Peter Ladefoged and Sandra Ferrari Disner

VOWELS AND CONSONANTS

THIRD EDITION

WILEY-BLACKWELL

Vowels and Consonants

This book is for Jenny Ladefoged, although a major portion of it already belongs to her. Many of the sentences are hers, and she compiled almost all the sound files.

It also honors the memory of Eliot Disner.

Vowels and Consonants

Third Edition

By
Peter Ladefoged
revised by
Sandra Ferrari Disner

WILEY-BLACKWELL
A John Wiley & Sons, Ltd., Publication

This third edition first published 2012

Edition History: Blackwell Publishing Ltd (1e, 2001 and 2e, 2005)

Blackwell Publishing was acquired by John Wiley & Sons in February 2007. Blackwell's publishing program has been merged with Wiley's global Scientific, Technical, and Medical business to form Wiley-Blackwell.

Registered Office
John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex, PO19 8SQ, UK

Editorial Offices
350 Main Street, Malden, MA 02148-5020, USA
9600 Garsington Road, Oxford, OX4 2DQ, UK
The Atrium, Southern Gate, Chichester, West Sussex, PO19 8SQ, UK

For details of our global editorial offices, for customer services, and for information about how to apply for permission to reuse the copyright material in this book please see our website at www.wiley.com/wiley-blackwell.

Library of Congress Cataloging-in-Publication Data

Ladefoged, Peter.
Vowels and consonants / by Peter Ladefoged ; revised by Sandra Ferrari Disner. – 3rd ed.
p. cm.
Includes bibliographical references and index.
ISBN 978-1-4443-3429-6 (pbk. : alk. paper)
1. Phonetics. I. Disner, Sandra Ferrari. II. Title.
P221.L244 2012
414–dc23

2011029136

A catalogue record for this book is available from the British Library.

Set in 10.5/13pt Minion by SPi Publisher Services, Pondicherry, India

1 2012

Contents

Table of Web Content

The following recordings, color figures, and videos are on the *Vowels and Consonants* website, www.wiley.com/go/ladefoged. Headphone prompts in the margin indicate where sound files are available to support the text. A list of the materials and their descriptions is provided below. You will find SciconWeb, a new browser, available on the website. This will not only play each recording when you open it, leaving the text visible during the audio portion, but also bring up a menu that allows you to make spectrograms and a pitch track of the sound that has been played, as well as other helpful options.

Users are reminded that all this material is copyright. Instructions whereby institutions can obtain similar material are available at:

www.linguistics.ucla.edu/faciliti/sales/software.htm.

[There are no recordings for chapters 11 and 12.]

In chapter 12:

Videos of the articulations of vowels: tongue, jaw, and larynx

Also in chapter 13:

Photographs of the vocal folds producing breathy voice and creaky voice

Author's Preface from the First Edition

This book is about the sounds of languages. There are thousands of distinct languages in the world, many of them with sounds that are wildly different from any that you will hear in an English sentence. People trill their lips and click their tongues when talking, sometimes in ways that are surprising to those of us who speak English. Of course, some of the things that we do, such as hearing a difference between *fin* and *thin*, or producing the vowel that most Americans have in *bird*, are fairly amazing to speakers of other languages, as we will see.

There are about 200 different vowels in the world's languages and more than 600 different consonants. There is no way that I can discuss all these sounds in an introductory book. I've just tried to give you some idea of what happens when people talk, explaining most of the well-known sounds, and giving you a glimpse of some of the more obscure sounds. If you want a fuller, more systematic, account of phonetics, there are many textbooks available, including one of my own.

Many of the sounds discussed are reproduced on the *Vowels and Consonants* website, www.wiley.com/go/ladefoged. If possible, you should listen to the sounds while you read. I hope you will be entertained by what you hear and read here, and will look at the suggestions for further reading at the end of the book. I've been thrilled by a lifetime chasing ideas in phonetics. Who knows, perhaps you, too, will go on to become a phonetician. Enjoy.

P.L.

Preface to the Third Edition

Work on this third edition of *Vowels and Consonants* began shortly after the death of Peter Ladefoged. His eightieth birthday party had been celebrated just months earlier, at a meeting of the Acoustical Society of America to which his students, colleagues and admirers had flocked from all over the US and around the world. His last days had been spent in fine health and spirits, engaged in his favorite pursuit, fieldwork, this time among the Toda people of Southern India. With his data gathered, he boarded a plane bound for home, and, en route, fell ill. His life of distinguished teaching, of scholarship and linguistic inquiry, and of great conviviality ended at Heathrow, just 15 miles from his birthplace. But in between those endpoints, he had spent a career teaching in the United States and doing fieldwork here and in Nigeria, Namibia, Sudan, Kenya, Botswana, Ghana, Congo, Uganda, Tanzania, Sierra Leone, Senegal, South Africa, Yemen, India, Nepal, Australia, Papua New Guinea, Thailand, China, Korea, Brazil, Mexico, and Scotland, to international acclaim.

A third edition of *Vowels and Consonants* was prompted by the need for regular updates to any chapters on speech technology and perception that appear in a twenty-first-century textbook, and informed by margin notes left by Professor Ladefoged in his desk copy.

The CD that had accompanied the previous editions has been replaced with a more readily accessible web-based collection of language files. These may be accessed on the *Vowels and Consonants* website, www.wiley.com/go/ladefoged.

The greatest help in producing this edition of *Vowels and Consonants* was provided by Jenny Ladefoged, to whom this book was, and shall always be, dedicated. Other commentators who gave generously of their time and expertise this time around were (in alphabetical order): Elaine Andersen, Sharon Ash, Roy Becker, Catherine Best, Tim Bunnell, Dani Byrd, Christina Esposito, Sean Fulop, Louis Goldstein, Mark Hasegawa-Johnson, Sarah Hawkins, Bruce Hayes, Caroline Henton, Fang-Ying Hsieh, Keith Johnson, Sun-Ah Jun, Patricia Keating, Jody Kreiman, Mona Lindau, Ian Maddieson, Bathsheba Malsheen, Maricruz Martinez, Shri Narayanan, Ann Syrdal, Henry Tehrani, Laura Tejada, and Eric Zee. Any faults in the book must be attributed to the second author. The editors of this book, Julia Kirk and Danielle Descoteaux, provided thoughtful guidance. And the faculty and students of the USC Department of Linguistics – where Peter Ladefoged spent the final years of his academic career and Sandra Disner currently teaches general and forensic linguistics – provided inspiration, valuable insights and camaraderie to both authors.

Acknowledgments from the Previous Editions

Many people have contributed wonderful ideas and comments for this book. Foremost among them is my colleague Pat Keating, who offered nuggets of teaching wisdom that I have incorporated, and suggested corrections for numerous errors (but don't blame her for those I have added since she read the draft version). Other helpful commentators include (in alphabetical order): Vicki Fromkin, Yoshinari Fujino, Tony Harper and his colleagues and students at New Trier High School, Bjorn Jernudd, Sun-Ah Jun, Olle Kjellin, Jody Kreiman, Peggy MacEachern, Yoshiro Masuya, Pam Munro, Peter Roach, Janet Stack, and Jie Zhang. I am indebted to Caroline Henton for comments on speech synthesis and speech recognition, and to Mark Hasegawa-Johnson for making me restructure the speech recognition chapter. Victoria Anderson let me use her palatography pictures, Didier Demolin gave me the MRI pictures, and Bruce Gerratt took the photographs of the larynx; many thanks to all of them. I am also very grateful to the many people from all over the world who kindly made recordings for me. Special thanks to Jean Acevedo, who encouraged me to write a book of this kind.

For the second edition, additional thanks are due to the numerous students and instructors who commented on the first edition, notably Coleen Anderson, Karen Chung, Susan Guion, and Jennifer Smith. The chapter on speech perception benefited from comments by Sarah Hawkins. Eric Zee helped with Chinese material. Siri Tuttle kindly allowed me to use her anatomical sketches. The CD accompanying the second edition was considerably improved by the weekly luncheon meetings in the UCLA Phonetics Lab, in which the faculty and graduate students went through the recordings and transcriptions of many languages and made numerous critical comments and suggestions. (Some of these suggestions have not been implemented due to my inability to obtain the relevant data, and all faults remain mine.) I am also grateful to Pat Keating and other members of the UCLA Phonetics Lab for allowing me to include on the CD many more items from the UCLA Phonetic Data archive.

Sources

Data on the numbers of languages and speakers in the world come mainly from *Ethnologue* (SIL International www.ethnologue.com).

The sources for the speech perception experiments in Chapter 10 are listed at the end of that chapter.

The data on the vowels of different dialects are from the following sources:

General American English: Peterson, G. E., and Barney, H. L. (1952). Control methods used in a study of the vowels. *Journal of the Acoustical Society of America*, 24: 175–184.

Californian English: Hagiwara, R. E. (1995). Acoustic realizations of American English /r/ as produced by women and men. *UCLA Working Papers in Phonetics*, 90: 1–187.

Northern Cities (US): Hillenbrand, J., Getty, L. A., Clark, M. J., and Wheeler, K. (1995). Acoustic characteristics of American English vowels. *Journal of the Acoustical Society of America*, 97(5): 3099–3111.

BBC English: Deterding, D. (1997). The formants of monophthong vowels in standard Southern British English pronunciation. *Journal of the International Phonetic Association*, 27: 47–55.

The mean tongue positions in chapter 12 are based on data and factor analyses reported in Harshman, R. A., Ladefoged, P., and Goldstein, L. M. (1977). Factor analysis of tongue shapes. *Journal of the Acoustical Society of America*, 62: 693–707.

The IPA chart on the following page has been reproduced with permission from the International Phonetic Association, www.langsci.ucl.ac.uk/ipa/. Inquiries concerning membership in the Association should be addressed to the Secretary, Dr. Katerina Nicolaidis, Department of Theoretical and Applied Linguistics, School of English, Aristotle University of Thessaloniki, Thessaloniki 54124, Greece, email: knicol@enl.auth.gr.

THE INTERNATIONAL PHONETIC ALPHABET (revised to 2005)

CONSONANTS (PULMONIC)

	Bilabial	Labiodental	Dental	Alveolar	Postalveolar	Retroflex	Palatal	Velar	Uvular	Pharyngeal	Glottal
Plosive	p b			t d		ʈ ɖ	c ɟ	k g	q ɢ		ʔ
Nasal	m	ɱ		n		ɳ	ɲ	ŋ	ɴ		
Trill	ʙ			r					ʀ		
Tap or Flap		ⱱ		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	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	’	Examples:
ǀ	Dental	ɗ	Dental/alveolar	pʼ	Bilabial
ǃ	(Post)alveolar	ʄ	Palatal	tʼ	Dental/alveolar
ǂ	Palatoalveolar	ɠ	Velar	kʼ	Velar
ǁ	Alveolar lateral	ʛ	Uvular	sʼ	Alveolar fricative

OTHER SYMBOLS

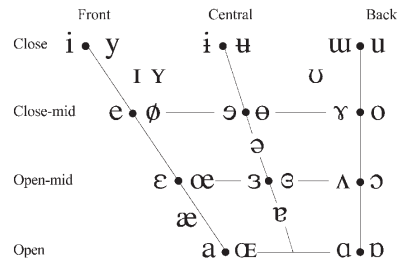
ʍ	Voiceless labial-velar fricative	ɕ ʑ	Alveolo-palatal fricatives
w	Voiced labial-velar approximant	ɺ	Voiced alveolar lateral flap
ɥ	Voiced labial-palatal approximant	ʢ	Simultaneous ʃ and x
ʜ	Voiceless epiglottal fricative		
ʡ	Voiced epiglottal fricative		
ʡ	Epiglottal plosive		

Affricates and double articulations can be represented by two symbols joined by a tie bar if necessary. k͡p t͡s

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

◌̥	Voiceless	n̥ d̥	◌̤	Breathy voiced	b̤ a̤	◌̪	Dental	t̪ d̪
◌̬	Voiced	s̬ t̬	◌̰	Creaky voiced	b̰ a̰	◌̺	Apical	t̺ d̺
◌ʰ	Aspirated	tʰ dʰ	◌̼	Linguolabial	t̼ d̼	◌̻	Laminal	t̻ d̻
◌̹	More rounded	ɔ̹	◌ʷ	Labialized	tʷ dʷ	◌̃	Nasalized	ẽ
◌̜	Less rounded	ɔ̜	◌ʲ	Palatalized	tʲ dʲ	◌ⁿ	Nasal release	dⁿ
◌̟	Advanced	u̟	◌ˠ	Velarized	tˠ dˠ	◌ˡ	Lateral release	dˡ
◌̠	Retracted	e̠	◌ˤ	Pharyngealized	tˤ dˤ	◌̚	No audible release	d̚
◌̈	Centralized	ë	◌̴	Velarized or pharyngealized	ɫ			
◌̽	Mid-centralized	e̽	◌̝	Raised	e̝	(ɹ̝ = voiced alveolar fricative)		
◌̩	Syllabic	n̩	◌̞	Lowered	e̞	(β̞ = voiced bilabial approximant)		
◌̯	Non-syllabic	e̯	◌̘	Advanced Tongue Root	e̘			
◌˞	Rhoticity	ə˞ a˞	◌̙	Retracted Tongue Root	e̙			

VOWELS



Where symbols appear in pairs, the one to the right represents a rounded vowel.

SUPRASEGMENTALS

ˈ	Primary stress	ˌfoʊnəˈtɪʃən	
ˌ	Secondary stress		
ː	Long	eː	
ˑ	Half-long	eˑ	
◌̆	Extra-short	ĕ	
|	Minor (foot) group		
‖	Major (intonation) group		
.	Syllable break	ɹi.ækt	
‿	Linking (absence of a break)		

TONES AND WORD ACCENTS

LEVEL			CONTOUR	
é͡ or ˥	Extra high	ě or ˩˥	Rising	
é ˦	High	ê ˥˩	Falling	
ē ˧	Mid	e᷄ ˧˥	High rising	
è ˨	Low	e᷅ ˩˧	Low rising	
ȅ ˩	Extra low	e᷄᷅ ˥˩˧	Rising-falling	
↓	Downstep	↗	Global rise	
↑	Upstep	↘	Global fall	

1

Sounds and Languages

1.1 Languages Come and Go

Once upon a time, the most important animal sounds were those made by predators and prey, or by sexual partners. As mammals evolved and signaling systems became more elaborate, new possibilities emerged. Nowadays undoubtedly the most important sounds for us are those of language. Nobody knows how vocal cries about enemies, food, and sex turned into language. But we can say something about the way the sounds of languages evolved, and why some sounds occur more frequently than others in the world's languages.

Although we know almost nothing about the origins of language, we can still consider the evolution of languages from a Darwinian point of view. Remember that Darwin himself did not know anything about the origin of life. He was not concerned with how life began but with the origin of the various species he could observe. In the same spirit, we will not consider the origin of language; but we will note the various sounds of languages, and discuss how they got to be the way they are. We will think of each language as a system of sounds subject to various evolutionary forces.

We will begin by considering why people speak different languages. There are many legends about this. Some say it was because God was displeased when the people of Babel tried to build a tower up to heaven. He smote them so that they could not understand each other. Others say that the Hindu God Shiva danced, and split the peoples of the world into small groups. Most linguists think that languages just grew apart as small bands of people moved to different places. We know very little about the first humans who used language. We do not even know if there was one origin of language, or whether people started talking in different parts of the

Vowels and Consonants, Third Edition. By Peter Ladefoged and Sandra Ferrari Disner.

world at about the same time. The most likely possibility is that speech developed in one place, and then, like any wonderful cultural development, it spread out as the advantages of talking became obvious.

People speak different languages because languages change, often quite rapidly. Elderly people cannot readily understand what their grandchildren are saying, and the same is true in reverse. My granddaughter does not know what I'm talking about when I mention a *jalopy* (old car) or a *davenport* (couch). New words are always needed for new things like *email*, *texting*, and *television*, which my grandfather did not know. Any change in living conditions will bring changes to the language. Time itself is often sufficient to bring about changes. When people are isolated from their neighbors, living in places where travel is difficult, they develop new ways of speaking. Even when travel was comparatively simple, as it is along rivers in many tropical areas, prehistoric groups became independent. If the land provided sufficient food, they had no need to trade or interact with their neighbors. When a small group lives by itself it develops its own way of speaking after only a generation or so, producing a new dialect that its neighbors will understand only with difficulty. In a few hundred years the group will have a new language which is different from that of their ancestors and of everybody else around them.

Languages come and go. The language you are reading now, English, did not exist 1,500 years ago. The people in England spoke a Celtic language at that time. Then the Angles and Saxons and other tribes invaded, bringing with them their own Low German dialects, which gradually evolved into English. English may last another 1,500 years, but, like Latin, it may disappear as a spoken language more quickly.

Historical forces have produced about 7,000 languages in the world today, but in 100 years or so there may be less than half that number. It is worth examining why languages are disappearing and considering whether it is a good or bad thing. At the moment nearly half the people in the world (actually 44 percent) speak one of the 10 major languages: Standard (Mandarin) Chinese, Spanish, English, Arabic, Hindi, Bengali, Portuguese, Russian, Japanese, and German. The first three of these languages are each spoken by more than a quarter of a billion people. (See "Acknowledgments" at the beginning of the book for the basis of numbers such as these.) But most of the world's languages are spoken by comparatively few people. Fifty-one percent of all languages are spoken by fewer than 10,000 people, the number in a small town in industrial countries. Nearly a quarter of all languages have fewer than 1,000 speakers, about the number of people in a village. It's only due to accidents of history that Chinese, Spanish, and English are so widely spoken. If other circumstances had prevailed, the Eskimo might have become a dominant power, and we might all be speaking a language with only three vowels.

More than half the 7,000 languages are spoken by small tribes in three tropical areas, one in the rain forests of South America, another in the equatorial regions

of Africa, and the third centered on Papua New Guinea. In these areas there is ample rainfall and the people have been relatively self-sufficient for thousands of years. As a result, many of them have lived in small groups for untold generations. Until recently they had no great need to talk to people outside their group. They had the resources to live and talk in their own way. Quite often they developed new sounds, constrained only by the general pressures that affect all human speech.

Now that governments, schools, radio, and even television are spreading into remote regions on every continent, the smaller tribes may want to learn more of the language of their dominant neighbors. Most of the world's population is at least partially bilingual, and a high proportion speaks three or more languages. With the advent of more trade and businesses the smaller groups are becoming part of larger communities and their languages are becoming endangered. Generally a language dies because mothers do not speak it to their children and the language of the home changes. Parents learn a new language that their children are learning in school. Soon the children no longer speak their parents' first language and their mother tongue is lost.

When a language disappears much of the culture often disappears with it. In the face of socioeconomic changes, small groups are forced into a choice that can seldom be fully satisfactory. They have to choose whether to keep at least partially to themselves, maintaining their traditional lifestyle, or to gain the benefits of belonging to a larger group by joining the world around them. They *may* (and it's a big *may*) gain access to schools, health care, and a higher standard of living. But they may lose many aspects of life that they hold dear. However, outsiders should note that the choice between remaining apart and assimilating can be made only by the members of the group themselves. No one except the speakers should decry the loss of a particular language. Others who do so are being paternalistic and assuming they know what is best for other people. Some groups may be better off if they retain their language and culture, which would require some degree of separateness. Others might find it preferable to change, and allow the loss of their mother tongue. As a linguist I am sad that many languages are disappearing so that I will no longer be able to study their wonders. But it is not up to me to decide whether efforts should be made to keep a particular language alive. The speakers may find the costs too great, and the benefits small in comparison with becoming potentially equal members of a larger group.

Studying endangered languages (as I have done for more than 10 years) may reveal previously unreported sounds. It's not that endangered languages are more likely to have unusual sounds. These languages are not endangered because of their sound systems, but because of socioeconomic changes. Many well-known languages have unusual sounds, but that does not make them likely to become endangered. American English has a rare vowel, the one in words such as *her, sir, fur*. This r-colored sound occurs as a vowel in less than 1 percent of the world's languages, but it won't cause the death of American English. Some endangered

languages have complex sets of sounds and others do not. But they are all a joy to phoneticians because there is always the chance that some of their unstudied sounds are unusual. By investigating little-known languages we get a further glimpse into the range of human phonetic capabilities, and the constraints on possible speech sounds.

1.2 The Evolving Sounds of Languages

The sounds of languages are constrained, first by what we can do with our tongues, lips, and other vocal organs, and second by our limited ability to hear small differences in sounds. These and other constraints have resulted in all languages evolving along similar lines. No language has sounds that are too difficult for native speakers to produce within the stream of speech (although, as we will see, some languages have sounds that would twist English-speaking tongues in knots). Every language has sounds that are sufficiently different from one another to be readily distinguishable by native speakers (although, again, some distinctions may seem too subtle for ears that are unfamiliar with them). These two factors, articulatory ease and auditory distinctiveness, are the principal constraints on how the sounds of languages develop.

There are additional factors that shape the development of languages, notably, from our point of view, how our brains organize and remember sounds. If a language had only one or two vowels and a couple of consonants it could still allow words of half a dozen syllables, and make a vast number of words by combining these syllables in different orders. But many of the words would be very long and difficult to remember. If words are to be kept short and distinct so that they can be easily distinguished and remembered, then the language must have a sufficient number of vowels and consonants to make more than a handful of syllables.

It would be an added burden if we had to make a large number of sounds that were all completely different from one another. It puts less strain on our ability to produce speech if the sounds of our languages can be organized in groups that are articulated in much the same way. We can think of the movements of our tongues and lips as gestures, much like the gestures we make with our hands. When we talk we use specific gestures – controlled movements – to make each sound. We would like to use the same gestures over and over again. This is a principle that we will call gestural economy. Typically, if a language has one sound made by a gesture involving the two lips such as **p** as in *pie*, then it is likely to have others such as **b** and **m**, as in *by* and *my* made with similar lip gestures. If you say *pie*, *by*, *my*, you will find that your lips come together at the beginning of each of them. If a language has *pie*, *by*, *my*, and also a sound made with a gesture of the tongue tip such as **t** in *tie*, then it is also likely to have other sounds made with the tongue tip, such as **d** and **n** in *die* and *nigh*. You can feel that your tongue makes a similar gesture in each of the words *tie*, *die*, *nigh*. The sounds that evolve in a language form a pattern; and there is a strong pressure to fill gaps in the pattern.