β	voiced bilabial fricative	<v> in PSp *ave* [ˈaβ̞e] 'bird'
ɔ	Cardinal Vowel no. 6 (open-mid back rounded)	First element of the RP diphthong /ɔɪ/ <oy> in *boy* [bɔɪ]
ɔː	long open-mid back rounded vowel	<or> in *port* [pɔːt]
d	voiced alveolar plosive	<d> in *dear* [dɪə]
ʤ	voiced postalveolar affricate	<dg> in *bridge* [brɪʤ]
ð	voiced dental fricative	<th> in *this* [ðɪs]

e	Cardinal Vowel no. 2 (close-mid front unrounded)	<e> in *dress* [dres]
ə	central unrounded vowel: "schwa"	post-nuclear and pre-nuclear <a> in *banana* [bəˈnɑːnə]
ɛ	Cardinal Vowel no. 3 (open-mid front unrounded)	<e> in Fr *père* 'father'
ɜː	long open-mid central unrounded vowel	<er> in *herb* [hɜːb]
f	voiceless labio-dental fricative	<f> in *fair* [feə]
g	voiced velar plosive	<g> in *hug* [hʌg]
h	voiceless glottal fricative	<h> in *hip* [hɪp]
ɦ	voiced glottal fricative	<h> in *ahead* [əˈɦed]
i	Cardinal Vowel no. 1 (close front unrounded)	<i> in PSp *isla* [ˈisla] 'island' and RP /i/ <y> in *noisy* [ˈnɔɪzi]
iː	long close front unrounded vowel	<ee> in *seed* [siːd]
ɪ	lax close front unrounded vowel	<i> in *this* [ðɪs]
ʝ	voiced palatal fricative	<y> in PSp <yeso> [ˈʝeso] 'plaster'
k	voiceless velar plosive	<c> in *cap* [kæp]
l	voiced alveolar lateral approximant	<l> in *eleven* [ɪˈlevn̩]
ɬ	velarised voiced alveolar lateral/ dark l	<l> in *peel* [piːɬ]
m	bilabial (realisation of a) nasal	<m> in *mother* [ˈmʌðə]
ɱ	labio-dental (realisation of a) nasal	<m> in *comfort* [ˈkʌɱfət]
ɯ	Cardinal Vowel no. 16 (close back unrounded)	RP /uː/ with spread lips
n	alveolar nasal	<n> in *plan* [plæn]
ŋ	velar (realisation of a) nasal	<ng> in *sing* [sɪŋ]
ɲ	palatal nasal	<ñ> in PSp *caña* [ˈkaɲa] 'cane'
o	Cardinal Vowel no. 7 (close-mid back rounded)	<o> in PSp *no* [no] 'not'
ø	Cardinal Vowel no. 10 (close-mid front rounded)	<eu> in Fr *peu* 'little'

œ	Cardinal Vowel no. 11 (open-mid front rounded)	<eu> in Fr *peur* 'fear'
Œ	Cardinal Vowel no. 12 (open front rounded vowel)	It has not been found to exist as a separate phoneme.
θ	voiceless dental fricative	<th> in *thin* [θɪn]
p	voiceless bilabial plosive	<p> in *pet* [pet]
r/ɹ	voiced post-alveolar approximant	<r> in *red* [red] or [ɹed]
r	voiced alveolar trill or multiple vibrant	<rr> in PSp *carro* [ˈkaro] 'cart'
ɾ	voiced alveolar tap	<r> in PSp *caro* [ˈkaɾo] 'expensive'
s	voiceless alveolar fricative	<ss> in *miss* [mɪs]
ʃ	voiceless postalveolar fricative	<sh> in *ship* [ʃɪp]
t	voiceless alveolar plosive	<t> in *tin* [tɪn]
ʧ	voiceless postalveolar affricate	<ch> in *choose* [ʧuːz]
u	Cardinal Vowel no. 8 (close back rounded)	<u> in PSp *útil* [ˈutil] 'useful'
uː	long close back rounded vowel	<oo> in *food* [fuːd]
ʊ	lax close back rounded vowel	<u> in *put* [pʊt]
v	voiceless labio-dental fricative	<v> in *very* [ˈveri]
ʌ	Cardinal Vowel no. 14 (open-mid back unrounded)	<u> in *mud* [mʌd]
w	voiced labial-velar central approximant semivowel	<w> in *white* [waɪt]
x	voiceless velar fricative	<j> in PSp *jarra* [ˈxara] 'jar'
y	Cardinal Vowel no. 9 (close front rounded)	<u> in Fr *du* 'from'
ʎ	voiced palatal lateral	<ll> in PSp *llama* [ˈʎama] 'flame'
ɤ	Cardinal Vowel no. 15 (close-mid back unrounded)	Realisation of PresE /ʊ/ in some dialects
z	voiced alveolar fricative	<z> in *zoo* [zuː]
ʒ	voiced postalveolar fricative	<s> in *measure* [ˈmeʒəʳ)]
ʔ	glottal stop	<tt> in *button* [bʌʔn̩]

ʘ	bilabial click	
!	alveolar click	
ǁ	velar click	
Diacritics	**Meaning**	**Examples**
ʰ [pʰ]	aspirated	<p> in *peel* [pʰiːɬ]
⁼ [p⁼]	unaspirated	<p> in *spider* [ˈsp⁼aɪdəʳ]
◌̆ [t̆]	voiced	<t> in *matter* [ˈmæt̆əʳ]
◌̥ [n̥] [d̥]	voiceless or devoiced	<d> in *did* [d̥ɪd̥]
ʲ [kʲ]	palatalised consonant	<k> and <n> in *keen* [kʲiːnʲ]
ʷ [pʷ]	labialised consonant (lip rounding)	<p> and <t> in *put* [pʷʊtʷ]
◌̪ [d̪]	dental	<n> in PSp *monte* [ˈmõn̪te] 'hill'
ˡ [dˡ]	lateral release	<d> in *middle* [ˈmɪdˡl̩]
ⁿ [tⁿ]	nasal release	<t> in *catnap* [ˈkætⁿnæp]
ᵐ [pᵐ]	nasal release	<p> in *topmost* [ˈtopᵐməʊst]
~ [ẽ]	nasalised	<e> in *ten* [tẽn]
ˀ [gˀ]	non-audible release	<g> in *big* [bɪgˀ]
̂ [p̂]	unreleased	First <p> in *top post* [ˌtʰɒp̂ ˈpʰəʊst⁼]"
₊ [k₊]	advanced (consonants)	<k> in *key* [k₊iː:] or [k₊iː:]
◌₊ [u₊]	advanced (vowels)	Quality of RP [uː]
◌̄ p̄	retracted (consonants)	<p> in *pool* [p̄ːu ɬ] or [p-ːuɬ]
◌₋ [ɑ₋]	retracted (vowels)	[ɑ₋ː] retracted variant of RP [ɑː]
◌̈ [ä]	centralised	Quality of RP [ɑː]
◌̝ [ɪ̝]	lowered or more open	<i> in *sit* [sɪ̝t]
◌̞ [ɪ̞]	raised or closer	<i> in *bit* [bɪ̞t]
◌̯ [i̯]	non-syllabic	<ai> in PSp *aire* [ˈai̯re] 'air'
◌̩ [n̩]	syllabic	<n> in *eleven* [ɪˈlevn̩]
ː	extra-length	<ee> in *bee* [biː:]
ˑ	half-length	<ea> in *beat* [biˑt]
:	normal length	<or> in *cord* [kɔːd]
ˈ	primary stress	*computer* [kəmˈpjuːtəʳ]
ˌ	secondary stress	*understand* [ˌʌndəˈstænd]

/ /	phonemic transcription	*post* /pəʊst/
[ ]	allophonic/phonetic transcription	*post* [pʰə·ʊstˢ]
*	ungrammatical/wrong pronunciation	*earliest* *[ˈɜːlɪst]
.	syllable boundary	PSp *reyes* [re.ɪes] ‘kings’
|	tone unit boundary	
||	pause	
_#	word-finally	
#_	word-initially	

Purpose and Scope of the Book

English Pronunciation for Speakers of Spanish. From Theory to Practice (EPSS) is aimed at meeting the needs of speakers of Spanish who want to learn or teach English **phonetics** and **phonology** at universities and teacher-training institutes, or otherwise wish to improve their English **pronunciation** and their skills in **transcribing** English phonetically. To be covered in one or preferably two semesters, the volume can be used in a course on English Phonetics and Phonology and/or on English Pronunciation. In addition, the book may be useful to anyone interested in gaining insight into the differences and similarities that exist between English and Spanish pronunciation to prepare the ground for more advanced and extensive reading in the field.

EPSS is supported by a companion website called **EPSS Multimedia Lab** available at http://www.usc.es/multimlab/index.html. It contains the **audio files** (audio illustrations or audio exercises) accompanying the book, with entries for each numbered soundtrack in its corresponding unit and tab, sampling the voices of **five native speakers** of **British English** (three female and two male) and **one** female speaker of **Peninsular Spanish**, as well as **animations**, **videos** and **additional material** that can be used in combination with this manual or independently, including: (1) an **Animated Sound Bank of English-Spanish** (with phonemic transcriptions and original recordings), (2) **Glossaries and Dictionaries of Phonetics and English Pronunciation**, (3) **Downloadable and Recorded Exercises** (with their keys), and (4) **Other Resources to Teach and Learn English Phonetics and Pronunciation**.

The term **pronunciation** in the title is a cover term for the contents of both the book and the website. EPSS provides a down-to-earth introduction to the basic principles, most significant concepts and terminology of English phonetics, adopting an essentially practical **contrastive** approach. Our intention is to show how practical phonetics can be effectively used both to learn English phonetics and pronunciation and to teach it to non-natives, in particular to **Spanish-speaking learners of English** (SSLE) by helping them to represent, perceive and reproduce the sounds of English as compared to those of Spanish. To this effect, the sounds of British English, more specifically the **Received Pronunciation** (RP) accent, are contrasted with those of Spanish, particularly **Peninsular Spanish** (PSp). Separate units are devoted to the discussion of **vowels**, **vowel glides**, **consonants**, and features of **connected speech**, including such phenomena as co-articulation, assimilation, elision, linking and prosody (stress, rhythm, intonation), as well as to the description of **sound/spelling relationships** in English. In addition, the volume also offers SSLE

guidance on how to pronounce and talk in conversations. To provide such guidance is of paramount importance to us, because after years of experience as teachers of English phonetics to Spanish university students we agree with Coe (2001: 91) that "European Spanish speakers, in particular, probably find English pronunciation harder than speakers of any other European language".

Accordingly, taking a **communicative approach**, the book highlights the phonetic and phonemic contrasts and specific cues that are most important to aiding comprehension in English. Likewise, the features of English pronunciation that are potentially problematic for speakers of Spanish are emphasised so as to prevent misconceptions and avoid, whenever possible, the presence of a **foreign accent**, which may result from a variety of factors, ranging from **language universal** and (L1 and L2) **language-specific constraints** (taking into account the learner's native language or linguistic variety and its linguistic similarity to the target accent) to **individual**-dependent **characteristics** (age, instruction, phonetic and auditory abilities, as well as such affective factors as attitude, identity and concern for good pronunciation) (Kenworthy 1987; Morley 1991; Lecumberri 1999; Moyer 1999). As we are aware that these factors mean that SSLE are unlikely to start on the study of phonetics with a native-like pronunciation but are likely to carry the signature of the phonological structure and "articulatory setting" (position of articulators) of Spanish, specific sections of this book are devoted to serving as a guide towards "correct" pronunciation habits. Our purpose is to help SSLE **sound as close as possible to native English** or, at least, **acquire an intelligible RP pronunciation** (being able to produce the sound patterns of English). By achieving **comprehensibility** (so that the meaning of what is said is understood) and **interpretability** (so that the purpose of what is said is understood), they will satisfy their communicative needs in any situation (**functional communicability**) and increase their self-confidence while also fostering their monitoring abilities and speech strategies (Burn 2003). Nevertheless, it should be noted that intelligibility may be affected by other factors besides pronunciation (Fayer and Krasinski 1987), such as **grammatical correctness** (Varonis and Gass 1981), the **fluidity** and **rhythm of speech** (Anderson-Hsieb and Kehler 1988), **familiarity** with the topic discussed (Gass and Varonis 1984) and background or ambient **noise** (Munro 1998).

The book contains **seven chapters**. Each begins with a general introduction to the topic named in its title, followed by detailed analyses of the relevant issues, which are regularly interspersed with illustrative **audio illustrations**, **examples** and **diagrams** (e.g. waveforms, spectrograms, midsagittal sections of facial diagrams, Tables, Figures and other kinds of artwork). At the end of each chapter, there are also sections with recommendations for **Further Reading** and a battery of **Exercises** of different kinds. The proposed activities are devised

not only to help the reader gain practice in ear-training, oral production and phonetic transcription using the symbols and diacritics provided by the **International Phonetic Alphabet**, but also to encourage scientific thinking about phonetic issues. Although all the chapters can be read in any order, we recommend following the order given, since both the explanations and the exercises are cumulative in that later chapters are based on the contents explained in earlier ones so that previously presented technical terms are used without any further explanation.

Chapter 1 gives an overview of the fields of **phonetics** and **phonology**, paying particular attention to the notions of phoneme and allophone and to the structure of the syllable and syllabic sounds. After this, the sounds of RP are presented as a pronunciation model for SSLE in comparison with those of PSp. In addition, the main differences between broad (or phonemic) and narrow (or allophonic) transcriptions are noted, and practical tips are given on how to represent speech sounds more accurately in transcriptions than would be possible using ordinary spelling, bearing in mind the complex and often unpredictable relationship between spelling and pronunciation.

Chapter 2 summarises the principles of **articulatory phonetics**, describing the process that takes place between our lungs and our lips in the production of speech sounds. The organs of speech are described in relation to the function each plays in the articulation of speech sounds, noting that these organs are also involved in the realisation of other primary biological functions (e.g. breathing, licking and biting), as well as in the production of noises which are not speech sounds (e.g. coughing, sneezing and whistling). Descriptions are also provided of the speech organs and the air-stream mechanisms that are used to produce (pulmonic, glottalic and velaric) speech sounds, noting the action of the vocal cords that is responsible for the distinction between voiced and voiceless sounds. The chapter closes with a characterisation and classification of speech sounds in terms of their articulatory and acoustic features.

Chapter 3 describes RP **pure vowels** and **complex vowels** (or **vowel glides**) in comparison with those of PSp, while **Chapter 4** focuses on **consonants**, distinguishing four main groups: plosives, fricatives, affricates and approximants. In these two chapters each RP sound is described according to nine parameters: (1) **IPA symbol**, (2) **Identification**, (3) list of **Allophones**, (4) articulatory **Description**, (5) **Environment and main allophonic realisations**, offering a description of the main contexts of appearance of the sound in question as well as of its main realisations, (6) **Spellings**, (7) **Regional and social variants**, mentioning the most important alternative pronunciations of each sound in RP and other accents in order to show that pronunciation is not monolithic (see § 1.5), (8) **Comparison with Spanish and advice**, providing pronunciation tips that are essential for

intelligibility or otherwise may be relevant to the imitation of a native-like accent, and (9) **Further practice**, which includes recorded (and transcribed) examples (extracted from our Sound Bank). The exercises included in these two chapters are specially devised to facilitate improvement targetting the potential weaknesses that speakers of Spanish may have to improve in their production and perception of RP sounds (e.g. difficult or subtle phonemic contrasts, sounds that exist in English but not in Spanish, and so on).

Chapter 5 explains common phenomena of **connected speech** in English: **coarticulation**, **assimilation**, **elision**, **linking**, **juncture** and **gradation**, the latter referring to the different realisations of sounds (i.e. weak vs. strong) that result from the metrical structure of speech and their position in the syllable. The chapter summarises the main variants (or **allophones**) of **RP phonemes** arising from the aforementioned phenomena with their corresponding notation conventions or diacritics, which show how sounds influence one another when put together in words, phrases, sentences and speech sequences. Roughly, what happens is that the faster we speak, the less carefully and clearly we distinguish the beginning of one word from the end of the previous one, and some features of final and initial sounds start merging together because of economy of articulatory effort (i.e. laziness).

In close connection with the above mentioned phenomena, **Chapter 6** concentrates on **stress**, **rhythm** and **intonation**. We shall see how words are stressed in isolation and in the stream of speech. Likewise, tonality, tonicity and tone are examined closely as the main constituents of intonation, and their functions are explained in detail.

Lastly, **Chapter 7** explores both the systematic and the unsystematic relationships between the **written** and **spoken forms** of English words. We believe it is important to know at least the main spelling patterns of each of the English phonemes because they can be used as predictors for pronunciation, although exceptions to general tendencies are also pointed out.

The **Answer Key** at the end of the book provides sample answers for the written exercises included in each chapter, as well as the phonetic transcriptions of the texts that are proposed as further transcription practice. These are complemented, as already noted, with the (audio) activities (and their keys), as well as the resources that are available on the **EPSS Multimedia Lab**. The volume closes with a **Reference** section listing the sources that are either cited throughout the text or included in the **Further Reading Section** of each chapter.

Given its practical orientation, the theory in the book has been kept as simple and accessible as possible. Our comparison of English and Spanish is based on prior literature but also on our own experience and observation over the years as university teachers of this subject. We accept responsibility for any

weaknesses and errors in this respect. To find out more about the issues raised in EPSS the reader is referred to such textbooks as *Gimson's introduction to the pronunciation of English* (Cruttenden 2014), *English phonetics and phonology: an introduction* (Carr 2012), *Understanding phonetics* (Ashby 2011), *Practical phonetics and phonology* (Collins and Mees 2009), *An introduction to phonetics and phonology* (Clark *et al.* 2007), *Speech sounds* (Ashby 2006), *English phonetics and phonology* (Roach 2005), and *A manual of English phonetics and phonology* (Skandera and Burleigh 2005), to mention but a few. Other accounts of English phonetics and pronunciation that are specifically addressed to SSLE can be found in *La pronunciación del inglés británico simplificada* (Monroy Casas 2012), *Teach yourself English pronunciation* (Estebas Vilaplana 2009), *English phonetics and phonology for Spanish speakers* (Mott 2005), *Fonética inglesa para españoles* (Alcaraz and Moody 1993), *La pronunciación del inglés RP para hablantes de español* (Monroy Casas 1980), *A course in English phonetics for Spanish speakers* (Finch and Ortiz Lira 1982), *Manual de pronunciación inglesa comparada con la española* (Sánchez Benedicto 1980), *The sounds of English and Spanish* (Stockwell and Bowen 1965), and *Una comparación entre los sistemas fónicos del ingles y del español* (Lado 1965); while studies contrasting English with other languages are, for instance, *The phonetics of English and Dutch* (Collins and Mees 2003) and *Comparing the phonetic features of English, French, German, and Spanish* (Delattre 1965). Turning to texts on Spanish phonetics and phonology, we recommend *Manual de fonética española. Articulaciones y sonidos del español* (Martínez Celdrán and Fernández Planas 2007), *Tratado de fonología y fonética españolas* by Quilis (1993, 1985), *Estudios de fonología española* by Navarro Tomás (1966 [1946], 1991[1918]) and *Fonología española* (Alarcos LLorach 1961 [1983]).

With respect to the phonetic transcription system used, it is very similar to that utilised by Peter Roach, James Hartman and Jane Setter in their different editions of Daniel Jones's (*Cambridge*) *English Pronouncing Dictionary* (EPD) (2011; 15th, 16th and 17th edns. 1997, 2003, 2006) and by J. C. Wells in his *Longman Pronunciation Dictionary* (LPD) (2008; 1st and 2nd edns. 1990, 2000). If you are interested in transcription manuals in particular, we recommend Tench (2011), Lillo (2009), Monroy Casas (2001) and García Lecumberri and Maidment (2000), but if what you want is to practise English pronunciation, some classic books are Baker (2007), Arnold and Gimson (1976) and Gimson (1980).

EPSS provides transcriptions of English words that are frequent and/or somehow troublesome for foreign learners, as well as passages that illustrate the common processes of connected speech, with the intention of providing a natural and accurate representation of how native speakers sound. Phonetic transcription is necessary to raise awareness of the target that should be aimed

at, as well as of the possible pronunciations to be expected from native speakers. But this is a skill that can be best mastered by regular practice. So, whether working alone or in a group (where you can learn from others), SSLE are encouraged to engage in the task itself as often as possible, first transcribing sets of words and then checking their progress with the help of the answers provided in the Appendix and the website, before moving on to more advanced transcriptions. It should be borne in mind, however, that the transcription keys provided are only model answers. This means that they are always acceptable, but not necessarily the only possible ones as there may be other alternatives since pronunciation is subject to more variation than any other aspect of language.

Finally, on the issue of speech analysis, we have used Speech Filing System (SFS 4.7 and SFS/WASP Version 1.54) for spectrographic and waveform analysis (Huckvale 2008), freely available at http://www.phon.ucl.ac.uk/resource/sfs/wasp.htm, while PRAAT 5.0.20 may be used for intonation curve analysis (Boersma and Weenink 2008), which can also be freely downloaded at http://www.fon.hum.uva.nl/praat/. Learners are advised to record their own pronunciation to use these audio files for reference and checking. Additional information and resources may be found in the corresponding sections of the EPSS Multimedia Lab.

Chapter 1

1 Phonetics and Phonology

1.1 Introduction

If we simplify the distinctions within the whole of linguistic science we can say that basically there are two kinds of branches: **external** and **internal** ones. External branches of linguistics deal with disciplines that can influence or be influenced by language (e.g. sociolinguistics, ethnolinguistics, psycholinguistics, neurolinguistics, etc.). In contrast, internal branches are concerned with the study of different aspects of language itself, such as **morphology** (the analysis of morphemes), **lexicology** (the study of words), **syntax** (the study of how words are used to create phrases, clauses and sentences), **semantics** (the exploration of meaning), or **pragmatics** and **discourse** (the analysis of individual utterances and of organised sets of utterances or text units in context).

Although in terms of methods they are certainly very different from the rest, **phonetics** and **phonology** can be regarded as two further interrelated internal fields of linguistics in that, broadly, both explore the **phonic** or **sound component** of language, an indispensable foundation of linguistic enquiry.[1] We do believe that the boundary between phonetics and phonology need not be sharply drawn, nor should it be constructed on assumptions about the primacy of one over the other. For, although we analyse speech by breaking it down into its several aspects, the reality is one of integration because speech sounds cannot be thoroughly studied exclusively in isolation without looking at their linguistic function and context, in much the same way that their function cannot be properly analysed without considering their articulatory and/or acoustic features (Lass 1984: 1). However, we shall distinguish phonetics from phonology for methodological reasons and because it seems true that phonetics can be studied without really exploring phonology, while phonology is closely dependent on phonetics for the data on which it relies to pursue its arguments (Gussenhoven and Jacobs 2005).

Ultimately, what this book shows is that one thing is to speak without deliberately pondering on what we are doing, and another is to study this process systematically for the purpose of its scientific analysis, as it happens in phonetics and phonology, two fields of linguistics that are being constantly updated and extended.

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1 Other dimensions of phonetic and phonological analysis are: (1) the combinatory possibilities of the sounds (the **phonotactics** or syllable structure, see § 1.3.3); (2) the **prosody** of the language (pitch, loudness, length, accent, rhythm, intonation, see Chapter 6); and (3) the relationship between sounds and letters (**graphology** or **graphemics**, see Chapter 7).

1.2 Phonetics

Often depending more on data, scaled measurements, instruments and technologies than other areas of linguistics, **phonetics** is an empirical science (based on the observation of facts) which studies the concrete characteristics of human sound-making, especially **speech sounds**[2] but also involuntary noises (e.g. hiccups and coughing) as well as other aspects of voice. For the phonetician, sounds are phenomena in the physical world and phonetics provides information on their physical properties, allowing us to devise methods of sound description, classification and transcription (Crystal 2008: 363–364). Phonetic categories are thus generally defined using terms which have their origins in external disciplines such as anatomy, physiology and acoustics, so that consonant sounds, for example, are usually described by making reference to anatomical place of articulation (dental, palatal, etc.) and their physical makeup (the frequency and amplitude of consonantal sound waves). The discipline is often referred to as **general phonetics** because it is based on the assumption that the methods of analysis are equally applicable to the sounds of any language in the world, which reflects the phoneticians' attempts to discover the universal principles underlying the nature and use of speech sounds. **Experimental phonetics** is another term used to emphasise the "pure" scientific endeavour of general phonetics.

General phonetics, interpreted as involving general studies of speech sounds, is usually distinguished from **functional phonetics**, which investigates the phonetic properties of specific languages or how the sounds are used within the pronunciation system of a language, an approach which is usually carried out under the heading of **phonology**, which will be further described in section 1.3.

Three branches of phonetics are generally recognised depending on which phase of the **speech chain** (the process in which humans produce and hear speech) is being described: **articulatory, acoustic** and **auditory**. Our ability to communicate is apparently an easy and unremarkable action, but beneath the surface there are five complex processes at work labelled A to E in Figure 1 below (adapted from Denes and Pinson 1993: 5). Stages A and E involve the formulation and interpretation of the message in the brains of speaker and listener respectively, forming the link between phonetics and **psycholinguistics**. We are constantly monitoring our own speech by listening to our performance, a process termed **audio-feedback**, which is represented in the diagram as the

2 Speech sounds are a small subset of all the noises which humans can produce with their vocal apparatus in order to form words.

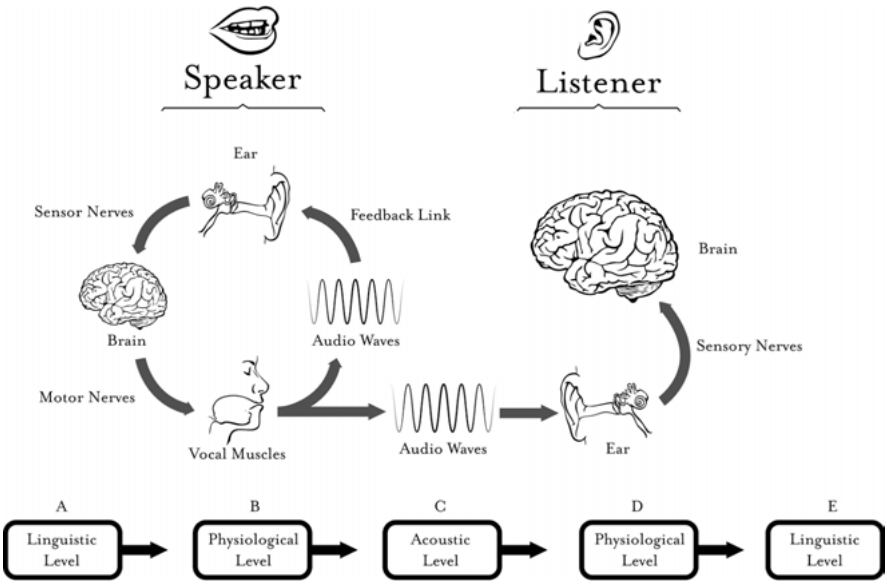


Figure 1: The speech chain

feedback link. Stage B symbolises the bodily function that is responsible for the production of speech sounds (**articulatory phonetics**). In Stage C the physical nature of speech sounds can be examined, as well as how they are transmitted through the air as sound waves (**acoustic phonetics**). Stage D corresponds to the way in which the addressee's ear perceives the speech signal (**auditory phonetics**).

We can thus conclude that phonetics analyses the anatomy and physiology of speech sounds, integrating the three aspects mentioned above, i.e. articulatory, acoustic and auditory/perceptual. The study of any of these aspects, involving appropriate instrumental analysis techniques (e.g. airflow measurement, speech synthesis, sound wave analysis, sampling, averaging, etc.) is covered by the umbrella term **instrumental phonetics**.

Phonetics plays an important role in the teaching of foreign languages and is also useful in the acquisition of good diction, in speech therapy for people with speech and hearing impediments, as well as in sound transmission and forensic linguistics. In what follows, separate sections will be devoted to describing articulatory, acoustic and auditory phonetics. The emphasis of this book is mainly on **articulatory phonetics**, but whenever necessary, acoustic and/or auditory considerations are also incorporated.

1.2.1 Articulatory Phonetics

Articulatory phonetics explores the nature and limits of the human ability to use the speech organs to articulate speech, despite organic differences, transforming aerodynamic energy into acoustic energy or **sound waves**, which are then perceived by the human auditory system as **speech sounds** (Laver 1994). Speakers differ organically from each other in anatomical factors such as the dimensions, mass and geometry of their vocal organs (e.g. the shape and size of the articulators and the speech cavities), and yet they may be judged to be producing linguistically and paralingistically identical utterances that are perceived as speech sounds. As a producer of speech sounds, you may be already aware, even if intuitively, of some aspects of articulatory phonetics. Now you need to deepen your awareness of the movements, gestures and feelings occurring in your **vocal tract** (VT) when producing speech sounds, and learn some specialised vocabulary to be able to verbalise such knowledge. For instance, we shall see that from an articulatory point of view the RP sound /p/ is a voiceless bilabial plosive because its production involves no vibration of the vocal cords, but a close compression of the lips and generally a palpable puff of air upon release from the mouth (see § 4.2.1.1).

Articulatory phonetics is the branch of phonetics most widely taught, underpinning both acoustic and auditory phonetics, in such wide-ranging disciplines as languages and linguistics, speech and language therapy, medical science, voice and singing studies, and drama, among others (Ashby 2011: 9). The principles and details of articulatory phonetics are further detailed in Chapters 2 to 5 when examining the production of speech, English vowels and consonants in comparison with those of Spanish, and connected speech phenomena, respectively.

1.2.2 Acoustic Phonetics

Acoustic phonetics studies the physical properties of speech sounds (e.g. frequency, amplitude, rate, etc.) as transmitted between mouth and ear (Crystal 2008: 7–8). Two instances of the same spoken sequence made by the same speaker are in fact most unlikely to be acoustically identical despite their phonetic likeness. Likewise, identical utterances from two different speakers are bound to be even more acoustically different. Acoustic measurements serve to support these and other articulatory or auditory judgements, the most widely used being those provided by **waveforms** and **spectrograms**.

The **waveform** of a sound represents a moving airstream which is modified by the articulators as it travels through the VT. Displaced particles of air move

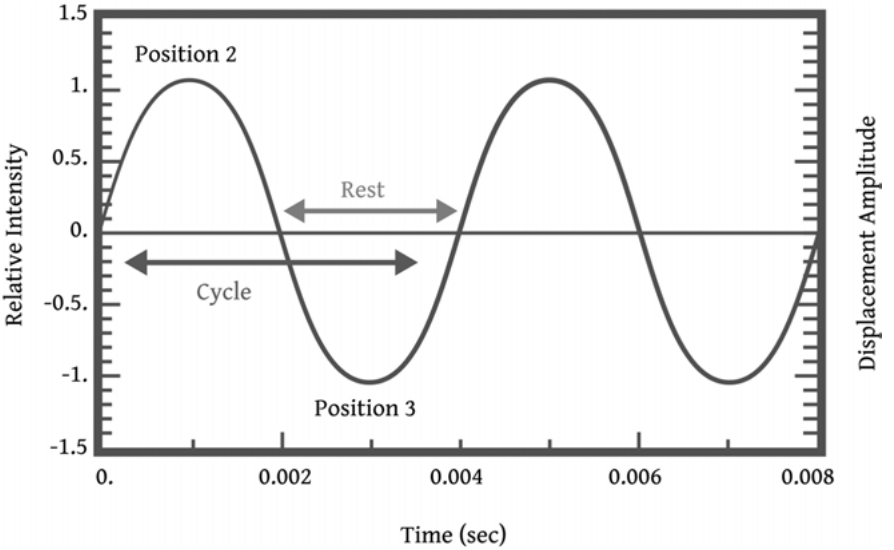
away from rest position and back to it, displacing other particles and causing them to repeat the same vibratory pendulum-like movement. This pattern of movement has the shape of a wave, and its acoustic representation is called a **sine** or **sinusoidal wave** on the grounds of certain mathematical properties that it has. Figure 2 below plots examples of sine waves, where the x axis indicates **time** in seconds or milliseconds (.001 second or 1 millisecond), and the y axis relative **intensity** in arbitrary units.

Waveforms may be **periodic** (as in Figure 2 (a) below) or **aperiodic** (as in Figure 2(b)). **Aperiodic waveforms** have no identifiable periodicity, and are characteristic of what we call **noise** (e.g. that produced by thunder, clapping hands and splashing water). **Periodic waveforms**, on the other hand, are more characteristic of speech, singing and birdsong, and can be described in terms of amplitude, intensity and frequency. The **amplitude** of the wave is the maximum distance that a particle moves in each direction from its starting point, that is the distance from the base line to the highest point of the curve. In general the greater the amplitude, the louder the sound is perceived to be. Amplitude correlates with **intensity**, which is measured in **decibels** (**dB**). In Figure 2 (a) below we can see that the two sine waves have identical amplitude and intensity (vertical axis).

The **frequency** of a sound wave is the number of cycles (movement from rest position to position 2, back to position 3 and back to rest again) completed within a given limit of time (usually one second). Frequency is measured in **Hertz** (**Hz**): one Hz equals one cycle per second. A cycle can be measured from any point on a wave to the next point. The **fundamental frequency** (**F_0**) of a sinewave is the number of times per second the vocal folds vibrate. At the same time as producing the fundamental frequency, a range of other higher frequencies called **overtones** or **harmonics** are also produced, which arise from the complex wave effects that occur when the vocal folds vibrate, a movement that can be viewed on stroboscopic images of vocal fold vibration and is often referred to as the **mucosal wave** (see § 2.2.2).

Harmonics are multiples of the fundamental frequency and contribute to the resonant **quality** or **timbre** of the sound. The arrow in Figure 2 (a) points to where the oscillation repeats itself at 0.004 seconds. This indicates that one cycle of this wave lasts 0.004 seconds, so its F_0 equals 1/0.004 seconds or 250 Hz. Then the second harmonic will be at approximately 500 Hz, the third at 750 and so on. These peaks of intensity are called **formants** (**F**) or VT resonances, and they are numbered upwards from the lowest in frequency. We shall see that the first two formants, F1 (**first formant**) and F2 (**second formant**) are related to vowel articulation (section 2.4.1). We perceive frequency as **pitch**. Pitch variation is produced primarily by stretching the length of the vocal folds which results in

(a) Periodic sinewaves



(b) Aperiodic sinewaves

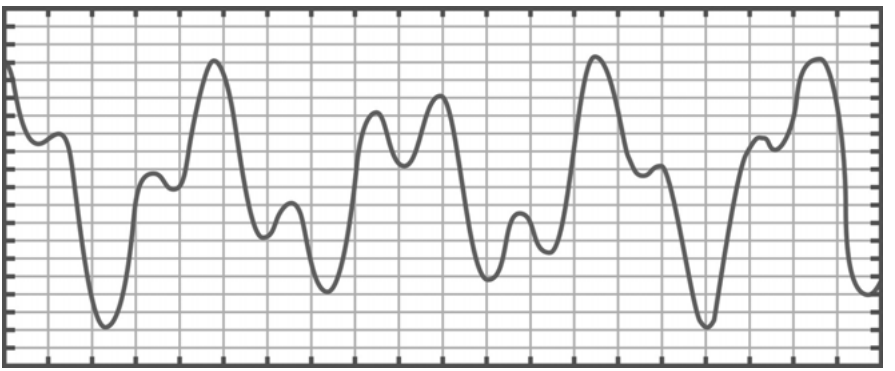


Figure 2: Periodic and aperiodic sinewaves

different intonation patterns and tonal distinctions on vowels. The higher the frequency, the higher the pitch. The range of pitch found in speech is about 60–500 Hz (men between 100 and 150 Hz, women between 200 and 325 Hz, and children around 265 Hz), although we do not usually use the entire range in speaking.

In Figure 3 below, sinewaves (a) and (b) have the same frequency (200 Hz) but different amplitudes, low (a) and higher (b); while sinewaves (c) and (d) share

approximately the same amplitude, but differ in frequency: (c) has a low frequency and (d) a much higher one.

Figure 3: Sinewaves with different amplitudes and frequencies

In addition, periodic waveforms can be **simple sinewaves** or **complex** ones, which consist of more than one sinewave and can be broken down into these component waves. In speech all periodic waveforms are complex, an illustration of which is presented in Figure 4 below, consisting of three sinewaves with different amplitudes and frequencies (viz. 100Hz with the greatest amplitude, 200Hz with the smallest amplitude, and 300Hz with a medium one) (Ladefoged 1996).

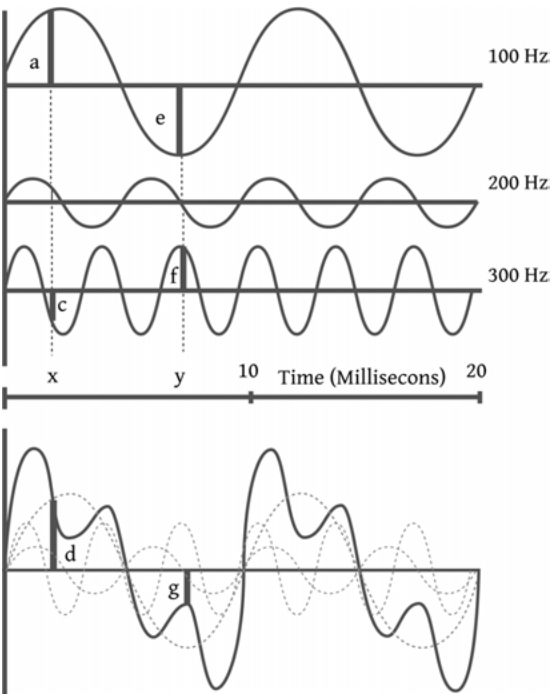


Figure 4: Constructing a complex wave

Spectrograms, on the other hand (also known as **spectral waterfalls**, **sonograms**, **voiceprints**, or **voicegrams**), are time-varying spectral representations (i.e. forming an image) that show how the spectral density of a sound varies with time. The instrument that generates a spectrogram is called a **spectrograph**. Spectrograms have a three-dimensional display. The horizontal axis represents **time**, the vertical axis **frequency**, and a third dimension indicates the **amplitude** of a particular frequency at a particular time, which is represented by the intensity, or concentration of energy at particular frequency bands (the formants) that stand out in darker colour in the image. Figure 5 below illustrates the speech waveform and wideband spectrogram for one realisation of the utterance "passed London".

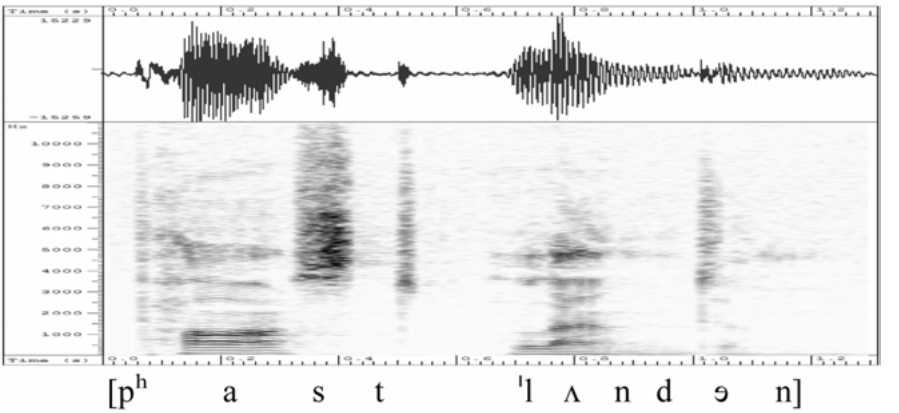


Figure 5: Speech waveform and spectrogram of "passed London"

Speech spectrograms are called **wideband** or **narrowband** depending on what window length is used, as shown in Figure 6 below containing the spectrographic representation of /m/ *in "machali"* (adapted from Jawale 2010).

The shorter the window, the larger its bandwidth. So if the window is shorter, the spectrogram is called **wideband**, and if the window is larger, **narrowband**. Wideband spectrograms are widely used in phonetics because they reflect a crucial feature of speech sounds, namely their **formant structure** (i.e. amplitude peak in the frequency spectrum of a sound); whereas narrowband spectrograms are less often used because they reveal **harmonic structure** (pitch), a kind of information which is of comparatively less importance to learners.

Acoustic measurements like those provided in Figure 6 below can be obtained quite easily using a computer, a microphone and freely downloadable

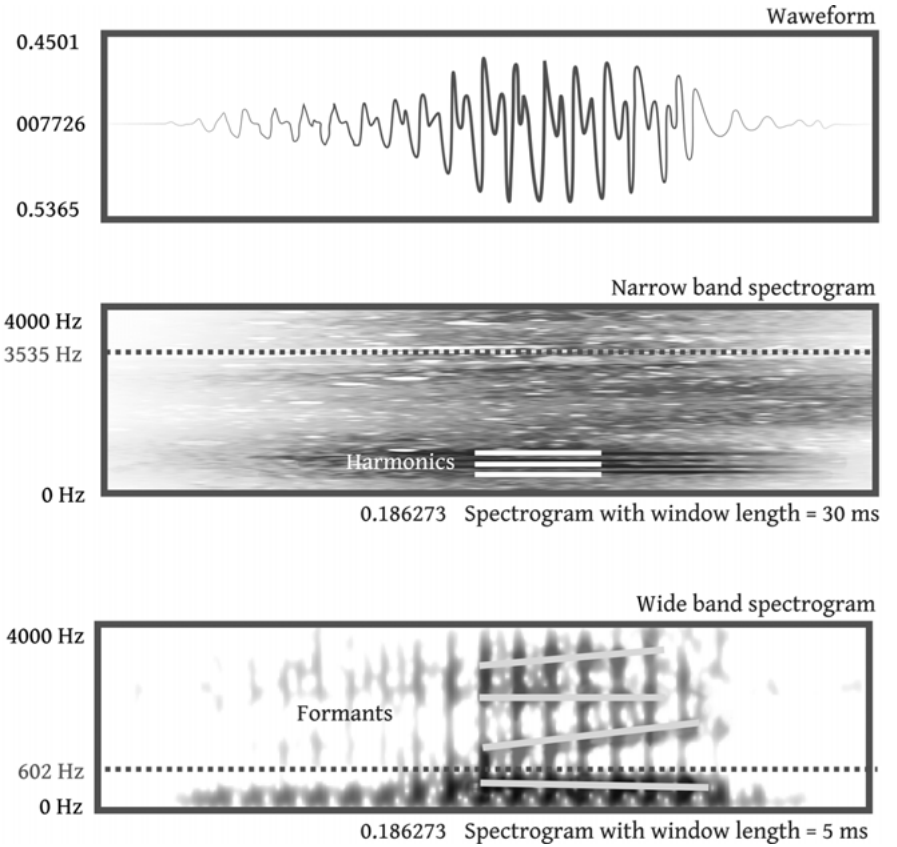


Figure 6: Narrowband and wideband spectrograms

software such as WASP or Praat. These programs allow us to process and analyse the acoustic recordings of speech. Increasingly today this kind of acoustic measurements and interactive displays are used in different disciplines such as forensics, psychology, speech therapy, pronunciation training, and language teaching, where interactive displays based on speech waveform analysis are increasingly used to assist specially foreign language learners in fine-tuning their pronunciations (Ashby 2011: 10), as in the case of Cabrera Abreu and Vizcaíno Ortega (2009). Chapter 2 offers acoustic representations of vowels and consonants (waveforms and spectrograms) and summarises the acoustic features of these speech sounds.

1.2.3 Auditory Phonetics

Phonetics is just as much about how we hear or perceive what is said as about how we say what we say. **Auditory phonetics** investigates the perceptual response to speech sounds, as mediated by ear, auditory nerve and brain (Crystal 2008: 44). Although the mental processes linked to the perception of speech are still largely unknown, we do know that the human ear can only hear sounds having certain characteristics. So the main interest of auditory phonetics lies in determining the processes whereby speakers discriminate speech sounds based on the perception of: (1) their temporal characteristics (i.e. perceived length); (2) their prosodic attributes (pitch, tone and loudness); and (3) the way these facets are interrelated with rhythm and stress in conformity with the metrical structure of speech.

Auditory phonetics underpins much of ear-training as well as practical phonetic training and accent coaching, which prove very useful for improving the pronunciation of a foreign language. So you would do well to try and identify (and reproduce) all the sounds of RP in comparison with those of PSp, as well as with the other sounds (and corresponding symbols) included in the IPA chart. At a more theoretical level, another dimension of auditory phonetics is the study of **speech perception** involving such aspects as the hearing mechanism and the effects of sounds on the brain which are explored by audiologists, psychologists, neurologists, and other specialists (Ashby 2011: 10).

1.2.4 The interface of the auditory, acoustic and articulatory levels

The categories recognised in auditory phonetics have correlates in acoustic and articulatory phonetics. Thus, as shown in Table 1 below (adapted from Alcaraz and Moody 1993: 13), we can say that pitch is articulatorily related to the position of the vocal folds and to the different articulations of speech sounds, on the one hand, and acoustically to the different formant structure of the spectrographic representation of such sounds, on the other.

Table 1: The interface of the auditory, acoustic and articulatory levels

Articulatory Phonetics	Acoustic phonetics	Auditory phonetics
Articulators	Formants	Pitch
Vocal folds	Frequency (n° cycles; wave; Hertz)	Tone
Effort/Intensity	Amplitude (intensity)	Loudness
Quantity/Duration	Rate / Tempo (pace delivery)	Length

Likewise, tone is articulatorily related with the action of the vocal cords, and acoustically, with the frequency of vibration of these organs; while loudness is in principle associated with articulatory effort and, acoustically, with amplitude. Lastly, length or duration relates to articulatory quantity and to rate or tempo in acoustic phonetics.

To summarise, remember that pitch, tone, loudness and length are psychological, perceptual characteristics, whereas formant structure, frequency, amplitude and rate are physical properties of speech sounds.

1.3 Phonology

Phonology is a branch of linguistics that studies the **systems** and **structures** of speech (Crystal 2008: 365–366) and intends to show how sounds function in a **systemic** way in a given language (Cruttenden 2014: 3). The term **system** indicates that we operate with the finite options that are available in a given language. The significance of any particular selection within a system lies in the contrast between what is selected and what could have been selected. Accordingly, in a phonological system, for example, the choices are limited and make sense only by reference to the system itself, a point which has long been recognised in discussion of **phonological distinctiveness** (Ball and Quayle 2009).

In contrast, the term **structure** suggests that choices are made within a "structured" scheme or framework, but sometimes it refers to the linear organisation of language. In this second sense, structure can be contrasted with **system**, reflecting the two dimensions of linguistic organisation that are often referred to as **paradigmatic** and **syntagmatic**, respectively. Paradigmatic relations are those that exist among the options in a system, for example between a phoneme and the other phonemes to which it is opposed. Syntagmatic relations, on the other hand, are linear or sequential, operative for example in the coarticulation or assimilation of adjacent sounds or in the organisation of alliteration or rhyme across longer stretches of language.

Sound systems comprise the meaningful relations and distinctions that exist among speech sounds across and within languages. Speech sounds are organised into a system of contrasts, which are analysed in terms of phonemes, distinctive features, combinations of sounds (sound structures such as syllables, words, etc.) or other phonological units according to the theory adopted. As a result, phonology is often said to be marked by abstraction and generality. It investigates what properties of speech sounds have a functional, communicative value. The aim of **phonologists** is to demonstrate the existence of distinctive

sounds and patterns in a language, to investigate their function, behaviour and organisation, and to spell out the principles and rules underlying phonetic relationships, making as general statements as possible about the nature of sound systems.

If phonetics provides descriptions of sounds and ways of classifying them, phonology is a kind of functional phonetics which employs these data to classify the speech sounds of a language into a system of contrasts. For example, the English words, *pan*, *tan*, *can*, *ban*, *Dan*, *fan*, *van* and *ran*, illustrate a meaning-bearing or **contrastive opposition** that is triggered by their initial consonants /p t k b d f v r/. These consonants create a **phonological system** because they stand in potential distinctive opposition to each other. **Phonologists** are interested in determining such oppositions and use such terms as **distinctive**, **functional**, **contrastive** or **information-bearing** to refer to them.

Two branches of the subject are usually recognised: segmental and suprasegmental phonology. **Segmental phonology** analyses speech into discrete segments or sounds (e.g. (semi)vowels, (semi)consonants), while **suprasegmental or non-segmental phonology** analyses those features which extend over more than one segment, such as intonation patterns. A further distinction is made between **diachronic** and **synchronic phonology**: the former explores patterns of sound change in the history of language, while the latter investigates sound patterns regardless of the processes of historical change.

In the following sections we shall address key issues in phonological theory: (1) the difference between **phoneme** and **allophone** (Section 1.3.1); (2) some basic principles of **phonological analysis** (Section 1.3.2); and (3) the basics of the **syllable**, its **structure** in English and Spanish and **syllabic consonants** (Section 1.3.3).

1.3.1 Phone, phoneme and allophone

A **phone** (enclosed between square brackets, as in [p]) is a single phonetic segment, viewed in terms of its phonetic character without regard to its possible phonological status. The term "phone" is related to "phoneme" in the same way "morph" is related to "morpheme". A **phoneme** (enclosed between slant brackets, as in /p/) is an abstract segment in the phonological system of a particular language or speech variety that is generally described as the smallest linguistic unit which can make a difference in meaning (Jones 1967/1976). The notion originated from the need to establish patterns of organisation out of the indefinitely large range of sounds that may be used in languages. Phonemes stand in **constrastive distribution**, that is, they can occur in the same phonetic context and if they do,

they produce a change of meaning. For example /d/ and /t/ are phonemes in English because both can occur word-finally and substituting one by the other (**substitution test**) triggers a change of meaning as in e.g. *bed* – *bet* /bed/ – /bet/. Such pairs of words (usually with different meanings) that differ only in one phoneme are called **minimal pairs**.

Closely related with this, another feature of phonemes is that they can be **contrasted**, that is, they can be characterised and opposed to or distinguished from the rest, in terms of the values they have as regards a limited set of **phonological features** (e.g. voice, place of articulation, manner of articulation, lip-rounding, back, central, etc.): different phonemes will have different phonological features.

A third feature of phonemes is that they are **limited** or fixed in number. We can only speak of the phonemes of some particular speech variety or a particular accent of a given language, because the number of phonemes varies from one language to another. Thus, in section 1.5 (see Table 4) it will be shown that RP has forty-nine phonemes, and PSp forty-two.

AI 1.1 Identification of phonemes

In addition, the notion of phoneme allows linguists to group together sets of phonetically similar phones as variants, or "members", of the same underlying unit. **Phones** are said to be realisations of one phoneme, and the variants are referred to as **allophones** of the phonemes. **Allophones** (represented between square brackets, as in [p^h]) are phonetically distinct realisations of a single phoneme that are contextually determined. There are two kinds of allophones:

(1) **intrinsic**, when they occur spontaneously as a result of the phonetic context (such as the nasalisations of vowels when followed by a nasal consonant); or
(2) **extrinsic**, which are produced systematically (without a physiological reason) by speakers of a certain language, as in the case of aspirated voiceless plosives at the beginning of stressed syllables in English (Tatham and Morton 2011).

Whether intrinsic or extrinsic, the allophones of a phoneme display three main characteristics:

(1) they exhibit **phonetic similarity**, that is, they show a similar phonetic make-up that allows us to relate them as variations of a particular phoneme;
(2) they do **not entail a change of meaning**; and

(3) they may stand in either **complementary distribution** or in **free variation**. Allophones are in complementary distribution when they occur in different, or mutually exclusive, phonetic environments (e.g. aspirated and unaspirated plosives in English); and they stand in free variation when they occur in the same phonetic context, usually as a result of regional, register or social pronunciation variants (see § 1.3.2).

To summarise, the phoneme can be described as an indivisible and minimally abstract structureless unit that has identifiable phonetic characteristics and may be realised in speech by phonetically different phones (its allophones) in the same or in different environments (Trask 2012). It is in this sense that phonemes may be viewed as a set of sounds: each member of this set is an allophone of the phoneme. The allophones of a phoneme, on the other hand, are united within it by their shared phonetic similarity and they may stand either in complementary distribution or in free variation.

The most important thing for communication is to be able to recognise and use not only the full set of phonemes of the language being used, but also its allophones, particularly those that stand in complementary distribution as they can cause intelligibility problems or otherwise can result in a foreign accent. For instance, an untrained English speaker can tell by simply listening that the two instances of [l] in *little* are not the same (clear [l] vs. dark [ɫ]), and yet s/he is aware that they correspond to one *l*-sound in English. Likewise, a Spanish speaker may not be aware of the fact that the two occurrences of [d] in the word *dedo* 'finger' are phonetically different ([dental plosive [d̪] vs. dental fricative [ð]), but s/he will certainly tell that the two phones correspond to one *d*-sound in Spanish. This can only be adequately explained by considering how speech sounds are produced (phonetics) in combination with how they function in a given language (phonology), which reinforces the idea presented in the Introduction, that phonetics and phonology are integrated.

1.3.2 Phonological analysis

A basic principle of phonological analysis consists in distinguishing **phonemes** from **allophones** (Crystal 2008: 361–362). By way of illustration, we can say that in RP /t/ and /p/ are two consonantal **phonemes** because they stand in **parallel** or **contrastive distribution**, as illustrated by a minimal pair such as *tin* – *pin*: if /t/ is replaced by /p/ (or vice versa) (**substitution test**) at the beginning of