

### Sign Language Phonology

A concise overview of key findings and ideas in sign language phonology and its contributions to related fields, including historical linguistics, morphology, prosody, language acquisition, and language creation. Working on sign languages not only provides important new insights on familiar issues, but also poses a whole new set of questions about phonology, because of the use of the visual communication modality. This book lays out the properties needed to recognize a phonological system regardless of its modality. Written by a leading expert in sign language research, the book describes the current state of the field and addresses a range of issues that students and researchers will encounter in their work, as well as highlighting the significant impact that the study of sign languages has had on the field of phonology as a whole. It includes lists of further reading materials, and a full glossary, as well as helpful illustrations that demonstrate the important aspects of sign language structure, even to the most unfamiliar of readers. A text that will be useful to both specialists and general linguists, this book provides the first comprehensive overview of the field.

DIANE BRENTARI is the Mary K. Werkman Professor in the Department of Linguistics at the University of Chicago. She is author or editor of six books including *Shaping Phonology* (co-edited with Jackson Lee, 2018), *Sign Languages: A Cambridge Language Survey* (Cambridge University Press, 2010), *A Prosodic Model of Sign Language Phonology* (1998) and *Foreign Vocabulary in Sign Languages: A Cross-linguistic Investigation of Word Formation* (2001).

## KEY TOPICS IN PHONOLOGY

*Key Topics in Phonology* focuses on the main topics of study in phonology today. It consists of accessible yet challenging accounts of the most important issues, concepts and phenomena to consider when examining the sound structure of language. Some topics have been the subject of phonological study for many years and are re-examined in this series in light of new developments in the field; others are issues of growing importance that have not so far been given a sustained treatment. Written by leading experts and designed to bridge the gap between textbooks and primary literature, the books in this series can either be used in courses and seminars, or as one-stop, succinct guides to a particular topic for individual students and researchers. Each book includes useful suggestions for further reading, discussion questions and a helpful glossary.

Already Published in the Series:

*Neutralization* by Daniel Silverman

*Underlying Representations* by Martin Krämer

*Intonation and Prosodic Structure* by Caroline Féry

*Phonological Tone* by Lian-Hee Wee

*Sign Language Phonology* by Diane Brentari

CAMBRIDGE

Cambridge University Press  
978-1-107-11347-3 — Sign Language Phonology  
Diane Brentari  
Frontmatter  
[More Information](#)

---

# Sign Language Phonology

DIANE BRENTARI

University of Chicago



CAMBRIDGE  
UNIVERSITY PRESS

Cambridge University Press  
978-1-107-11347-3 — Sign Language Phonology  
Diane Brentari  
Frontmatter  
[More Information](#)

## CAMBRIDGE UNIVERSITY PRESS

University Printing House, Cambridge CB2 8BS, 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

79 Anson Road, #06-04/06, Singapore 079906

Cambridge University Press is part of the University of Cambridge.

It furthers the University's mission by disseminating knowledge in the pursuit of education, learning, and research at the highest international levels of excellence.

[www.cambridge.org](http://www.cambridge.org)

Information on this title: [www.cambridge.org/9781107113473](http://www.cambridge.org/9781107113473)

DOI: 10.1017/9781316286401

© Diane Brentari 2019

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.

First published 2019

Printed in the United Kingdom by TJ International Ltd. Padstow Cornwall

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

*Library of Congress Cataloging-in-Publication Data*

Names: Brentari, Diane, author.

Title: Sign language phonology / Diane Brentari.

Description: New York, NY : Cambridge University Press, 2019. | Series: Key topics in phonology

Identifiers: LCCN 2019010022 | ISBN 9781107113473 (hardback)

Subjects: LCSH: Sign language. | American Sign Language. | Grammar,

Comparative and general - Phonology. | BISAC: LANGUAGE ARTS & DISCIPLINES / Linguistics / Phonetics & Phonology.

Classification: LCC HV2474 .B724 2019 | DDC 419-dc23

LC record available at <https://lcn.loc.gov/2019010022>

ISBN 978-1-107-11347-3 Hardback

Cambridge University Press 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

<i>List of Figures</i>	<i>page x</i>
<i>List of Tables</i>	<i>xvi</i>
<i>Acknowledgments</i>	<i>xvii</i>
1 Introduction: Sign Language versus Gesture; Sign Language versus Speech	1
1.1 Introduction to the Topics of this Volume	1
1.2 Historical Perspectives on Sign Language Phonology	4
1.3 Sign Language and Gesture	6
1.3.1 Neuroimaging	9
1.3.2 Conventionalization	10
1.4 Sign Language and Speech at the Word Level	11
1.4.1 The Core Lexicon	13
1.4.2 The Spatial Lexicon	31
1.4.3 The Non-native Lexicon: Fingerspelling, Mouthings, and the Foreign Component	35
1.5 New Theoretical Contributions to Sign Language Phonology	39
1.5.1 Optimality Theory	39
1.5.2 Cognitive and Usage-Based Approaches	41
1.6 Summary	42
1.7 Further Reading	42
2 Modality Effects	44
2.1 Why Is Communication Modality So Important?	44
2.2 Signal Differences	46
2.3 Phonetic Differences: Perception	49
2.4 Phonetic Differences: Articulation	52
2.5 Complexity	55
2.5.1 Articulatory Complexity	55
2.5.2 Frequency as Complexity	57

vi		<i>Contents</i>
	2.5.3 Complexity as Expressed by Order of Acquisition	57
	2.5.4 Complexity as Expressed by Phonological Structure	58
	2.6 Prominence: Single versus Multiple Oscillators	58
	2.7 Modality Effects on Phonology	60
	2.7.1 Movements, Segments, Features: How Are They Organized?	60
	2.7.2 Sonority	62
	2.7.3 Sonority, Movement, and Syllable Nuclei	64
	2.7.4 Syllable Weight	70
	2.7.5 Morphophonology and Word Shape	72
	2.8 Summary	74
	2.9 Further Reading	74
3	Iconicity	75
	3.1 Introduction to Central Issues of Iconicity in Sign Languages	75
	3.1.1 Types of Iconicity	78
	3.1.2 Avoiding the “Gesture-Is-Iconic/Language- Is-Not” Trap: Clarifying the Relevant Terms	79
	3.2 Iconicity across the Lexicon	82
	3.2.1 Iconicity in Word Building: Movement and Event Structure	84
	3.2.2 Arbitrary Distribution of Orientation in Iconic Classifier Constructions	87
	3.2.3 The Feature [Stacked] and Iconicity	88
	3.3 Iconicity in the Grammar: Agreement	90
	3.4 Iconicity in Sign Language Processing	94
	3.5 Conclusion	96
	3.6 Further Reading	97
4	Interfaces	99
	4.1 Introduction to Interface Phenomena in Sign Languages	99
	4.2 The Language–Gesture Interface	101
	4.2.1 The <i>Inter</i> -modality Gestural Interface	101
	4.2.2 The <i>Intra</i> -modality Gestural Interface	102
	4.3 Interfaces of Phonology and Other Grammatical Components	106
	4.3.1 Phonetics–Phonology Interface: Constrained Flexibility	107

<i>Contents</i>	vii
4.3.2 Morphology–Phonology Interface	111
4.3.3 Prosodic Units and Sentence/Discourse Meaning	120
4.3.4 Nondominant Hand (H2)-Spread	126
4.4 Conclusion	130
4.5 Further Reading	131
5 The Emergence of Phonology	132
5.1 Introduction to the Issues	132
5.2 Where Do Phonological Features and Phonological Patterns Come From?	138
5.3 Applying Internal Phonological Principles to Emerging Sign Languages	141
5.3.1 The Development of Grammatical Non-manuals and Their Alignment	142
5.3.2 Dispersion and Handshape Morphology within the Phonemic Space	144
5.3.3 Repetition: Loss and Reorganization of Iconicity in Distinguishing Nouns and Verbs	156
5.4 External Pressures on a Phonological System	159
5.4.1 Applying Principles External to the Phonological System in Emerging Sign Languages	160
5.4.2 Are Internal or External Factors More Important in Emerging Phonologies?	162
5.5 Conclusions	164
5.6 Further Reading	165
6 Sign Language Phonological Processing	166
6.1 Introduction	166
6.2 Language Processing of Phonological Units	167
6.2.1 Production Evidence: Slips of the Hand	167
6.2.2 Production Evidence: Tip-of-the-Finger Phenomena	168
6.2.3 Perceptual Evidence: Movement	171
6.2.4 Perceptual Evidence: Handshape	178
6.3 Phonological Processing and Neighborhood Density	186
6.4 Neurological Mapping of Sign Language Phonology	188
6.5 Conclusions	198
6.6 Further Reading	199

viii	<i>Contents</i>
7 Sign Language Acquisition	200
7.1 Introduction	200
7.2 Typical First-Language (L1) Acquisition	203
7.2.1 Iconicity in L1 Acquisition	204
7.2.2 IDS and Iconicity	204
7.2.3 Time Course of L1 Acquisition in ASL Phonology	206
7.2.4 Acquisition of Classifier Handshapes	212
7.2.5 Prosodic Acquisition	213
7.2.6 Acquisition of Fingerspelling	215
7.3 Second-Language (L2) Acquisition	218
7.3.1 L2 Acquisition of Sign Parameters	218
7.3.2 L2 Acquisition and Iconicity	220
7.3.3 Acquisition of Classifier Constructions in L2 Signers	222
7.3.4 Acquisition of Prosody in L2 Signers	222
7.4 The Critical Period for Language Acquisition and the “Phonological Bottleneck”	224
7.5 Connection between Sign Language Phonology and Reading	229
7.5.1 The Use of Spoken and Signed Phonological Codes in Deaf Readers	230
7.5.2 Cross-Modal Activation	234
7.5.3 Phonological Readiness for Reading in Deaf Children	236
7.6 Conclusions	239
7.7 Further Reading	240
8 Sign Language Phonological Variation and Change	241
8.1 Introduction	241
8.1.1 Sources of Data	242
8.1.2 Language Variation, Change, and Emergence	245
8.2 Synchronic Variation	246
8.2.1 Synchronic Variation Based on Linguistic Factors	246
8.2.2 Synchronic Variation Based on Sociolinguistic Factors	249
8.3 Diachronic Change	253
8.3.1 Frishberg’s Contribution	253
8.3.2 Further Developments in ASL Historical Studies	258
8.4 Combining Synchronic and Diachronic Sources	261



<i>Contents</i>	ix
8.5 Conclusions	266
8.6 Further Reading	267
8.7 Further Corpus Information	267
<i>Glossary</i>	269
<i>References</i>	274
<i>Index</i>	318

## Figures

1.1	The two ASL stems <i>THINK</i> (left) and <i>SELF</i> (center), which form the compound <i>THINK^SELF</i>	page 5
1.2	Possible mechanisms that can facilitate conventionalization of the signifier-signified relationship	10
1.3	The three components of a sign language lexicon	12
1.4	Minimal pair contrasts in American Sign Language (ASL) and British Sign Language (BSL)	16
1.5	Confusion matrix of phonological features employed in Lane et al. (1976)	22
1.6	The features and parameters of ASL represented as a flat structure (ca. 1980)	23
1.7	The ASL sign <i>INFORM</i>	24
1.8	Four post-Stokoe models of sign language phonological representation	25
1.9	Hierarchical organization of selected fingers and orientation	28
1.10	Binary branching nodes of the handshape feature structure in the Prosodic model (Brentari, 1998)	29
1.11	Polymorphemic classifier predicate in ASL meaning <i>two-people-hunched-go forward-carefully</i>	32
1.12	The timing of the two hands' articulation in classifier constructions hints at constituent structure	34
1.13	The ASL manual alphabet	36
1.14	The BSL manual alphabet	36
1.15	Partially lexicalized fingerspelled forms in BSL and ASL	37
1.16	Closed and open variants of -E- in ASL fingerspelling	38
2.1	Typical and distalized production of the ASL sign <i>HARD</i>	54
2.2	The joints of the arm that generate movements in sign languages, from largest to smallest with their associated phonological features	59

<i>List of Figures</i>	xi
2.3 The hierarchical organization of movement subtypes in the Prosodic model	61
2.4 Results from Berent et al. (2008) for Korean, showing that a spoken language with no consonant clusters respects the Sonority Sequencing Principle (SSP)	63
2.5 (repeated from Figure 1.1) THINK has a movement when produced as a single sign, but not in the compound THINK^SELF	65
2.6 The full and reduced fingerspelled form in ASL for P-H-O-N-O-L-O-G-Y	66
2.7 Sample stimuli from Berent et al. (2013) with four possible combinations of syllables and morphemes	68
2.8 Results from the four experiments in Berent et al. (2013)	69
2.9 Examples of word structure in the four types of languages, resulting from crossing the number of syllables with the number of morphemes	73
3.1 The distinctive use of the [direction] feature in the ASL minimal pair TEND and BE-MOVED/TOUCHED	81
3.2 Telic and atelic verbs according to the Event Visibility Hypothesis (Wilbur, 2010) and their schematic phonological representations	85
3.3 Distribution of phonological and morphological uses of orientation in ASL classifier predicates	88
3.4 Examples of [stacked] handshapes in the three components of the ASL lexicon	90
3.5 Examples of morphological use of the [direction] feature in ASL	91
3.6 Examples of the phonological expression of verb agreement in ASL	92
3.7 Sample stimuli from Bosworth & Emmorey (2010) showing semantically related iconic, semantically related non-iconic, and unrelated non-iconic ASL signs	96
3.8 Possible mechanisms that can facilitate conventionalization of the signifier–signified relationships	97
4.1 Three forms of UNDERSTAND: the citation form, UNDERSTAND-A-LITTLE, and UNDO–UNDERSTANDING utilizing phonemic features of the handshape	103
4.2 Handshapes in core, foreign, and spatial vocabulary to investigate phonetic preferences	108
4.3 The [stacked] feature used allophonically in the ASL “core” sign SEE	109

xii	<i>List of Figures</i>
4.4 Flexion of the metacarpal joint used allophonically in two ASL classifier forms: <i>person move away</i> and <i>person come towards</i>	110
4.5 Examples of different forms of Prosodic words in ASL	115
4.6 The ASL sentence BOY SAY YOU MY FRIEND without and with a point-of-view predicate	118
4.7 Changes in the non-manual markers between the two I-phrases in a conditional phrase of Israeli Sign Language	124
4.8 The progressive spread of the nondominant hand in a phonological phrase in ASL	127
4.9 The progressive spread of the nondominant hand in two parenthetical phrases in ASL	128
4.10 The proportion of H2-Spread in conversation and in narratives in Sign Language of the Netherlands	129
5.1 Descriptions of motion and location events by an American gesturer and a signer of ASL	133
5.2 Examples of object handshapes and handling handshapes	146
5.3 Feature organization for joints and selected fingers within the Handshape structure of the Prosodic model	146
5.4 Handshapes with low, medium, and high joint complexity within the Handshape structure of the Prosodic model	147
5.5 Handshapes with low, medium, and high selected finger complexity within the Handshape structure of the Prosodic model	147
5.6 Examples of low-, medium-, and high-complexity handshapes for joints and selected fingers	148
5.7 Examples of vignettes used to elicit object handshapes (left) and handling handshapes (right)	149
5.8 Average overall complexity across adult study groups in Nicaragua	150
5.9 Joint and selected finger complexity across signers and gesturers in the United States, China, Italy, and Nicaragua	152
5.10 Selected finger complexity in adult signers, homesigners, and gesturers	154
5.11 Average finger group complexity for a single Nicaraguan child at five time points	154
5.12 Comparison of NSL1, NSL 2, and NSL3 signers on the four types of devices used to express the noun-verb distinction	157
5.13 Comparison of homesigners on the four types of devices used to express the noun-verb distinction	158

<i>List of Figures</i>	xiii
5.14 Two variants of DOG and one family's form of EGG in Al-Sayyid Bedouin Sign Language	161
6.1 A slip of the hand in German Sign Language involving regressive assimilation of the whole handshape	170
6.2 A slip of the hand in ASL involving regressive assimilation of the selected fingers	170
6.3 Perceptual salience judgments from signers and non-signers for lexical and morphological movements	174
6.4 Example stimuli of Berent et al. (2016)	177
6.5 The two parts of an ideal categorical perception result	179
6.6 Handshape intervals for a phonemic and allophonic handshape pair in ASL	181
6.7 Example stimuli from Best et al. (2010) with intervals for a spread and unspread handshape (pseudosigns)	182
6.8 Sample stimuli from the animated video stimuli used in Morford et al. (2008) with intervals for a phonemic handshape pair in ASL	182
6.9 Sample stimuli from McCullough and Emmorey (2009) showing intervals for ASL grammatical and affective facial expressions	183
6.10 Example stimulus handshapes and signs used in Eccarius (2008) for flat and round handshapes	185
6.11 Regions in the left hemisphere attributed to language processing	190
6.12 Phonemic substitutions in selected finger specifications for handshapes produced by an aphasic ASL signer	192
6.13 Example stimuli from MacSweeney et al. (2004) showing sequences of complex forms in a nonlinguistic system ("TicTac") and British Sign Language (BSL)	194
6.14 Stimuli from the three tasks in MacSweeney et al. (2008) to assess phonological processing in BSL	195
7.1 Low- and high-frequency cyclical movements in sign- and speech-exposed infants	207
7.2 Error rates on the three manual parameters of signs in four deaf children of deaf parents	209
7.3 Stages of handshape acquisition	211
7.4 Recall of fingerspelled English words in deaf readers when similarity/dissimilarity was based on spoken English or on the manual form of the fingerspelled word	217
7.5 Mean frequency of proximalization versus distalization of movement in the imitation of single- and	

xiv		<i>List of Figures</i>
	multiple-jointed ASL signs in deaf and hearing L2 learners	219
7.6	The interaction between iconicity and complexity in L2 BSL production	221
7.7	Schema of the hypotheses considered in Brentari et al. (2012b) regarding the prosodic patterns of L1 deaf, L1 hearing, and L2 hearing ASL signers	223
7.8	Evidence for the “phonological bottleneck.” Effects of late L1 acquisition showing that as age of acquisition of an L1 increases, the number of phonological errors increases, and semantic errors decrease	227
7.9	Mean phonological and semantic priming effects for ASL sign recognition as a function of age of acquisition	228
7.10	Sample items from the phoneme judgment task and phoneme manipulation task reported in Hirshorn et al. (2015)	232
8.1	Variants of the ASL sign ANGRY showing historical change from a one- to a two-handed variant and then back to a one-handed variant again	245
8.2	The ASL sentence translated into English as <i>I cook</i> articulated in citation form and with regressive assimilation	247
8.3	The ASL sign DEAF in citation form and in two non-citation variants	248
8.4	The ASL sign KNOW in citation form and in a non-citation variant after undergoing the phonological rule of displacement	249
8.5	The grid used in McCaskill et al. (2011) to determine if a sign was produced in “typical” signing space or in a larger signing space, illustrated by two variants of the ASL sign LIGHT	250
8.6	The ASL sign QUIET in citation form and after undergoing the phonological rule of Weak Drop	251
8.7	Normalized pairwise variability index plotted for Sign Variety ((m)ainstream, (b)lack), Age (older (squares), younger (circles)), and Gender ((m)ale, (f)emale) for twenty-three individuals	252
8.8	Phonological changes from Old French Sign Language (O-FSL) to Modern ASL (ca. 1965) showing a move towards concentration of lexical information on the hands in the sign COMPARE	255

<i>List of Figures</i>	xv
8.9 Phonological changes from Old French Sign Language (O-FSL) to Modern ASL (ca. 1965) showing displacement toward the midline in the ASL sign <i>HELP</i> (top) and <i>SWEETHEART</i> (bottom)	256
8.10 A Type 3, Type 2, and Type 1 two-handed version of the ASL sign <i>WHISKEY</i>	257
8.11 (repeated from Figure 1.1) The two ASL stems <i>THINK</i> (left) and <i>SELF</i> (center), which form the compound <i>THINK^SELF</i> translated as <i>decide for oneself</i> (right). The compound (right) has two morphemes but just one syllable, just one movement	258
8.12 Three historical variants of the ASL sign <i>WHO</i>	259
8.13 Historically related ASL signs (left) <i>WHICH</i> , <i>WITH</i> , and <i>BOSS/CHIEF</i>	260
8.14 The ASL sign <i>FULL</i> and Italian Sign Language sign <i>BOTTLE</i> . Both signs have undergone phonological change, whereby both hands move in a symmetrical fashion	264
8.15 Form of the sign <i>BIRTHDAY</i> used by older and younger signers of LIS	264
8.16 Form of <i>SIGN LANGUAGE</i> used by older and younger signers of Italian Sign Language (LIS) showing a change to a relatively more marked handshape	265

## Tables

2.1 Differences between signed and spoken languages at the level of the signal, phonetic system, and phonological system	<i>page 46</i>
4.1 Differences between affective and grammatical facial expressions	105
4.2 Morpho-syntactic and corresponding prosodic units	107
4.3 The distribution of the number of morae in core lexical stems of FinSL	113
5.1 Narrative by one of the first users of Al-Sayyid Bedouin Sign Language (ABSL; cf. Sandler et al., 2011b)	142
5.2 Narrative by one of the two older signers of ABSL (cf. Sandler et al., 2011b)	143
5.3 Narrative by one of the two younger signers of ABSL (cf. Sandler et al., 2011b)	144
6.1 Comparison of signed and spoken language “slips” in German Sign Language and German	169
7.1 Sample sentence pairs for the discrimination task reported in Boechner et al. (2011)	220



## Acknowledgments

I would like to thank my colleagues who provided support while I was preparing this manuscript by reading chapters or helping with the manuscript preparation itself (in alphabetical order): Iris Berent, Rain Bosworth, Marie Coppola, Karen Emmorey, Jordan Fenlon, Laura Horton, Aurora Martinez del Rio, Kathryn Montemurro, and Gary Morgan. Also, special thanks to my sign language phonology seminar in the fall of 2018 that helped me iron out the final kinks of the text and to Petra Eccarius who assisted with excellent comments, as well as editorial and logistical help. All of you helped to make the text clearer and more readable. All of the mistakes are my own.

I'd like to acknowledge my funding sources that helped support this work over the years from NSF grants 0112391, 0547554, 1227908, and 1400998. I would also like to thank the Center for Gesture Sign and Language at the University of Chicago, particularly my co-directors Susan Goldin-Meadow and Anastasia Giannakidou, for the most stimulating group of colleagues and students one could ever hope for.

I am extremely grateful to Susan Elizabeth Rangel and David Reinhart for being the sign language models for the original photos in this book, and to Andrew Gabel, Rita Mowl, Drucilla Ronchen, and Robin Shay for their help and advice on many issues concerning ASL and the Deaf community. And a big thank you also goes to all of the deaf and hearing people – too numerous to name – who helped with this research over these last twenty years in Nicaragua, Italy, the United Kingdom, Hong Kong, and many other sites. Without your patience and generosity, this work would not be possible.

And, always, thank you to my husband and conversation partner in all things, Arnold I. Davidson, who is a constant reminder of not only how important the life of the mind is but also how important it is to have someone with whom to share it.

Cambridge University Press  
978-1-107-11347-3 — Sign Language Phonology  
Diane Brentari  
Frontmatter  
[More Information](#)

---