

The Cambridge Handbook of Bilingual Phonetics and Phonology

Bilingualism, phonetics, and phonology are some of the largest areas of inquiry in linguistics. This handbook sits at the intersection of these fields, providing a comprehensive overview of the most recent, cutting-edge work on the sound systems of adult and child bilinguals. Bringing together contributions from an international team of world-leading experts, it covers all aspects of the speech perception, production, and processing of bilingual individuals, as well as surveying cross-linguistic influences on the phonetics and phonology of bilingualism. The thirty-five chapters are divided into thematic areas covering the theoretical foundations and methodological approaches employed to investigate bilingual speech, overviews of major findings and developments in child and adult bilingual phonology and phonetics, descriptions of the major areas of research within the speech perception, production, and processing of the bilingual individual, and examinations of various predictors of cross-linguistic influence and variables affecting the outcomes of bilingual speech.

MARK AMENGUAL is Professor and Chair of the Department of Languages and Applied Linguistics and Director of the Bilingualism Research Laboratory at the University of California, Santa Cruz.

CAMBRIDGE HANDBOOKS IN LANGUAGE AND LINGUISTICS

Genuinely broad in scope, each handbook in this series provides a complete state-of-the-field overview of a major sub-discipline within language study and research. Grouped into broad thematic areas, the chapters in each volume encompass the most important issues and topics within each subject, offering a coherent picture of the latest theories and findings. Together, the volumes will build into an integrated overview of the discipline in its entirety.

Published titles

The Cambridge Handbook of Phonology, edited by Paul de Lacy

The Cambridge Handbook of Linguistic Code-switching, edited by Barbara E. Bullock and Almeida Jacqueline Toribio

The Cambridge Handbook of Child Language, Second Edition, edited by Edith L. Bavin and Letitia Naigles

The Cambridge Handbook of Endangered Languages, edited by Peter K. Austin and Julia Sallabank

The Cambridge Handbook of Sociolinguistics, edited by Rajend Mesthrie

The Cambridge Handbook of Pragmatics, edited by Keith Allan and Kasia M. Jaszczolt

The Cambridge Handbook of Language Policy, edited by Bernard Spolsky

The Cambridge Handbook of Second Language Acquisition, edited by Julia Herschensohn and Martha Young-Scholten

The Cambridge Handbook of Biolinguistics, edited by Cedric Boeckx and Kleanthes K. Grohmann

The Cambridge Handbook of Generative Syntax, edited by Marcel den Dikken

The Cambridge Handbook of Communication Disorders, edited by Louise Cummings

The Cambridge Handbook of Stylistics, edited by Peter Stockwell and Sara Whiteley

The Cambridge Handbook of Linguistic Anthropology, edited by N.J. Enfield, Paul Kockelman and Jack Sidnell

The Cambridge Handbook of English Corpus Linguistics, edited by Douglas Biber and Randi Reppen

The Cambridge Handbook of Bilingual Processing, edited by John W. Schwieter

The Cambridge Handbook of Learner Corpus Research, edited by Sylviane Granger, Gaëtanelle Gilquin and Fanny Meunier

The Cambridge Handbook of Linguistic Multicompetence, edited by Li Wei and Vivian Cook

The Cambridge Handbook of English Historical Linguistics, edited by Merja Kytö and Päivi Pahta

The Cambridge Handbook of Formal Semantics, edited by Maria Aloni and Paul Dekker

The Cambridge Handbook of Morphology, edited by Andrew Hippisley and Greg Stump

The Cambridge Handbook of Historical Syntax, edited by Adam Ledgeway and Ian Roberts

The Cambridge Handbook of Linguistic Typology, edited by Alexandra Y. Aikhenvald and R. M. W. Dixon

The Cambridge Handbook of Areal Linguistics, edited by Raymond Hickey

The Cambridge Handbook of Cognitive Linguistics, edited by Barbara Dancygier

The Cambridge Handbook of Japanese Linguistics, edited by Yoko Hasegawa

The Cambridge Handbook of Spanish Linguistics, edited by Kimberly L. Geeslin

The Cambridge Handbook of Bilingualism, edited by Annick De Houwer and Lourdes Ortega

The Cambridge Handbook of Systemic Functional Linguistics, edited by Geoff Thompson, Wendy L. Bowcher, Lise Fontaine and David Schöenthal

The Cambridge Handbook of African Linguistics, edited by H. Ekkehard Wolff

The Cambridge Handbook of Language Learning, edited by John W. Schwieter and Alessandro Benati

The Cambridge Handbook of World Englishes, edited by Daniel Schreier, Marianne Hundt and Edgar W. Schneider

The Cambridge Handbook of Intercultural Communication, edited by Guido Rings and Sebastian Rasinger

The Cambridge Handbook of Germanic Linguistics, edited by Michael T. Putnam and B. Richard Page

The Cambridge Handbook of Discourse Studies, edited by Anna De Fina and Alexandra Georgakopoulou

The Cambridge Handbook of Language Standardization, edited by Wendy Ayres-Bennett and John Bellamy

The Cambridge Handbook of Korean Linguistics, edited by Sungdai Cho and John Whitman

The Cambridge Handbook of Phonetics, edited by Rachael-Anne Knight and Jane Setter

The Cambridge Handbook of Corrective Feedback in Second Language Learning and Teaching, edited by Hossein Nassaji and Eva Kartchava

The Cambridge Handbook of Experimental Syntax, edited by Grant Goodall

The Cambridge Handbook of Heritage Languages and Linguistics, edited by Silvina Montrul and Maria Polinsky

The Cambridge Handbook of Arabic Linguistics, edited by Karin Ryding and David Wilmsen

The Cambridge Handbook of the Philosophy of Language, edited by Piotr Stalmaszczyk

The Cambridge Handbook of Sociopragmatics, edited by Michael Haugh, Dániel Z. Kádár and Marina Terkourafi

The Cambridge Handbook of Task-Based Language Teaching, edited by Mohammed Ahmadian and Michael Long

The Cambridge Handbook of Language Contact: Population Movement and Language Change, Volume 1, edited by Salikoko Mufwene and Anna Maria Escobar

The Cambridge Handbook of Language Contact: Multilingualism in Population Structure, Volume 2, edited by Salikoko Mufwene and Anna Maria Escobar

The Cambridge Handbook of Romance Linguistics, edited by Adam Ledgeway and Martin Maiden

The Cambridge Handbook of Translation, edited by Kirsten Malmkjær

The Cambridge Handbook of Chinese Linguistics, edited by Chu-Ren Huang, Yen-Hwei Lin, I- Hsuan Chen and Yu-Yin Hsu

The Cambridge Handbook of Intercultural Pragmatics, edited by Istvan Kecskes

The Cambridge Handbook of Role and Reference Grammar, edited by Delia Bentley, Ricardo Mairal-Usón, Wataru Nakamura and Robert D. Van Valin Jr.

The Cambridge Handbook of Historical Orthography, edited by Marco Condorelli and Hanna Rutkowska

The Cambridge Handbook of Third Language Acquisition, edited by Jennifer Cabrelli, Adel Chaouch-Orozco, Jorge González Alonso, Eloi Puig-Mayenco, Sergio Miguel Pereira Soares and Jason Rothman

The Cambridge Handbook of Language in Context, edited by Jesús Romero-Trillo

The Cambridge Handbook of Slavic Languages, edited by Danko Šipka and Wayles Browne

The Cambridge Handbook of Gesture Studies, edited by Alan Cienki

The Cambridge Handbook of the Dictionary, edited by Edward Finegan and Michael Adams

Cambridge University Press & Assessment

978-1-009-09860-1 — The Cambridge Handbook of Bilingual Phonetics and Phonology

Mark Amengual

Frontmatter

[More Information](#)

The Cambridge Handbook of Methods in Conversation Analysis, edited by Jeffrey Robinson, Rebecca Clift, Kobin H. Kendrick and Chase Wesley Raymond

The Cambridge Handbook of Technology in Language Teaching and Learning, edited by Glenn Stockwell and Yijun Wang

The Cambridge Handbook of Bilingual Phonetics and Phonology

Edited by
Mark Amengual
University of California, Santa Cruz



CAMBRIDGE
UNIVERSITY PRESS



CAMBRIDGE
UNIVERSITY PRESS

Shaftesbury Road, Cambridge CB2 8EA, United Kingdom
One Liberty Plaza, 20th Floor, New York, NY 10006, USA
477 Williamstown Road, Port Melbourne, VIC 3207, Australia
314–321, 3rd Floor, Plot 3, Splendor Forum, Jasola District Centre,
New Delhi – 110025, India
103 Penang Road, #05–06/07, Visioncrest Commercial, Singapore 238467

Cambridge University Press is part of Cambridge University Press & Assessment, a department of the University of Cambridge.

We share the University's mission to contribute to society through the pursuit of education, learning and research at the highest international levels of excellence.

www.cambridge.org
Information on this title: www.cambridge.org/9781009098601
DOI: 10.1017/9781009105767

© Cambridge University Press & Assessment 2024

This publication is in copyright. Subject to statutory exception and to the provisions of relevant collective licensing agreements, no reproduction of any part may take place without the written permission of Cambridge University Press & Assessment.

When citing this work, please include a reference to the DOI 10.1017/9781009105767

First published 2024

A catalogue record for this publication is available from the British Library

Library of Congress Cataloging-in-Publication Data

Names: Amengual, Mark, editor.

Title: The Cambridge handbook of bilingual phonetics and phonology / edited by Mark Amengual, University of California.

Other titles: Handbook of bilingual phonetics and phonology

Description: Cambridge, United Kingdom ; New York : Cambridge University Press, 2024. |

Series: CHL Cambridge handbooks in language and linguistics | Includes bibliographical references and index.

Identifiers: LCCN 2024011632 | ISBN 9781009098601 (hbk) | ISBN 9781009101349 (pbk) | ISBN 9781009105767 (ebk)

Subjects: LCSH: Bilingualism. | Phonetics. | Grammar, Comparative and general – Phonology.

Classification: LCC P115 .C37 2024 | DDC 404.2–dc23/eng/20240710

LC record available at <https://lcn.loc.gov/2024011632>

ISBN 978-1-009-09860-1 Hardback

Cambridge University Press & Assessment has no responsibility for the persistence or accuracy of URLs for external or third-party internet websites referred to in this publication and does not guarantee that any content on such websites is, or will remain, accurate or appropriate.

To mum *i papà*, for the gift of multilingualism.

Contents

<i>List of Figures</i>	<i>page</i> xii
<i>List of Tables</i>	xvii
<i>List of Contributors</i>	xviii
<i>Acknowledgments</i>	xxvi
 Introduction: Bilingual Phonetics and Phonology – An Interdisciplinary Field of Inquiry <i>Mark Amengual</i>	 1
 Part I Approaches to Bilingual Phonetics and Phonology	 21
1 Generative Approaches to Bilingual Phonetics and Phonology <i>Ellen Broselow</i>	23
2 Usage-Based Approaches to Bilingual Phonetics and Phonology <i>Esther L. Brown</i>	44
3 Sociolinguistic Approaches to Bilingual Phonetics and Phonology <i>Manuel Díaz-Campos, Molly Cole, and Matthew Pollock</i>	65
4 Psycholinguistic Approaches to Bilingual Phonetics and Phonology <i>María Fernanda Gavino and Matthew Goldrick</i>	86
5 Neurolinguistic Approaches to Bilingual Phonetics and Phonology <i>Fernando Llanos and Benjamin Zinszer</i>	104
6 Computational Approaches to Bilingual Phonetics and Phonology <i>Frans Adriaans</i>	126
 Part II Theoretical Models of Bilingual Phonetics and Phonology	 145
7 The Perceptual Assimilation Model: Early Bilingual Adults and Developmental Foundations <i>Michael D. Tyler and Catherine T. Best</i>	147
8 The Second Language Linguistic Perception Model <i>Paola Escudero and Kakeru Yazawa</i>	173

9	The Automatic Selective Perception Model	<i>Valerie L. Shafer</i>	196
10	The Ontogeny Phylogeny Model	<i>Roy C. Major</i>	217
11	Bilingual Speech and Exemplar Theory	<i>Molly Babel, Michelle Kamigaki-Baron, and Rachel Soo</i>	241
Part III The Phonetics and Phonology of the Bilingual Child			261
12	The Speech Perception of Bilingual Infants	<i>Megha Sundara</i>	263
13	The Speech Production of Bilingual Children	<i>Margaret Kehoe</i>	285
14	Phonological Disorders in Child Bilingualism	<i>Elena Babatsouli</i>	308
15	Acquisition of Segmental Phonology in Child Bilingualism	<i>Laura Bosch</i>	339
16	Acquisition of Suprasegmental Phonology in Child Bilingualism	<i>Mariia Pronina and Pilar Prieto</i>	359
Part IV The Phonetics and Phonology of the Bilingual Adult			383
17	The Speech Perception of Bilingual Adults	<i>Mark Antoniou</i>	385
18	The Speech Production of Bilingual Adults	<i>Joseph V. Casillas</i>	407
19	Phonological Processing and Lexical Encoding in Bilingual Speech	<i>Isabelle Darcy and John R. Rothgerber</i>	426
20	Acquisition of Segmental Phonology in Adult Bilingualism	<i>Jeffrey Steele</i>	448
21	Acquisition of Suprasegmental Phonology in Adult Bilingualism	<i>Marta Ortega-Llebaria</i>	471
Part V The Diversity of Bilingual Speakers			499
22	The Phonetics and Phonology of Early Bilinguals	<i>Robert Mayr, Jonathan Morris, and Simona Montanari</i>	501
23	The Phonetics and Phonology of Adult L2 Learners in the Classroom	<i>Olga Dmitrieva</i>	521
24	The Phonetics and Phonology of Adult L2 Learners After Study Abroad	<i>Charlie Nagle and Germán Zárate-Sández</i>	542
25	The Phonetics and Phonology of Heritage Language Speakers	<i>Ji Young Kim</i>	560
26	The Phonetics and Phonology of Indigenous Language Bilinguals	<i>Brandon Baird and Stanislav Mulík</i>	584
27	The Phonology of Bimodal Bilinguals	<i>Diane Lillo-Martin, Shengyun Gu, L. Viola Kozak, and Deborah Chen Pichler</i>	607
28	Comparing Bilingual and Trilingual Phonetics and Phonology	<i>Ulrike Gut and Magdalena Wrembel</i>	631
Part VI Variables and Outcomes of Bilingual Speech			653
29	Language Dominance Effects in the Phonetics and Phonology of Bilinguals	<i>David Birdsong and Mark Amengual</i>	655
30	Code-Switching and Language Mode Effects in the Phonetics and Phonology of Bilinguals	<i>Daniel J. Olson</i>	677


	Contents	xi
31	Orthographic Effects in the Phonetics and Phonology of Second Language Learners and Users <i>Bene Bassetti</i>	699
32	Phonetic and Phonological L1 Attrition and Drift in Bilingual Speech <i>Esther de Leeuw and Charles B. Chang</i>	721
33	Bilingual Speech Intelligibility <i>Ann R. Bradlow</i>	746
34	Using a Characteristic Speech Production (CSP) Procedure to Elicit Monolingual and Bilingual Speech <i>James E. Flege</i>	767
35	Bridging the Gap between Bilingual Phonetic Research and Pronunciation Teaching <i>John M. Levis and Charlie Nagle</i>	791
	<i>Index</i>	813

Figures

- | | | |
|-----|---|----------------|
| 2.1 | Bilingual (Spanish-English) lexical representation.
Source: Brown (2015, p. 401). | <i>page 49</i> |
| 3.1 | CIT illustrating social variation in the VOT of the voiced stop /g/. Source: McKinnon (2020, p. 150). | 80 |
| 4.1 | Simplified schematic of cognitive mechanisms in picture naming and reading aloud. | 88 |
| 4.2 | Connectionist implementation of retrieval of phonological forms of words from Spanish-Catalan bilingual memory for target word <i>GAT</i> . (a) Target word and sounds, along with connections. (b) Introduction of a coactivated cognate with connections and implications for sound activation. | 89 |
| 4.3 | Differences between Spanish and English VOT using dental/alveolar stops as an example. Sounds in brackets indicate phones, while sounds in forward slashes indicate phonemes (differences between the two explained in Section 4.3.2). Spanish has pre-voiced voiced stops and short-lagged voiceless stops, while English has short-lagged voiced stops and long-lagged voiceless stops. | 94 |
| 5.1 | Neuroimaging. (a) Noninvasive neurolinguistic technologies and (b) representative brain regions and white matter tracts for speech processing. MBG = medial geniculate body; IC = inferior colliculus; CN = cochlear nucleus; AC = auditory cortex; STG = posterior superior temporal gyrus. | 107 |
| 5.2 | The frequency following response. (a) Waveforms and spectrograms of speech sounds (e.g., one rising Mandarin lexical tone) and their averaged FFR are very similar. (b) In FFR experiments, participants are usually exposed to thousands of stimulus repetitions. One FFR montage includes three electrodes placed on the vertex (Cz, active channel), left (LM, ground), and right (RM, reference) mastoids. (c) Top: Native speakers exhibit | |

more-faithful temporal encoding of phonetic cues. This is shown for the neural tracking of a rising Mandarin tone in one native speaker of Mandarin and one of English. Bottom: Native speakers also exhibit more-robust spectral encoding of phonetic cues. This is shown for the fundamental frequency (F0) of a flat-pitch Mandarin tone in one native speaker of Mandarin and one of English.	109
5.3 The mismatch negativity. (a) Schematic representation of the oddball paradigm for standard and deviant sounds contrasting in phonological voicing (left) and their average EEG responses (right). The origin of the x-axis corresponds to the onset of the sounds. (b) Electrode configuration in a 64-channel cap (left) and schematic representation of MMN sources and putative dynamics (right). IFG = inferior frontal gyrus; AC = auditory cortex; STG = posterior superior temporal gyrus.	110
5.4 Connected speech and fMRI. (a) EEG oscillations in delta (1–4 Hz) and theta (4–8 Hz) bands entrain to the broadband envelope of the speech waveform. This can be observed in both time (left) and spectral (right) domains. (b) In fMRI univariate analysis, the magnitude of the hemodynamic response in one voxel (or averaged across voxels) is used to index functional differences in speech processing. (c) A common approach in multivariate fMRI analysis is to calculate the neural distance or dissimilarity between distributions of hemodynamic responses elicited with different speech sounds in a region of interest.	114
6.1 A computational model provides an explicit description of an input–output mapping.	128
8.1 Current full architecture of L2LP.	177
8.2 The five theoretical ingredients of L2LP.	178
8.3 Three types of learning scenarios in L2LP.	179
8.4 Illustration of the CSWL paradigm.	185
9.1 Auditory evoked potentials to a 250-ms vowel /ε/ at the onset of a sequence of ten stimuli (intersequence interval 1,250 ms) for monolingual AE adults (N = 14) and five to seven-year-old children (N = 14) and bilingual Spanish-English adults (N = 7) and five to seven-year-old children (N = 13) (both languages learned before age five years). The upper-right graph shows the adult P1-N1-P2 sequence at Fz and the upper-left graph exhibits the child P100-N2 sequence. The increased negativity (Nd shift) in the ERP of bilingual adults indicates allocation of attentional resources to processing the stimuli, even when instructed to ignore the auditory stimuli (see Datta et al. [2020]). The bottom-right graph shows the T-complex measures for left and right electrode sites (1 cm above the ears). The increased positivity of the Ta for	

<p>bilingual adults may be the polarity reversal of the frontal Nd effect. The bottom-left graph shows the maturing T-complex, with the positive-going Ta peak beginning to emerge (see Shafer, Yu, & Wagner [2015]). The bilingual children show more negative T-complex responses (see Rinker et al. [2017]).</p> <p>9.2 Mismatch responses (deviant minus standard) to the 250 ms vowel /ε/ (ISI 400 ms) from the same participants as in Figure 9.1. The MMN peak is 18 ms later for bilingual than for monolingual adults. Monolingual children show a pMMR followed by an MMN that is about 110 ms later than seen for adults. The bilingual children show a pMMR followed by a small MMN deflection.</p> <p>10.1 Chronological corollary of the OPM.</p> <p>10.2 Stylistic corollary of the OPM.</p> <p>10.3 Similarity corollary of the OPM.</p> <p>10.4 Markedness corollary of the OPM.</p> <p>15.1 Representation of elements that need to be considered in accounts of addressing variability in segmental phonology acquisition in young learners exposed to a dual input.</p> <p>19.1 A simplified view of phonological and lexical processing during recognition. Boxes illustrate different levels of representation, while arrows indicate processes intervening between representations. Source: Adapted from Ramus et al. (2010) and McQueen et al. (2006).</p> <p>21.1 The prosodic hierarchy. Prosodic domains are hierarchically organized. As a stress-accent language, the melodic tier in Catalan attaches to stressed vowels and the right edge of intonational phrases.</p> <p>21.2 Acoustic cues to English stress (a) and Japanese pitch accent (b) in the cognate “America.” Pitch and duration cue stress in English, while only pitch – the ascending F0 on “e” – cues the Japanese pitch accent.</p> <p>26.1 The approximate geographical location of the indigenous languages (language family) mentioned in this chapter. The letters do not denote any linguistic relation between languages, as distinct languages that are in geographical proximity are represented with the same letter.</p> <p>26.2 Examples of indigenous vowel systems with fewer or more phonemes than the majority language. Source: Adapted from Guion (2003) and Mulík et al. (2023).</p> <p>26.3 Tentative consonant inventory of Light Warlpiri: gray = phonemes from English and/or Kriol; black = phonemes from English; others = phonemes that exist in Warlpiri, English, and Kriol. Source: Adapted from</p>	<p>203</p> <p>205</p> <p>219</p> <p>222</p> <p>225</p> <p>227</p> <p>349</p> <p>427</p> <p>472</p> <p>473</p> <p>586</p> <p>591</p>
--	---

	Bundgaard-Nielsen & O'Shannessy (2021, p. 14), where more details are provided on this consonant inventory.	594
26.4	Sample pitch tracks of the Spanish word /ba'nana/ with (a) a late peak (H) aligned in a post-tonic syllable produced by a Spanish-dominant bilingual and (b) an early peak (H) aligned within the tonic syllable produced by a K'ichee'-dominant bilingual. Source: Based on data in Baird (2015).	596
27.1	Target and child forms of ASL signs READ and WATER showing substitutions of less-marked handshapes. (a) Target version of READ; (b) Child's production of READ; (c) Child's production of WATER; (d) Target version of WATER. Source: Whitworth (2011, p. 64).	612
27.2	(a) Target form of ASL sign WHERE displaying  handshape with opposed thumb; Source: Hochgesang, Crasborn, & Lillo-Martin (2021, n.p.); (b) M2L2 handshape error due to unopposed thumb position; Source: Chen Pichler, <i>Deaf Around the World: The Impact of Language</i> , Oxford University Press (2011, p. 112). Reproduced with permission of the Licensor through PLSclear.	614
27.3	(a) Target form for ASL sign RAIN showing movement from wrists; Source: Hochgesang et al. (2021, n.p.); (b) Reproduction of a proximalized form of RAIN showing movement from shoulder and wrist.	615
27.4	English question "Have you ever visited Gallaudet/ GALLAUDET?" featuring the spoken word "Gallaudet" aligned with the lexical movement of the code-blended sign GALLAUDET. Source: UConn Sign Linguistics and Language Acquisition Laboratory (2021).	617
27.5	Cross-modal activation of sign language and spoken language (both orthography and speech) in bimodal bilingualism.	620
29.1	Correlation of BLP scores with relative peak F0 alignment scores for Spanish-K'ichee' bilinguals from Cantel (n = 10) and Nahualá (n = 10). Zero-upward BLP scores show increasing Spanish dominance; zero-downward BLP scores represent increasing K'ichee' dominance. Relative peak alignment scores = duration from syllable onset to peak F0 divided by total duration of the syllable; values are individual participant averages. The broken vertical line indicates the end of the tonic syllable. Source: Baird (2015, p. 170).	657
29.2	Individual Pillai scores as a measure of /o/-/ɔ/ vowel merger plotted as a function of individual speakers' BLP score. Fitted lines show Spanish-dominant and Galician-dominant bilinguals. Source: Adapted from Amengual and Chamorro (2015, p. 223).	664

-
- | | | |
|------|---|-----|
| 29.3 | Identification of stimuli along the /e/-/ε/ and /o/-/ɔ/ continua as a function of language dominance (Spanish-dominant and Galician-dominant). Source: Adapted from Amengual and Chamorro (2015, p. 216). | 669 |
| 32.1 | Theoretical similarities and differences between drift and attrition. | 724 |
| 33.1 | Three sliders representing the three foundational relations of the Talker–Listener–Language (TL2) framework. Talker–LBS = the relation of the talker to the language being spoken; Listener–LBS = the relation of the listener to the language being spoken; Talker–Listener = the relation between the talker’s and the listener’s language repertoire. While Talker–LBS and Listener–LBS can vary independently, Talker–Listener depends on the settings of the other two. The settings shown in this figure represent the conversational condition of a relatively low proficiency L2 talker and an L1 listener. The Talker–Listener relation is (necessarily) Mismatch. | 749 |
| 33.2 | Three levels of description for any conversational interaction. | 752 |
| 34.1 | Distributions of VOT values produced in phrase-initial and phrase-final words by native English (NE) speakers and native speakers of Spanish who learned English as children (Early) or as adults (Late). | 771 |
| 34.2 | Averaged weighted intelligibility scores obtained for nineteen /r/-initial and nineteen /l/-initial words produced by eleven native English (NE) speakers and by a single NE participant (#6) considered separately. | 776 |

Tables

3.1	Mixed-effects logistic regression for age of speakers in Cañar, Ecuador	<i>page 78</i>
6.1	A model of phonotactic learning based on biphone transitional probabilities (TPs) in the toy corpus	133
6.2	A biphone model with mixed English-Dutch statistics	139
10.1	Comparison of normal, similar, and marked phenomena	229
14.1	The Differential Diagnosis System	313
14.2	Cultural and linguistic diversity manuals for speech language pathology	315
14.3	Studied language pairs in bilinguals with PDs per language family	319
14.4	Speech assessment tests cross-linguistically per language family	322
14.5	Bi/multilingual speech assessment tests cross-linguistically	323
14.6	Intelligibility in Context Scale tests cross-linguistically	324
14.7	Quantitative measures of bilingual PD	326
33.1	The typology of conversational interactions that emerges from the foundational language relations shown in Figure 33.1.	751

Contributors

Frans Adriaans is Assistant Professor of Linguistics at the Institute for Language Sciences at Utrecht University, in the Netherlands. His research focuses on computational models of early language acquisition. Previously, he was an Assistant Professor at NYU Linguistics and a postdoctoral researcher at the UPenn Infant Language Center.

Mark Amengual is Professor and Chair of the Department of Languages and Applied Linguistics and Director of the Bilingualism Research Lab at the University of California, Santa Cruz. His research interests focus primarily on experimental phonetics, bilingualism, and psycholinguistics.

Mark Antoniou is Associate Professor at the MARCS Institute for Brain, Behaviour and Development, Western Sydney University. His published works on bilingual speech perception were the first attempts to extend the Perceptual Assimilation Model to account for language mode effects on speech perception in fluent bilingual listeners.

Elena Babatsouli is Associate Professor, Blanco/BORSF Endowed Professor in Communicative Disorders, University of Louisiana at Lafayette and the editor of the *Journal of Monolingual and Bilingual Speech* (Equinox). Latest projects include *Multilingual Acquisition and Learning: An Ecosystemic View of Diversity* (John Benjamins, 2024).

Molly Babel is Associate Professor of Linguistics at the University of British Columbia, where she directs the Speech in Context lab. Her research focuses on the perception, processing, and production of phonetic variation, using theories and methods from phonetics, psycholinguistics, and sociolinguistics.

Brandon Baird is Associate Professor of Luso-Hispanic Studies and Linguistics and Director of the Linguistics Program at Middlebury College (Vermont, USA). His research focuses on the phonetics and phonology of

Mayan languages, Mayan-Spanish bilingualism, and language revitalization in Guatemala.

Bene Bassetti is an applied linguist at the University of Modena and Reggio Emilia, Italy, and the University of Birmingham, UK. She is researching bilingualism and second language learning, in particular the learning and use of L2 writing systems (including effects of literacy on L2 phonology), and language and thought in bilinguals and language learners.

Catherine T. Best is Professor and Chair in Psycholinguistics Research at the MARCS Institute for Brain, Behaviour and Development, Western Sydney University, and Editor-in-Chief of the journal *Phonetica*. She is the originator of the Perceptual Assimilation Model (PAM) and her work focuses on the effects of language experience on speech perception and production in adults and infants.

David Birdsong is Professor of French Linguistics in the Department of French and Italian at the University of Texas at Austin. He has held the positions of Visiting Professor of Linguistics at Georgetown University, Visiting Professor at the Paul Valéry University of Montpellier, Visiting Research Fellow at the Max Planck Institute for Psycholinguistics in Nijmegen (NL), and International Chair, LABEX-Empirical Foundations of Linguistics in Paris. His research relates to second language acquisition, bilingualism, psycholinguistics, and French linguistics. His interests include the neurocognitive, biological, and experiential factors that influence variable outcomes in a second language; the relationship between age and second language acquisition; and the conceptualization, measurement, and predictive power of language dominance in bilingualism.

Laura Bosch is Associate Professor in Psychology at the University of Barcelona (UB) and a member of the Institute of Neurosciences (UB-Neuro). She is the coordinator of the Attention, Perception and Acquisition of Language (APAL) research group, affiliated to UB-Neuro. Her research interests are focused on audiovisual speech perception, phonological acquisition, and word learning, in both monolingual and bilingual populations, including groups at risk for language and cognitive deficits.

Ann R. Bradlow is the Abraham Harris Professor of Linguistics at Northwestern University. She received her PhD in linguistics from Cornell University in 1993 and completed postdoctoral fellowships in psychology at Indiana University (1993–1996) and hearing science at Northwestern University (1996–1998). Her work has been supported by grants from the National Institutes of Health (NIH). Recent publications have appeared in the *Journal of the Acoustical Society of America*, the *Journal of the Association for Laboratory Phonology*, the *International Journal of Audiology*, *Applied Psycholinguistics*, the *Journal of Phonetics*, *Language & Speech*, and *Bilingualism: Language and Cognition*.

Ellen Broselow is Professor of Linguistics at Stony Brook University, State University of New York. She has published widely on both first and second language phonology and in 2013 was named a Fellow of the Linguistic Society of America.

Esther L. Brown is Associate Professor of Hispanic Linguistics in the Department of Spanish and Portuguese at the University of Colorado Boulder. She examines linguistic variation and change from a usage-based perspective.

Joseph V. Casillas is Associate Professor of Spanish Linguistics in the Department of Spanish and Portuguese at Rutgers University, New Brunswick. His research interests are in phonetics, laboratory phonology, and second language acquisition. Additionally, he enjoys coding, statistical analysis, data visualization, and is a proponent of open science practices and reproducible research.

Charles B. Chang is Associate Professor of Linguistics at Boston University (BU), where he directs the Phonetics, Acquisition & Multilingualism Lab (PAMLab). Funded in part by BU's Center for the Humanities and Center for Innovation in Social Science as well as the National Science Foundation, his research examines phonetic and phonological aspects of language learning, bilingualism and multilingualism, and language attrition.

Deborah Chen Pichler is a Hearing Professor of Linguistics at Gallaudet University, specializing in L1, L2, and bilingual acquisition of sign languages by deaf and hearing learners.

Molly Cole completed her PhD in Hispanic linguistics at Indiana University, Bloomington. Her main areas of focus are sociophonetics, language contact, and Indigenous languages. Her work has been published in *The Routledge Handbook of Variationist Approaches to Spanish* (Routledge, 2022) and she has collaborated on forthcoming chapters in the *Concise Encyclopedia of Spanish Dialects* and *The Handbook of Usage-Based Linguistics*.

Isabelle Darcy is Professor of Second Language Psycholinguistics at Indiana University (USA). She obtained a PhD in linguistics and cognitive science from the EHESS (School for Advanced Studies in Social Sciences) in Paris (France) and the Gutenberg University in Mainz (Germany). Her research includes pronunciation instruction, native and nonnative phonological acquisition, speech perception, and word recognition.

Esther de Leeuw is Associate Professor of Language Acquisition and Multilingualism at the University of Lausanne. Her research concerns the production, processing, representation, acquisition, and development of speech sounds in the context of bilingualism, multilingualism, and language contact; the cognitive organization of dual phonetic and phonological systems; and the phonetic and phonological interactions that occur during bilingualism, L1 attrition, and L2 acquisition.

Manuel Díaz-Campos is a Full Professor of Hispanic Sociolinguistics at Indiana University, Bloomington. His current research focuses on sociolinguistic variation and usage-based theoretical approaches. His research appears in journals such as *Language in Society*, *Studies in Second Language Acquisition*, *Spanish in Context*, and *Hispania*. He is the editor of *The Handbook of Hispanic Sociolinguistics* (Wiley, 2011) and *The Routledge Handbook of Variationist Approaches to Spanish* (Routledge, 2022), and he authored *Introducción a la Sociolingüística Hispánica* (Wiley, 2014) and coauthored *Introducción y Aplicaciones Contextualizadas a la Lingüística Hispánica* (Wiley, 2017).

Olga Dmitrieva is an Associate Professor of Russian and linguistics at Purdue University. She received her PhD in linguistics from Stanford University. She specializes in acoustic phonetics and speech perception, especially in their application to the study of bilingual and second language speech.

Paola Escudero is Professor in Linguistics at the MARCS Institute for Brain, Behaviour and Development at Western Sydney University. She is an expert in language learning and created the L2LP model to explain speech perception, production, and comprehension in monolingual and multilingual children and adults.

James E. Flege carried out NIH-supported research at the University of Alabama at Birmingham for twenty-five years before retiring in 2006 and emigrating to Italy. He continues to collaborate on speech production and perception research with colleagues in the USA and Europe.

María Fernanda Gavino completed her PhD in linguistics at Northwestern University. Her research explores bilingual language processing through the lenses of psycholinguistics, phonetics, and sociolinguistics. Her work focuses on how bilinguals' language mechanisms process language when they are perceiving and producing sounds.

Matthew Goldrick is Professor of Linguistics and (by courtesy) Psychology at Northwestern University. His research draws on behavioral experiments, acoustic analysis, and computational modeling to develop theories of the cognitive and neural mechanisms underlying spoken language in mono- and multilingual speakers.

Shengyun Gu is a PhD candidate in the Department of Linguistics at the University of Connecticut. Her research interests include phonology, its interfaces with morphology/syntax, and phonological development in signed and spoken languages.

Ulrike Gut is Chair of English Linguistics at the University of Münster, Germany. She obtained her PhD from the University of Mannheim and her habilitation from the University of Freiburg. Her areas of research include second and third language acquisition and the phonetics and phonology of varieties of English and corpus linguistics.

Michelle Kamigaki-Baron is a PhD candidate in the Department of Linguistics at the University of British Columbia. She is interested in questions dealing with speech production and perception, phonetics, bilingualism, and language continua, often within the context of Indigenous and contact languages.

Margaret Kehoe is a senior lecturer at the University of Geneva. She teaches classes on speech sound disorders and bilingualism. She has conducted research on phonetic and phonological acquisition in English-, German-, Spanish-, and French-speaking children and bilingual children.

Ji Young Kim is an Associate Professor in the Department of Spanish and Portuguese at the University of California, Los Angeles. Her research focuses on the production and perception of heritage and second language speech sounds.

L. Viola Kozak received her PhD in linguistics from Gallaudet University in 2018, focusing on phonology and bimodal bilingual language acquisition. She currently works as a researcher for an educational company.

John M. Levis is Professor of Applied Linguistics and Technology at Iowa State University. He is founding editor of the *Journal of Second Language Pronunciation* and the founder of the Pronunciation in Second Language Learning and Teaching Conference.

Diane Lillo-Martin is Board of Trustees Distinguished Professor and Head of Linguistics at the University of Connecticut and a senior research scientist at Haskins Laboratories. Her research concerns monolingual and bilingual acquisition and use of American Sign Language.

Fernando Llanos is an Assistant Professor in the Department of Linguistics at the University of Texas at Austin. His main research area is neurolinguistics. He investigates the neural processing of speech in monolingual and multilingual populations.

Roy C. Major is Professor Emeritus at Arizona State University. His research focuses on second language phonological acquisition and variation, including relationships between universals, transfer, similarity, and markedness. He has also researched bilingual acquisition and Brazilian Portuguese phonology.

Robert Mayr is a reader in linguistics at Cardiff Metropolitan University, where he leads the Speech, Hearing and Communication Research Group. His research aims to gain a better understanding of the cognitive, social, and interactional factors that affect speech sound development in bilinguals and multilinguals across their lifespan.

Simona Montanari is a Full Professor in the Department of Child and Family Studies at California State University, Los Angeles, where she teaches courses in first and second language acquisition. Her research focuses on the emergence of different language components (speech sounds, vocabulary,

verbal morphology, narrative skills, pragmatics) in Spanish-speaking children growing up multilingually in the United States.

Jonathan Morris is a Senior Lecturer at the School of Welsh, Cardiff University. His research aims to investigate sociolinguistic aspects of bilingualism and second language acquisition and, particularly, the extent to which social and interactional factors influence sound variation and cross-linguistic interactions in the bilingual repertoire.

Stanislav Mulík is a postdoctoral scholar at the Department of Spanish, Italian, and Portuguese at the Pennsylvania State University. His research interests comprise bilingualism and multilingualism in speakers of Indo-European and Mexican Indigenous languages, especially at the level of phonetics, phonology, and lexical learning and processing.

Charlie Nagle is Associate Professor of Spanish and Applied Linguistics at the University of Texas at Austin. He studies second language speech perception and production and the linguistic and learner variables that regulate development. His work has been supported by the National Science Foundation and the Fulbright Commission.

Daniel J. Olson is a Professor at Purdue University in the School of Languages and Cultures and Director of the Purdue Bilingualism Lab. His research focuses on the phonetics and psycholinguistics of bilingual populations, with a particular interest in both the outcomes of code-switching and the underlying mechanisms that govern language separation and selection.

Marta Ortega-Llebaria is a phonetician working in prosody. Her background in Hispanic linguistics, acoustics, laboratory phonology, and sociolinguistics informs her experimental work. She is currently an Associate Professor in the Linguistics Department, University of Pittsburgh, with a secondary appointment at Hispanic Languages & Literatures, and a Center Associate at the Learning Research and Development Center (LRDC) at the University of Pittsburgh.

Matthew Pollock is Assistant Professor of Linguistics and Spanish at Louisiana State University Shreveport. His research deals with sociolinguistics, phonetics, phonology, and the construction of speaker identity, with a recent focus on regional variation in Peninsular Spanish political speech. He has published articles in *Language and Communication*, *Hispania*, *The Handbook of Usage-Based Linguistics*, and *Languages*, and has chapters in volumes including *The Routledge Handbook of Sociolinguistics Around the World* (Routledge, 2023) and *Variation and Evolution: Aspects of Language Contact and Contrast Across the Spanish-Speaking World* (John Benjamins, 2020).

Pilar Prieto is an ICREA Research Professor in the Department of Translation and Language Sciences at Pompeu Fabra University, in Barcelona, Spain. Her research focuses on the communicative role of prosody and gesture in language, as well as their significance in language development and second

language learning. She serves as associate editor of the journals *Language and Speech* and *Frontiers in Communication*.

Mariia Pronina is a Doctor of Language Sciences from Pompeu Fabra University. Her research focuses on understanding the role that prosody and gesture play in pragmatic development and the interplay between pragmatics and other linguistic and sociocognitive abilities. Her research areas include first language acquisition, multimodal gestural and prosodic development, and bilingual phonetics and phonology.

John R. Rothgerber is a lecturer of English in the School of Policy Studies at Kwansei Gakuin University (Japan). He received a PhD in second language studies from Indiana University (USA). His research interests include phonological acquisition, speech perception, and pronunciation instruction.

Valerie L. Shafer is a Professor in the PhD Program in Speech-Language-Hearing Sciences, Linguistics and the MS Program in Cognitive Neuroscience at the Graduate Center, City University of New York. Her research focuses on first and second speech and language processing, and developmental language disorders, with a focus on their neurobiological basis.

Rachel Soo completed her PhD in linguistics at the University of British Columbia. Her research interests are in phonetics, speech perception, and psycholinguistics. Her work examines perception, recognition, and encoding of phonetic variation and its intersections with social meaning in multilingual communities.

Jeffrey Steele is an Associate Professor in the Department of Language Studies at the University of Toronto Mississauga. His research focuses on second/third language acquisition, particularly of phonetics and phonology, second language assessment, evidence-based pronunciation teaching, and bilingual reading development in early French immersion learners.

Megha Sundara has a PhD from McGill University and is a Professor at the UCLA Department of Linguistics. Her research is focused on language acquisition in preverbal, monolingual, and bilingual infants. Currently, she is investigating the acquisition of phonotactics, the morphology–phonology interface, and pronunciation variants in speech directed to infants.

Michael D. Tyler is an independent researcher with interests in speech perception and second language speech learning. He is the co-originator of the Perceptual Assimilation Model of Second-Language Speech Learning (PAM-L2).

Magdalena Wrembel is a Professor at the Faculty of English, Adam Mickiewicz University in Poznań and the head of Bilingualism Matters@Poznań. Her main research areas involve phonetics and phonology, second and third language acquisition, multilingualism, language awareness, as well as cross-linguistic influence in L3 phonological acquisition. She has published extensively in international journals and edited

collections. She is currently Vice-President of Societas Linguistica Europaea and the principal investigator of two international projects (OPUS and GRIEG).

Kakeru Yazawa is an Assistant Professor at the Institutes of Humanities and Social Sciences, University of Tsukuba, Japan. His recent research focuses on computational-phonological modeling of speech perception and the development of second language speech production corpora.

Germán Zárate-Sánde is Associate Professor of Linguistics and Director of Basic and Intermediate Spanish in the Department of Spanish at Western Michigan University. His research focuses primarily on the effectiveness of teaching methodologies, issues of social justice in language learning, and instructed second language pronunciation learning.

Benjamin Zinszer is currently a Visiting Assistant Professor in the Department of Psychology at Swarthmore College in Pennsylvania, USA. He studies the lexical and conceptual knowledge of language learners, as well as brain imaging and computational methods.

Acknowledgments

This three-year-long project has required the support of many people. First and foremost, I wish to express my gratitude and appreciation to each and every author who has contributed to this handbook. This is even more meaningful given that this large-scale team effort took place through a global pandemic as well as during multiple political, social, and financial challenges due to war, social unrest, and steep inflation. I realize that we have all felt (and are still feeling) a great deal of anxiety and uncertainty navigating these unprecedented times, which have brought a number of personal challenges. For this, I am even more grateful to this team of world-leading experts and colleagues for their sustained efforts to contribute to this volume.

A project like this one depends heavily on input from experts in the field. I am thankful for the comments and suggestions given by the anonymous reviewers of the original proposal. I am especially indebted to the eighty-seven (!) colleagues who agreed to review individual chapters, providing constructive and detailed feedback for the authors. Their generosity and attention to detail are not only very much valued and appreciated but also crucial in safeguarding the quality and high standard of academic integrity in the research published in this volume. These reviewers are listed in recognition of the important service they have provided: Abby Walker, Ala Symonchyk, Amanda Boomershine, Amanda Dalola, Anabela Rato, Antje Stoehr, Avizia Y. Long, Brandon Baird, Brandon Rogers, Brendan Regan, Cristopher T. Fennell, Carolina González, Celia Gorba, Charles B. Chang, Charlie Nagle, Christine Shea, Christoph Gabriel, Christos Pliatsikas, Ciara Celata, D. Eric Holt, Daniel R. Isbell, Daniel J. Olson, David Ingram, Denise Osborne, Erin O'Rourke, Earl Brown, Elena Babatsouli, Elizabeth Kissling, Esther L. Brown, Gemma Repiso-Puigdelliura, Gerardo Ortega, Gerry Docherty, Gillian Lord, Gisela Tomé Lourido, Henna Tamminen, Haydée Carrasco-Ortíz, Jennifer Mah, Jacqueline Serigos, Jeffrey Steele, Jesse Stewart, John Archibald, Jorge Valdés Kroff, Joseph V. Casillas, Joshua Gordon, Laura Colantoni, Lauren Schmidt, Laurence Bruggeman, Leah C. Geer, Linda Polka, Lisa Davidson,