

The Cambridge Handbook of Working Memory and Language

Bringing together cutting-edge research, this Handbook is the first comprehensive text to examine the pivotal role of working memory in first and second language acquisition, processing, impairments, and training. Authored by a stellar cast of distinguished scholars from around the world, the Handbook provides authoritative insights on work from diverse, multidisciplinary perspectives, and introduces key models of working memory in relation to language. Following an introductory chapter by working memory pioneer Alan Baddeley, the collection is organized into thematic sections that discuss working memory in relation to: theoretical models and measures; linguistic theories and frameworks; first language processing; bilingual acquisition and processing; and language disorders, interventions, and instruction. The Handbook is sure to interest and benefit researchers, clinicians, speech therapists, and advanced undergraduate and postgraduate students in linguistics, psychology, education, speech therapy, cognitive science, and neuroscience, or anyone seeking to learn more about language, cognition, and the human mind.

JOHN W. SCHWIETER is a Professor of Spanish and linguistics, Cross-Appointed in Psychology, and the director of Bilingualism Matters @ Laurier and the Language Acquisition, Multilingualism, and Cognition Laboratory at Wilfrid Laurier University. He is Executive Editor of the Bilingual Processing and Acquisition book series and Coeditor of Cambridge Elements in Second Language Acquisition.

ZHISHENG (EDWARD) WEN is an Associate Professor at Macao Polytechnic University in Macau. He has extensive teaching and research experience in applied linguistics, second language acquisition, and cognitive science. He has authored and edited volumes on working memory and language aptitude published by Cambridge University Press, Routledge, Benjamins, and Multilingual Matters.



CAMBRIDGE HANDROOKS 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 Schönthal

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 Malmkjaer



The Cambridge Handbook of Working Memory and Language

Edited by

John W. Schwieter Wilfrid Laurier University

Zhisheng (Edward) Wen *Macao Polytechnic University*







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/9781108958110

DOI: 10.1017/9781108955638

© Cambridge University Press & Assessment 2022

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.

First published 2022

First paperback edition 2024

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

Library of Congress Cataloging-in-Publication data

Names: Schwieter, John W., 1979- editor. | Wen, Zhisheng, editor.

Title: The Cambridge handbook of working memory and language / edited by John W. Schwieter, Wilfrid Laurier University, Ontario ; Edward Z.S. Wen, Macao Polytechnic Institute.

Description: Cambridge; New York, NY: Cambridge University Press, 2022. | Series: Cambridge handbooks in language and linguistics | Includes bibliographical references and index.

Identifiers: LCCN 2022001124 (print) | LCCN 2022001125 (ebook) | ISBN 9781108845342 (hardback) | ISBN 9781108958110 (paperback) | ISBN 9781108955638 (epub)

Subjects: LCSH: Language acquisition–Psychological aspects. | Second language acquisition–Psychological aspects. | Language disorders in children. | Short-term memory. | Psycholinguistics. | BISAC: LANGUAGE ARTS & DISCIPLINES / Linguistics / General | LCGFT: Essays.

Classification: LCC P118 .C365 2022 (print) | LCC P118 (ebook) | DDC 401/.93-dc23/eng/20220113

LC record available at https://lccn.loc.gov/2022001124 LC ebook record available at https://lccn.loc.gov/2022001125

ISBN 978-1-108-84534-2 Hardback ISBN 978-1-108-95811-0 Paperback

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.



Contents

List of Figures	page x
List of Tables	xi
About the Editors	xiv
About the Contributors	xvi
Acknowledgments	xxxi
Overview of the Handbook	
1 Working Memory and Language: An Overview of Key Topics	_
John W. Schwieter, Zhisheng (Edward) Wen, and Teresa Bennett	3
Part I Introduction	
2 Working Memory and the Challenge of Language Alan Baddeley	, 19
2 Working Memory and the chancings of Language Than Business	1,
Part II Models and Measures	
3 The Evolution of Working Memory and Language	
Frederick L. Coolidge and Thomas Wynn	31
4 The Phonological Loop as a "Language Learning Device":	
An Update Costanza Papagno	51
5 The Embedded-Processes Model and Language Use	
Eryn J. Adams, Alicia Forsberg, and Nelson Cowan	73
6 Long-Term Working Memory and Language Comprehension	
R. Lane Adams and Peter F. Delaney	98
7 The Cognitive Neuroscience of Working Memory and Language	
Nina Purg, Anka Slana Ozimič, and Grega Repovš	120
8 Computational Models of Working Memory for Language	
Graham J. Hitch, Mark J. Hurlstone, and Tom Hartley	143
9 The Time-Based Resource Sharing Model of Working Memory	
for Language Valérie Camos and Pierre Barrouillet	175
10 The Ease of Language Understanding Model Jerker Rönnberg,	
Emil Holmer, and Mary Rudner	197



viii CONTENTS

 11 Assessing Children's Working Memory Milton J. Dehn 12 Measuring Individual Differences in Working Memory Capacity and Attention Control and Their Contribution to Language Comprehension Alexander P. Burgoyne, Jessie D. Martin, Cody A. Mashburn, Jason S. Tsukahara, Christopher Draheim, and Randall W. Engle 	219247
Part III Linguistic Theories and Frameworks	
13 Have Grammars Been Shaped by Working Memory and If So, How? John A. Hawkins	275
14 Branching and Working Memory: A Cross-Linguistic	275
Approach Federica Amici, Alejandro Sanchez-Amaro,	
and Trix Cacchione	304
15 Working Memory and Natural Syntax William O'Grady	322
16 The Role of Working Memory in Shaping Syntactic	
Dependency Structures Chunshan Xu and Haitao Liu	343
17 Working Memory in the Modular Cognition Framework John Truscott and Michael Sharwood Smith	368
18 Short-Term and Working Memory Capacity and the Language	300
Device: Chunking and Parsing Complexity Bingfu Lu and	
Zhisheng (Edward) Wen	393
Part IV First Language Processing	
19 Working Memory in Word Reading Sun-A Kim	421
20 The Role of Working Memory in Language Comprehension and Production: Evidence from Neuropsychology Rachel Zahn,	
Autumn Horne, and Randi C. Martin	435
21 Working Memory and High-Level Text Comprehension Processes	450
Ana I. Pérez Muñoz and M. Teresa Bajo 22 Working Memory and Speech Planning Benjamin Swets	459
and Iva Ivanova	482
23 How Do Novice and Skilled Writers Engage Working Memory?	402
Thierry Olive	504
Part V Bilingual Acquisition and Processing	
24 How Measures of Working Memory Relate to L2 Vocabulary	
Elisabet Service and Daphnée Simard	529
25 Working Memory and L2 Grammar Development in Children	
Paul Leseman and Josje Verhagen	550
26 Working Memory and L2 Grammar Learning among Adults	
Timothy McCormick and Cristina Sanz	573
27 Working Memory and L2 Sentence Processing Ian Cunnings	593
28 Methodological Issues in Research on Working Memory and L2 Reading Comprehension Michael J. Leeser and Eric Herman	610
Reading Comprehension - whillder J. Leeser and Eric Herman	613



		Contents	ix
20	Working Moment and Second Language Checking Teeks		
29	Working Memory and Second Language Speaking Tasks Peter Skehan	635	
30	Working Memory in Second Language Interaction Hyejin An		
	and Shaofeng Li	656	
31	Working Memory and Interpreting Studies Binghan Zheng		
	and Huolingxiao Kuang	698	
32	A Methodological Synthesis of Working Memory Tasks in		
	L2 Research Jihye Shin and Yuhang Hu	722	
Pa	rt VI Language Disorders, Interventions, and Instruction		
	Specific Learning Disorders as a Working Memory Deficit		
	H. Lee Swanson	749	
34	A New Perspective on the Connection between Memory and		
	Sentence Comprehension in Children with Developmental		
	Language Disorder James W. Montgomery, Ronald B. Gillam,		
	and Julia L. Evans	776	
	Working Memory and Childhood Deafness Gary Morgan	801	
36	Working Memory Training in the Classroom		
	Tracy Packiam Alloway, Rachel K. Carpenter, Tyler Robinson, and	!	
	Andrea N. Frankenstein	820	
37	Working Memory and Classroom Learning Joni Holmes,		
	Elizabeth M. Byrne, and Agnieszka J. Graham	835	
38	Cognitive Load Theory and Instructional Design for		
	Language Learning John Sweller, Stéphanie Roussel,		
	and André Tricot	859	
39	Working Memory Training Meta-Analyses and		
	Clinical Implications Domenico Tullo and Susanne M. Jaeggi	881	
Pa	rt VII Conclusion		
40	Toward an Integrated Account of Working Memory		
	and Language Zhisheng (Edward) Wen and		
	John W. Schwieter	909	
Ind	lex	928	



Figures

2.1	The working memory model (Baddeley & Hitch, 1974)	page 20
5.1	The embedded-processes model of working memory	75
7.1	Working memory and language-related brain regions and	
	their structural connections	123
8.1	Illustration of simple (a) and compound (b) chaining	
	models	151
8.2	Schematic of the architecture of context-free (a–c) and	
	context-based (d-f) CQ models and the steps involved in	
	producing a three-item sequence	154
8.3	The central role of serial order in connecting detailed	
	implementations of working memory in specific tasks	
	with more abstract and general theories	159
8.4	Example of responses of syllabic phase model oscillators	
	during processing of the sentence "Iguanas and alligators	
	are tropical"	162
8.5	Phase and amplitude responses of a population of	
	oscillators with different tunings (spaced between 0.1 Hz	
	and 1.28 Hz) in the BUMP model of Hartley et al. (2016)	164
9.1	The cognitive architecture of working memory according	
	to the TBRS model	180
0.1	The ELU-WM system	200
1.1	Working memory processes	220
2.1	The substantial and significant contribution of working	
	memory capacity to fluid intelligence after accounting	
	for short-term memory	253
2.2	A structural equation model depicting attention control	
	fully mediating the relationship between working memor	У
	capacity and fluid intelligence	253
2.3	A structural equation model depicting task-unrelated	
	thoughts partially mediating the relationship between	
	attention control and reading comprehension	255



List of Figures

хi

12.4	Attention control supports information maintenance and	
	disengagement in service of complex cognition	257
12.5	Reliability of a difference score (Y-axis) decreasing as the	
	correlation between the component scores increases (X-axis)	259
14.1	Box plots representing the data distribution for the	
	number of correctly recalled initial and final stimuli in	
	the WM tasks	313
15.1	Direct mapping	324
15.2	Mediated mapping	324
16.1	Phrase structure and the dependency structure of	
	a sentence	344
16.2	Long and short dependency distance in a sentence	347
18.1	Linguistic chunks	397
18.2	Procedure for obtaining DCs	399
18.3	Major-branch tree	399
	The orbit-layering diagram	400
	On-line chunking	401
	Depth hypothesis	405
	Comparison of MMCN, DMM, and W/IC ratio metrics	405
	The domain-specific model of WM (adapted from Martin	
	et al., 1999)	436
21.1	Reading times index (fourth sentence divided by the mean	
	of the first three sentences or context, in milliseconds)	471
21.2	Electrophysiological activity (N400) for the disambiguating	
	word, as a function of language, condition, and working	
	memory (L2 divided by L1)	472
22.1	Model of language production (adapted from Levelt, 1989)	484
	An example item in Word Associates Format	532
	DKFVT item with the correct answers	532
	Publication types included in the methodological synthesis	664
	Mizuno's (2005) model of interpreting based on Cowan's	
0 1.11	(1988, 1995) Embedded-Processes Model of Memory	700
31.2	Dong and Li's (2020) attentional control model of	, , ,
01.2	interpreting	701
31.3	Darò and Fabbro's (1994) model of simultaneous	, 01
01.0	interpreting	703
32.1	Change in the use of WM tasks over time	728
	Change in the use of verbal and nonverbal WM tasks over	720
02.2	time	728
32.3	Change in the use of simple and complex span tasks over	720
02.0	time	729
34 1	Structural equation model of the direct relationships	14)
J- T . I	between cognitive processing and sentence comprehension	788
34 2	Structural equation model of the relationships between	700
J 1 .4	cognitive processing and sentence comprehension with	
	working memory as a mediator	789
	working inclinity as a incurator	109



Tables

7.1	Event-related potentials (ERPs) related to language	
	processes page	132
8.1	Benchmark findings of serial recall	150
11.1	Multibattery analysis completed worksheet example	237
12.1	Working memory tasks available for download from	
	https://englelab.gatech.edu	263
12.2	Attention control tasks available for download from	
	https://englelab.gatech.edu	266
13.1	Subject > Object and Object > Subject for full NPs in	
	grammars (cf. Comrie, 2013)	293
13.2	Processing predictions for Subject > Object and Object >	
	Subject Orders	295
18.1	First calculation of MMCN, DMM, and W/IC ratio metrics	407
18.2	Second calculation of MMCN, DMM, and W/IC ratio metrics	407
19.1	Summary of studies containing a WM variable in Chinese	
	word reading	426
20.1	Examples of relative clause sentence types (adapted from	
	Martin, 1987)	447
20.2	Examples of stimuli with syntactic and semantic interference	•
	(adapted from Tan & Martin, 2018)	452
21.1	Example of text used in the situation model revision task	465
22.1	Summary of evidence for the role of working memory	
	in various stages of language production	485
23.1	Relations between writing processes and working memory	
	components as proposed by Kellogg (1996)	508
23.2	An update on the relations between writing processes and	
	working memory components in skilled writers	518
24.1	Correlations between versions of L1 pseudoword span	
	and explicit memory for new L1 or L2 word forms (L1 was	
	Finnish and L2 was Korean for young adults and	
	eight-year-old children)	535



		List of Tables	xiii
24.2	Correlations between L2 word repetition and memory intentionally or incidentally learned new word forms		
	young adults and eight-year-old children (L1 was Finn	ish	
	and L2 Korean)	536	
28.1	Comparison of L2 reading-WM studies that used writt	en	
	summary protocols	625	
30.1	Predictor and criterion variables in the synthesis	662	
30.2	Sample characteristics of included studies ($K = 33$)	665	
30.3	Methodological features of included studies $(K = 33)$	665	
32.1	Methodological features of the six most commonly us	ed	
	WM tasks	730	
32.2	Scoring methods used in complex span tasks	733	
32.3	Scoring methods used in simple span tasks	736	
39.1	List of meta-analyses included and excluded from the		
	current review	885	
40.1	A unified understanding of working memory	912	



About the Editors

John W. Schwieter is a Professor of Spanish and Linguistics, Cross-Appointed in Psychology, and the Director of Bilingualism Matters @ Laurier and the Language Acquisition, Multilingualism, and Cognition Laboratory at Wilfrid Laurier University in Canada. His research interests include psycholinguistic and neurolinguistic approaches to multilingualism and language acquisition; translation, interpreting, and cognition; and second language teaching and learning. He is Executive Editor of the Bilingual Processing and Acquisition series (Benjamins) and Coeditor of the Cambridge Elements in Second Language Acquisition series (Cambridge University Press, with Benati). His recent books include Introducing Linguistics: Theoretical and Applied Approaches (2021, Cambridge University Press), The Handbook of the Neuroscience of Multilingualism (2019, Wiley-Blackwell), and The Cambridge Handbook of Language Learning (2019, Cambridge University Press, with Benati). His forthcoming books include The Cognitive Neuroscience of Bilingualism (Cambridge University Press, with Festman), Introduction to Translation and Interpreting Studies (Wiley, with Ferreira), and The Routledge Handbook of Bilingualism, Translation, and Interpreting (Routledge, with Ferreira). Some of his research has appeared in journals such as Acta Psychologica, Bilingualism: Language and Cognition, Biological Psychology, Cerebral Cortex, Frontiers in Psychology, International Journal of Bilingualism, Language Learning, The Mental Lexicon, Psychophysiology, among others.

Zhisheng (Edward) Wen is an Associate Professor in the School of Languages and Translation at Macao Polytechnic University. His research interests include second language acquisition, task-based language teaching and learning, psycholinguistics, and cognitive science, with a particular focus on the roles of working memory and language aptitude in language sciences and bilingualism research. His recent books include Working Memory in Second Language Acquisition and Processing (2015, Multilingual Matters, with Borges Mota & McNeill), Working Memory and Second



About the Editors

XV

Language Learning (2016, Multilingual Matters), Language Aptitude (2019, Routledge, with Skehan et al.), and Researching L2 Task Performance and Pedagogy (2019, Benjamins, with Ahmadian). His forthcoming books include Cognitive Individual Differences in Second Language Acquisition (de Gruyter, with Biedroń, Teng, & Sparks), Language Aptitude Theory and Practice (Cambridge University Press, with Skehan & Sparks), Memory in Science for Society (Oxford University Press, with Logie, Gathercole, Cowan, & Engle), and Working Memory in First and Second Language (Cambridge University Press, with Baddeley & Cowan). Some of his publications have appeared in Annual Review of Applied Linguistics, Language Teaching, International Journal of Applied Linguistics, and The Language Learning Journal, among others.



About the Contributors

The contributors to this handbook are international experts based at and/or affiliated with institutions and research centers in Australia, Canada, China (mainland), England, France, Germany, Greece, Hong Kong, Italy, Macao, Northern Ireland, Scotland, Slovenia, Spain, Sweden, Switzerland, Taiwan, The Netherlands, and the United States. Below are brief bios about these contributors:

- Eryn J. Adams is a PhD candidate and member of the Working Memory Lab at the University of Missouri in the United States. Her research interests include the development of working memory and language in young children. Some of her recent publications have appeared in the *Journal of Cognition and Development* and *Language, Speech, and Hearing Services in Schools.*
- **R. Lane Adams** is a graduate student at the University of North Carolina at Greensboro in the United States. His research interests include memory and expertise.
- Tracy Packiam Alloway is a Professorof Psychology and the Director of the Working Memory Lab at the University of North Florida in the United States. Her research interests include the role of working memory in mental health, decision-making, and education. Some of her significant publications have appeared in *Child Development* and the *Journal of Experimental Child Psychology*. Her recent book, *Think like a girl* (2021, Zondervan), explores the myths about the female brain.
- Federica Amici is a postdoctoral researcher at the Department of Human Behavior, Ecology and Culture at the Max Planck Institute for Evolutionary Anthropology and at the Leipzig University in Germany. Her main research interests lie in the evolutionary forces explaining behavioral and cognitive variation in humans and other species, including the role of language and culture in shaping human behavioral diversity. Her research has been published in several journals including



About the Contributors

xvii

Current Biology, Proceedings of the National Academy of Sciences of the United States of America, and Nature Communications.

Hyejin An is a PhD student in Foreign and Second Language Education at Florida State University in the United States. Her research interests include the role of learners' cognitive and affective individual difference in language learning and the psycholinguistic aspects of foreign language written production.

Alan Baddeley is an Emeritus Professor of Psychology at the University of York in England. He is best known for his development with Graham Hitch of the multicomponent model of working memory some 40 years ago. The model continues to be refined with an overview published in 2019 in Memory and Cognition and new developments outlined in his book Working Memories: Postmen, Divers, and the Cognitive Revolution (2019, Routledge).

M. Teresa Bajo is a full professor at the Department of Experimental Psychology in the University of Granada. She is head of the Memory and Language research group. Her research interests include memory retrieval in young and older adults, and language processing and control in bilinguals and monolinguals. Some of her recent publications have appeared in Cognition, Neurobiology of Learning and Memory, Bilingualism: Language and Cognition, and the Journal of Experimental Psychology: Learning, Memory and Cognition.

Pierre Barrouillet is an Honorary Professor of Cognitive Development and the Former Director of the Archives Jean Piaget at the University of Geneva in Switzerland. His research interests include working memory, reasoning, and mathematical cognition. He developed the Time-Based Resource Sharing model of working memory with Valérie Camos and coauthored with her several books and articles in leading scientific journals on working memory structure, functioning, and development.

Teresa Bennett is a Research Assistant to coeditor Schwieter and a four-time recipient of the Dean's Honour Roll within the Faculty of Science at Wilfrid Laurier University in Canada. Throughout her time as an undergraduate student in the Health Sciences program, she has conducted research pertaining to both the social and physiological aspects of health. This includes studies on innate immune stimulants as cancer therapies, as well as how the social determinants of health, such as racism, discrimination, stigma, social exclusion, and the like, negatively impact the health and well-being of racialized/marginalized groups. Her interest in language and the mind primarily pertains to examining the cognitive benefits of bi- and multilingualism as she enjoys the field of cognitive and behavioral neuroscience and hopes to pursue a career in the field of healthcare in the future.

Alexander P. Burgoyne is a Research Scientist II in the Attention and Working Memory Lab at the Georgia Institute of Technology in the United States. His research interests include individual differences in



xviii

ABOUT THE CONTRIBUTORS

intelligence, experience, motivation, and personality, and their relationships to real-world outcomes such as academic achievement and job performance. Some of his recent publications have appeared in *Current Directions in Psychological Science*, *Psychological Science*, *Cognition*, and *Psychological Bulletin*.

Elizabeth M. Byrne is a dual-affiliated Research Associate at the Centre for Play in Education, Development, and Learning at the University of Cambridge in England, and at the LEGO Foundation in Denmark. Her research interests include cognitive development, play-based learning, and educational interventions in early childhood. Some of her recent publications have appeared in *Brain & Cognition* and *Child: Care, Health, & Development.* She recently published a book chapter entitled "Cognitive plasticity and transcranial electrical stimulation" in *Cognitive Training: An Overview of Features and Applications* (2021, Springer, edited by Strobach & Karbach).

Trix Cacchione is a Professor at the University of Applied Sciences and Arts Northwestern Switzerland. She is specialized in developmental psychology, with a focus on conceptual development. Her research interests span from psycholinguistics to comparative psychology and include cross-specific work aiming to trace the evolutionary origins of human cognition.

Valérie Camos is a Full Professor in Cognitive Development and the Director of the Working Memory Development Lab at the University of Fribourg in Switzerland. Her research interests include the role of attention in working memory and the relationships between long-term and working memory in childhood and adulthood. Her work led to the development of the Time-Based Resource Sharing model with Pierre Barrouillet. In addition to several books, her significant publications have appeared in the Journal of Experimental Psychology: General, Journal of Memory and Language, Developmental Psychology, and Current Directions in Psychological

Rachel K. Carpenter is a PhD candidate in the Clinical Psychology Doctoral Program at East Tennessee State University in the United States. She completed her master's degree in Psychological Science at the University of North Florida with a focus on working memory and augmented reality. She approaches the study of digital games and other media using a clinical approach, hoping to use advanced technology to reduce symptomology in a variety of clinical pathologies. Her published work has focused on working memory and testing modalities, augmented reality and mood, and the ecological considerations of intimate partner violence. Her current research explores working memory, intimate partner violence, suicide, and severe mental health considerations.

Frederick L. Coolidge is a Professor and the Codirector of the University of Colorado, Colorado Springs Center for Cognitive Archaeology in the United States. He received his BA, MA, and PhD in Psychology and completed a two-year Postdoctoral Fellowship in Clinical



About the Contributors

xix

Neuropsychology at the University of Florida. He has received three Fulbright Fellowships, three outstanding teaching awards, the lifetime title University of Colorado Presidential Teaching Scholar, and two research excellence awards. Recently, he published his 10th book, Evolutionary Neuropsychology: An Introduction to the Evolution of the Structures and Functions of the Human Brain (2020, Oxford University Press).

Nelson Cowan is Curators' Distinguished Professor at the University of Missouri in the United States. His interests include working memory, its relation to selective attention, and its development. Based on his embedded-processes view of working memory, collaborations have explored working-memory factors in language impairment, dyslexia, autism, schizophrenia, amnesia, and Parkinson's disease. Two recent publications in *Perspectives on Psychological Science* report on a theory of cognitive growth, and on the process of adversarial collaboration based on a working memory project. His coedited volume *Working Memory: State of the Science* (2020, Oxford University Press, with Logie & Camos) summarizes current working memory theories.

Ian Cunnings is an Associate Professor of Psycholinguistics in the School of Psychology and Clinical Language Sciences at the University of Reading in England. His research interests are in language comprehension in different populations of speakers, with a focus on the working memory operations that subserve sentence processing. Much of his recent research has examined the similarities and differences between native and nonnative language comprehension. His recent publications have appeared in journals such as the *Journal of Memory and Language, Applied Psycholinguistics*, and *Bilingualism: Language and Cognition*.

Milton Dehn was an Associate Professor and School Psychology Program Director at the University of Wisconsin–La Crosse in the United States until his retirement. Currently, he is the test development project director for Schoolhouse Educational Services. His interests include assessment of cognitive abilities, memory, dyslexia, and executive functions and using a pattern of strengths-and-weaknesses approach to the identification of specific learning disabilities. His publications on working memory include *Working Memory and Academic Learning:*Assessment and Intervention (2008, Wiley) and Essentials of Working Memory: Assessment and Intervention (2015, Wiley).

Peter F. Delaney is a Professor of Psychology and the Director of the Cognition, Learning, and Memory Lab at the University of North Carolina at Greensboro in the United States. His research interests include expertise, intentional forgetting, and spacing effects in memory. His recent work has appeared in outlets such as Clinical Psychology Review, Memory, and the Journal of Expertise.

Christopher Draheim is a Visiting Assistant Professor at Lawrence University in the United States. His research interests include the measurement and nature of individual differences in executive



XX ABOUT THE CONTRIBUTORS

functioning, particularly working memory capacity and attention control. Some of his recent publications in this area have appeared in *Psychological Bulletin* and *Journal of Experimental Psychology: General.*

Randall W. Engle is a Professor in the School of Psychology at the Georgia Institute of Technology in the United States. His research is on individual differences in attention control, working memory capacity, and fluid intelligence and the role those differences play in performing complex tasks. He is a member of the National Academy of Sciences.

Julia L. Evans is a Professor in the Department of Speech, Language, and Hearing and Director of the Child Language and Cognitive Processes Lab at the University of Texas—Dallas in the United States. The focus of her research program is the neurobiology of language, cognitive processing, implicit learning, and memory in children with developmental language disorder. Her publications appear in a wide range of language, cognitive psychology, and neuroscience journals.

Alicia Forsberg is a Postdoctoral Research Fellow at the University of Missouri in the United States, where she is part of Professor Nelson Cowan's research group. She received her PhD in 2019 from the University of Edinburgh in Scotland. She is interested in the lifespan development of working memory, focusing on the causes and consequences of these lifespan changes. Some of her recent research on the relationship between working and long-term memory is published in *Psychonomic Bulletin & Review*.

Andrea N. Frankenstein is a graduate student in Psychology at the University of Illinois at Chicago in the United States, where she specializes in cognitive psychology and statistics, methods, and measurement. Her broad research interests include cognitive and social-cognitive factors that influence learning outcomes. She is especially interested in applying this work in the context of higher education. Some of her recent publications have appeared in *Cognition* and *Memory & Cognition*.

Ronald B. Gillam holds the Raymond and Eloise Lillywhite Endowed Chair in Speech-Language Pathology and is the Director of the Interdisciplinary Doctoral Program in Neuroscience at Utah State University in the United States. His research interests include the neurobiology of language and cognition as well as evidence-based practices for children with developmental language disorders. Some of his recent publications have appeared in *Brain and Cognition*, *Human Brain Mapping*, *PLoS ONE*, and the *Journal of Speech*, *Language*, *and Hearing Research*.

Agnieszka J. Graham is a Lecturer in Applied Developmental
Psychology at the Queen's University of Belfast in Northern Ireland. She
studies higher-level cognition and its development across the lifespan
and is particularly interested in new and original approaches to tackling
educational underachievement. The goal of her work is to understand
how executive functions develop and how their development can be best



About the Contributors

xxi

supported. She is currently working on a project exploring mind wandering in children, examining its nature, and considering the costs and benefits that mind wandering can bring in the context of educational attainment.

Tom Hartley is a neuroscientist and Senior Lecturer in Psychology at the University of York in England. His research interests include brain mechanisms of perception, memory, and complex behavior, which he investigates with neuroimaging, computational modeling, neuropsychology, and experimental psychology. His PhD thesis at University College London developed a model of linguistic constraints on serial order in verbal short-term memory. After remaining at UCL for a series of postdoctoral positions focusing on the neuroscience of spatial memory, he moved to his current role in 2005, where his research continues on a broad range of topics, including studies of timing in auditory verbal short-term memory.

Jack (John A.) Hawkins is a Distinguished Professor of Linguistics at the University of California, Davis, in the United States and Emeritus Professor of English and Applied Linguistics at Cambridge University in England. He has held previous positions at the University of Southern California, the Max Planck Institute for Psycholinguistics in Nijmegen, and the University of Essex. He has broad interests in the language sciences and has published widely on typology and universals, efficiency and complexity in grammars and usage, language processing and learning, the Germanic language family, and language change.

Eric Herman is a PhD student at Florida State University in the United States. His research interests include second language reading comprehension and instructed second language learning.

Graham J. Hitch is an Emeritus Professor of Psychology at the University of York in England. He completed his first degree in physics and switched to experimental psychology through an MSc at the University of Sussex. He went on to do a PhD on short-term memory at the Medical Research Council Applied Psychology Unit (now called the Medical Research Council Cognition and Brain Sciences Unit) at Cambridge University. This was followed by a postdoctoral fellowship with Alan Baddeley investigating working memory at the University of Sussex and University of Stirling. He has continued this life-long interest ever since, first back at the MRCAPU, then at the universities of Manchester and Lancaster and finally at the University of York, where he is presently an Emeritus Professor of Psychology.

Emil Holmer is a Senior Lecturer of Disability Research and the Head of Division at the Disability Research Division at Linköping University in Sweden. His research interests include behavioral, cognitive, and neural aspects of language processing and development in populations with and without disabilities. Some of his recent publications have appeared in *Frontiers in Psychology* and *Cerebral Cortex*.



xxii ABOUT THE CONTRIBUTORS

Joni Holmes is a Senior Scientist and Head of the Centre for Attention Learning and Memory at the Medical Research Council's Cognition & Brain Sciences Unit at the University of Cambridge in England. Her research interests center around understanding the cognitive mechanisms that give rise to developmental difficulties. Some of her significant publications have appeared in Current Biology, Developmental Science, Journal of Educational Psychology, Journal of Memory and Language, the Journal of the American Academy of Child and Adolescent Psychiatry.

Autumn Horne is a PhD Student working under the guidance of Dr. Randi Martin in the Department of Psychological Sciences at Rice University in the United States. Her research interests include individual differences in working memory and their relationship with language comprehension, production, and prediction.

Yuhang Hu is a PhD student in applied linguistics at Northern Arizona University. Her research interests include quantitative research methods in applied linguistics research, research synthesis and meta-analysis, and individual differences (particularly psychological variables) in bi/multilingualism research.

Mark J. Hurlstone is a Lecturer in the Department of Psychology at Lancaster University in England and an Honorary Research Fellow in the School of Psychological Science at the University of Western Australia. His research interests include working memory for order information and its relation to language processing, computational and mathematical modeling of cognitive processes, and the psychology of climate change, vaccination, and misinformation. His research on working memory has featured in top-tier psychology journals including Cognitive Psychology, Journal of Experimental Psychology: Learning, Memory, and Cognition, Journal of Experimental Psychology: Human Perception and Performance, and Psychological Bulletin.

Iva Ivanova is an Assistant Professor of Psychology and the Director of the Language and Communication Lab at the University of Texas at El Paso in the United States. Her research interests include bilingualism, language production and dialogue, and their relationships with working memory and attention. A current project explores how bilinguals' control of which language they speak when impacts the quality and fluency of spontaneous connected speech. Some of her recent publications have appeared in Cognition, Journal of Memory and Language, Journal of Experimental Psychology: Learning, Memory and Cognition, and Bilingualism: Language and Cognition.

Susanne M. Jaeggi is a Professor in Education and Cognitive Science and Director of the Working Memory & Plasticity Lab at the University of California, Irvine, in the United States. She studies working memory and related cognitive functions across the lifespan, and within that domain, her major work focuses on the development of cognitive interventions and the investigation of whether, how, and for whom those interventions



About the Contributors

xxiii

generalize to nontrained cognitive domains. Her work has appeared in PNAS, Psychological Science, and Developmental Science.

Sun-A Kim is an Associate Professor of Second Language Acquisition and Teaching Chinese as a Foreign Language in the Department of Chinese and Bilingual Studies at the Hong Kong Polytechnic University. Her research interests include individual differences in language processing and learning, psycholinguistic approaches to second language acquisition, and teaching Chinese and Korean as second languages.

Huolingxiao Kuang is a PhD candidate at the School of Modern Languages and Cultures, Durham University in England. She holds an MA in Translation and Interpreting from Peking University. She has been working as a part-time interpreter, providing interpreting services for the Development Research Center of China State Council, the Ministry of Health in Zambia, Mercedes Benz, and Peking University. Her research interests include interpreting process research and note-taking in consecutive interpreting.

Michael J. Leeser is an Associate Professor of Spanish and Linguistics and Director of Spanish Basic Language Instruction at Florida State University in the United States. His research interests include second language comprehension, input processing, and processing instruction. He is the coeditor of the recent volume *Research on Second Language Processing and Processing Instruction* (2021, Benjamins, with Keating & Wong).

Paul Leseman is a Psychologist and Full Professor of Educational Sciences at Utrecht University in The Netherlands, where he leads a research unit focusing on early and middle childhood language, literacy, mathematics, and executive function development in relation to school achievement in multicultural and multilingual contexts. He is leader of national cohort studies on child development and coordinated European research projects among immigrant and ethnic minority communities on equity and inclusion. Recent work has appeared in journals such as *Bilingualism:* Language and Cognition, Child Development, Developmental Psychology, Learning and Instruction, and Review of Educational Research.

Shaofeng Li is an Associate Professor of Foreign and Second Language Education at Florida State University in the United States. He received his PhD from Michigan State University. His main research interests include second language acquisition, working memory, language aptitude, and the interface between cognitive and affective learner differences and instruction type. His publications have appeared in Applied Linguistics, Applied Psycholinguistics, Language Learning, Language Teaching, Language Teaching Research, Modern Language Journal, and Studies in Second Language Acquisition, among others.

Haitao Liu is a Qiushi Distinguished Professor of Linguistics and Applied Linguistics at Zhejiang University and a Yunshan Leading Visiting Professor at Guangdong University of Foreign Studies in China. He is a member of the Esperanto Academy. His research interests include



xxiv ABOUT THE CONTRIBUTORS

computational cognitive science, quantitative linguistics, dependency grammar, and digital humanities. He is the author of more than 230 scientific publications with some recent research work appearing in Cognitive Linguistics, Language Sciences, Journal of Chinese Linguistics, Journal of Second Language Writing, Physics of Life Reviews, Frontiers in Psychology, Folklore, Digital Scholarship in the Humanities, Muttersprache, Français moderne, and Вопросы языкознания.

Bingfu Lu is a Professor of Linguistics at Beijing Language and Culture University in China. His research interests include linguistic typology, syntax, and applied linguistics. Some of his publications in English have appeared in the *Proceedings of the Third International Conference on Cognitive Science* and *Cahiers linguistique—Asie orientale* and in books published by Hong Kong University Press and de Gruyter.

Jessie D. Martin is a Senior Human Factors Psychologist with Battelle Memorial Institute. Her research interests include the measurement of attention control in applied contexts including linguistics and second language learning. Some of her recent publications in this area have appeared in the Journal of Experimental Psychology: General and the Journal of Applied Research in Memory and Cognition.

Randi C. Martin is the Elma Schneider Professor of Psychological Sciences and Director of the T. L. L. Temple Foundation Neuroplasticity Lab at Rice University in the United States. Her research interests include the psychology and neuropsychology of language, with a focus on the role of working memory and executive function in language comprehension and production. A recent interest is whether the knowledge/access distinction for semantic memory is warranted. Her work has drawn on behavioral and neural findings from healthy and brain-damaged individuals. Significant recent publications have appeared in *Brain, Cerebral Cortex Communications, Cortex, Current Directions in Psychological Science*, and *Psychonomic Bulletin & Review*.

Cody A. Mashburn is a PhD student in Cognition and Brain Science at the Georgia Institute of Technology in the United States. His research interests include individual differences in attention control, working memory capacity, processing speed, and intelligence, as well as applications of psychological testing. His research has appeared in journals such as Psychological Bulletin, Journal of Applied Research in Memory and Cognition, and Journal of Experimental Psychology: General.

Timothy McCormick is a Language Data Researcher with Amazon's Alexa. He completed his PhD in Spanish Linguistics at Georgetown University in Washington, DC, in the United States, where he focused on cognitive control and early and emergent bilingual sentence processing. His research interests include bilingualism and cognitive capacity, with publications in Studies in Second Language Acquisition and in volumes such as Research on Second Language Processing and Processing Instruction (2021,



About the Contributors

XXV

Benjamins) and The Routledge Handbook of Study Abroad Research and Practice (2018, Routledge).

James W. Montgomery is a Professor of Communication Sciences and Disorders and Director of the Developmental Psycholinguistics Lab at Ohio University in the United States. His research interests focus on understanding the intersection of working memory, long-term memory, and sentence comprehension in school-age children with Developmental Language Disorder. His publications appear in a variety of discipline-specific journals as well as language and psychology journals.

Gary Morgan is a Professor of Psychology at the Department of Language Communication Science at City University of London in England. He has researched a range of topics linked to childhood deafness including language development, theory of mind, and executive functions. His current research looks at the impact of early experiences on later language and cognitive outcomes in children. Some of his recent significant papers have appeared in *Pediatrics, Child Development*, and *Infant Behaviour and Development*.

William O'Grady is a Professor in the Department of Linguistics at the University of Hawai'i at Mānoa in the United States. He is well known for his writings on syntactic theory and language acquisition, as well as for his work on Korean and Jejueo. A major theme in his research is his commitment to emergentism, the idea that language is a complex system whose properties derive from the interaction for more basic factors and forces, especially processing pressures. He is author of numerous journal articles and several books including How Children Learn Language (2005, Cambridge University Press), Syntactic Carpentry, and Jejueo: The Language of Korea's Jeju Island (2019, University of Hawai'i Press, with Yang and Yang). He is the coeditor of The Handbook of Language Emergence (2014, Wiley-Blackwell, with MacWhinney) and the coeditor of a widely used textbook, Contemporary Linguistic Analysis (2021, Pearson, with Archibald), now in its ninth edition.

Thierry Olive is a Senior Researcher at the Centre National de la Recherche Scientifique (CNRS) in France and Director of the Maison des Sciences de l'Homme et de la Société, a federative lab at the University of Poitiers. He is author of recent articles published in *Reading and Writing*, *Frontiers in Psychology*, *Reading Research Quarterly*, *Written Communication*, and *Journal of Writing Research*, and of the book *Executive Functions in Writing* (2021, Oxford University Press, with Teresa Limpo). He is also coeditor of the book series Studies in Writing (Brill).

Anka Slana Ozimič is an Assistant Professor in Cognitive Science at the University of Ljubljana in Slovenia. She holds a PhD in Neuroscience and a master's in Cognitive Science. She is active in the field of cognitive neuroscience and uses a combination of behavioral and fMRI experiments to study cognitive processes related to working memory and cognitive



xxvi

ABOUT THE CONTRIBUTORS

and Psychological Review.

control. Her recent publications focusing on systems limiting working memory capacity have appeared in the *Journal of Memory and Language*. **Costanza Papagno** is a Neurologist and Full Professor of Neuropsychology at the University of Milano-Bicocca and the Director of the Neurocognitive Rehabilitation Center at the University of Trento in Italy. Her research interests include verbal short-term memory and language, neuropsychological deficits in low-grade glioma patients, and the abstract/concrete dissociation. Some of her significant publications on verbal short-term memory have appeared in *Cortex*, *Human Brain Mapping*, *Journal of Cognitive Neuroscience*, *Journal of Memory and Language*, *Memory*,

Ana I. Pérez Muñoz is a currently Principal Investigator of a MSCA-COFUND Athenea3i project, working at the University of Granada in Spain. Her main research interest focuses on the study of high-level cognitive processes underlining text comprehension (such as inference making, comprehension monitoring, updating information, and information integration) in monolingual and bilingual children, young adults, and elderly people. Some of her significant publications have appeared in *Memory and Cognition*, *Bilingualism: Language and Cognition*, and *Neuropsychologia*.

Nina Purg is a PhD Candidate in Neuroscience and a Teaching Assistant in Cognitive Science at the University of Ljubljana in Slovenia. She obtained a BSc degree in Biomedical Sciences and Synthetic Organic Chemistry and an MSc degree in Neuroscience from the University College London. Her research work focuses on studying human cognition, particularly executive functions, with a combination of behavioral and neuroimaging experimental approaches, such as fMRI and EEG.

Grega Repovš is a Professor in General Psychology at the University of Ljubljana in Slovenia, where he leads the Mind and Brain Laboratory in the Department of Psychology. He holds a PhD and MSc in Psychology. His research focuses on the integration of behavioral, EEG, and fMRI methods in studying human cognition, with a specific focus on working memory, cognitive control, and integration of brain function in health and disease. His work includes the development of neuroimaging analytics with an emphasis on brain functional connectivity. His recent publications have appeared in the *Journal of Memory and Language*, *Biological Psychiatry*, *Neuroimage*, and *Psychophysiology*.

Tyler Robinson is a PhD student with the Cognitive Neuroscience and Affective Psychopathologies (CNAPs) lab at Louisiana State University in the United States. His research interests are working memory, executive function, and cognition of aging using functional neuroimaging. His work in the CNAPs Lab has centered on cognitive and attentional emotion regulation. Following completion of his degree, he will begin a postdoctoral position at the University of Toronto in Canada to study white-matter changes in aging as they relate to cognitive performance.



About the Contributors

xxvii

Jerker Rönnberg is a Professor Emeritus of Psychology at Linköping University in Sweden. He has been the Director of the Swedish Institute for Disability Research (SIDR) for the last 20 years and continues to pursue his research at the Linnaeus Centre HEAD (HEaring And Deafness). With a background in memory research, he has recently published in *Nature Communications, Frontiers in Systems Neuroscience,* and *Cerebral Cortex* with a focus on hearing impairment and deafness, signed language, speech understanding in noise, signal processing in hearing instruments, and working memory capacity. He has contributed to the establishment of Cognitive Hearing Science as a new field of research.

Stéphanie Roussel is an Associate Professor of applied linguistics and the Director of a Language Department at the University of Bordeaux in France. Her research interests include second language learning and teaching, second language acquisition, computer assisted language learning, and content and language integrated learning.

Mary Rudner spent twenty years studying the nexus of cognition and communication, especially in relation to hearing loss and deafness as well as developmental processes. Her early work in collaboration with Rönnberg showed greater recruitment of superior parietal cortex when working memory tasks are performed in sign language rather than speech. More recent research with Rönnberg, Holmer, and others shows that regions of auditory cortex that process sound in hearing individuals are recruited during working memory tasks in profoundly deaf individuals. Rudner has retired from academic work and devotes her time to family, music, and art.

Alejandro Sanchez-Amaro is a Postdoctoral Researcher at the Department of Comparative Cultural Psychology at the Max Planck Institute for Evolutionary Anthropology in Germany. His main research interests include the comparative study of humans and great apes with a special emphasis on how primates solve cooperative social dilemmas from a dyadic and a group-level perspective. He is also interested in the psychological mechanisms underlying the nature of primates' decision-making biases and in the relationship between language and memory across cultures. Some of his recent publications have appeared in *Proceedings of the Royal Society B: Biological Sciences* and *Evolution and Human Behaviour*.

Cristina Sanz is Full Professor of Spanish and Linguistics at Georgetown University in the United States, where she holds several administrative positions. She has published over 100 volumes, articles, and book chapters on the multiple interactions between learning context and individual differences, including working memory, in the development of multilingualism across the lifespan. Some of her recent publications have appeared in Neuropsychologia, Applied Psycholinguistics, Studies in Second Language Acquisition, Bilingualism: Language and Cognition, and Language Learning. Currently, she is coediting two volumes on methods in study



xxviii

ABOUT THE CONTRIBUTORS

abroad research (Benjamins) and on the teaching of Spanish (Wiley) and has recently coauthored *Introducción a la lingüística hispánica* (2020, Cambridge University Press).

John W. Schwieter (see "About the editors").

Elisabet Service is a Professor and member of ARiEAL (Centre for Advanced Research in Experimental and Applied Linguistics) at McMaster University in Canada. She is Director of the Language, Memory, and Brain Lab, which employs behavioral and psychophysiological methods. Her research interests include working memory in language acquisition and processing, dyslexia, developmental language disorder, and cognitive load in bilingual task performance. She has published in the Journal of Memory and Language, Applied Psycholinguistics, Cerebral Cortex, Frontiers in Human Neuroscience, Frontiers in Psychology, among many others. Best known is her research of individual differences in secondlanguage acquisition.

Michael Sharwood Smith is an Emeritus Professor at Heriot-Watt University in Scotland and a EUROSLA Distinguished Scholar. His current major research interest is in identifying the role of language representation, processing, and development (of any kind) within human cognition as a whole. He is currently working on a long-term project with John Truscott developing a cross-disciplinary framework called the Modular Cognition Framework. He is founding editor emeritus of Second Language Research and a former vice president of the European Second Language Association. His 13 books include the Internal Context of Bilingual Processing (2019, Benjamins, with Truscott), Introducing Language and Cognition: A Map of the Mind (2017, Cambridge University Press), The Multilingual Mind: A Modular Processing Perspective (2014, Cambridge University Press, with Truscott), and Second Language Learning: Theoretical Foundations (1994, Pearson).

Jihye Shin is a Research Associate in the Systems Development & Improvement Center at the University of Cincinnati in the United States. She holds a PhD in Applied Linguistics from Northern Arizona University. Her research interests lie in second language reading, psycholinguistics, second language acquisition, TESOL, and research methods. Her recent publications on working memory and L2 reading have appeared in TESOL Quarterly, Applied Psycholinguistics, and in the edited volume Challenges in Language Testing around the World: Insights for Language Test Users (2021, Springer).

Daphnée Simard is a Full Professor of second language acquisition in the Department of Linguistics at the Université du Québec à Montréal in Canada, where she was the director of the Institute of Cognitive Science from 2014 to 2017. She is currently one of the two editors-in-chief of the Canadian Modern Language Review. Her research interests are twofold. First, she investigates the role played by individual variables such as attentional capacity and memory in second language acquisition. She is



About the Contributors

xxix

also interested in the relationship between metalinguistic behavior and second language acquisition. Her work has appeared in *Bilingualism:* Language and Cognition and Language Learning, among others.

Peter Skehan is an Honorary Research Fellow in the Institute of Education at University College London in England. His interests are in second language acquisition, task-based learning and teaching, second language spoken performance, and foreign language aptitude. He has published in the Modern Language Journal, the Journal of Instructed Second Language Acquisition, the Annual Review of Applied Linguistics, System, as well as the book Second Language Task-Based Performance: Theory, Research, Assessment (2018, Routledge).

H. Lee Swanson is a Research Professor in Educational Psychology at the University of New Mexico in the United States. He was previously Distinguished Professor and Peloy Endowed Chair of Educational Psychology at the University of California, Riverside. His primary research focuses on cognitive development in children at risk for learning disabilities. He has been the previous editor of the Journal of Learning Disabilities and Learning Disability Quarterly. He has published in several journals such as Developmental Psychology, Journal of Educational Psychology, Journal of Experimental Child Psychology, Intelligence, among others.

John Sweller is an Emeritus Professor of Educational Psychology at the University of New South Wales in Australia. His research is associated with cognitive load theory. The theory is a contributor to both research and debate on issues associated with human cognition, its links to evolution by natural selection, and the instructional design consequences that follow. Based on many hundreds of randomized, controlled studies carried out by many investigators from around the globe, the theory has generated a large range of novel instructional designs from our knowledge of human cognitive architecture.

Benjamin Swets is a Professor of Psychology at Grand Valley State
University in the United States. His research interests include planning in language production, individual differences in working memory and language processing, and the effects of real-world pressures on language comprehension and production. Some of his recent publications have appeared in Frontiers in Psychology, Cognitive Science, and the Journal of Memory and Language.

André Tricot is a Professor of Cognitive Psychology at Paul Valéry University of Montpellier in France and a researcher at the Epsylon lab. He obtained his PhD in cognitive psychology at Aix-Marseille University in 1995. His research investigates the relationships between natural and artificial memories in which he examines how the design of an artificial memory (a document) can help the natural memory instead of overloading it. Applications are in instructional design, human—computer interaction, ergonomics, and transport safety. He was the head of the group that designed the current curricula for grades 1, 2, and 3 in France.



XXX ABOUT THE CONTRIBUTORS

John Truscott is an Emeritus Professor at National Tsing Hua University in Taiwan. His primary research interest is in development of the Modular Cognition Framework (formerly known as MOGUL). He has published extensively on this and related topics in cognitive science, as well as in various areas of second language learning and teaching, notably including error correction. He is the author of *Consciousness and Second Language Learning* (2015, Multilingual Matters), *Working Memory and Language in the Modular Mind* (in press, Routledge) and coauthor of *The Multilingual Mind: A Modular Processing Perspective* (2014, Cambridge University Press, with Sharwood Smith) and *The Internal Context of Bilingual Processing* (2019, Benjamins, with Sharwood Smith).

Jason S. Tsukahara is a PhD Student in Cognition and Brain Science at the Georgia Institute of Technology in the United States. His research interests include understanding the nature of individual differences in attention control, the role of the locus coeruleus in intelligence, and tracking the focus of attention using behavioral, physiological, and eye-tracking measures. Some of his recent publications have appeared in *Cognition* and the *Journal of Experimental Psychology: General*.

Domenico Tullo is a Postdoctoral Research Associate at the Centre Hospitalier Universitaire Sainte-Justine, affiliated with l'Université de Montréal in Canada. Domenico is currently examining the predictive validity of genetic and EEG biomarkers in response to an attention training intervention. More specifically, his area of research assesses effectiveness of training attention for children and adolescents with autism spectrum disorder and other neurodevelopmental conditions. Domenico's doctoral research, which examined the feasibility and efficacy of training attention in children and adolescents with alternative learning profiles has been published in *Developmental Science, Intelligence*, and *Journal of Vision*.

Josje Verhagen is an Associate Professor of Dutch Linguistics at the University of Amsterdam in the Netherlands. Her work focuses on language acquisition, with special reference to bilingualism in children. She is particularly interested in relationships between language and other aspects of cognition (memory and attention), statistical learning, and effects of the linguistic environment on acquisition. Some of her recent publications have addressed nonword repetition in monolingual and bilingual children, effects of input quantity and input quality on bilingual acquisition, and the role of sociopragmatic cues (e.g., eye gaze and pointing) in monolingual and bilingual children's language learning.

Zhisheng (Edward) Wen (see "About the editors").

Thomas Wynn is a Distinguished Professor of Anthropology at the University of Colorado, Colorado Springs, in the United States. In the 1970s his research opened a hitherto unexplored direction in Palaeolithic studies, the explicit use of psychological theory to interpret archaeological remains. He has published extensively (150+ books,



About the Contributors

xxxi

articles, and book chapters) with an emphasis on cognitive evolution. His books include *The Evolution of Spatial Competence* (1989, University of Illinois Press), *The Rise of* Homo Sapiens: *The Evolution of Modern Thinking* (2018, 2nd ed., with F. Coolidge), *How to Think Like a Neandertal* (2012, Oxford University Press, with F. Coolidge), and *First Sculpture: Handaxe to Figure Stone* (2018, Nasher Sculpture Center, with T. Berlant).

Chunshan Xu is a Professor of the School of Foreign Studies at Anhui Jianzhu University in China. His research interests include dependency grammar and cognitive linguistics. Some of his recent publications have appeared in *Poznań Studies in Contemporary Linguistics, Physics of Life Reviews,* and *Quantitative Analysis of Dependency Structures.*

Rachel Zahn is a PhD Student in the Department of Psychological Sciences at Rice University in the United States. She is working with Dr. Randi Martin in the T. L. L. Temple Foundation Neuroplasticity Lab. Her research interests include the role of working memory in language production, particularly longer utterances such as storytelling and sentence production. Her work has focused on neuropsychological populations, specifically individuals with aphasia poststroke.

Binghan Zheng is an Associate Professor of Translation Studies and Director of the Centre for Intercultural Mediation at Durham University in England. His research interests include cognitive translation and interpreting studies, neuroscience of translation, and comparative translation and interpreting studies. His recent publications have appeared in journals such as Target, Across Languages & Cultures, Journal of Pragmatics, Brain & Cognition, Perspectives, LANS-TTS, Babel, Translation & Interpreting Studies, Foreign Language Teaching & Research, Translation Studies, and Journal of Foreign Languages. He is a guest editor of journals including Translation & Interpreting Studies and Foreign Language Teaching & Research.



Acknowledgments

First, we are very thankful to all of the individuals who kindly accepted our invitation to contribute to this massive project. Without their dedication, diligence, and, above all, their scholarly wisdom, this handbook simply would not exist. In particular, we wish to thank Alan Baddeley and John Hawkins for their additional advice, encouragement, and generous support to both the handbook and the working memory-language enterprise along the way.

As always, the editorial team at Cambridge University Press was efficient, attentive, and supportive. A special thank you goes to Rebecca Taylor, Commissioning Editor, Linguistics, for initially discussing this handbook idea with us and shepherding it to production. We also want to thank Isabel Collins, Senior Editorial Assistant and Joshua Penney, Senior Content Manager, for their excellent work throughout the production of the handbook.

We are grateful to our editorial assistant, Teresa Bennett, for her excellent work during the preparation of the manuscript. We gratefully acknowledge that financial support to hire her was provided by the Office of Research Services at Wilfrid Laurier University.

Securing peer reviewers to volunteer their even-more-precious time in the wake of a global pandemic was challenging. But despite this, we are extremely grateful to the scholars, many of whom also contributed their own work, who dedicated their time and expertise to anonymously evaluate contributions to this handbook. It is without a doubt that their knowledge and expertise have strengthened the chapters and their implications for ongoing and future research. These individuals include the following:

Federica Amici, University of Leipzig and Max Planck Institute for Evolutionary Anthropology, Germany

Pierre Noël Barrouillet, Université de Genève, Switzerland Michael Bunting, University of Maryland, United States



Acknowledgments

xxxiii

Rendong Cai, Guangdong University of Foreign Studies, China

Valérie Camos, Université de Fribourg, Switzerland

Frederick L. Coolidge, University of Colorado, Colorado Springs, United States

Nelson Cowan, University of Missouri, United States

Ian Cummings, University of Reading, England

Peter Delaney, University of North Carolina at Greensboro, United States

Denis Foucambert, Université du Québec à Montréal, Canada

Ron Gillam, Utah State University, United States

William Grabe, Northern Arizona University, United States

Agnieszka J. Graham, Queens University Belfast, Northern Ireland

John A. Hawkins, University of California, Davis, United States

Graham Hitch, University of York, England

Emil Holmer, Linköping University, Sweden

Mark Hurlstone, Lancaster University, England

Daniel O. Jackson, Kanda University of International Studies, Japan

Susanne M. Jaeggi, University of California, Irvine, United States

Sun-A Kim, Hong Kong Polytechnic University

Huolingxiao Kuang, Durham University, England

James Lee, Texas Tech University, United States

Michael Leeser, Florida State University, United States

Paul Leseman, Utrecht University, The Netherlands

Shaofeng Li, Florida State University, United States

Haitao Liu, Zhejiang University, China

Bingfu Lu, Beijing Language and Culture University, China

Jim Montgomery, Ohio University, United States

Gary Morgan, City University London, England

William O'Grady, University of Hawai'i at Manoa, United States

Thierry Olive, Centre national de la recherche scientifique and Université de Poitiers, France

Anka Slana Ozimič, University of Ljubljana, Slovenia

Dora Pan, Chinese University of Hong Kong

Costanza Papagno, University of Trento and University of Milano-Bicocca, Italy

Ana I. Pérez Muñoz, University of Granada, Spain

Nina Purg, University of Ljubljana, Slovenia

Grega Repovš, University of Ljubljana, Slovenia

Jerker Rönnberg, Linköping University, Sweden

Nuria Sagarra, Rutgers, The State University of New Jersey, United States

Elisabet Service, McMaster University, Canada

Daphnée Simard, Université du Québec à Montréal, Canada

Peter Skehan, University College London, England

H. Lee Swanson, University of California, Riverside and University of New Mexico, United States

John Sweller, University of New South Wales, Australia



xxxiv

ACKNOWLEDGMENTS

Benjamin Swets, Grand Valley State University, United States André Tricot, University Paul Valéry Montpellier 3, France John Truscott, National Tsing Hua University, Taiwan Domenico Tullo, McGill University, Canada Josje Verhagen, University of Amsterdam, The Netherlands Thomas Wynn, University of Colorado, Colorado Springs, United States Janire Zalbidea, Temple University, United States Binghan Zheng, Durham University, England