

Copyright

by

Kathryn Mesh

2017

The Dissertation Committee for Kathryn Mesh  
certifies that this is the approved version of the following dissertation:

**Points of Comparison: What Indicating Gestures tell  
Us About the Origins of Signs in San Juan Quiahije  
Chatino Sign Language**

**Committee:**

---

David Quinto-Pozos, Supervisor

---

Richard P. Meier

---

Hilaria Cruz

---

Angela Nonaka

---

Jürgen Streeck

---

Danny Law

**Points of Comparison: What Indicating Gestures tell  
Us About the Origins of Signs in San Juan Quiahije  
Chatino Sign Language**

by

**Kathryn Mesh**

**Dissertation**

Presented to the Faculty of the Graduate School of

The University of Texas at Austin

in Partial Fulfillment

of the Requirements

for the Degree of

**Doctor of Philosophy**

**The University of Texas at Austin**

August 2017

## Acknowledgments

Agradezco a la gente chatina su apoyo con mi investigación en el municipio de Quiahije. Gracias, Hilaria y Emiliana Cruz, por invitarme a realizar investigaciones sobre el idioma que hablan, investigan y avalan. Doy las gracias a los participantes en mis estudios, especialmente a los consultores sordos Sendo, Koyu, Stina, Gina y Stin y sus familias: ustedes compartieron conmigo su idioma y me hicieron sentir bienvenida en sus hogares. También agradezco a las autoridades de San Juan Quiahije y Cieneguilla por apoyar este trabajo y aclararlo a la comunidad. Doy las gracias especialmente a: mis anfitrionas en Cieneguilla, Manuela Jiménez, María Lorenzo Cruz y Veronica Jiménez; los entrevistadores para mi proyecto, María Lorenzo Cruz y Tomás Cruz Cruz; y el transcriptor del proyecto, Kevin Cruz Cruz. Agradezco por ultimo a Isabel Cruz y Jorge (Nico) Sánchez por la compañía, las lecciones de idioma y la conducción experta entre la ciudad de Oaxaca y Quiahije.

This dissertation benefitted greatly from the perspectives of my committee members. David, I am grateful for your unfailing ability to pose questions that I find compelling, and that have led me to the projects I pursue. Thank you for your patience and support throughout the process of turning an absorbing question into a dissertation project. Richard, thank you for showing interest at every stage in the details of the work. I have come to rely on your curiosity and company as I chip away at an emerging concept: I look forward to continuing many of our ongoing conversations. Hilaria, your role in my academic life defies a short description: you introduced me to the community where you were born and to the language that you

speak and study; you designed spoken Chatino tutorials to support my fieldwork; you reviewed the collected films and consistently supplied insight into the language use within them. I am so grateful for all of these things. Angela, you taught me to look at language use in context, and to look carefully and persistently: thank you for this lesson, and for becoming my friend as well as my mentor. Jürgen, you have been a source of insight and great encouragement, and you have helped me to not shy away from investigating the stuff of human interactive behavior, noisy though its patterns may be. Danny, I have benefitted from your calm and clarifying comments when those noisy patterns of naturalistic data tested my composure. Thank you both. To Tony Woodbury: you have been an invaluable mentor from the outset of my research on SJQCSL. Thank you for your persistent encouragement to investigate the *speech* component of co-speech gesture in its own right.

I owe an enormous debt of gratitude to my research partner, Lynn Hou. For your keen eye, and your companionship in the field, I am grateful. My thanks also goes to the members of the Chatino Language Documentation Project: Hilaria Cruz, Emiliana Cruz, Eric Campbell, Stéphanie Villard, Justin McIntosh, and especially Ryan Sullivant for meticulous and reliably helpful feedback.

This dissertation is brimming with statistical models that I could not have run without the expertise and persistence of Sally Ragsdale in UT's Department of Statistics and Data Sciences. I am so very grateful to you, Sally, and to Cindy Blanco and Michael Mahometa for statistical consultation. I also benefitted from the expertise of people who can model the world and/or query the modelers. Thank you, Morgan Erhardt and Jessica Trelogan, for lending your map-making skills, and Karl Pichotta for writing a Python script to query the Google Maps API.

I am grateful to the graduate student members of UT Signed Language Lab for many years of productive conversation: Lynn Hou, Elena Liskova, Leah Geer, Ryan Fan, Grace Neveu, Justin Power, Frances Cooley, and Dag Lindeberg; and

to the undergraduate students in the lab who assisted with video annotation and mapping tasks: Roxanne Zech, Marcus Martinez, Alexis Suarez, and Phoebe Minz.

I thank Marianne Gullberg and Niclas Burenhult for help in envisioning a future for my research on indicating gestures and demonstrative expressions, and Mandana Seyfeddinipur, Marie Coppola, Olivier le Guen, Josefina Safar, and Laura Horton for practical and professional advice about researching signed language emergence in Latin America.

I could not have completed a Ph.D. without the support of my family and a set of very close friends. Mom, Dad, and Aaron, thank you for your unquestioned love and support and your encouraging calls during my fieldwork. Much love and thanks to the Harrison family, starting with Amelia, who made me feel that I had a family in Texas. To Hannah Alpert-Abrams: thank you for being my peer and model, my occasional proofreader, and my very dear friend. Dan Garrette, Sarah Welsh, Rebecca Morrison, Samuel Chu and Abi Mack: thank you for brightening my time in Austin. Addy Brown and Abe Louise Young: I am profoundly grateful for you, my chosen family.

This work was supported in part by a grant from the Endangered Language Documentation Programme (SG0186, co-PI: Lynn Y.-S. Hou), an E.D. Farmer International Fellowship from the Teresa Lozano Long Institute of Latin American Studies at the University of Texas at Austin, and a Carlota Smith Memorial Fellowship from the Linguistics Department at the University of Texas at Austin.

KATHRYN MESH

*The University of Texas at Austin*  
*August 2017*

**Abstract**

## **Points of Comparison**

Kathryn Mesh, Ph.D.

The University of Texas at Austin, 2017

Supervisor: David Quinto-Pozos

New languages emerge under rare conditions, when deaf children who cannot access the vocal-auditory language(s) used around them invent visual-manual communication systems of their own. Such *homesign* or *family sign* systems have simple structures but nevertheless show the hallmarks of language, including a stable lexicon of signs composed of meaningful, recombinable elements. Prior research has found that many of these elements are invented by signers, though some are adapted from the gestural input received from hearing interlocutors. The current project returns to this claim, examining the influence of gestures on the structure of two emerging family sign languages used in a rural, indigenous community in Oaxaca, Mexico. It focuses on foundational, visually accessible ‘indicating gestures’ such as pointing that direct the addressee’s attention to a region in physical space.

Three linked studies were performed to investigate whether indicating gestures have internal structure that is accessible to deaf signers, and whether such structure is incorporated into their emerging languages. In the first, the spontaneous, speech-linked indicating gestures of hearing people were examined for internal structure. They were found to comprise three recombinable elements that, through systematic modulations in form, convey information about the direction and distance of targets. A second study looked for a relationship between the form of indicating gestures and the features of the speech that accompanies them. No such relationship was found, suggesting that the meaningful modulation of the gesture features occurs independently from speech. The final study compared the forms and meanings of two deaf signers' indicating gestures with those of the hearing participants. Signers were found to use the direction and elbow height features, but not the handshape features, from the conventional indicating system.

These findings reveal that indicating gestures, often described as holistic, non-composite signals, in fact exhibit an internal structure that can be incorporated into an emerging signed language. Interestingly, they also reveal that not all features of gestures—even ones that exhibit clear patterning—will be adopted by signers, perhaps because gesture features must be both systematically patterned and transparently visually meaningful for signers to interpret them as meaningful.



# Table of Contents

|  |             |
|--|-------------|
| <b>List of Tables</b>  | <b>xiii</b> |
| <b>List of Figures</b>   | <b>xiv</b>  |
| <b>Chapter 1 Introduction</b>  | <b>1</b>    |
| <b>Chapter 2 Reconsidering Input to Home and Family</b>                  |             |
| <b>Sign Languages</b>  | <b>6</b>    |
| 2.1 Overview . . . . .   | 6           |
| 2.2 Home and family sign languages: an introduction . . . . .            | 6           |
| 2.3 Gestural input to home and family sign languages . . . . .           | 8           |
| 2.3.1 Syntactic input . . . . .  | 10          |
| 2.3.2 Morphological input . . . . .                                      | 12          |
| 2.3.3 Summary . . . . .  | 14          |
| 2.3.4 Indicating gestures as morphological input . . . . .               | 15          |
| 2.4 The current project . . . . .  | 16          |
| 2.5 Conclusion . . . . .   | 17          |
| <b>Chapter 3 Introduction to the Research Site</b>                       | <b>18</b>   |
| 3.1 Overview . . . . .   | 18          |
| 3.2 Introduction . . . . .   | 18          |
| 3.3 Setting the scene: the Chatino people of San Juan Quiahije . . . . . | 20          |
| 3.3.1 The Chatino people and language . . . . .                          | 20          |
| 3.3.2 The San Juan Quiahije municipality . . . . .                       | 22          |
| 3.3.3 Quiahije and its neighbors . . . . .                               | 28          |
| 3.4 Deafness and sign language emergence in Quiahije . . . . .           | 31          |
| 3.5 Fieldwork in Quiahije . . . . .                                      | 33          |

|   |  |           |
|---|--|-----------|
| 3.6   | Conclusion . . . . .   | 36        |
| <b>Chapter 4 Study 1: Indicating Gestures in San Juan Quiahije</b>  |  | <b>37</b> |
| 4.1   | Overview . . . . .   | 37        |
| 4.2   | Two indicating scenes . . . . .                                    | 38        |
| 4.3   | A functional definition of indicating gestures . . . . .           | 42        |
| 4.4   | Indicating gestures map information to distinct features . . . . . | 45        |
| 4.4.1   | Gesture direction conveys target direction . . . . .               | 46        |
| 4.4.2   | Gesture height conveys target distance . . . . .                   | 47        |
| 4.4.3   | Gesture height conveys target altitude . . . . .                   | 48        |
| 4.4.4   | Gesture handshape conveys target distance/localizability . . . . . | 50        |
| 4.4.5   | Effects of hand dominance . . . . .                                | 51        |
| 4.5   | A study of indicating gestures in San Juan Quiahije . . . . .      | 52        |
| 4.5.1   | Data & Analysis . . . . .  | 53        |
| 4.5.1.1   | Data . . . . .   | 53        |
| 4.5.1.2   | Participants . . . . .   | 53        |
| 4.5.1.3   | Materials and procedure . . . . .                                  | 54        |
| 4.5.1.4   | Equipment and software . . . . .                                   | 56        |
| 4.5.1.5   | Data selection . . . . .   | 56        |
| 4.5.1.6   | Transcription and translation . . . . .                            | 56        |
| 4.5.1.7   | Gesture coding . . . . .   | 57        |
| 4.5.1.8   | Identifying targets of indicating gestures . . . . .               | 59        |
| 4.5.1.9   | Geospatial coding . . . . .  | 59        |
| 4.5.1.10  | Experimental design and statistical analysis . . . . .             | 60        |
| 4.5.2   | Results . . . . .  | 61        |
| 4.5.2.1   | Introduction to the study results . . . . .                        | 61        |
| 4.5.2.2   | Direction . . . . .  | 64        |
| 4.5.2.3   | Elbow height . . . . .   | 65        |
| 4.5.2.4   | Handshape . . . . .  | 71        |
| 4.5.2.5   | Discussion . . . . .   | 76        |
| 4.6   | Conclusion . . . . .   | 80        |
| <b>Chapter 5 Study 2: Multimodal Reference in San Juan Quiahije</b> |  | <b>82</b> |
| 5.1   | Overview . . . . .   | 82        |

|         |  |     |
|---------|--|-----|
| 5.2     | Two indicating scenes, revisited . . . . .                       | 83  |
| 5.3     | Gesture and speech in multimodal referring acts . . . . .        | 85  |
| 5.3.1   | How gesture and speech establish a ground . . . . .              | 87  |
| 5.3.2   | How gesture and speech establish a figure . . . . .              | 90  |
| 5.3.3   | Might gesture forms reflect features of linked speech? . . . . . | 92  |
| 5.3.4   | Summary and connection to the current research . . . . .         | 93  |
| 5.4     | A study of multimodal reference in San Juan Quiahije . . . . .   | 93  |
| 5.4.1   | Data and analysis . . . . .                                      | 94  |
| 5.4.1.1 | Local environment interviews . . . . .                           | 95  |
| 5.4.1.2 | Metalinguistic interviews . . . . .                              | 96  |
| 5.4.2   | Results . . . . .  | 97  |
| 5.4.2.1 | Introduction to the study results . . . . .                      | 97  |
| 5.4.2.2 | Relationship between speech and gesture forms . . . . .          | 99  |
| 5.4.2.3 | Demonstrative expressions with indicating gestures . . . . .     | 101 |
| 5.4.2.4 | Direction expressions with indicating gestures . . . . .         | 108 |
| 5.4.2.5 | Descriptive expressions with indicating gestures . . . . .       | 115 |
| 5.4.3   | Discussion . . . . .   | 119 |
| 5.5     | Conclusion . . . . .   | 121 |

**Chapter 6 Study 3: Indicating Signs in SJQCSL 123**

|         |   |     |
|---------|---|-----|
| 6.1     | Overview . . . . .  | 123 |
| 6.2     | Indicating scenes in a developing signed language . . . . . | 124 |
| 6.3     | Indicating in signed languages . . . . .                    | 128 |
| 6.4     | Introduction to the focal deaf signers . . . . .            | 131 |
| 6.5     | A study of indicating signs in SJQCSL . . . . .             | 137 |
| 6.5.1   | Methods . . . . .   | 137 |
| 6.5.1.1 | Participants. . . . .                                       | 137 |
| 6.5.1.2 | Materials and procedure . . . . .                           | 138 |
| 6.5.1.3 | Equipment and software . . . . .                            | 138 |
| 6.5.1.4 | Data selection . . . . .                                    | 138 |
| 6.5.1.5 | Glossing signed language . . . . .                          | 139 |
| 6.5.1.6 | Coding indicating signs . . . . .                           | 139 |
| 6.5.1.7 | Identifying referents of indicating gestures . . . . .      | 140 |
| 6.5.1.8 | Geospatial coding . . . . .                                 | 140 |

|                             |  |            |
|-----------------------------|--|------------|
| 6.5.1.9                     | Experimental design and statistical analysis . . . . .   | 140        |
| 6.5.2                       | Results . . . . .  | 140        |
| 6.5.2.1                     | Results: Koyu . . . . .  | 141        |
| 6.5.2.2                     | Results: Sendo . . . . .   | 155        |
| 6.5.3                       | Adopting an available system: what components of the ambi-<br>ent indicating gesture system are present in the signers' indi-<br>cating signs? . . . . . | 167        |
| 6.5.4                       | Adapting while adopting: how signers changed the Quiahije<br>indicating system . . . . .   | 170        |
| 6.6                         | Conclusion . . . . .   | 178        |
| <b>Chapter 7 Conclusion</b> |  | <b>180</b> |
| 7.1                         | Overview . . . . .   | 180        |
| 7.2                         | General discussion and research directions . . . . .   | 180        |
| 7.3                         | Conclusion . . . . .   | 185        |
| <b>Appendices</b>           |  | <b>186</b> |
| A:                          | Abbreviations . . . . .  | 186        |
| B:                          | Interview Codes . . . . .  | 187        |
| C:                          | Script for Local Environment Interviews . . . . .  | 188        |
| D:                          | Photo stimuli for Local Environment Interviews . . . . .   | 197        |
| <b>Bibliography</b>         |  | <b>214</b> |
| <b>Vita</b>                 |  | <b>228</b> |

## List of Tables

|            |   |     |
|------------|---|-----|
| Table 3.1  | SJQ phonological tones . . . . .                            | 21  |
| Table 3.2  | A selection of trade centers in and outside of Quiahije . . | 30  |
| Table 4.1  | Interview participant demographics . . . . .                | 55  |
| Table 4.2  | Handshape, elbow height codes . . . . .                     | 58  |
| Table 4.3  | Total of indicating gestures, reflecting hand dominance .   | 63  |
| Table 4.4  | Distance categories for statistical analysis . . . . .      | 64  |
| Table 4.5  | Analysis: distance and altitude effects on EH . . . . .     | 66  |
| Table 4.6  | Analysis: effects of distance, gest. type on EH . . . . .   | 67  |
| Table 4.7  | Analysis: distance and hand dom. effects on EH . . . . .    | 69  |
| Table 4.8  | Analysis: distance and altitude effects on HS . . . . .     | 72  |
| Table 4.9  | Analysis: effects of distance and gest. type on HS . . . .  | 74  |
| Table 4.10 | Analysis: effects of distance, hand dom. on HS . . . . .    | 76  |
| Table 5.1  | The demonstrative expressions of SJQ . . . . .              | 102 |
| Table 5.2  | A sample of place names from E. Cruz (2017) . . . . .       | 116 |
| Table 6.1  | Indicating signs produced in the LEI task: Koyu . . . . .   | 142 |
| Table 6.2  | Analysis: effects of distance and altitude on EH, Koyu . .  | 145 |
| Table 6.3  | Analysis: effect of altitude on EH, Koyu . . . . .          | 145 |
| Table 6.4  | Analysis: effects of distance, gest. type on EH, Koyu . .   | 147 |
| Table 6.5  | Analysis: effects of distance and hand dom. on EH, Koyu     | 150 |
| Table 6.6  | HS by gesture type: Koyu . . . . .                          | 151 |
| Table 6.7  | Indicating signs produced in the LEI task: Sendo . . . . .  | 156 |
| Table 6.8  | Analysis: effects of distance, altitude on EH, Sendo . . .  | 158 |
| Table 6.9  | Analysis: effects of distance, gest. type on EH, Sendo . .  | 161 |
| Table 6.10 | Analysis: effects of distance, repetition on EH, Sendo . .  | 162 |
| Table 6.11 | Handshapes by Gesture Type: Sendo . . . . .                 | 162 |

## List of Figures

|             |   |    |
|-------------|---|----|
| Figure 3.1  | San Juan and Cieneguilla . . . . .                        | 25 |
| Figure 3.2  | San Juan and Cieneguilla, viewed from San Juan . . . . .  | 26 |
| Figure 3.3  | Dirt roads and walking trails . . . . .                   | 26 |
| Figure 3.4  | The town of San Juan. . . . .                             | 27 |
| Figure 3.5  | Cieneguilla Catholic church, town hall building . . . . . | 27 |
| Figure 3.6  | The municipality and trade destinations . . . . .         | 29 |
| Figure 4.1  | ‘That one or this one’ . . . . .                          | 40 |
| Figure 4.2  | ‘And also towards Ash Mountain here...’ . . . . .         | 40 |
| Figure 4.3  | ‘Along the road towards here...’ . . . . .                | 41 |
| Figure 4.4  | An uninflected <i>go</i> gesture . . . . .                | 44 |
| Figure 4.5  | A <i>go</i> gesture with a displaced endpoint . . . . .   | 44 |
| Figure 4.6  | Three height distinctions in Arrernte pointing . . . . .  | 49 |
| Figure 4.7  | Distal locative point in Kata Kolok . . . . .             | 49 |
| Figure 4.8  | Elbow height categories . . . . .                         | 58 |
| Figure 4.9  | Handshape categories . . . . .                            | 59 |
| Figure 4.10 | EH by distance: all IGs . . . . .                         | 66 |
| Figure 4.11 | EH by distance: points . . . . .                          | 68 |
| Figure 4.12 | EH by distance: <i>go</i> gestures . . . . .              | 68 |
| Figure 4.13 | EH by distance: dom. hand . . . . .                       | 70 |
| Figure 4.14 | EH by distance: non-dom. hand . . . . .                   | 70 |
| Figure 4.15 | HS by distance: all IGs . . . . .                         | 71 |
| Figure 4.16 | HS by distance: points . . . . .                          | 73 |
| Figure 4.17 | HS by distance: <i>go</i> gestures . . . . .              | 73 |
| Figure 4.18 | HS by distance: dom. hand . . . . .                       | 75 |
| Figure 4.19 | HS by distance: non-dom. hand . . . . .                   | 75 |
| Figure 5.1  | Proportion of MRAs containing each exp. type . . . . .    | 98 |

|             |  |     |
|-------------|--|-----|
| Figure 5.2  | Distribution of EH features w/ expressions of 3 types . . .        | 100 |
| Figure 5.3  | Distribution of HS features w/ expressions of 3 types . . .        | 100 |
| Figure 5.4  | Demonstrative choice by distance category . . . . .                | 105 |
| Figure 5.5  | Slope-based direction axes in Cieneguilla & San Juan . . .         | 110 |
| Figure 6.1  | Koyu indicates near and far locations . . . . .                    | 126 |
| Figure 6.2  | Sendo indicates near and far locations . . . . .                   | 127 |
| Figure 6.3  | Grammaticalization path for pointing gestures . . . . .            | 129 |
| Figure 6.4  | Two deaf siblings: Koyu and his sister . . . . .                   | 133 |
| Figure 6.5  | Koyu with his wife and daughter . . . . .                          | 133 |
| Figure 6.6  | Sendo with his daughter . . . . .                                  | 135 |
| Figure 6.7  | EH by distance: all IGs, Koyu . . . . .                            | 143 |
| Figure 6.8  | EH by distance: all IGs, hearing participants . . . . .            | 143 |
| Figure 6.9  | EH by altitude for targets in Quiahije: Koyu . . . . .             | 144 |
| Figure 6.10 | EH by distance: points, Koyu . . . . .                             | 146 |
| Figure 6.11 | EH by distance: points, hearing participants . . . . .             | 147 |
| Figure 6.12 | EH by distance: <i>go</i> signs, Koyu . . . . .                    | 148 |
| Figure 6.13 | EH by distance: <i>go</i> gestures, hearing participants . . . . . | 148 |
| Figure 6.14 | HS by distance: all indicating signs, Koyu . . . . .               | 152 |
| Figure 6.15 | HS by distance: all IGs, hearing participants . . . . .            | 152 |
| Figure 6.16 | HS by distance: points, Koyu . . . . .                             | 153 |
| Figure 6.17 | HS by distance: points, hearing participants . . . . .             | 153 |
| Figure 6.18 | HS by distance: <i>go</i> , Koyu . . . . .                         | 154 |
| Figure 6.19 | HS by distance: <i>go</i> , hearing participants . . . . .         | 154 |
| Figure 6.20 | EH by distance: all indicating signs, Sendo . . . . .              | 157 |
| Figure 6.21 | EH by distance: all IGs, hearing participants . . . . .            | 157 |
| Figure 6.22 | EH by distance: points, Sendo . . . . .                            | 159 |
| Figure 6.23 | EH by distance: points, hearing participants . . . . .             | 159 |
| Figure 6.24 | EH by distance: <i>go</i> signs, Sendo . . . . .                   | 160 |
| Figure 6.25 | EH by distance: <i>go</i> gestures, hearing participants . . . . . | 160 |
| Figure 6.26 | HS by distance: all indicating signs, Sendo . . . . .              | 164 |
| Figure 6.27 | HS by distance: all IGs, hearing participants . . . . .            | 164 |
| Figure 6.28 | HS by distance: points, Sendo . . . . .                            | 165 |
| Figure 6.29 | HS by distance: points, hearing participants . . . . .             | 165 |
| Figure 6.30 | HS by distance category: <i>go</i> , Sendo . . . . .               | 166 |

|             |   |     |
|-------------|---|-----|
| Figure 6.31 | HS by distance category: <i>go</i> , hearing participants . . . . | 166 |
| Figure 6.32 | Koyu: ‘there, (it’s a) school, there’ . . . . .                   | 171 |
| Figure 6.33 | Sendo: ‘there, a road, there (is what is pictured) here’ .        | 173 |
| Figure 6.34 | Sendo: ‘there’ . . . . .  | 173 |
| Figure 6.35 | ‘Bryan, Juve, Alma, (who is in the) north’ . . . . .              | 174 |
| Figure 6.36 | ‘Go on the road, it’s to that side of it. . .’ . . . . .          | 177 |
| Figure 6.37 | ‘A graveyard, it’s there, the road leads up like this. . .’ .     | 177 |



# Chapter 1

## Introduction

New languages emerge under rare conditions: when people with a need to communicate have no access to an existing natural language, they must create one of their own. These conditions hold for some deaf people in the world who cannot access the vocal-auditory language(s) used around them and do not have access to a local signed language. Deaf people in these circumstances are linguistically isolated, but no less social beings than their hearing counterparts: they require a communicative system to convey the variety of messages—requests, complaints, instructions, observations, questions, endearments, and more—that are the substance of interpersonal communication. Out of necessity, then, deaf people in these circumstances invent visual-manual communication systems to meet their needs. Such systems have been called *homesign systems*, *family sign systems*, and *family sign languages* depending on the social and demographic circumstances of their users (Frishberg, 1987; Goldin-Meadow, 2013; Osugi and Webb, 1999; for a discussion of the use of these terms see Hou, 2016, as well as Chapter 2 of this dissertation). These early linguistic systems may give rise to more elaborate signed languages if they are transmitted across multiple generations of signers (Kegl, Senghas, & Coppola, 1999; Nyst, 2012; Senghas, 2005). At their earliest stages, however, they are created and maintained by one or more deaf people without access to input in a developed signed language.

In this dissertation, the term ‘home/family sign language’ will be used to characterize the languages created by signers who lack access to a developed visual-manual language model. Following Hou (2016), the word ‘language’ will be used throughout, reflecting the fact that no definitive line between a complex communicative system and a ‘full-fledged language’ has been successfully drawn in the literature on signed language emergence. Some human communicative systems are

greatly more complex than others, yet all employ some combination of developed conventions and contextual cues to relay the speaker/signer's chosen messages.

Home/family sign languages are among the communicative systems with the simplest structures, yet they nevertheless show the hallmarks of language, including a stable lexicon of signs composed of meaningful, recombinable elements (Goldin-Meadow, Mylander, & Butcher, 1995; Goldin-Meadow, Mylander, & Franklin, 2007) and a systematic approach to combining multiple signs using a hierarchical structure (Coppola & Newport, 2005; Goldin-Meadow & Mylander, 1983, 1984). When a home/family sign language is transmitted to a new generation of learners, its structures are quickly elaborated, a fact that suggests that the precursors of more complex grammar are present at the earliest stages of the language's emergence (So, Coppola, Licciardello, & Goldin-Meadow, 2005).

Because home/family signers invent their languages without access to a conventional language model, their creations have been said to shed light on the linguistic capacities of the the human mind. Researchers have suggested that the use and organization of home/family sign languages may tell us whether language is innate in humans (Goldin-Meadow, 2006) or, at the very least, help us understand the biases that humans bring to the input that they receive, affecting how they perceive and generalize patterns (Goldin-Meadow, 2007; Morford & Kegl, 2009; Newport, 1999; Singleton & Newport, 2004).

To pursue these questions, researchers have performed systematic comparisons of the signs produced by deaf home/family signers with the gestures they likely received as input from hearing speaker-gesturers. Much of this work has centered on the meaningful combination of signs, and has shown that home/family signers reliably organize their signs using syntactic patterns their hearing interlocutors do not model for them. These same researchers have also looked for the precursors to signs' internal structure (i.e., looked for evidence of discrete, meaningful, recombinable elements of signs) in the gestures produced by hearing people, and have found limited evidence of structure at the level of the gesture in the gesticulations of hearing people. Notably, this research has found that deaf home/family signers use a greater number of meaningful sign elements, and structure them more systematically, than do their hearing, gesturing interlocutors. While this second line of research has considered only a small set of gestures and related signs, the broad conclusion drawn from the findings is that deaf home/family signers both borrow

and invent meaningful sign elements to form a robust morphological system.

The current project returns to this claim, investigating the relationship of gestures to signs in an community where a constellation of family sign languages is emerging in Oaxaca, Mexico. It focuses on the internal structure of ‘indicating gestures’ such as pointing that direct the addressee’s attention to a region in physical space. Gestures of this kind are foundational in face-to-face communication, and as such they are used in the daily communication of hearing and deaf people alike. This dissertation presents three linked studies that investigate: (1) whether indicating gestures have internal structure, (2) whether that structure is fully accessible to deaf signers, and (3) whether those structures that are accessible are incorporated into the family signers’ emerging languages.

Chapter 2, ‘Reconsidering Input to Home/Family Signs,’ reviews the literature on the gestural behaviors that home/family signers receive as the sole source of accessible input to their emerging sign languages. It considers an early and influential claim about indicating gestures: that they are holistic signals without internal structure, and therefore could not serve as a source of patterned input for home/family signs. Challenges to this argument are foreshadowed in this chapter.

Chapter 3, ‘Introduction to the Research Site,’ presents the community in which San Juan Quiahije Chatino Sign Language—a constellation of young family sign languages—is emerging in Oaxaca, Mexico. The Chatino ethnic group and the spoken and signed languages used in the San Juan Quiahije municipality are described. Features of the municipality are discussed, with a focus on the presence of 11 deaf people distributed across 6 families. The chapter describes the circumstances under which these 11 people are creating family sign languages, and reviews the author’s approach to fieldwork with deaf signers and hearing speaker-gesturers at the research site.

The three studies that form the core of the dissertation project are presented in chapters 4, 5, and 6. The chapters have a parallel structure, with elements that are repeated and explicitly linked within the three component studies.

Chapter 4, ‘Study 1: Indicating gestures in San Juan Quiahije,’ presents the first of three linked studies that investigate the relationship of indicating gestures to indicating signs in the Quiahije Municipality. For this study, 29 hearing, non-signing residents of the Quiahije municipality participated in semi-structured interviews about the locations of landmarks in and outside of the community and the routes

that lead to them. The indicating gestures that participants produced in these interviews were identified and coded for the presence of discrete, meaning-linked features. The results of the analysis show that indicating gestures are formed from three recombinable elements, and that each element conveys information about the direction or distance of the indicated location through systematic modulations in form.

Chapter 5, ‘Study 2: Multimodal Reference in San Juan Quiahije,’ takes information-rich indicating gestures as a point of departure, and explores the relationship of these gestures to the speech that often accompanies them. The chapter’s central study considers two questions: (1) are the forms of indicating gestures determined in any significant sense by features of the speech that they accompany? and (2) does the speech accompanying indicating gestures narrow or shift their interpretation? An analysis of the talk co-occurring with gestures in the original interviews found little evidence that their forms were determined by the features of the accompanying speech, or that their interpretation was critically tied to the contributions that speech made to the multimodal message. Indicating gestures, then, systematically convey meaning in a manner that is accessible to exclusively visual perceivers.

Chapter 6, ‘Study 3: Indicating Signs in SJQCSL’ presents the third of the linked studies on indicating in gesture and sign in the Quiahije municipality. For this study, two deaf users of distinct family sign languages within the SJQCSL constellation were interviewed using the protocol from the original study with gesturers, and their indicating signs were analyzed using methods from the earlier study. The two signers were found to use the direction and elbow height features of indicating signs to convey information about the direction and distance of indicated locations, just as hearing gesturers had done. The signers did not, however, use the handshape feature of indicating gestures to convey information about distance as the gesturers did. Notably, one of the signers introduced new features into the indicating system, using a modulation to the path movement of indicating signs to mark the distance of the indicated location, and using a new handshape (a v-shape moved to mimic a pair of walking legs) to convey information about the manner in which a described subject moved toward an indicated region.

Chapter 7, ‘Conclusion,’ reviews the findings of the dissertation’s three studies. The results of these studies reveal that indicating gestures, previously classed as

holistic, non-composite signals, exhibit an internal structure. The features of indicating gestures are mapped to meanings in ways that are often motivated by features of the physical environment, but that are nevertheless instantiated in different ways across cultures. The study results also show that while multiple features of indicating gestures are available to be incorporated into an emerging signed language, not all of these features—even ones that map forms to meanings highly systematically—will be adopted by signers. This may be the case because gesture features must be both patterned and transparently visually motivated in order for signers to interpret them as meaningful. Finally, the chapter highlights areas for future research, calling for additional comparative studies considering gesturers' and signers' manual and nonmanual indicating behaviors across cultures.

## Chapter 2

# Reconsidering Input to Home and Family Sign Languages

### 2.1 Overview

This chapter reviews the literature on the gestural behaviors that home/family signers receive as the sole source of accessible input to their emerging sign languages. Section 2.2, ‘Home/family sign languages: an introduction,’ outlines the broad goal of research on home/family sign language emergence: to determine what essential components of human language are developed even when the learner receives little conventional input. Section 2.3, ‘Gestural input to home/family sign languages,’ reviews the literature comparing the gestures hearing people produce alongside speech—the input to deaf home/family signers—with the linguistic structures that these signers produce. It considers an early and influential claim about indicating gestures: that they are holistic signals without internal structure, and therefore could not serve as a source of patterned input for home/family signs. Challenges to this argument are foreshadowed in this chapter. Section 2.4, ‘The current project,’ connects the literature review to the dissertation’s three linked studies on indicating gestures. Finally, Section 2.5, ‘Conclusion,’ reviews the progression of the chapter and connects it to the upcoming chapter that introduces the field site in which data for the three linked studies were collected.

### 2.2 Home and family sign languages: an introduction

In 1977, Goldin-Meadow and Feldman authored the first publication on language development in deaf, language deprived children. The authors described the sit-

uation of a set of profoundly deaf children “who lack specific linguistic input but who otherwise have normal home environments”—a result of their parents’ decision to expose them exclusively to oral, rather than signed, language (Goldin-Meadow & Feldman, 1977, p. 401). This group of children, and the many others who were found to live in similar circumstances around the world, were eventually to be called ‘homesigners’ because their sole source of communication became, not oral language as their parents had hoped, but signs developed and maintained for communication with hearing caregivers in their homes. These children, as the sole deaf people in their social worlds, developed systems of communication that their hearing caregivers did not come to share: the children communicated nearly exclusively through the use of gestures, while their caregivers continued, in accordance with the oral language education method that they had chosen, to communicate with their children using gesture-studded spoken language.

As Goldin-Meadow’s work with a variety of co-authors progressed, the significance of their research findings for the fields of linguistics and psychology crystallized. The communicative systems they were studying were developed without conventional linguistic input, and nevertheless showed the organizational features of language: these systems might, therefore, shed light on just how such organizational features arise in human languages. “The controversial question,” Goldin-Meadow (2007) explained, “is whether children bring biases to their input that influence the generalizations they make” (p. 417). Phrased differently: do children, simply by virtue of being human, develop certain features of language even when they are not exposed to these features in their communicative input? (For a discussion of this and related questions in the literature on homesign, see Morford & Kegl, 2009).

This question would be posed again and again as the languages of homesigners around the world were analyzed using video recordings of their spontaneous interactions. Many of the children who were originally studied as homesigners were later exposed to developed signed languages: a happy outcome of their families’ acknowledgement (or their own, later in life) that the oral method had not succeeded in helping them to acquire a language that they could share with hearing or deaf people. Still other homesigners, living in societies or circumstances where no local signed language *could* be transmitted to them, matured into adulthood using and refining the homesign languages they had created out of necessity in childhood (see, e.g., Coppola, 2002).

Studies of homesigners later came to be compared with studies of small, shared ‘family sign systems’ developed by one or more deaf signers and maintained in a family for more than one generation (Hou, 2016; Osugi & Webb, 1999). Like homesign, these systems arose out of necessity for one or more deaf people who could not access the spoken language used by their hearing family members. Unlike the situation for homesigners, however, the hearing family members of deaf people in these cases were not committed to an oral-only language environment in the home, and in some cases became willing and skilled signers.

While home and family sign languages differ based on the social and demographic circumstances of their users, they share a critical feature: they are created and maintained without input from a developed signed language model. The systematic features found in home and family sign languages, then, can provide a window onto the human capacity to abstract and reproduce patterns from degraded and/or unsystematic input. For a fuller discussion of home and family sign languages, see Hou (2016). For more extensive literature reviews on the homesign research of Goldin-Meadow and her colleagues, see Morford (1996), Goldin-Meadow (2013), and Brentari and Goldin-Meadow (2017).

### **2.3 Gestural input to home and family sign languages**

A feature of every documented home/family sign language is the use of meaningful gestures familiar to hearing people outside of the signer’s immediate social circle. It is presumed that these gestures were observed by the signers—either in manual-visual messages directed to them or in interactions between others that are visually accessible to them—and integrated into the signers’ developing lexicons, with possible changes to the form-meaning mappings of the gestures.

Some accounts of home/family sign languages provide a list of gestures that are common to both the signer’s system and the surrounding non-signing culture. Volterra, Beronesi, and Massoni (1994), for example, list 14 gestures that are used by a young Italian homesigner that the authors recognize to be “commonly used in the nonverbal communication of hearing people...in Italy” (p. 207). A similar list is provided by Washabaugh (1986), who, as an outsider to the Caribbean Island of Providence, could not rely on his own intuitions of what gestures in the developing family sign languages of the island were shared with the ambient hearing culture.



He created a list of 59 suspected shared emblems (gestures with wellformedness standards and conventions of form-meaning mapping among hearing people), and surveyed hearing non-signers to see if these gestures indeed functioned as emblems. Variants of all 59 gestures were recognized as emblems by non-signers, suggesting that much of the core vocabulary of the family sign languages was derived from gestures used in the surrounding community. In a study of a family sign language on Amami Island in Japan, Osugi and Webb (1999) present evidence that a small set of gestural emblems was incorporated into the signed language. The authors gave deaf signers, hearing signers, and sign-naive gesturers a picture-naming task with 25 stimuli, and observed that 3 pictures were uniformly named by all the participants, suggesting that the signed language had, in at least these three cases, incorporated a set of conventional gestures.<sup>1</sup> Finally, in a study of a homesigning child in the United States, Franklin, Giannakidou, and Goldin-Meadow (2011) observe that the child used two recognizable negative gestures: a side-to-side finger wag, and a palm-up ‘shrugging’ gesture. The authors describe these gestures as “recruited” from the behaviors of ambient speaker-gesturers (p. 409).

To the author’s knowledge, a single study of a developed signed language provides a comprehensive list of emblems that are shared across gesturers and signers alike. Marsaja (2008) lists over 30 signs in the Balinese signed language Kata Kolok that are recognized by hearing nonsigners as local gestures. These include signs characterizing daily routines and cultural activities, as well as a set of conventional pointing signs that share handshape and palm orientation features with their gestural counterparts. Marsaja describes many of these signs as “borrowed in their entirety” from local gestures, and contrasts these with other signs that are likely to have undergone structural changes as they entered the signed language (p. 216).<sup>2</sup> While Marsaja’s account describes borrowing between developed languages,

---

<sup>1</sup>Given that Osugi and Webb (1999) did not choose the stimuli with any knowledge of the ambient community gesture system in mind, it is likely that these were just some of the gestures incorporated into the family sign language on Amami Island.

<sup>2</sup>Crucial to Marsaja’s use of the term “borrowing” is the assumption that Kata Kolok—a village signed language that has been in existence for at least 80 years (see discussion in Marsaja, 2008, and de Vos, 2013)—is a mature linguistic system, one that can borrow elements from the distinct co-speech gestural system of Bali a result of language contact. It is unclear whether this analysis can be applied to the contact between home/family sign languages and the conventional gesture systems from which they draw, since home/family sign languages are, by definition, emerging rather than

it provides another example of the influence that an ambient gesture system may have on the vocabulary of a signed language.

That home/family signers make use of the gestural resources available to them is unquestioned. It is also clear, after decades of research on the structure of home/family sign languages, that signers put the gestures they borrow (and the many they invent) to novel uses, employing the gestures in two ways that hearing co-speech gesturers do not. First, home/family signers combine the gestures into meaningful strings with clear hierarchical structure—that is, they develop a simple *syntax* with structuring principles that are not attested in co-speech gesture. Second, signers develop a simple *morphology* in which discrete units of meaning are combined at the level of the gesture—a design feature that is present in only some of the gestures that hearing people produce alongside speech.

### 2.3.1 Syntactic input

Two early, linked studies compared the gesture-ordering patterns of young homesigners with the patterns displayed by the hearing caregivers who were their source of their gestural input (Goldin-Meadow & Mylander, 1983, 1984). These studies found that hearing caregivers tended to produce a single gesture alongside stretches of speech: a pattern that, from the perspective of an exclusively visual perceiver, constitutes an utterance composed of a single gesture. Young homesigners, by contrast, were much more likely to produce strings of two gestures, though rarely more than two.<sup>3</sup> These tendencies, originally studied in American homesigners, were later found in caregiver-homesigner dyads in Turkey and China, revealing that the ten-

---

mature linguistic systems. The relationship between emerging and developed linguistic systems is not often characterized as one of language contact. There is precedent, however, for describing the relationship as one between a degraded lexifier language (the gestural component of gesture-speech composites in a given language) and a substrate language (the signing conventions created without reference to gesture; see, e.g., Kegl et al., 1999). Importantly, since Kata Kolok can be presumed to have originated in a home/family sign language system, Marsaja’s language contact analysis may not be best suited to explain how local gestures first entered this language in particular. Though a language contact analysis bears further consideration, it will not be pursued in this dissertation.

<sup>3</sup>Strings of just two gestures are common in many of the child homesigners studied in the United States, Turkey, and China. Evidence from older homesigning children and from homesigning adults, i.e., those who did not later acquire a developed signed language in an education setting, reveal that much longer gesture strings are eventually developed (see, e.g., Coppola, 2002).

dency of co-speech gesturers to produce a single gesture, and of child homesigners to generate more complex gesture strings, is not constrained to a single culture (Goldin-Meadow, Özyürek, Sancar, & Mylander, 2009).

Goldin-Meadow & Mylander (1983, 1984) did find some cases in which the caregivers of homesigners produced two-gesture strings, allowing them to compare the caregivers' productions with those of the homesigners. The differences between the two groups were striking. Homesigners showed two types of syntactic patterning that was largely absent from their caregiver's behaviors: patterns of gesture production/deletion, and patterns of gesture order. Since the homesigners/caregivers were producing a set of only two gestures, it was impossible for them to express a predicate and all of its arguments in most sentences. For example, to express the proposition, 'the mouse ate the cheese,' the homesigners/caregivers were constrained to select two of the three constituent elements: *mouse*, *eat*, and *cheese*. The homesigners showed a strong probability of expressing a predicate (*eat*) and selected the additional element to include based on the transitivity of the expressed predicate. Transitive predicates were expressed with patients (*cheese-eat*), and intransitive predicates were expressed with agents (*mouse-sleep*). Predicates were typically expressed after their arguments: the order reflected in the parenthetical examples above. In contrast with the homesigners' patterns, all but two caregivers showed no patterning in their selection/deletion of expressed arguments, and in the ordering of the elements in their multi-gesture strings. Again, these patterns were later replicated with caregiver-homesigner dyads in Turkey and China, providing strong evidence that in the absence of patterned syntactic input, human communicators are biased to produce a default set of structures at the level of the sentence (Goldin-Meadow et al., 2009).

A substantial body of research was subsequently conducted to investigate the syntactic patterns of homesigning children. (For a comprehensive overview, see Brentari & Goldin-Meadow, 2017; Goldin-Meadow, 2013). Homesigners, but not their caregivers, were found to organize points and descriptive gestures to produce constituents that could be embedded inside larger, multi-sign utterances (Hunsicker & Goldin-Meadow, 2012). Homesigners alone were found to use gestures marking questions and expressing negation in distinct positions at the periphery of multi-gesture strings (Franklin et al., 2011). Again and again, the multi-gesture strings of homesigners were shown to exhibit the syntactic patterning that is a hallmark

of language, without clear precursors in the gestural behavior that the homesigners received as input.

### 2.3.2 Morphological input

In another early study on homesign, Goldin-Meadow and Mylander (1990), Goldin-Meadow et al. (1995), and Goldin-Meadow et al. (2007) looked in the behaviors of (4 American, and later 4 Chinese) child homesigners and their caregivers for evidence of structure at the level of the gesture. For these studies, the researchers coded ‘characterizing’ gestures—those that represented the behavior of a hand on an object (e.g., a hand holding a drumstick to beat a drum) or that represented an object itself (e.g., a drumstick). The researchers observed that both homesigning children and their mothers produced gestures of this kind, presenting a rich opportunity for comparison.

To complete the study, the researchers coded the handshape of each gesture (e.g., a fist grasping an imagined drumstick) and the movement of the gesture (e.g, the path motion of a hand waving a drumstick) in an extensive dataset of filmed interactions between homesigners and their caregivers. The researchers additionally coded the combinations of handshapes/movements in each gesture token.

Every handshape and motion found in the dataset was produced by both caregivers and homesigners, providing evidence that homesigners attend to, and incorporate, the formal elements that they observe in the gestural behaviors of others. Homesigners differed from their caregivers, however, both in the meanings that they systematically mapped to handshapes and movements, and in the combinations of handshapes and movements that they produced. Each of the homesigning children consistently mapped a standard meaning to each observed handshape and movement. A fist, for example, might be used by a child homesigner to describe holding a long thin object (the now familiar drumstick, a spoon, or balloon string or a handle). The child would not use the fist handshape to express other meaning elements. By contrast, the caregivers’ meaning-mappings were inconsistent, with the same handshape or movement being used to convey a variety of meanings. Homesigning children had clearly taken advantage of the available handshapes and movements that occur with multiple meaning-mappings in the caregivers’ gestures, and had assigned each one a stable meaning.

More striking was the evidence from the combination of handshapes and movements. Across the 8 homesigner-caregiver dyads, the caregivers' handshape/movement combinations were shared with their homesigning children in an average of just 31% of cases ( $SD = 07$ ). Homesigning children were evidently creating new meaning complexes out of the handshape and movement elements, and the majority of these complexes were ones that their caregivers did not model. The authors of the study concluded that the homesigning children had developed robust, productive morphological systems from their caregiver's relatively weaker and inconsistent systems. Importantly, the studies of morphology showed a gestural precursor for the more complex systems that the homesigning children ultimately developed. In this respect the results were unlike those found in the studies of homesigner's syntactic patterns, where most caregivers appeared not to provide any type of syntactic model.

A related set of studies considered the development of morphology in a deaf child learning American Sign Language (ASL) from his parents, two late acquirers of the language who had only incompletely mastered its morphological system (Newport, 1999; Singleton & Newport, 2004). The case of "Simon" was unlike those of the homesigners studied by Goldin-Meadow in that he was exposed to a rich, accessible set of linguistic behaviors. However, it was similar to the case of the homesigners in that the morphological input Simon received was severely degraded: like the caregivers of the homesigners, Simon's parents mapped the handshapes and movements of signs to a variety of meanings, and combined them to create meaning complexes in inconsistent ways. The studies of Simon focused on the development of morphology for a set of motion verbs in ASL that comprise a variety of meaningful movements and handshapes. Simon's parents mapped these elements to meaning inconsistently, though they showed preferential mappings for many of the elements. Simon developed motion verbs that were different from those of his parents in two ways: first, where his parents showed even weak preferences for a form-meaning mapping that was visually meaningful (as, for example when they produced an up-and-down movement to convey the meaning *jump*), Simon "boosted" the pattern, using the form-meaning mapping much more consistently than did his parents. Like the homesigners, Simon took a noisy pattern and developed a consistent set of morphological primes. Second, when Simon's parents showed strong but arbitrary form-meaning mapping tendencies (as, for example, when they used an extended

index finger to represent the shape of vehicles), Simon did not adopt or “boost” the frequency of their tendencies. This results suggests that for a pattern in the gestural input to be adopted, it is not sufficient for it to be modeled consistently: it must also be possible for the home/family signer to discern a meaning behind the pattern. Whether a gestural form is motivated by the perceptual, sensory-motor characteristics of its referent may significantly influence its salience for home/family signers as they look for meaning-linked forms to incorporate into their developing linguistic systems.

The results of the studies of Simon and the homesigning children reveal that that even weak morphological patterning can be adopted and modified by deaf children creating language from degraded input. The difference between the two studies is in the source of the morphological patterns: Simon’s parents derived their (incompletely mastered) patterns from a developed signed language. The caregivers of homesigners, by contrast, created improvised morphological systems by mapping the features of handshape and movement to visually similar phenomena in the world. Notably, while the caregivers’ systems were improvised, they nevertheless exhibited patterns that could be developed into more robust, productive morphological systems.

### 2.3.3 Summary

The studies of syntax and morphology in home/family signers differ with respect to two features. **Variety of gesture types:** the studies on syntax in homesign considered patterns that operated on many types of gestures: points, ‘characterizing’ gestures, gestural emblems such as shrugs and finger-wags (meaning ‘no’ or ‘not’), and more. By contrast, the studies of morphology considered only ‘characterizing’ gestures (and, for the study of Simon, a limited set of motion verbs). **Patterning in the input:** the studies on syntax found that the majority of caregivers did not organize their gestures at the level of the sentence. Homesigning children, then, appeared to innovate the syntactic patterns that were found in their signing. By contrast, studies of morphology showed that some of the gestures that serve as input for deaf home/family signers do show reliable form-meaning mappings. While starting with only these mappings in the input, homesigners can develop more complex and productive morphological systems.

Morphology presents a fascinating area for exploration in the study of home/family sign languages: it allows for a thorough comparison of the manual form-meaning mappings that hearing co-speech gesturers produce and combine with those that deaf home/family signers adopt and elaborate. Hearing individuals, while they display morphological patterning in some of their co-speech gestures, pair these gestures with speech and do not require them to bear the full burden of communication. Deaf home/family signers, however, require a set of gesture-level structures that can be used stably, and interpreted reliably, without the accompaniment of an additional communicative channel. The changes that deaf signers impose on the morphological systems they adopt can, therefore, shed light on the minimal requirements for a productive morphological system in an emerging language.

#### **2.3.4 Indicating gestures as morphological input**

A clear candidate for continued research on morphology in home/family sign is the set of indicating gestures—i.e., gestures like pointing that direct attention to regions in physical space and the objects located within them. Like the ‘characterizing’ gestures explored by Goldin-Meadow and colleagues, indicating gestures are used with overwhelming frequency in home/family sign languages. Points indicating present objects are a mainstay in the face-to-face communication of hearing non-signers, and they have been described as early and crucial components of every documented home or family signed language. In a seminal early study of four homesigners, Feldman (1975) found that pointing gestures comprised between 41% and 62% of the gestures the children produced. Because indicating gestures are vital to, and plentiful within, everyday conversation, an extensive dataset of indicating gesture tokens could easily be collected from the spontaneous interactions both home/family signers and their hearing, gesturing counterparts. Given the availability and frequency of indicating gestures among the two groups that are compared in home/family sign research, why have we not already seen a comparative morphological analysis of indicating in home/family signers and co-speech gesturers?

It is likely that the original work on morphology in homesign did not take indicating gestures into consideration because this gesture type was assumed to lack a morphological structure, at least when it is used by hearing people. Indicating gestures are overwhelmingly produced alongside speech, and are frequently classified

in the literature on gesture as ‘gesticulations’—idiosyncratic, holistic representations with formal features that depend on, and co-vary with, features of the accompanying speech (see, e.g., McNeill, 1992, pp.19-23). Researchers on signed languages have defined pointing signs as crucially different from pointing gestures precisely because there is intra-*sign* structure where intra-*gesture* structure does not exist (see, e.g., Emmorey, 1999, p. 148).

Gesticulations (though not pointing gestures in particular) are described by Goldin-Meadow and her colleagues in the following terms: “Gesticulations are idiosyncratic, global representations that lack the hierarchical, combinatorial principles considered to be the hallmark of natural language organization. Thus, although speech conveying an idea is organized by linguistic principles, the co-occurring gesticulations are not” (Singleton, Goldin-Meadow, & McNeill, 1995, p. 288). Gesticulations, then, and by association pointing gestures, have not been treated in the homesign literature as candidates for an examination of structure at the level of the gesture.

## 2.4 The current project

This dissertation presents three linked studies that investigate: (1) whether indicating gestures have internal structure, (2) whether that structure is fully accessible to deaf creators of home/family sign languages, and (3) whether the structures that are accessible are incorporated into emerging family sign languages. In Chapter 4, a review of the literature on indicating gestures considers the claims that these gestures are internally structured, and that their form-meaning mappings vary across cultures. The chapter then presents a study of indicating gestures used by non-signing, hearing people in a Chatino community in Oaxaca, Mexico. Following the methodology of the Goldin-Meadow research lab, the study looks only at the gestural component of the multi-modal messages produced by hearing people. It looks within the gestures for evidence of morphological structure.

Chapter 5 examines the relationship of the co-speech indicating gesture forms to features of the speech that accompanies them in multimodal messages. The chapter presents a study that looks for, but fails to find, evidence that indicating gesture forms are determined by the speech that they accompany. The analysis then turns to ways in which speech may alter or augment the message of indicating



gestures. Finally, Chapter 6 compares the structures of the documented indicating gestures with those of indicating signs in emerging family signs in the community. It presents a study that highlights the shared morphological features of co-speech indicating gestures and indicating signs, and examines the changes that signers are imposing on the indicating system as they incorporate it into their morphological systems.

Throughout the three studies, the terms ‘indicating gesture’ and ‘indicating sign’ are used with a single definition in mind: meaningful bodily action that directs attention to a delimited area in space by projecting a vector from the gesturing articulator to the focused location. The word ‘gesture’ will be used to refer to the embodied communicative behaviors of hearing people, performed largely though not exclusively alongside speech. The word ‘sign’ will be used to refer to the embodied communicative behaviors of deaf people, performed in the visual-manual modality alone. The terms are used with this functional distinction in mind, and do not imply that a ‘gesture’ and a ‘sign’ necessarily differ in their morphological features (form-meaning mappings and combination of meaningful elements).

## 2.5 Conclusion

This chapter reviewed the literature on the gestural input to home/family sign languages. It reviewed a body of literature showing that deaf children developing language without conventional input (1) invent syntactic structures that are absent from the input they receive, and (2) innovate productive morphological structure from the noisy morphological patterns in their input. The chapter presented an early and influential claim about indicating gestures: that they are holistic signals without internal structure, and therefore could not serve as a source of patterned input for home/family signs. The current project—a set of three studies challenging these claims—was briefly introduced.

To set the stage for the three linked studies, the upcoming chapter introduces the reader to the San Juan Quiahije Municipality of Oaxaca, Mexico. A description of the Chatino people and culture, including the deaf people who anchor the emerging family sign languages in the region, is provided.

## Chapter 3

### Introduction to the Research Site

#### 3.1 Overview

This chapter introduces the community in which San Juan Quiahije Chatino Sign Language (hereafter, SJQCSL) is emerging. In Section 3.2, ‘Introduction,’ the San Juan Quiahije Chatino Sign Language Project is introduced, and its history is briefly outlined. In Section 3.3, ‘Setting the scene: the Chatino people of San Juan Quiahije,’ the Chatino ethnic group and the spoken and signed languages used in the San Juan Quiahije municipality are described. Features of the municipality itself, including its physical setting and its longstanding relationship to the neighboring Chatino and non-indigenous communities, are discussed. Section 3.4, ‘Deafness and sign language emergence in Quiahije,’ describes the circumstances of 11 deaf signers in the municipality, and the family sign languages that they are creating out of necessity. Section 3.5, ‘Fieldwork in Quiahije,’ describes the project that the author undertook to collect data from deaf and hearing community members, and is presented from a first-person perspective. Section 3.6, ‘Conclusion,’ reviews the contents of the chapter.

#### 3.2 Introduction

This dissertation is the result of 11 months of fieldwork conducted by the author in the San Juan Quiahije (hereafter, Quiahije) municipality of Oaxaca, Mexico, between 2012 and 2015. Much of the data for the dissertation were collected for the larger San Juan Quiahije Chatino Sign Language Documentation Project, a collaboration with linguist Lynn Y.-S. Hou. This project is a satellite of the Chatino

Language Documentation Project (hereafter, the CLDP) headed by Tony Woodbury at the University of Texas at Austin and anchored by two linguists and native speakers of the San Juan Quiahije variety of Chatino, Emiliana Cruz and Hilaria Cruz (E. Cruz & Woodbury, 2014).

The sign language project in particular is distinct from the larger CLDP in its focus on embodied communication in Quiahije, both in hearing speaker-gesturers and in deaf signers. Seeds for the project were planted in 2010 when Hilaria Cruz and Lynn Hou visited Quiahije together, meeting with deaf signers (some of whom were Cruz's family members), learning more about the distribution of deaf people in the municipality, and observing the signing practices of these people within their families. Lynn Hou and the author initiated the San Juan Quiahije Chatino Sign Language Documentation Project in 2012, conducting a two-month field trip in the Quiahije municipality and formally introducing the project research goals to deaf signers, their families, and the community's civil-religious authorities. Both researchers conducted multiple trips to the municipality over the following three years, enlarging the research project to encompass not only signing practices, but the spoken and gestural practices in contact with signing in the municipality. The project was approached through the lens of ecolinguistics, a theoretical framework emphasizing that the existence and use of multiple languages in a given region are interdependent (Mühlhäusler, 2011; contributors to Fill and Mühlhäusler, 2006). Specifically, the SJQCSL Documentation Project took the analytical approach of ecolinguistics by “begin[ning] not with a particular language but with a particular area, not with selective attention to a few languages but with comprehensive attention to all the languages in the area” (Voegelin & Voegelin, 1964). This approach was possible because a substantial amount of research on the structure and use of the spoken languages in the community had already been performed, most recently and thoroughly by the CLDP.

The language ecology of San Juan Quiahije comprises, at minimum:

1. San Juan Quiahije Chatino, used by the majority of community members as their first and primary language;
2. Spanish, used by the subset of the population that has been educated in local primary and secondary schools;

3. Manual and facial gestures, some of which are highly conventional in form and function;
4. San Juan Quiahije Chatino Sign Language, a constellation of emerging sign languages used by 11 deaf people and their families.

These components of the language ecology, and the municipality in which they are found, are described in the sections to follow. A brief description of the data collection process for this dissertation project is provided, as well.

### **3.3 Setting the scene: the Chatino people of San Juan Quiahije**

#### **3.3.1 The Chatino people and language**

The Chatino people form an indigenous ethnic group who traditionally inhabit an area of the contemporary Mexican state of Oaxaca stretching between the Oaxaca Valley and the Pacific Coast. As an ethnic group, the Chatino are offset from their Zapotec and Mixtec neighbors through differences in cosmology and material culture that likely predate the Spanish conquest of Mexico (Greenberg, 1981; Joyce, 2011; Pérez Rodríguez, 2013) and through the use of the Chatino languages, which form a shallow family in the Zapotecan branch of the Oto-manguean language stock.

Today, an estimated 17 varieties of Chatino are spoken in 21 communities (E. Cruz & Woodbury, 2014; Sullivant, 2015). The varieties belong to three languages, distinguishable on the basis of phonological and morphological criteria: Zenzontepec Chatino, Coastal Chatino, and Eastern Chatino (E. Campbell, 2013). All Chatino varieties are characterized by a complex morphophonological structure, with grammatical and lexical distinctions encoded tonally.

San Juan Quiahije Chatino (hereafter SJQ) is a variety of Eastern Chatino and is named for the municipality in which it is spoken. The SJQ variety is distinguished by its high degree of tonality: the language has 5 tone qualities that, when used in isolation or fused into tone contours, create 14 phonological tones. Twelve of these tones are contrastive at the lexical (pre-sandhi) level and mark aspect on verbs as well as person on multiple parts of speech (E. Cruz, 2011, p. 262). Following the early conventions of the Chatino Language Documentation Project of the

University of Texas at Austin (hereafter the CLDP), the table employs the numbers 0—4 to represent the distinct tone qualities. The pitch levels associated with these numbers range from super-high (tone 0) to low (tone 4). The tone-bearing unit in SJQ Chatino is the syllable, and words in the language are monosyllabic, so that every word bears one phonological tone. To reflect this orthographically, a number representing a level tone, or a pair of numbers representing a tone contour, is placed at the end of every written Chatino word. Table 3.1 displays a set of SJQ words selected to exemplify each of the twelve phonological tones at the pre-sandhi level. While the CLDP later adopted an orthography that assigns letters to tones, this dissertation uses the numeric orthography throughout. The chosen approach allows readers unfamiliar with the language to distinguish level and contour tones, and to develop a general sense of the pitch of a given phonological tone. (See E. Cruz and Woodbury (2014) for an overview of the CLDP approach to writing transcription).

| <b>Tone Type</b> | <b>Tone</b> | <b>Example</b> | <b>Gloss</b>      |
|------------------|-------------|----------------|-------------------|
| Level            | 1           | kla1           | ‘loom’            |
|                  | 2           | kla2           | ‘pool’            |
|                  | 3           | kla3           | ‘dream’           |
|                  | 4           | kla4           | ‘old’             |
| Falling          | 14          | nten14         | ‘people’          |
|                  | 24          | kla24          | ‘she will arrive’ |
|                  | 04          | lyuq04         | ‘little’          |
| Rising           | 10          | Ska10          | ‘sugar’           |
|                  | 20          | xtyon20        | ‘cat’             |
|                  | 32          | sqen32         | ‘spider’          |
|                  | 40          | skwan40        | ‘I threw’         |
|                  | 42          | kta42          | ‘shrimp’          |

Table 3.1: SJQ phonological tones and corresponding lexical examples

In this dissertation SJQ will be contextualized relative to other languages in the Meso-american linguistic family. This term is used consistently with its introduction in L. Campbell, Kaufman, and Smith-Stark (1986), and refers to a set of languages with shared phonetic/phonological, morphological, and syntactic features that are found in a geographically contiguous area stretching from Mexico

to northern Costa Rica. In some cases, features of SJQ will be discussed in relation to Spanish. Contact between the two languages likely began shortly after the Spanish conquest of Mexico, but increased significantly after the introduction of bilingual education to San Juan Quiahije municipality in the 1950s. The impact of bilingual schools on language use in the municipality is discussed further below.

### 3.3.2 The San Juan Quiahije municipality

Located at the base of the southern Sierra Madre del Sur mountain range, the San Juan Quiahije municipality (hereafter, the Quiahije municipality) encompasses both the mountaintop town of San Juan Quiahije (hereafter, San Juan)<sup>1</sup> and the smaller village of Cieneguilla in the valley below. A constellation of *rancherías* (seasonal farming communities) are distributed in the lowland valleys extending north, east and west from San Juan and Cieneguilla: these communities do not share the political status of the San Juan *municipio* (municipal seat) and its *agencia*, or politically dependent hamlet, Cieneguilla. The *rancherías* are, however, located within the municipality. The total population of the municipality is 3,628 according to the most recent Mexican national census: this total comprises the population of San Juan and Cieneguilla, and does not sample the surrounding farming sites since their inhabitants treat the village or town as a permanent home (Instituto Nacional de Estadística y Geografía, 2017).

San Juan is the oldest of the inhabited communities in the municipality and is believed to be between 200 and 300 years old. Oral tradition in the community states that a crowing rooster on the top of a hill in San Juan drew attention to a pond below, and that the future citizens of San Juan—participants of a wave of Chatino migration spurred by Catholic evangelism—took note of the pond and settled in the surrounding lowlands (E. Cruz, 2017, p. 22). The town of San Juan became a political center for these settlers, who spent most of the year in *ranchos* (farming sites) scattered through the temperate valleys surrounding the mountaintop town. A set of such farming sites eventually fused and was incorporated as the *agencia* of Cieneguilla, and over time, citizens of the municipality began to spend the majority of the year in the town and hamlet, treating their farming sites

---

<sup>1</sup>Following Cruz (2015), this dissertation uses the term Quiahije to designate the municipality, and the name San Juan for the town at its center.

as seasonal living places only (H. Cruz, 2014, p. 22). Today the town, village, and surrounding farming sites function together as a closed corporate community (in the sense of Wolf, 1957, 1986) whose members grow and exchange the crops suited to the distinct mountaintop and valley ecologies in the municipality. Travel between the town, village, and outlying farm sites is overwhelmingly frequent, since farming tasks, trade, and visits to the homes of family members require community members to move between these locations.

San Juan and Cieneguilla have discrete political structures. Each community is led by its own governing body with distinct legislative, executive, and judicial branches. In line with the *cargo* system found throughout mesoamerica, these branches comprise numerous civil-religious posts that are organized hierarchically: political figures rise through these posts to assume positions in the respected elders council (H. Cruz, 2009, p.30; Greenberg, 1981, p. 61). The civil-religious nature of the political system is reflected in the layout of the communities: at the center of both San Juan and Cieneguilla are Catholic churches—a legacy of the colonial influence on the communities’ religious practices—flanked by town hall buildings where there government authorities meet daily. That these locations are the social center of the communities is attested by the presence of basketball courts where men, boys, and increasingly, girls gather to play ball in the afternoons. Notably, while the civil-religious *cargo* system integrates the government with the Catholic church, there is a growing population of evangelical christians in the municipality. Their religious gatherings take place in buildings at the periphery of each community and their congregants are underrepresented in the local political systems.

Public education is relatively new to both communities in the municipality: schools arrived in San Juan in the 1950’s and were only introduced to Cieneguilla after it was incorporated as an *agencia* in the 1970’s. Schools were built in both communities as part of the Mexican state’s initiative to increase the sense of national unity—and minimize identification with local languages and cultures—in diverse indigenous communities (H. Cruz, 2009, p. 28; Heath, 1972, p. 92). While nominally bilingual, the schools employ teachers who are overwhelmingly drawn from outside of the municipality: those teachers who speak Chatino languages typically do not speak the SJQ variety intelligible to the children of the municipality (H. Cruz, 2009, p. 28). Increasingly, then, young people are acquiring Spanish as a second language as a result of their exposure—brief or extended—to the public education

system. Today preschools, primary schools, and secondary schools are distributed throughout both San Juan and Cieneguilla: most families send some if not all of their children to school for at least some period of time. To receive an education beyond the 3rd grade requires children to travel to residential schools outside of the municipality, the closest of which is in the district seat of Santa Catarina Juquila, approximately 8 km away.

A map of San Juan and Cieneguilla is provided in Figure 3.1.<sup>2</sup> Images of the municipality's two polities and the roads and trails that connect them are provided in Figures 3.2 through 3.5.<sup>3</sup>

---

<sup>2</sup>Base map data sources for Figure 3.1: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community.

<sup>3</sup>Photo credit for the image in Figure 3.2: Lynn Y-S Hou. The image in Figure 3.4 was retrieved from the San Juan Quiahije Oaxaca Facebook page on July 1, 2017. [www.facebook.com/sanjuanquiahije.oaxaca](http://www.facebook.com/sanjuanquiahije.oaxaca)





Figure 3.1: San Juan and Cieneguilla: the two polities of the Quiahije municipality.



Figure 3.2: San Juan and Cieneguilla as viewed from San Juan.



Figure 3.3: Dirt roads and walking trails connecting San Juan, Cieneguilla and farming sites.



Figure 3.4: The town of San Juan.



Figure 3.5: Catholic church (domed red roof, right) and town hall building (flat red roof, left) at the center of Cieneguilla.

### 3.3.3 Quiahije and its neighbors

Historically, travel to and from the Quiahije municipality has been a difficult undertaking. San Juan and Cieneguilla are connected to outside communities by dirt roads that are rendered impassible when extreme weather (heavy rains and hurricanes) floods the streams that cross them. Yet the municipality has long maintained a thriving relationship to the surrounding Chatino and mestizo (non-indigenous) communities, primarily by traveling to these communities on foot (see discussions in E. Cruz (Manuscript submitted for publication); H. Cruz (2014)). A series of footpaths were widened into dirt roads in the latter half of the 20th century, making truck travel convenient, if still challenging after extreme weather events. Today citizens travel outside of the municipality with frequency: trade draws them to a variety of commercial centers in the Juquila district and the wider state of Oaxaca. Increasingly, people from the municipality seek temporary or permanent work in these locations. They travel well beyond the state, as well: as many as one third of the citizens of the municipality migrate to the United States in order to earn enough money to buy construction supplies for house-building and to supplement seasonal harvests that provide food for only part of the year (Boixander, 2002; H. Cruz, 2014, p. 25).

Table 3.2 provides a list of trade centers to which the citizens of San Juan Quiahije frequently travel. Destinations marked in *italic typeset* will be discussed in greater detail throughout the dissertation, as they were mentioned frequently by participants in the interviews conducted for the dissertation research. The distance between each community and the town of San Juan is provided to give the reader an indication of the travel preparations necessary to reach each site by walking or traveling in a truck. Finally, the elevation of each community is provided to showcase the striking change in altitude between communities at the base of the Sierra Madre del Sur mountain range and those at the Pacific coast. Travel between these communities requires the negotiation of steep slopes, a fact that is especially notable given that citizens of the municipality historically undertook this travel on foot. A map of the corresponding trade centers is provided in Figure 3.6.<sup>4</sup>

---

<sup>4</sup>Base map data sources for Figure 3.6: SRTM: NASA, NGA, USGS, EROS, ESRI.

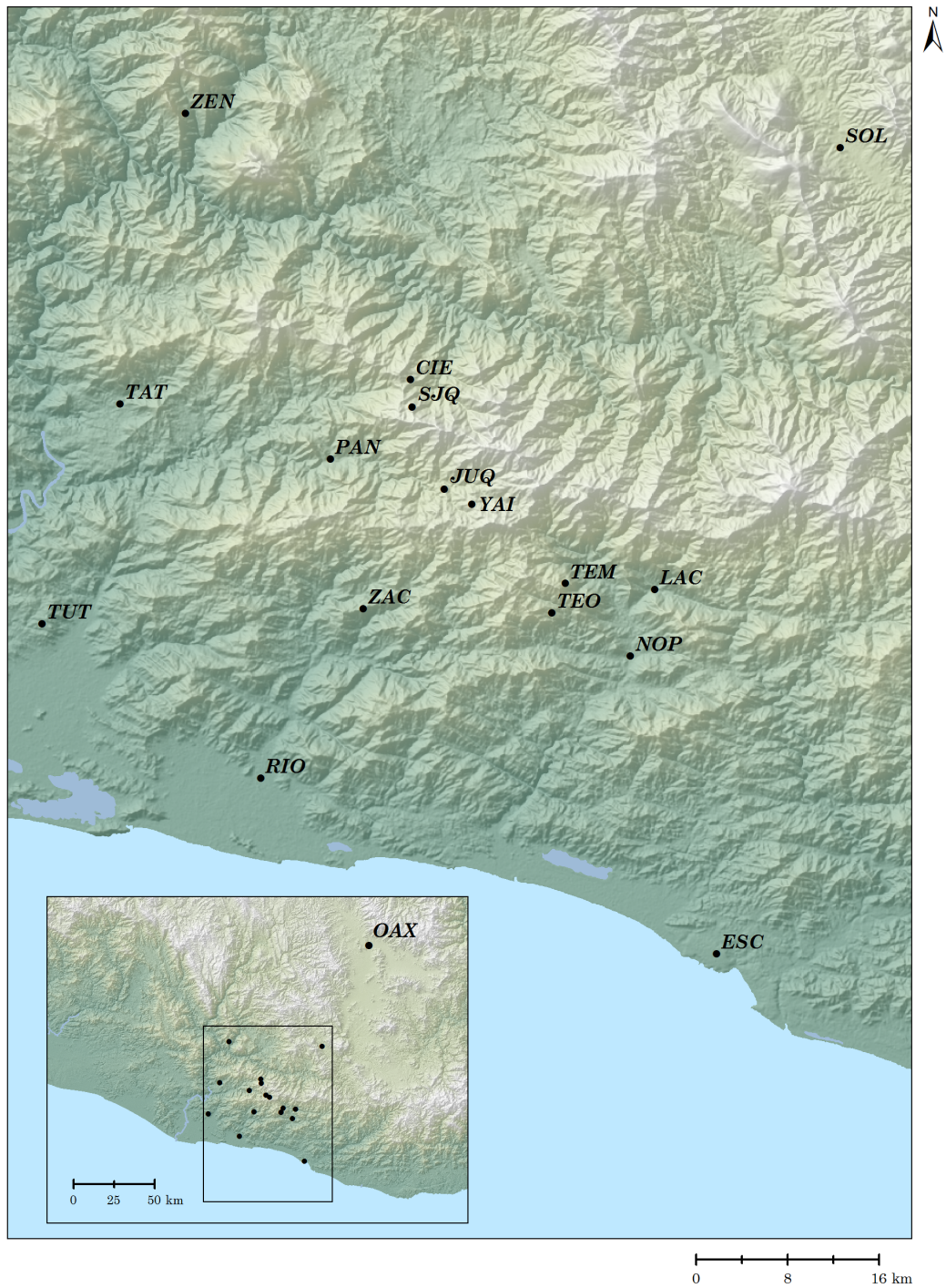


Figure 3.6: Towns in the Quiahije Municipality and Frequent Destinations for Trade

| <b>Chatino community</b>        | <b>Distance from San Juan in m.</b> | <b>Elevation in m.</b> |
|---------------------------------|-------------------------------------|------------------------|
| <i>San Juan</i>                 | N/A                                 | 2300                   |
| <i>Cieneguilla</i>              | 2450                                | 1600                   |
| <i>Santa Catarina Juquila</i>   | 7700                                | 1500                   |
| <i>San Miguel Panixtlahuaca</i> | 8250                                | 770                    |
| Santiago Yaitepec               | 10000                               | 1800                   |
| Santa Maria Zacatepec           | 18100                               | 800                    |
| Santa Maria Temaxcaltepec       | 20100                               | 1600                   |
| Santa Lucia Teotepec            | 21550                               | 1100                   |
| Tataltepec de Valdes            | 25600                               | 400                    |
| San Juan Lachao                 | 25950                               | 575                    |
| Santos Reyes Nopala             | 28500                               | 500                    |
| Santa Cruz Zenzontepec          | 32050                               | 1000                   |
| San Pedro Tututepec             | 36500                               | 275                    |
| <b>Non-Chatino community</b>    |                                     |                        |
| <i>Oaxaca de Juárez</i>         | 106150                              | 1575                   |
| <i>Villa Sola de Vega</i>       | 42550                               | 1450                   |
| <i>Rio Grande</i>               | 34900                               | 30                     |
| <i>Puerto Escondido</i>         | 27350                               | 75                     |

Table 3.2: A selection of trade centers in and outside of the Quiahije municipality, with measures of elevation and distance from San Juan

Citizens of Quiahije cultivate a close relationship to their physical surroundings, a fact evidenced by community members' comprehensive knowledge of the local topography. As part of a project documenting local geographic knowledge, Smith Aguilar (2017) asked groups of Quiahije citizens to model the topography of the municipality using clay. Elders completed the task with remarkable accuracy, modeling not only the slopes of San Juan and Cieneguilla but the surrounding mountain ranges in all directions. A crucial competence for citizens of the municipality, then, is the ability to locate significant regions and landmarks, and to negotiate the local paths that lead to these destinations. This competence will become relevant for the studies in this dissertation, since landmark location and route description will be performed by participants in the studies outlined in Chapters 4—6.

### **3.4 Deafness and sign language emergence in Quiahije**

Of the 1,328 citizens of the Quiahije municipality, a total of 11 were born deaf or became deaf in early infancy. This represents a 0.3% incidence of congenital or pre-lingual deafness in the community. Whether the community is unusual in having a deaf population of this size is unknown, since little research has been performed to calculate and compare the incidence of deafness in rural communities in Mexico (p. 5 Hou, 2016; Tucci, Merson, & Wilson, 2010, for a review of the relevant literature, see). It is certainly the case that this incidence of deafness is higher than the estimated 0.1% incidence in developed countries (Nyst, 2012).

Six of the eleven deaf people in the municipality are adults (5 men), and the remaining five deaf children are all girls. With two exceptions, all deaf people in the municipality are biologically related to one another. This fact suggests a genetic cause of deafness, though the distribution of deafness across families in the community makes it difficult to identify the (one or more) type(s) of genetic cause at play (Hou, 2016, p. 55). The oldest deaf signer is in her late fifties, and there are few stories in the community about prior deaf signers.

None of the deaf people in the municipality has sufficient residual hearing to allow them to acquire SJQ or Spanish. To the knowledge of the SJQCSL research team, none of the deaf people has been exposed to any form of deaf education that is offered in Mexico's mestizo (non-indigenous) communities, and as a consequence they have not been exposed to the national sign language of Mexico, Lengua de Señas

Mexicana (LSM). The deaf people do make use of sign systems to communicate with their family members and associates, and they are forming the features of these systems themselves out of necessity. Hou (2016) classified these systems as discrete family sign languages, observing that “the signing community of [San Juan] consists of multiple, extended families in co-residence’, each of which has developed a distinctive set of signing practices (p. xii). Hou (2016) and Mesh and Hou (in press) acknowledge that many of the families’ signing practices are shared, and therefore refer to the constellation of family sign languages in the municipality as San Juan Quiahije Chatino Sign Language (hereafter, SJQCSL).

The study in Chapter 6 closely considers the family signs of two of the adult deaf men in the community. The men are introduced, and their social and linguistic networks briefly characterized, at the outset of the study. The responses of the men during interview sessions serve as the primary data for the study of deaf signers. These responses were sought and contextualized using information collected outside of formal interview sessions, a topic discussed at greater length in the first-person account of fieldwork methods provided in §3.5. Data for this dissertation were originally collected from 5 of the 6 adult deaf signers: a single signer declined to participate in this or other research activities for the documentation project. Although the 5 interview participants were willing to engage in the activity and had been productively interviewed on a variety of topics during the SJQCSL documentation project, three of the signers did not understand the objective of the particular interview performed for the dissertation (to locate landmarks in and outside of the community, and to discuss viable routes to them). The responses of these signers to interview questions suggested that they were not providing the same types of landmark-locating and route navigational directions that two of their deaf counterparts, and all of their hearing counterparts, provided.<sup>5</sup> Since they were, in essence,

---

<sup>5</sup>Data from these three participants were excluded for the following reasons: one participant produced narratives that were only loosely related to the sites pictured in the photo stimuli. The interviewer for this participant expressed doubt that the participant understood the goals of the interview. A second participant asked her interviewer to answer many of the interview questions, expressing interest in the interviewer’s answers and commenting on them extensively. It was not clear how much the interviewer’s behaviors had influenced the participant’s signing, or affected her approach to answering the questions herself. The final participant with excluded data remarked that she understood the task, but could not complete it: she explained that she did not know the locations of the items in the photo stimuli, a problem that most likely related to her difficulty



performing a different task (engaging with features of their interviewers' questions that were unrelated to local landmarks and routes, and in many cases politely deferring to the interviewer's opinion rather than providing a reply), it would be ill advised to force a comparison between their visual-manual behaviors and those of the other deaf signers and the hearing participants. The present study therefore compares the behaviors of two signers with those of hearing people in the Quiahije municipality.

### 3.5 Fieldwork in Quiahije

In this portion of the dissertation alone, I adopt a first-person perspective in order to describe and reflect on my role in the language documentation project. In 2012 I joined linguist Lynn Y.-S. Hou to form the San Juan Quiahije Chatino Sign Language Documentation Project. Lynn is deaf, while I am hearing: this fact has afforded us many opportunities to witness the same event from two perspectives, and to share notes afterwards about the features of the event—communicative and non-communicative—that were most salient to each of us. Early in our collaboration we recognized that many of our daily observations were about the forms and functions of gestures used by hearing nonsigners in the community, both in their interactions with us and in their interactions with deaf and hearing community members. There is considerable variation in the opinions of community members about deafness, signing, and gesturing—a fact that Lynn documented carefully in her 2016 dissertation. Many daily events, however, place hearing and deaf people in contact, and all parties to the communication evidently draw on community gesturing conventions to craft their message. It became clear to Lynn and me that documenting the gestural resources of the community, and the use of these resources in the talk among and between hearing and deaf people, would be foundational to our research project. We determined early on that while both of us would document features of gestures and sign, Lynn would work especially closely with deaf people—children and adults—and their families to document the kinship networks and language socialization patterns that underlie the emergence of SJQCSL. I, on the other hand, would work more closely with adult hearing SJQ speaker-gesturers and would work primarily with adult deaf signers, comparing the (presumably) first-generation sign

---

recognizing even familiar locations when they were displayed in photographs.

language users' signing conventions with the gesturing conventions observable in the larger community. Lynn and I met frequently when our field trips overlapped, but we lived in separate spaces (Lynn with a family in San Juan and I with a family in Cieneguilla), allowing us to establish our own relationships to the community and to make distinct though related observations of signing and gesturing events.

Throughout 11 months of fieldwork I spent much of my time in the company of accommodating hosts: I lived in hearing family anchored by a monolingual SJQ-speaking matriarch, and I ate many weekly meals with the families of 5 deaf adults (3 in San Juan, 2 in Cieneguilla) with whom I conducted much of my research. I had access, then, to a considerable amount of talk in gesture-studded SJQ and in SJQCSL. As an aspiring learner of both languages who in the end suffered from a dull ear for the tonal distinctions of SJQ, the meaning I received from messages directed to me often came through the visual channel. At the outset of my fieldwork in particular I had difficulty separating observations of speech-accompanied gesture from those of sign: the systems blurred in my mind, and I frequently found myself describing a signer or speaker's behavior in my fieldnotes and writing in the margins: 'is this a feature of gesture, or of sign, or of both?' The present dissertation project was born with this question.

Of course, there was a reason for my confusion: SJQCSL is a young signed language emerging in a community with a rich set of gestural conventions. There are meaningful patterns in the embodied communicative behaviors of hearing people, and meaningful patterns in the embodied communicative behaviors of deaf people. Many, but not all, of these patterns appear to be fully or partially shared across the two groups. For my dissertation research, I chose to focus on a set of behaviors that I saw daily in the communication of hearing and deaf interlocutors: manual pointing, and the related *go* gesture that fuses elements of pointing with features of an emblem representing forward motion. Throughout this dissertation, I call this related set of manual behaviors, *indicating gestures/signs*.

I worked with two SJQ-Spanish bilingual interviewers—Tomás Cruz Cruz, the former president of San Juan Quiahije, and María Jimenez Cruz, a member of my host family—to design and conduct interviews in which hearing SJQ speakers located landmarks, and described the contours of routes, inside and outside of the municipality (a full description of this process is provided in Chapter 4). I created a set of visual stimuli for interviews with deaf signers, and I worked with the family

members of deaf people to adapt the interview questions for use in SJQCSL. I conducted interviews with a total of 51 hearing people and 5 deaf people, and in the end I used data from 29 hearing people and 2 deaf people in my dissertation.

The time of my research assistants was limited, and we could not transcribe and translate all of the spoken SJQ in the collected interview footage. To maximize the set of manual behaviors available for analysis I focused our efforts on transcribing talk surrounding manual gestures in the interviews. This resulted in a dataset from hearing gesturers that is excellent for the analysis of gesture features, and that is lacking in examples of the contexts in which spoken language behaviors are performed *without* gestures. A goal for the continuation of this project is to transcribe and translate the nearly five hours of talk in the selected video interviews in which gesture does not occur. This will allow for a comparison of, for example, the types of spoken language referential behaviors (demonstrative expressions, direction expressions, and descriptive noun phrases) that are performed with and without gestures. This, in turn, will support a richer comparison of the functions that are performed by speech, by speech-accompanied gestures, and by signs in the municipality.

A final set of remarks is critical to contextualize the research performed with all participant groups, but especially the deaf signers. I based my original research hypotheses, and my analytical approach, on films and fieldnotes recording spontaneous indicating behaviors of deaf and hearing people. Many of the films of deaf signers in particular have been glossed and translated for other studies in the SJQCSL documentation project. While recorded interviews with deaf signers comprise less than an hour of the analyzed dataset for this dissertation project, the behaviors that are described in the dissertation occur again and again in videos of spontaneous signing that were excluded from the dissertation study for a single reason: I cannot reliably identify the locations/objects that the signers indicated with their pointing signs in these recordings. In some cases, for example, signers point to identify distant farm sites, and the location that they are indicating in the moment could be one of several farming sites where the signer works. This fact about the recordings of spontaneous talk prevented me from coding the geospatial information for indicated targets that is crucial to the current research project. I hope to use much of the video-recorded spontaneous conversations of deaf signers—including the many tokens of indicating—in future research in which geospatial coding will play a lesser role.

This dissertation project represents a first attempt to systematically compare the indicating behaviors of hearing and deaf people in the Quiahije municipality. It is joined by a study performed with Lynn Hou comparing the use of negative manual gestures and negative signs in the municipality (Mesh & Hou, in press). The comparative component of both studies is critical, I believe, to the documentation of emerging signed languages. We cannot make claims about linguistic inventions in emerging languages without first demonstrating that the phenomenon in question is indeed limited to the behavior of signers. This work was made possible through multiple, extended field trips to the Quiahije municipality, in which the forms and functions of gestures and signs could be observed in naturalistic contexts, and elicited in semi-structured interviews. Work of this kind is rare because it places demands on the limited time and resources of researchers, yet an increasing number of investigators is conducting sustained fieldwork in the village contexts in which signed languages emerge (see, e.g., Zeshan & de Vos, 2012). This work was also made possible through the generosity and accommodation of individuals who good-naturedly endured being recorded as they went about their daily activities, and who willingly participated in interviews. Not everyone who was approached for the project was willing to participate: a fact that makes me all the more grateful for the people who cheerfully invited me and my camera into their homes.

### **3.6 Conclusion**

This chapter introduced the community in which San Juan Quiahije Chatino Sign Language is emerging. It reviewed features of the cultural context, physical geography, and language use of the Chatino people in the San Juan Quiahije municipality. It introduced the signers of the emerging language, and described the fieldwork that the author undertook to observe, elicit, record and compare the indicating behaviors of deaf and hearing community members. In the upcoming chapter, the first study conducted by the author—an investigation of the indicating behaviors of hearing non-signers—will be presented.

## Chapter 4

### Study 1: Indicating Gestures in San Juan Quiahije

#### 4.1 Overview

This chapter is the first of a three-part exploration of indicating gestures in the Quiahije municipality. The aim of the study is to compare the indicating gesture use of hearing non-signers in the municipality with that of deaf people developing a signed language in the same region. The similarities and differences between two groups' uses of indicating gestures can shed light on how local conventions for gesture use contribute to the development of visual-manual languages. As a first step towards this larger investigation, the current chapter presents a study of indicating gesture use in hearing non-signers, exploring: (1) the types of information that are conveyed in these gestures, and (2) the extent to which this information is conveyed in a stable manner across use contexts. By examining their conventions for the use of indicating gestures, this chapter facilitates an exploration of whether and how users of a developing signed language in this same region draw on gesturing conventions to create a fully visual-manual indicating system.

The structure of the chapter is as follows. Section 4.2, 'Two indicating scenes,' introduces the indicating gestures of San Juan Quiahije via examples from a single gesturer. Two types of indicating gesture are introduced: the point and the *go* gesture, a form that identifies the direction of a target while symbolizing motion toward it. Section 4.3, 'A functional definition of indicating gestures,' provides a definition of the indicating function that will be used throughout the dissertation. Section 4.4, 'What types of information do indicating gestures convey?' provides a review of the literature on the form-meaning mappings of indicating gestures. Particular attention is given to the claims that indicating gestures convey information

about not only the direction of the indicated target, but also its distance from the gesturer. Section 4.5, ‘A study of indicating gestures in San Juan Quiahije,’ considers the types of information conveyed in one community’s indicating gestures, and the degree to which that information is conveyed in a systematic manner across contexts. The study finds that both the height of all indicating gestures and the handshape of pointing gestures convey information about target distance in a highly systematic manner. Finally, Section 4.6, ‘Conclusion,’ reviews the findings of the chapter and connects them to the second study of the dissertation, an investigation of the relationship between indicating gestures and the speech that accompanies them.

## 4.2 Two indicating scenes

Talya,<sup>1</sup> a speaker of San Juan Quiahije Chatino, is answering questions about the mountain community in which she lives. When the interviewer asks her about the routes she takes to reach the church at the center of town, she replies economically: “I travel on foot”. The interviewer presses Talya to identify the path she prefers, reminding her that there are multiple footpaths between her home and the center of the village. “That one,” Talya replies, pointing toward a footpath 20 meters to her left, “or this one,” pointing toward a path around 60 meters to her right (Figure 4.1).<sup>2</sup> Talya’s pointing gestures have the same basic form: she lifts her elbow only slightly, allowing her forearm and pointing hand to extend out from her body in the direction of her target. She extends the index finger of her pointing hand, making a loose fist with her other fingers and thumb.

---

<sup>1</sup>The Chatino name Tal20=ya24 was selected as a pseudonym to meet the participant’s request for anonymity. The name is derived from the Spanish name Natalia (with adaptations to reflect Chatino phonological conventions) and is used commonly in the Quiahije municipality. Use of the name reflects a history in which Chatino speakers were compelled by both the Mexican government and the Catholic Church to adopt Spanish naming practices. There is no modern record of the historical Chatino naming system, and Spanish-derived first and last names are used exclusively in contemporary Chatino communities (E. Cruz, 2017).

<sup>2</sup>For this and all other examples, see video clips made available in the Texas Data Repository: Mesh, Kate, 2017, “Video examples for: for Points of Comparison: What Indicating Gestures Tell Us About the Origins of Signs in San Juan Quiahije Chatino Sign Language,” doi: 10.18738/T8/CEWOEX. All videos are labeled with chapter and example numbers from the dissertation.

- (1) no4 kwa24 qo1 no4 nde2  
 NOM DEM3 CONJ NOM DEM1

‘this one or that one’

LEI14-CF13, 01:27.0

A few minutes later, the interview topic has turned to farming sites where Talya lives during the planting season. “You live at a plot by Green Plain?” the interviewer asks, using the name of a outlying farming community to the west of the village. Talya responds affirmatively, adding “and also by Ash Mountain here, (where) we grow corn.” She simultaneously points towards the location in question (Figure 4.2). Talya’s gesture in this case is noticeably different from her earlier gestures: her elbow is raised well above her shoulder, and straightened to place her hand high in the air. Her handshape is different as well: she points with an open hand, with all five fingers extended and adducted and her thumb resting loose and unopposed.

- (2) qo1 kwiq24 te20 qya2 ji42 re2 ntyji14 jyan3 qwa42  
 CONJ also LOC mountain ash DEM1 HAB:find cornfield POSS:1EXCL

‘and also towards Ash Mountain here (where) we grow corn’

LEI14-CF13, 02:49.0

Talya only partially lowers her hand before adding an explanation about her route: “along the road towards here is where we grow corn”. Alongside her description of the road, she raises her arm to indicate the direction of Ash Hill again. This time, rather than simply extending her arm to point, she traces an arc through the air in the direction of Ash Hill. Just as in the immediately prior gesture, Talya indicates the direction of the farming site with an elevated elbow and an open hand (Fig 4.3). The addition of the arc motion to Talya’s gesture tells a knowledgeable Chatino observer something about the gesture’s meaning: the target in this case is the goal of motion. Talya thus identifies the direction of the target while symbolizing motion toward it, using a gesture that will be referred to hereafter as the *go* gesture.

- (3) twen3 ri20 nde2 ntyji24 jyan3 qwa42  
 road LOC DEM1 HAB:find cornfield POSS:1EXCL

‘along the road towards here is where we grow corn’

LEI14-CF13, 02:51.0



Figure 4.1: *no4 kwa24 qo1 no4 nde2*, 'that one or this one'



Figure 4.2: *qo1 kwiq24 te20 qya2 ji42 re2 ntyji14 jyan3 qwa42*, 'and also towards Ash Mountain here where we grow corn'





Figure 4.3: *twen3 ri20 nde2 ntyji24 jyan3 qwa42*, ‘along the road towards here is where we grow corn’

Talya’s gestures in these two scenes are different in form. When pointing to each of the roads, she keeps her elbow unelevated and uses an extended index finger handshape. When indicating her farm site (either with a pointing gesture or with a *go* gesture), she raises her elbow and gestures with her entire open hand.

Importantly, the gestures themselves are not the only feature to differ across the two scenes. The targets that Talya indicates with her gestures also differ in one important feature: their distance from the interview location. The relevant stretches of the roads in question are a matter of meters away, whereas the farm site is at a distance of several kilometers. This difference in distance has a number of practical ramifications for Talya. She can see the nearby roads and move to them with ease, and she can rely on the fact that her interlocutor can do these things as well. Because of their visual and physical accessibility, Talya can single out each road from the surrounding space, using the individuating expressions “this one” and “that one.” Consider, by way of contrast, the distant farming site: it is invisible to all parties to the communication, and would take multiple hours to reach by any available means of travel. It is impossible to single out in the interlocutors’ visual field, and it is difficult to isolate conceptually from the surrounding regions

in large-scale space. The one geospatial feature of the farm site that *is* accessible is the direction in which it lies, and Talya’s talk brings this feature into focus. She observes that the site is ‘towards’ the direction of a farming community, and extends her hand to individuate the direction in which the target can be found.

This chapter considers the thesis that information about both the direction and the distance of the target is conveyed in Talya’s indicating gestures—i.e., her pointing and *go* gestures. The chapter investigates the degree to which this information is systematically expressed in two features of indicating gesture form—gesture height and handshape—in the gestures of Talya and of other San Juan Quiahije Chatino speakers. To support this investigation, a functional definition of indicating gestures is provided in §4.3 below. This is followed by a review of the literature on indicating gestures (§4.4) and finally by a study of indicating gestures produced in the San Juan Quiahije municipality (§4.5)

### 4.3 A functional definition of indicating gestures

Each of Talya’s gestures in the scenes above is part of a multimodal referring act—a combination of speech and gesture that brings an object of interest to the attention of her addressee. More narrowly, these are referring acts that *indicate* the referent, i.e, draw the addressee’s attention to a delimited space in the physical world where the referent can be found (Clark, 1996; Clark & Bangerter, 2004). In Chapter 5, the contributions of speech and gesture to multimodal referring acts will be explored at greater length. Here, attention will be given expressly to the *indicating gestures* that anchor these multimodal expressions.

A gesture *indicates* an object or location in the world by creating a ‘physical connection’ to it (Clark, 1996; Peirce, 1955, p. 165). This is accomplished by extending some part of the body to form an appreciable line (or to trace one) extending towards the relevant entity. Pointing is the prototypical indicating gesture, and is often produced by an extending a finger, though other articulators can be employed (Enfield, 2001; Sherzer, 2008). In the end, any extended body part or artifact can function to indicate, provided that it forms or traces a clear line that can conceptually extended by the addressee. When the hand is used to point, the gesture is usually characterized by a moment of stillness at the apex of the gesture (the moment of greatest arm or finger extension, see (Levelt, Richardson, & La Heij, 1985,

p. 134). This allows the addressee to calculate the angle of the projected vector or ‘pointing beam’ and to direct their attention to objects and locations along (and alongside) the beam (Kranstedt, Lücking, Pfeffer, Rieser, & Wachsmuth, 2006).

For an example of pointing in Talya’s indicating scenes, consider the gestures that she produces to direct the interpreter’s attention to paths near her home (Figure 4.1). To produce each point, Talya raises an arm with the elbow slightly bent, so that her entire forearm and pointing hand form a line, out of which the conceptual pointing beam is projected. In this case, each pointing beam can be followed until it intersects with a visible object: the roads to which Talya refers using the phrase ‘that one or this one’ (ex. 1).

Pointing is the closest approximation to a ‘pure’ indicating form, in that it directs attention to items in the world rather than describing or naming these items. Other gestures blend the indicating function with a descriptive one. Kita (personal communication, 2017) uses the term *motion-direction-blend* to refer to gestures in which depictions of particular, speaker-anchored actions (e.g., pushing an object away from the speaker) are blended with an environment-linked indicating motion (directing attention to the real-world direction in which the object was pushed.) Like any indicating gestures, motion-direction-blends create a ‘physical connection’ with real-world spaces, drawing the addressee’s attention to those spaces.

For an example of a motion-direction-blend in Talya’s indicating scenes, consider the gesture that she produces alongside the expression “we set out on the road towards here” (ex. 3). The gesture in this case is a conventional one used by Chatino people to express the idea of forward motion—an emblem (in the sense of (Efron, 1972) and (Hanna, 1996) that is labeled the *go* gesture throughout this dissertation. The *go* gesture is frequently accompanied by the verb *tša24*, ‘to go [away from one’s hometown]’ or *kya24*, ‘to go [towards one’s hometown]’ (E. Cruz, 2017; H. Cruz, n.d.), verbs that signify an agent’s movement forward and away from their current location. One version of the *go* gesture encodes nothing more than forward motion: to produce this version, the gesturer moves an outstretched hand outward and upward, producing an arc motion directly in front of their torso (Figure 4.4). The gesture can be modified, however, to include information about the direction of motion: the gesturer need only shift the endpoint of the outward-moving arc towards a real-world location (Figure 4.5). Talya produces such a modified *go* gesture when she directs the endpoint of the arc towards Ash Mountain (Figure 4.3).



Figure 4.4: An uninflected *go* gesture, characterized by an arc movement with the fingertips (sometimes exaggerated through flexion of the wrist)



Figure 4.5: A *go* gesture with a displaced endpoint, indicating the direction of motion

In this dissertation, the entire set of gestures that function to indicate locations in the world will be described using the term *indicating gestures*. In the discussion of gestures used in San Juan Quiahije, indicating gestures will be more narrowly categorized as *points* when they do no more than indicate a location, and as *go* gestures when they both indicate a direction and, through the use of the incorporated arc movement, symbolize forward motion in that direction.

Indicating gestures are united by a single function: directing the addressee’s attention to locations in space. When the gestures target real-world locations in the surround of the speaker, their function is described as *locative* (see, e.g., Johnston, 2013). Speakers and signers can use indicating gestures with a non-locative function, as well: they can direct the gestures toward empty space in order to refer to imagined or conceptual targets (McNeill, Cassell, and Levy, 1993; Newport and Meier, 1986). This *abstract* function builds on, and abstracts away from, the original locative function of indicating gestures, and it develops later in gestural and signed communication systems (see, e.g., Pfau, 2011). The current study is focused on gestures that indicate real-world regions and the objects within them; that is, it considers indicating gestures with a true locative function rather than an abstract one.

A definition of indicating gestures requires a final, terminological clarification. Spoken language expressions that refer to a location or object in the world are said to have a *referent*. Indicating gestures, by contrast, are typically described as picking out a *target*. Both the words *referent* and *target* may be subsumed under the expression *indicatum*, and some authors prefer the term to convey a modality-free concept of indicating (see, e.g., Clark, 1996). For the sake of accessibility, however, this dissertation will describe the ‘targets’ of gestures, the ‘referents’ of spoken language expressions, and, where relevant, the ‘referents’ of multimodal referring acts that pick out entities using both speech and gesture.

#### 4.4 Indicating gestures map information to distinct features

Early work that attempted to categorize gestures into distinct types treated locative indicating gestures as *gesticulations*: ad-hoc constructions that conveyed meaning in a context-dependent manner. Pointing gestures in particular were described as holis-

tic behaviors that could not be decomposed into meaningful parts (see, e.g., discussions in McNeill, 1992). The authors arguing that pointing was mere gesticulation—mainly researchers in the field of psychology—do not appear to have been in dialogue with the authors in linguistic anthropology who were contemporaneously reporting that multiple, meaningful signals combine within pointing gestures. The current section reviews the literature from this latter set of researchers (incorporating observations from other fields where relevant), considering the types of information that pointing gestures have been said to convey, and features of pointing that have been claimed to encode this information.

#### 4.4.1 Gesture direction conveys target direction

The very mechanism of indicating—extending or tracing an articulator in the direction of an indicated region—requires that the gesture provide information about the direction of the target location relative to the speaker’s body. When the target is close to the gesturer and/or visible to her, the gesturer will extend the gesturing articulator in the target’s real direction. This fact is so fundamental to the act of indicating that few authors consider the notion of geospatial inaccuracy in indicating. The issue does arise, however, in cases where the target is extremely distant and/or invisible to the gesturer.

Levinson (2003) reports that many gesturers have a tendency to lose track of the location of landmarks and regions in distant space, and to point inaccurately toward them as a consequence. He observes, however, that errors of this kind occur less frequently in communities where the spoken language strategies for locating objects in space are anchored to features of the surrounding geography. For example, speakers of Tenejapan Tseltal, a language of Mexico, and Guugu Yimithirr, a language of Australia, refer to the position of items in space exclusively using geographically-anchored expressions like ‘North’ and ‘West’<sup>3</sup> rather than body-anchored expressions like ‘left’ and ‘right’. Levinson (2003) observed that speakers of these languages almost never point inaccurately when locating landmarks and regions. He concludes that, because speakers of these languages are required to perform acts of ‘dead reckoning’ with considerable frequency (i.e., to determine their own position relative to

---

<sup>3</sup>In fact, Tseltal speakers use a set of slope-based directions with terms like ‘uphill’ and ‘downhill’—a fact that will be reviewed in Chapter 5, since the speakers of San Juan Quiahije Chatino whose language and gestures are studied in this dissertation use a related system.

coordinates in the surrounding geography), (1) they are more attentive to their own position, and (2) they expect their interlocutors to accurately locate referents in both speech and gesture.

Whether they accurately or inaccurately indicate their intended target, gesturers meaningfully extend an articulator (typically a handoutstretched arm) in a particular direction relative to their torsos. The articulator can be extended in any direction in the 360-degree arc surrounding the gesturer: direction, then, is a gradient property rather than a categorical one. Gesturers modulate the direction of their pointing gestures in relation to their perception of the real-world direction of the indicated target. That is, they map the feature of pointing direction onto the feature of target direction, producing a meaningful analog signal. Pointing direction is one of multiple analog signals that encodes information about the indicated target's location in space. The second such signal is pointing height.

#### **4.4.2 Gesture height conveys target distance**

Manual indicating gestures are produced by extending a finger, hand, and/or arm, and gesturers necessarily extend the articulator at some height relative to their torsos. Empirical studies performed across multiple cultures have shown the height of indicating gestures conveys information about the distance of the indicated target.

In a broad description of pointing features, Eco (1976) observed that pointing to locations at a distance is performed with greater energy than pointing to locations nearby (p. 119). His description of energy suggests that the term is a proxy for elbow extension and arm height. Although Eco did not connect this observation to a specific culture's gesturing conventions, modulation of indicating gesture height was later shown to express information about target distance in users of the Australian languages Warlpiri, Warramungu (Kendon, 1980) and Guugu Yimithirr, (Levinson, 2003), the Mexican languages Tsotsil (Haviland, 2009), Tseltal (Levinson, 2003) and Yucatec Maya (Le Guen, 2011), the Nigerian language Yoruba (Ola Orié, 2009), and Ilokano, a language of the Philippines (Streeck, 2009). A similar mapping of gesture height to target distance has been reported for the locative pointing gestures of multiple signed languages, including Sign Language of the Netherlands (van der Kooij, 2002) and the Balinese signed language Kata Kolok (de Vos, 2014).

That this phenomenon occurs across manual pointing systems is not coinci-

dental: distant objects generally appear higher in the visual field (Gibson, 1950); (Shephard & Hurwitz, 1984) and this sensory experience can be reflected in pointing height. Human gesturers exaggerate the height-to-distance mapping, as evidenced by gesturers who point well above the horizon where distant objects might be observed (Levinson, 2003, p. 261).

The height of an indicating gesture is gradient, and can be finely modulated. Height does not appear to be produced or perceived as a discrete, categorical phenomenon in most cases: rather, gesturers appear to map gesture height to distance in an analog fashion. Some exceptions have been reported however: some gesture systems appear to have developed a categorical distinction between the heights mapped to ‘near,’ ‘far,’ and potentially intermediate distance categories. Wilkins (2003) found evidence for a three-way distance distinction encoded in the height of the pointing gestures of Arrernte speakers of northern Australia (Figure 4.6). These speakers pair categorical pointing with the three spoken demonstratives in the language to signal a near-mid-far distinction. A two-way categorical pointing system was documented in the rural Balinese signed language, Kata Kolok (de Vos, 2014); see Figure 4.7. Signers of the language make the near-far distinction using pointing height. Whether the origins of the Kata Kolok system can be traced back to patterns in the pointing gestures of Balinese speakers is as yet unexplored (but see discussion in Perniss & Zeshan, 2008, p. 127).

Gesture height, then, may be a discrete signal encoding rough distance categories, or an analog signal encoding a gradient notion of distance, depending on the indicating system in which it is expressed. This is not the only information about the target location that is conveyed through indicating gesture height, however: this signal can also convey information about the altitude of the target relative to the gesturer.

#### **4.4.3 Gesture height conveys target altitude**

When a gesturer indicates a location above herself, she is likely to raise her arm, since this behavior will make the angle of her forearm (or her entire arm, if it is fully extended) perspicuous to her interlocutor, facilitating their search for the target. The height of the gesture, then, can convey two different kinds of information about the target location—its distance and its altitude relative to the gesturing



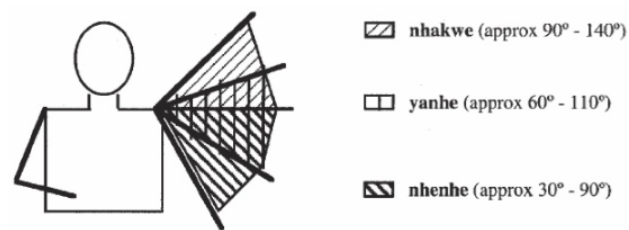


Figure 4.6: Three height distinctions in Arrernte pointing. Reprinted from Wilkins, 2003.



Figure 4.7: Distal locative point in Kata Kolok. Reprinted from de Vos, 2014.

site. Perceivers must therefore contend with ambiguity in the feature of gesture height (see discussion in de Vos, 2013, p. 337). Perceivers make use of cues in the surrounding context to disambiguate the message in gesture height. They may do this on the basis of probability: if gesturers are more likely to convey one of the two types of information using a raised arm, then perceivers may default to a reading in which this is the conveyed information, considering another reading only when the default one is unavailable. To date, the factors of target altitude and target distance have not been isolated in research on indicating gesture height.

#### **4.4.4 Gesture handshape conveys target distance/localizability**

All indicating gestures project a vector: a series of connected points that form a line extending from the gesturer's raised arm and hand to an idealized point in space. A person may use their gesture to draw attention to a target located at the final point of the vector: 'x is there'. Alternatively, a person may gesture toward a point on the horizon in order to direct a vector without indicating the location of the target along the vector: 'x is that way'. One way for gesturers to signal whether or not they are indicating an end point to their projected vector, or simply a vector of unspecified length, is through the shape of the gesturing hand.

(Levinson, 2003) observes: "The index finger individuates, and by contrast the whole hand suggests a vector or a plane" (p. 262). Levinson's claims, made specifically about the indicating gesture handshapes of Guugu Yimithirr and Tzeltal speakers, are echoed in a second account of Tzeltal gestures: "symbolic hand shapes... distinguish reference to individuals from reference to pure direction. The flat hand apparently indicates 'that away' as opposed to the index fingers 'that one'" (Haviland, 2003, p. 160). Similar observations have been made about the function of handshapes in indicating gestures produced by speakers of Yoruba (Ola Orié, 2009) and Arrernte (Wilkins, 2003). The use of an open hand to indicate directions is observable in Yucatec Maya speakers in Le Guen (2006). Streeck (2009) makes this observation without connecting to a culture or language, and highlights examples from speakers of English.

Importantly, the decision to indicate an end point on a projected vector, or simply to direct attention to the vector itself, is related to the distance of the targeted object or region. The farther an object is from the speech/gesturing site,

the less practical it becomes for the gesturer to locate it at a precise point along the vector (see, e.g., discussions in Cooperrider, 2011, p. 28; de Vos, 2013, p. 335; Kranstedt and Wachsmuth, 2005; Kranstedt et al., 2006). Accordingly, the gesturer will be more likely to draw attention to the direction of a distant object than to attempt to individuate its location (see discussion in Cochet & Vauclair, 2012).

Handshape, then, conveys information about the distance and/or ‘localizability’ of the target along the beam projected by the indicating gesture. Importantly, the handshape signal that has been described in the literature is discrete: the extended index finger marks the proximity/localizability of target, while the open hand marks the distance of the target and the greater difficulty of localizing it on the projected indicating beam. Handshape, then, marks this information in a discrete, categorical signal. This signal is combined with the analog signals of pointing direction and gesture height to produce a composite signal, the indicating gesture.

#### 4.4.5 Effects of hand dominance

A manual indicating gesture is produced by extending one or more fingers of a single hand (and often by raising the arm, as well). Gesturers typically show a preference to use one hand in particular to indicate (Cochet & Vauclair, 2012).<sup>4</sup> While this is the case, gesturers can and do produce indicating gestures on their non-dominant hand.

No research to date has investigated the degree to which the meaning-encoding formal patterns of indicating gestures are maintained across gestures of the dominant and non-dominant hand. Researchers may have implicitly assumed that indicating

---

<sup>4</sup>Hand preference for gestural behavior has been shown to depend not simply on a person’s hand dominance for noncommunicative behaviors, but on which brain hemisphere is dominant for language. In laboratory experiments, people who are right-handed in object manipulation tasks, and whose language processing functions are largely found in the left hemisphere, have shown a preference for producing communicative, speech-accompanied gestures on the right hand (Kimura, 1973b). People who are left-handed in object-manipulation tasks may have linguistic processing functions in either or both hemispheres, and in laboratory contexts have correspondingly shown an ambidextrous or left-dominant pattern of communicative, speech-accompanied gesture (Kimura, 1973a). This finding may not apply to all gesture types: Lausberg and Kita (2003), for example, found that the semantic message of iconic gestures was the factor that determined whether they were produced on the right hand, the left hand, or both. But the link between hand preference and linguistic lateralization in the brain has been found for indicating gestures, both in adults (Cochet & Vauclair, 2012) and in children (Vauclair & Cochet, 2013).

gesture patterns are realized in the same way on both hands, since semantic encoding systems must be realized consistently in order to be recognizable to, and informative for, perceivers. A reasonable hypothesis, then, is that the features of gesture direction, gesture height, and handshape will be realized in the same way, whether on gestures produced with the dominant hand or the non-dominant hand. However reasonable, this hypothesis remains untested.

## 4.5 A study of indicating gestures in San Juan Quiahije

The present study considers the indicating gestures of San Juan Quiahije Chatino (SJQ) speakers during conversations about local landmarks and the paths taken to reach them. The study was conducted in service of a larger goal: to investigate whether the gesturing conventions of SJQ speakers in the Quiahije municipality are reflected in the pointing of deaf people in the municipality who are developing a signed language. As a first step towards this larger project, the study investigates indicating gesture conventions among hearing non-signers. It considers locative indicating gestures—ones with a direction feature that conveys information about the true or assumed direction of the target—and considers whether additional morphological features of these gestures convey information about the distance of the target. The study takes as its object the following hypotheses:

1. The HEIGHT feature of indicating gestures systematically covaries with the distance of the indicated target. Increased distance correlates with increased height of gesture.
  - (a) The GESTURE TYPE (indicating vs. *go* gestures) should have no effect on the systematic use of the height feature to encode the distance of the indicated target.
  - (b) The (NON-)DOMINANCE OF THE INDICATING HAND should have no effect on the systematic use of the height feature to encode the distance of the indicated target.
2. The HANDSHAPE feature of indicating gestures systematically covaries with the distance of the indicated target. Increased distance correlates with increased

use of an open shape. Conversely, decreased distance correlates with increased use of an extended index finger.

- (a) The `GESTURE TYPE` (points vs. *go* gestures) should have no effect on the systematic use of the handshape feature to encode the distance of the indicated target.
- (b) The `(NON-)DOMINANCE OF THE GESTURING HAND` should have no effect on the systematic use of the handshape feature to encode the distance of the indicated target.

### 4.5.1 Data & Analysis

#### 4.5.1.1 Data

Data for the study were collected and analyzed by the author during an 8-month field trip to the Quiahije municipality in 2015. The data consist of video recorded `LOCAL ENVIRONMENT INTERVIEWS`: semi-structured interviews in which participants answered questions about the locations of community landmarks and the paths used to reach them.

#### 4.5.1.2 Participants

Participants were 50 adult native speakers of SJQ from the Quiahije municipality (31 women). Data from a total of 21 participants were eliminated for various reasons. Sixteen “infrequent gesturers” produced 6 or fewer location- or route-indicating gestures in the course of an interview; this number was deemed too low to merit their inclusion in the study. Data from one participant was excluded because he had a severe spoken language stutter that may have impacted his gesture production. Data from another participant were eliminated because she voiced her suspicion that the study was about hand movements and her awareness of the research focus may have influenced her gesture production. Finally, three participants withdrew permission to use their data.

Data from a total of 29 participants (18 women; 6 hours, 39 minutes of footage) were included for analysis. All included participants were native speakers of Chatino. Of these, 10 identified Spanish (Sp.) as their second language and an additional 7 were identified as passive Spanish (P. Sp.) users, either by their own

report or because they used Chatino to answer questions posed in Spanish without requiring a translation. Education level, language use, age, gender, home community and interview length of the included hearing participants is provided in Table 4.1.

#### 4.5.1.3 Materials and procedure

Three research assistants were recruited to design and conduct semi-structured interviews about locations and routes in the community. The interview materials were designed following the Locally Anchored Spatial Gestures Interview protocol developed at the Max Planck Institute Kita (2001). The research assistants were given an original set of interview questions in Spanish and systematically translated them into SJQ Chatino, checking their translations for naturalness with their mother-in-law, a monolingual SJQ Chatino speaker. Assistants were trained to conduct the interviews by loosely following an interview script composed of open-ended questions.

The interviewers asked participants to describe gathering places of particular types (e.g., “schools” and “churches”) and to discuss their patterns of travel to and from: (1) family ranching sites, whose locations varied across the participants, (2) the homes of ‘communion godparents’ (sti4 jyaq3, ‘communion godfather, or yqan1 jyaq3, ‘communion godmother’), which varied across the participants, and (3) major trade locations in and outside of the Juquila district, which were discussed by all participants. A complete set of spoken language interview questions appears in Appendix D.

After giving consent to participate and to be video and audio recorded, participants selected a location in their home for the interview. Participants provided chairs for themselves, for the interviewer, and for the author who sat off-camera and operated the camcorder and microphone. Participants were asked to close windows when backlighting affected the light balance of the video recording, or to shift the locations of chairs when their position did not provide both the interviewer and the camera an unobstructed view of the participant’s torso, hands and head. It was explained that the interview was about local landmarks and the routes used to reach them. Participants were informed that while questions would be posed by an interviewer, the questions originated with the author, a beginner-level Chatino speaker and a community outsider. This explanation helped to contextualize questions that

| Home Village | Gender | Age  | First Language | Second Language(s) | Length (mm:ss)          |
|--------------|--------|------|----------------|--------------------|-------------------------|
| Cien.        | F      | 63   | SJQ            | None               | 6:47                    |
| Cien.        | F      | 68   | SJQ            | None               | 7:13                    |
| Cien.        | F      | 40   | SJQ            | P. Sp.             | 6:35                    |
| Cien.        | F      | 51   | SJQ            | P. Sp.             | 10:24                   |
| Cien.        | F      | 63   | SJQ            | None               | 12:19                   |
| Cien.        | F      | 58   | SJQ            | None               | 33:33                   |
| Cien.        | F      | 59   | SJQ            | None               | 33:33 (2nd participant) |
| Cien.        | F      | 70   | SJQ            | None               | 13:45                   |
| Cien.        | F      | 73   | SJQ            | P. Sp.             | 11:52                   |
| Cien.        | M      | 64   | SJQ            | Sp.                | 14:17                   |
| Cien.        | M      | 74   | SJQ            | P. Sp.             | 21:30                   |
| Cien.        | M      | 63   | SJQ            | Sp.                | 27:36                   |
| Cien.        | M      | 63   | SJQ            | P. Sp.             | 17:53                   |
| Cien.        | M      | 55   | SJQ            | None               | 17:12                   |
| Cien.        | M      | 38   | SJQ            | Sp.                | 22:25                   |
| Cien.        | M      | 66   | SJQ            | Sp.                | 22:50                   |
| SJ           | F      | ≈ 65 | SJQ            | unknown            | 23:19                   |
| SJ           | F      | 85   | SJQ            | None               | 14:17 (2nd participant) |
| SJ           | F      | 64   | SJQ            | None               | 22:30                   |
| SJ           | F      | 41   | SJQ            | Sp.                | 27:36 (2nd participant) |
| SJ           | M      | 50   | SJQ            | Sp.                | 12:03                   |
| SJ           | M      | 90   | SJQ            | None               | 15:13                   |
| SJ           | M      | 57   | SJQ            | P. Sp.             | 12:06                   |
| SJ           | M      | 46   | SJQ            | Sp.                | 15:53                   |
| SJ           | M      | 66   | SJQ            | P. Sp.             | 17:17                   |
| SJ           | M      | 50   | SJQ            | Sp.                | 20:21                   |
| SJ           | M      | 48   | SJQ            | Sp.                | 23:36                   |
| SJ           | M      | 62   | SJQ            | None               | 10:50                   |

Table 4.1: Local Environment Interview participant demographics

could seem disingenuous when posed by interviewers who were well acquainted with the regions, landmarks and routes discussed.

A female research assistant interviewed single female participants and groups of women, while a male assistant interviewed single male participants and co-participating male-female couples. Interviewers were asked not to mention the author's interest in gestures and not to gesture at any stage during the interview. To prevent their own gesturing, interviewers held a printed list of question prompts with both hands. This method of suppressing gestures was largely successful, though interviewers occasionally removed their hands from the paper to mirror an interviewee's gesture.

#### **4.5.1.4 Equipment and software**

Interviews were recorded with a Canon HF G10 camcorder with an attached Audio Technica AT875R directional microphone. Recordings were produced in MP4 format with an interlaced frame rate of 60i. Footage was annotated using the ELAN video annotation software (available online: <http://www.lat-mpi.eu/tools/elan/>).

#### **4.5.1.5 Data selection**

To create a dataset useful for the analysis of indicating gestures and of co-occurring speech (see Ch. 5), the author identified all gestures of the hands, arms, and lips, whether or not they were deemed to be communicative, in the 6 hours and 37 minutes of video data. the author identified spoken language utterances that fully or partially overlapped with the annotated gestures.

#### **4.5.1.6 Transcription and translation**

Selected utterances were transcribed and translated with the assistance of three SJQ-Spanish bilingual research assistants. For each selected utterance, an assistant first confirmed that the author had correctly identified the utterance boundary. The assistant then repeated the utterance in SJQ Chatino slowly, emphasizing word boundaries, to facilitate phonetic transcription by the author. Transcriptions were created using the orthographic conventions developed by Emiliana Cruz in collaboration with members of the Chatino Language Documentation Program (E. Cruz



& Woodbury, 2014).<sup>5</sup> Finally, the assistant provided a sentence-level translation in Spanish and confirmed, where necessary, that the author understood which SJQ lexical items/phrases gave rise to select meanings in the Spanish translation.

#### 4.5.1.7 Gesture coding

All manual gestures annotated in the video data were assigned a gesture type label by the author on the basis of functional and formal criteria. POINTING functioned solely to individuate locations or vectors was formed by stretching out the arm and hand to project a vector in the direction of a target. GO gestures had the same indexical function as pointing, in addition to a symbolic component: an arc movement of the fingertips, symbolizing forward motion and made by flexing the elbow and/or wrist as the hand moved into the final indicating position. OTHER gestures had communicative or non-communicative functions (e.g., iconic representation, marking of speech rhythms, self-grooming) determined to be unrelated to spatial reference. The functions of INDETERMINATE gestures were evident neither to the author nor to multiple SJQ-Spanish bilingual research assistants.

All gestures of the POINTING and GO types were coded for HANDSHAPE, HEIGHT and HAND DOMINANCE. The *height* feature in particular was measured at the gesturer’s elbow, a decision made after observing the behavior of gesturers in the video data: participants appeared to lift their elbows, and not simply to raise their fingertips by flexing the elbows, when pointing to distal targets in particular. This observation could be empirically tested through systematic measurements of elbow height.<sup>6</sup>

---

<sup>5</sup>the author diverged from CLDP conventions in not marking lexical tone in the initial transcript. All examples selected for use in this dissertation were updated to reflect post-sandhi tone realizations.

<sup>6</sup>Researchers in both gesture studies and signed language linguistics differ in their approaches to measuring and reporting indicating gesture height. Many observational studies simply report “higher” and “lower” gesture heights without specifying a means of measurement. In the few studies in which indicating gesture features are systematically measured and reported, gesture height has been measured in multiple ways. Levinson (2003) measured the fingertip height of gestures while analyzing features of pointing in Tseltal and Guugu Yimithirr communities. Enfield, Kita, and de Ruiter (2007) measured the elbow height of points in a study of discourse-marking effects on the pointing gestures of Lao speakers. Finally, in a study of pointing sign features in the Balinese signed language, Kata Kolok, de Vos (2014) coded a “lifted upper arm” in some points. de Vos notes that the height feature of gestures was not systematically coded, however (p. 352). The choice to code

| Morphological Category | Coding Options   |
|------------------------|--|
| HANDSHAPE              | IP (Index Point), OH (Open Hand), Thumb, Other, Indeterminate                  |
| ELBOW HEIGHT           | 0—Unelevated, 1—Below shoulder, 2—At shoulder, 3—Above shoulder, Indeterminate |
| HAND DOMINANCE         | Dominant, Non-dominant   |

Table 4.2: Codes for the formational categories of handshape and elbow height



Figure 4.8: Elbow height categories

All three features were treated as categorical: although degrees of elbow raising could be understood as a continuous phenomenon, elbow height coding was facilitated using four ordinal values. Codes for each category are listed in Table 4.2, and images of the motor behaviors captured by the codes are provided in Figs. 4.8 and 4.9.<sup>7</sup>

Hand dominance was determined by the number of communicative gestures produced on each hand: the hand that produced the greater number of gestures was coded as dominant.<sup>8</sup>

elbow height for the current study was made after examining the behaviors of Chatino speaker-gesturers, and reflects an observed pattern in their gesturing practices.

<sup>7</sup>The code ‘IP,’ and abbreviation of ‘Index Point,’ was used to mark the extended index finger handshape. This code was selected because it has been used frequently in the literature on communicative gestures. In this use of the coding scheme, however, an IP handshape could be coded for a point or a *go* gesture, and related only to handshape rather than to the gesture’s function.

<sup>8</sup>Following Cochet and Vauclair (2012), this approach treats hand dominance for communicative and non-communicative behaviors as distinct, and relies on observations of the participants’ communicative behaviors to establish hand dominance.



Figure 4.9: Handshape categories

A single HANDSHAPE and HEIGHT code was selected for each eligible gesture: in those tokens where elbow height or handshape changed during the articulation of the gesture, the code reflected the final feature value; that is, the one present before the retraction phase of the gesture. The code INDETERMINATE was used in cases where the participant’s gesture was visually inaccessible, typically because it was blocked by the participant’s torso or by another object or person on screen.

#### 4.5.1.8 Identifying targets of indicating gestures

Research assistants who performed translation and transcription tasks also identified the targets of the participants’ indicating gestures and corresponding speech. Target identifications performed by one research assistant were reviewed with a second assistant. Targets were marked as INDETERMINATE when neither the author nor multiple research assistants could identify the object’s location.

#### 4.5.1.9 Geospatial coding

All identifiable target locations were marked with placemarks using the Google Earth software (freely available online at [https://www. google.com/earth.](https://www.google.com/earth)) A placemark

(a collection of geodata including latitude and longitude for a given location) was assigned to the target's approximate center or midpoint, whether the target was a landmark (e.g., a school building), a region (e.g., a farming hamlet or city) or a road/footpath. When participants used separate indicating behaviors to identify multiple locations along a single route, the route was segmented and the midpoint of each segment received a placemark.

Geodata from Google Earth placemarks were used to determine the metric distance between each target and the interview site, and the altitude of every target relative to the interview site. First, the latitude and longitude values for each location marker were exported from Google Earth in a .kml file. The file was then converted to .csv format using the KMLSCSV Converter software (freely available online).<sup>9</sup> The distance in meters between an interview site and the site of each target was calculated using an Excel formula of the Haversine equation that accounts for the curvature of the path between two sites on the earth's surface.<sup>10</sup> To collect elevation values for every place mark, a python script was used to query the Elevation Service of the Google Maps API which returned an elevation value in meters for each latitude/longitude pair in the .csv file.<sup>11</sup> The returned elevation values were used to calculate the altitude difference in meters between an interview site and the site of a target.

#### 4.5.1.10 Experimental design and statistical analysis

The Local Environment Interview protocol was designed to elicit naturalistic talk about landmarks and routes of importance to interview participants (Kita, 2001). The factor of target distance was anticipated to vary based on the location of the interview itself as well as the locations of the community gathering places, family ranches, and godparents' residences discussed by individual participants. Since these locations were anticipated to lie within the municipality itself—that is, within roughly 5 km of participants' homes, and since the major trade locations were at

---

<sup>9</sup><http://choonchernlim.com/kmlcsv/>

<sup>10</sup>The equation, and information about its use, are publicly available at <http://bluemm.blogspot.com/2007/01/excel-formula-to-calculate-distance.html>.

<sup>11</sup>Many GIS software packages provide a more direct means of obtaining elevation values. Since this feature is not currently provided by Google Earth, the author used a script that has been made publicly available at <https://github.com/kpich/latlong2elev>.

locations roughly 8, 40 or 100 km from the center of the municipality, the factor of distance was coarsely controlled. The study was therefore approached as a quasi-experiment investigating the influence of target distance and target altitude on gesture form.

A series of mixed-effects linear and logistic regression models were constructed in R (RStudio 0.99.903) using the lme4 package (v1.1—6) to test the hypothesis described in §4.5. These models treated elbow height and handshape as dependent variables, target distance and altitude as fixed effects and person as a random effect. For all models, distance was treated as an ordinal variable, with values 0-6 assigned to distance spans corresponding to regions targeted by participants' indicating gestures (§4.5.2.1). Elbow height was treated as an ordinal variable, with the value 0 assigned to the 'unelevated' height code, 1 to 'below shoulder,' 2 to 'at shoulder' and 3 to 'above shoulder'. Handshape was treated as a binary categorical variable, with values comprising the two handshapes that predominated in the dataset: index point and open hand. (Tokens of the 'thumb' and 'other' handshapes were omitted from analysis because they occurred so infrequently in the dataset; see §4.5.2.4.1). All models, and the dataset on to which they were fitted, have been made available at the Texas Data Respository.<sup>12</sup>

## 4.5.2 Results

### 4.5.2.1 Introduction to the study results

The 29 study participants produced a total of 2,285 gestures in 6 hours, 37 minutes of interview footage. Of these, 230 had indeterminate functions, and 886 had communicative, but not indicating, functions. A total of 1,169 gestures were identified as indicating gestures: 801 points and 368 *go* gestures. Of these, 630 points and 243 *go* gestures were directed towards identifiable targets, (see §4.5.1.8), forming a dataset of 873 indicating gestures available for analysis. The remaining 296 indicating gestures were excluded because their targets were not identifiable, typically for one of four reasons: (1) the targets were locations of buildings that no longer exist and that could not be located by the author or the research assistants, (2) the gesture

---

<sup>12</sup>Mesh, Kate, 2017, "Local environment interview data for Points of Comparison: What Indicating Gestures Tell Us About the Origins of Signs in San Juan Quiahije Chatino Sign Language", doi:10.18738/T8/PJXZJI.

targeted the home of a person unidentifiable by the author and research assistants, (3) the accompanying speech identified a direction but not an object or region in the indicated direction, and (4) the target was a person walking or standing nearby the interview site, but out of view of the camera, and their location could not be ascertained during video annotation.

Participants produced an average of 30 indicating gestures per interview (SD = 23.3). On average, 16% of a participant's indicating gestures was performed on the non-dominant hand (SD = 15.8) The total number of indicating gestures, as well as the proportion of these gestures performed on the dominant and non-dominant hands, is provided for each participant in Table 4.3.

The 884 gestures in the dataset targeted locations at a variety of distances from the participants. Targets clustered in the two villages of the Quiahije municipality, the outlying farming sites in the municipality, two major trade locations in the Juquila district (the district seat, Santa Catarina Juquila, and the town of San Miguel Panixtlahuaca), the state capitol, Oaxaca de Juárez, and work sites in the United States characterized simply as *(ti20) nor=te24*, '(up) North'. Gestures targeting locations between these towns and cities were nearly nonexistent, with the exception of some discussion of roads and state highways connecting major trade destinations. To facilitate an analysis of distance without targets uniformly distributed across continuous space targets were grouped into 8 categories, which were assigned the ordinal values 0—7. Ordinal distance values, corresponding distance ranges, types of objects targeted within each each range, and number of targets within each range are provided in Table 4.4.

For gestures toward the United States and the U.S./Mexico border, the broad descriptor *(ti20) nor=te24*, 'towards (the) North' did not allow the location of a Google placemark in a specific area of the country. When the placemark was located near the center of the United States, the distance span between targets in categories 6 and 7 was so great that the model could not be fitted to the data. For this reason, the 13 targets in the United States were eliminated from the dataset, leaving a total of 860 gestures distributed across 6 ordinal distance categories.

Gestures toward targets in distance categories 4 and 5 were distinct in three respects that should be noted. First, there were fewer tokens to analyze in these categories, because only a few participants indicated targets in this distance range. Second, the gestures toward these targets were produced as a component of route

| Person | Total gestures (n) | % Non-Dom. Hand |
|--------|--------------------|-----------------|
| CF01   | 8                  | 0               |
| CF02   | 9                  | 11              |
| CF05   | 21                 | 33              |
| CF06   | 6                  | 0               |
| CF07   | 37                 | 32              |
| CF10   | 9                  | 0               |
| CF11   | 15                 | 27              |
| CF13   | 24                 | 0               |
| CF17   | 5                  | 0               |
| CM02   | 42                 | 24              |
| CM03   | 44                 | 14              |
| CM05   | 38                 | 21              |
| CM06   | 70                 | 33              |
| CM07   | 43                 | 30              |
| CM08   | 33                 | 24              |
| CM09   | 22                 | 45              |
| SF04   | 5                  | 40              |
| SF05   | 38                 | 3               |
| SF06   | 7                  | 0               |
| SF08   | 4                  | 0               |
| SF12   | 27                 | 30              |
| SM01   | 62                 | 0               |
| SM02   | 103                | 3               |
| SM03   | 13                 | 0               |
| SM04   | 18                 | 0               |
| SM05   | 43                 | 37              |
| SM07   | 48                 | 40              |
| SM08   | 57                 | 7               |
| SM10   | 22                 | 14              |

Table 4.3: Total number of indicating gestures, with proportions performed on the non-dominant hand, by participant

| Ordinal<br>dist. value | Dist range<br>in km | Target type                             | No. of Targets |
|------------------------|---------------------|---|----------------|
| 0                      | 0—1.5               | Participant’s village                   | 486            |
| 1                      | 1.5—3.5             | Other village in municipality           | 61             |
| 2                      | 3.5—7               | Family ranching sites                   | 114            |
| 3                      | 7—12                | Trade locations in the Juquila District | 104            |
| 4                      | 12—18               | Footpaths and roads to trade locations  | 37             |
| 5                      | 40—48               | State highways                          | 12             |
| 6                      | 100—110             | State capitol, Oaxaca de Juárez         | 43             |
| 7                      | 2000+               | U.S./ Mexico border and U.S. cities     | 13             |

Table 4.4: Distance categories for statistical analysis

descriptions (‘start in the village; walk to community A; take a paved highway to community B’). By contrast, the gestures towards targets in the remaining categories were usually articulated as part of a locating act (‘the city is there’ or ‘I take that road’). Finally, participants showed a strong tendency to trace their indicating gestures along an imagined, abstracted route when indicating targets in categories 4 and 5. This was certainly attested in gestures toward targets in the other distance categories, but the tendency was much stronger for targets in distance categories 4 and 5. These facts in combination suggest that gestures indicating targets in distance categories 4 and 5 were tokens of a slightly different behavior, and may not be fully comparable to the indicating gestures articulated towards targets in other distance categories. The results for all 6 distance categories will be reported here: however, visualizations of the results will include a light grey box around results from categories 4 and 5, to call attention to the slightly different behaviors reflected in this set of gestures.

#### 4.5.2.2 Direction

The 884 gestures in the dataset had true locative functions—that is, they indicated the real world locations of non-imaginary referents. Participants modulated the direction of their outstretched fingers, arms and hands to create a vector originating at the joint at the base of the finger, the wrist, the elbow or the shoulder and extending in the true direction of the target. Participants appeared to possess, and



to convey, accurate information about the location of the targets in most cases, even in the many instances when the targets were so distant as to be invisible to the participants. However, since accuracy of pointing direction was not coded for this study, no quantitative results related to accuracy can be reported here.

The hypotheses for the study did not relate to the direction feature of pointing, since it was assumed that locative gestures by definition modulate the feature of pointing direction meaningfully. The hypothesis instead related to two other features of pointing that have been said to convey information systematically: elbow height and handshape. Results related to each of these features are reported below.

### **4.5.2.3 Elbow height**

#### **4.5.2.3.1 Is elbow height patterned in SJQ speakers indicating gestures?**

The elbow height feature of participants' indicating gestures was expected to be influenced by the distance of the indicated location. It was assumed that gesturing to indicate targets near the gesturer would be performed using a low elbow height, and that, as the distance between the gesturer and the target increased, the elbow height of the gesture would also increase. This was borne out in the collected dataset, as the mean height of gestures largely increased with increases in the value of the distance category. There were two exceptions to this trend: elbow height was highly variable for gestures toward targets in distance categories 4 and 5, and the mean height of these gestures was not greater than the mean height of gestures towards targets in distance category 3. The proportion of indicating gestures with each elbow height directed toward targets in each distance category are presented in Figure 4.15.

A statistical analysis was performed to determine whether the effects of target distance on the elbow height of participants' indicating gestures was statistically significant. Because target altitude had been anticipated to affect the elbow height of at least some indicating gestures, the model was designed to take the effects of both distance and altitude into account. A mixed-effects linear regression model was constructed with elbow height as the dependent variable, target distance and target altitude as fixed effects, and person as a random effect. A main effect of distance remained after accounting for altitude ( $p < 0.001$ ). The mean elbow height averaged to 1.04 when the target distance value was zero ( $SE = 0.20$ ), and increased by an

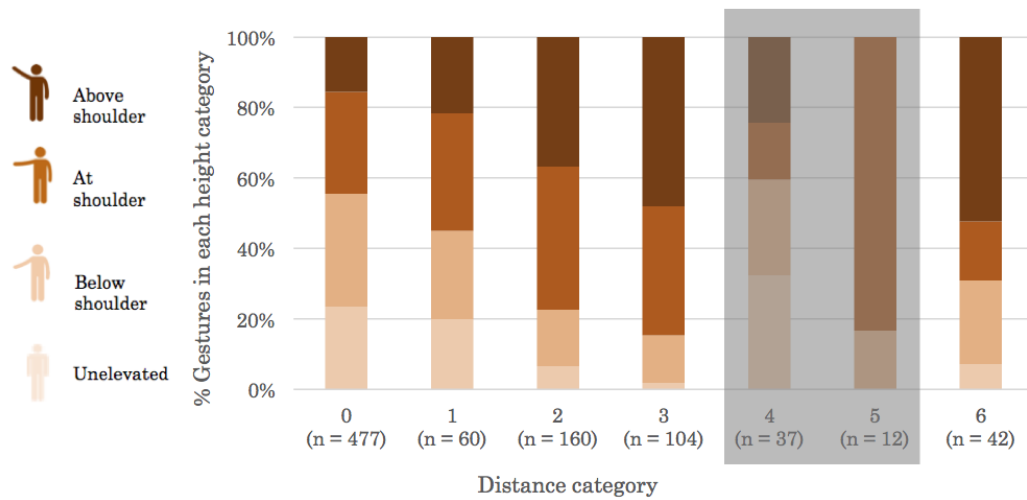


Figure 4.10: Elbow height by distance category: all indicating gestures

average of 0.18 with every increase in distance category ( $SE = 0.02$ ). While holding distance constant there was no significant effect of altitude ( $p = 0.13$ ). Results of the mixed model are provided in Table 4.8. An additional test looked for an interaction between the effects of distance and altitude. No significant interaction was found ( $p = 0.15$ ): the effect of distance on elbow height was the same for targets at different altitudes.

| Fixed effects      | Estimate | SE       | Pr(> t ) |
|--------------------|----------|----------|----------|
| (Intercept)        | 1.04     | 0.20     | < 0.001  |
| Distance           | 0.18     | 0.02     | < 0.001  |
| Altitude           | 0.02     | 0.02     | 0.13     |
| Random effects     |          | Variance |          |
| Person (Intercept) | 0.35     |          |          |
| Residual           | 0.76     |          |          |

Table 4.5: Mixed effects linear regression analysis of distance and altitude effects on elbow height

#### 4.5.2.3.2 Is the elbow height pattern robust regardless of the indicating gesture type used (points vs *go* gestures)?

It was anticipated that target distance would affect the elbow height of both types of gestures considered in the study: points and *go* gestures. This was borne out in the collected data: distance effects are seen in gestures of both types. The proportion of pointing gestures with each elbow height directed toward targets in each distance category are presented in Figure 4.11. The proportion of *go* gestures with each elbow height directed toward targets in each distance category are presented in Figure 4.12.

A statistical analysis was performed to determine whether the gesture type used (points or *go* gestures) influenced the elbow height of indicating gestures when distance was taken into account. A mixed-effects linear regression model was constructed with elbow height as the dependent variable, target distance and gesture type as fixed effects, and person as a random effect. There was no significant effect of gesture type ( $p = 0.3$ ). A main effect remained for distance ( $p < 0.001$ ): while holding gesture type constant, the mean elbow height of indicating gestures averaged to 1.23 when the target distance value was zero ( $SE = 0.13$ ), and increased by an average of 0.17 with every increase in distance category ( $SE = 0.02$ ). Results of the analysis are provided in Table 4.6. An additional model looked for an interaction between the factors of distance and gesture type. No significant interaction was found ( $p = 0.46$ ): the effect of distance on elbow height was consistent for indicating gestures of both types.

| Fixed effects      | Estimate | SE   | Pr(> t ) |
|--------------------|----------|------|----------|
| (Intercept)        | 1.23     | 0.13 | < 0.001  |
| Distance           | 0.17     | 0.02 | < 0.001  |
| Gesture Type       |          |      |          |
| Pointing           | (ref)    |      |          |
| <i>go</i> Gest.    | 0.07     | 0.07 | 0.3      |
| Random effects     |          |      |          |
| Person (Intercept) | Variance |      |          |
| Residual           | 0.35     |      |          |
|                    | 0.76     |      |          |

Table 4.6: Mixed effects linear regression analysis of distance and gesture type effects on elbow height

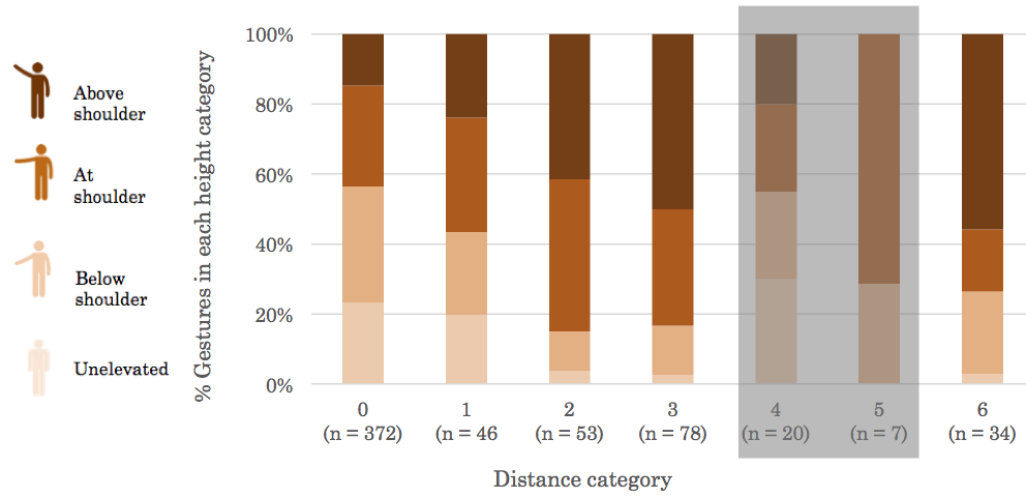


Figure 4.11: Elbow height by distance category: points

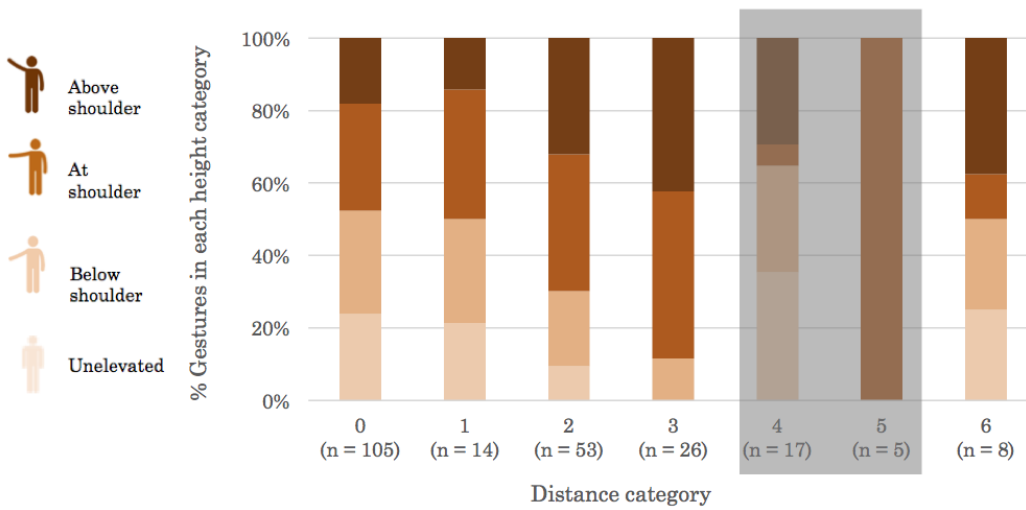


Figure 4.12: Elbow height by distance category: go gestures

#### 4.5.2.3.3 Are the patterns robust across gestures produced on the dominant and non-dominant hands?

It was anticipated that target distance would affect the elbow height of gestures produced on both the dominant and non-dominant hands. This was the case in the collected data. The mean elbow height of dominant-hand gestures across all distance values are presented in Figure 4.13. The mean elbow height of non-dominant hand gestures across all distance values are presented in Figure 4.13.

To examine the effects of hand dominance and distance on indicating gesture elbow height, a mixed-effects linear regression model was constructed with elbow height as the dependent variable, target distance and hand dominance as fixed effects, and person as a random effect. There was a significant effect of hand dominance ( $p < 0.05$ ): while holding distance constant, the mean elbow height was greater for gestures produced using the non-dominant hand. A main effect remained for distance ( $p < 0.001$ ): while hand dominance was held constant, the mean elbow height of indicating gestures averaged to 1.26 when the target distance value was zero ( $SE = 0.12$ ), and increased by an average of 0.17 with every increase in distance category ( $SE = 0.02$ ). Results of the analysis are presented in Table 4.7. An additional model looked for an interaction between the factors of distance and hand dominance. No interaction was found: the effect of distance on elbow height was consistent for gestures performed on the dominant and the non-dominant hand.

| Fixed effects      | Estimate | SE   | Pr(> t ) |
|--------------------|----------|------|----------|
| (Intercept)        | 1.26     | 0.12 | < 0.001  |
| Distance           | 0.17     | 0.02 | < 0.001  |
| Hand Dominance     |          |      |          |
| Dom.               | (ref)    |      |          |
| Non-Dom.           | 0.17     | 0.08 | < 0.05   |
| Random effects     | Variance |      |          |
| Person (Intercept) | 0.77     |      |          |

Table 4.7: Mixed effects linear regression analysis of distance and hand dominance effects on elbow height

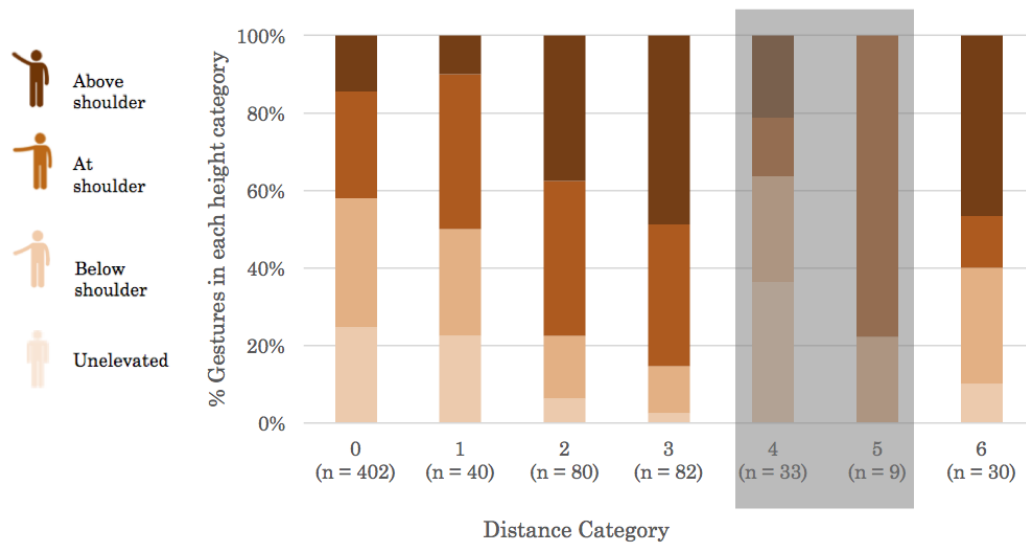


Figure 4.13: Elbow height by distance category: dominant hand gestures

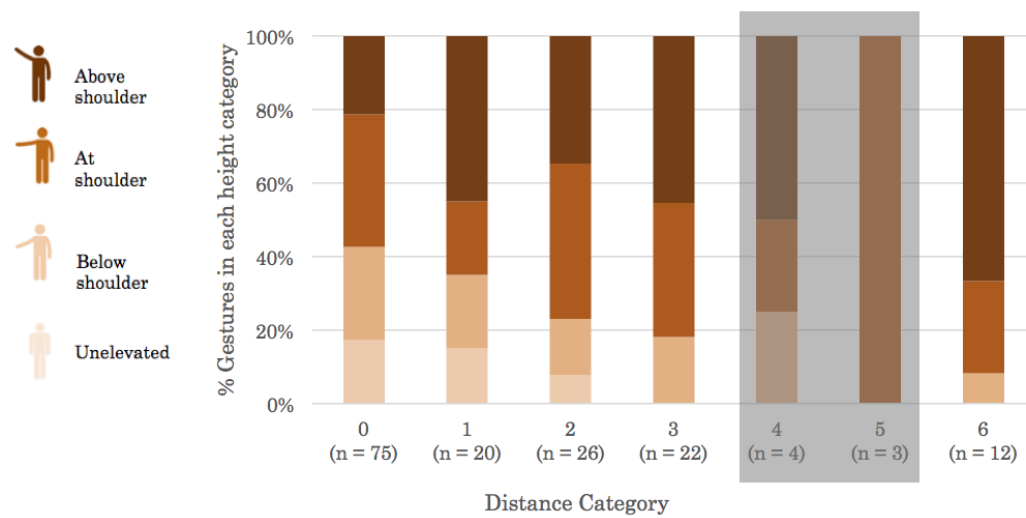


Figure 4.14: Elbow height by distance category: non-dominant hand gestures

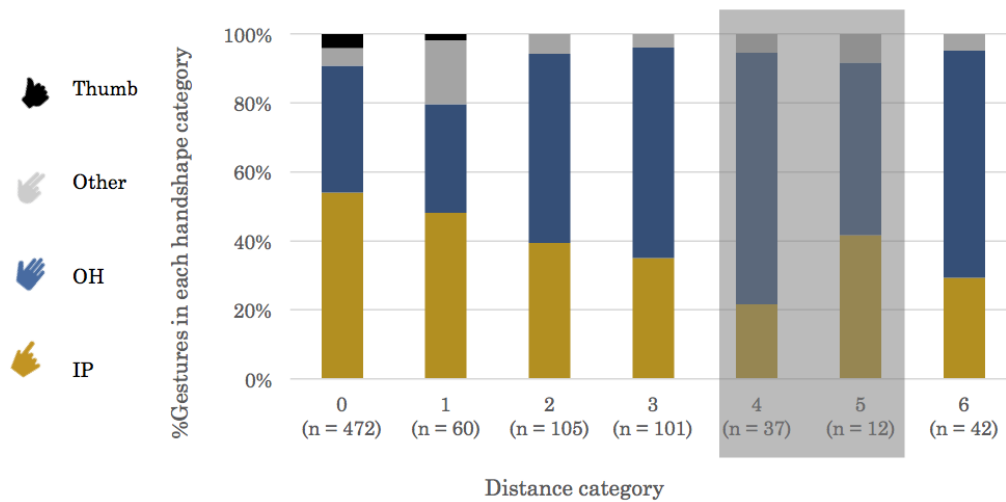


Figure 4.15: Handshape by distance category: all indicating gestures

#### 4.5.2.4 Handshape

##### 4.5.2.4.1 Is handshape patterned in SJQ speakers indicating gestures?

The handshape feature of participants' indicating gestures was expected to be influenced by the distance of the indicated location. It was assumed that gesturing to indicate targets near the gesturer would be performed using an extended index finger, and that, as the distance between the gesturer and the target increased, the odds of using an open handshape would increase. This was borne out: a greater proportion of indicating toward targets in the lower distance categories had the IP (extended index finger) handshape, and a greater proportion of gestures indicating targets in the higher distance categories had the OH (open hand) handshape. Gestures with the Thumb handshape were used to indicate only a small set of targets ( $n = 20$ ), and all of these for targets behind, and relatively nearby, the participants (within the first two distance categories). A small number of gestures classified with the Other handshape were distributed across the distance categories ( $n = 50$ ). The proportions of gestures with IP, OH, Thumb and Other handshapes across all distance values are presented in Figure 4.15.

A statistical analysis was performed to determine whether the effect of target distance on the handshape of participants' indicating gestures was statistically significant. Again target altitude was accounted for in the model, to ensure that

all potentially relevant factors affecting elbow height were considered. Since gestures with two handshapes predominated in the dataset, handshape was treated as a binary categorical variable with values of IP and OH. A mixed-effects logistic regression model was constructed with handshape as the dependent variable, target distance and target altitude as a fixed effect, and person as a random effect. A main effect of distance remained after accounting for altitude ( $p < 0.001$ ). For each increase in the distance category, the odds of gesturing with an OH handshape increased by 38% ( $SE = 0.06$ ). There was no significant effect of altitude while holding distance constant ( $p = 0.56$ ). Results of the regression model are provided in Table 4.8. An additional model looked for an interaction between the factors of distance and altitude. No significant interaction was found ( $p = 0.86$ ): the effects of distance on handshape were the same across altitude categories.

| Fixed effects      | Estimate | SE   | Pr(> t ) |
|--------------------|----------|------|----------|
| (Intercept)        | 0.67     | 0.39 | 0.51     |
| Distance           | 1.38     | 0.08 | < 0.001  |
| Altitude           | 0.97     | 0.45 | 0.56     |
| Random effects     | Variance |      |          |
| Person (Intercept) | 2.52     |      |          |

Table 4.8: Mixed effects logistic regression analysis of distance and altitude effects on handshape

#### 4.5.2.4.2 Is the handshape pattern robust regardless of the gesture type used (points vs ‘go gestures)?

It was anticipated that target distance would affect the handshape of both gesture variants considered in the study: points and *go* gestures. This was not reflected in the collected data, however: distance appeared to affect only the handshape of points, and not the handshape of *go* gestures. The proportions of points with IP, OH, Thumb and Other handshapes across all distance values are presented in Figure 4.16. The proportions of *go* gestures with IP, OH, Thumb and Other handshapes across all distance values are presented in Figure 4.17.

A statistical analysis was performed to confirm that gesture type (points or *go* gestures) as well as the distance of the target had an effect on the handshape of



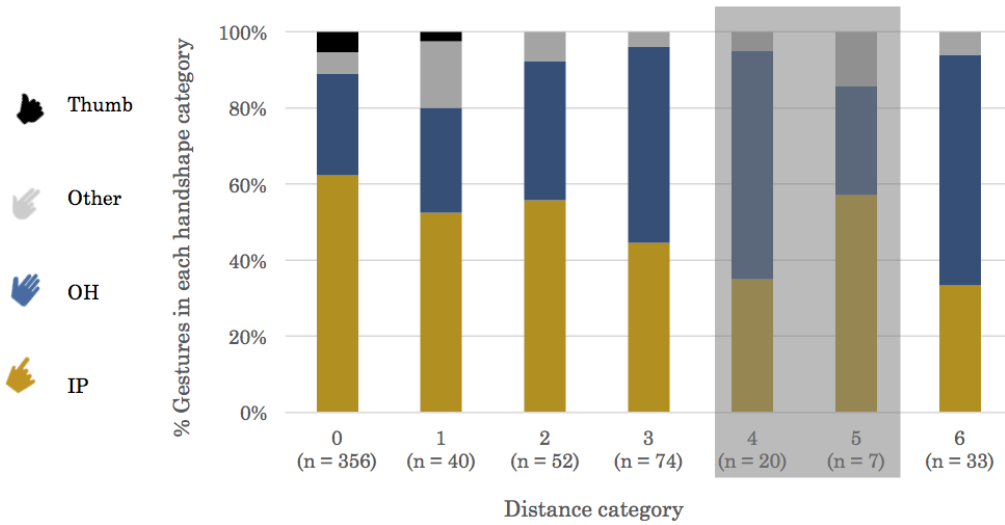


Figure 4.16: Handshape by distance category: points

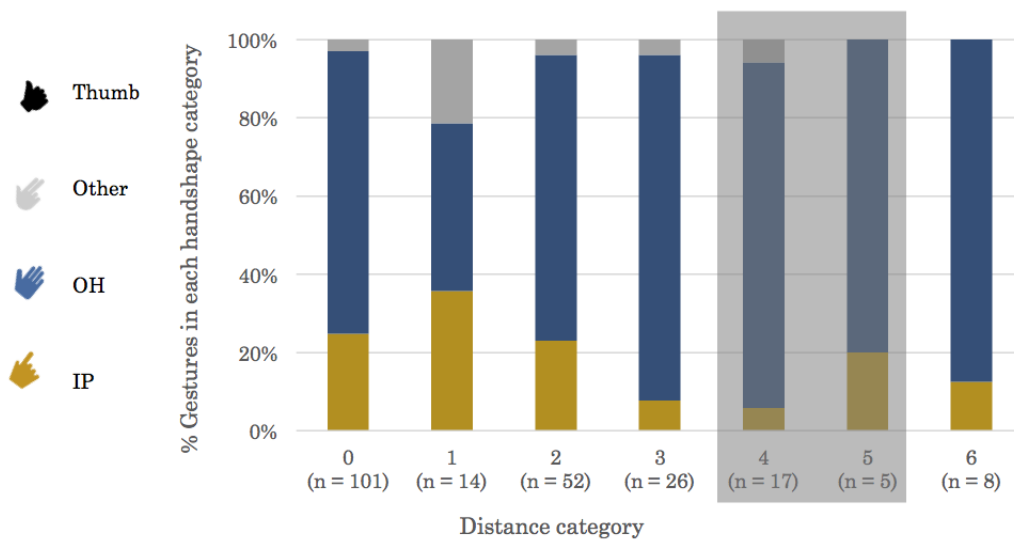


Figure 4.17: Handshape by distance category: go gestures

points and *go* gestures. A mixed-effects logistic regression model was constructed with handshape as the dependent variable, target distance and gesture type as fixed effects, and person as a random effect. A main effect was found for gesture type ( $p < 0.001$ ). While controlling for distance, the odds of having an open hand shape were 88% lower for points compared to *go* gestures (OR = 0.12). A main effect remained for distance ( $p < 0.001$ ): while accounting for gesture type, the odds of producing an OH handshape increased by 37% with each increase in distance category (SE = 0.06). Results of the analysis are provided in Table 4.10. An additional model looked for an interaction between the factors of distance and gesture type. No significant interaction was found ( $p = 0.13$ ): the effect of distance on handshape was the same for indicating gestures of both types.

| Fixed effects      | OR       | SE   | Pr(> t ) |
|--------------------|----------|------|----------|
| (Intercept)        | 2.44     | 0.93 | < 0.05   |
| Distance           | 1.38     | 0.08 | < 0.001  |
| Gesture Type       |          |      |          |
| <i>Go</i> gest.    | (ref)    |      |          |
| Pointing           | 0.12     | 0.03 | < 0.001  |
| Random effects     | Variance |      |          |
| Person (Intercept) | 2.64     |      |          |

Table 4.9: Mixed effects logistic regression analysis of distance and gesture type effects on handshape

#### 4.5.2.4.3 Are the patterns robust across gestures produced on the dominant and non-dominant hands?

It was anticipated that target distance would affect the handshape of gestures produced on both the dominant and non-dominant hands. This was the case in the collected data. Notably, the distance-marking pattern of handshape selection was in fact stronger in the set of gestures produced on the non-dominant hand. The proportions of dominant-hand gestures with IP, OH, Thumb and Other handshapes across all distance values are presented in Figure 4.18. The proportions of non-dominant hand gestures with IP, OH, Thumb and Other handshapes across all distance values are presented in Figure 4.19.

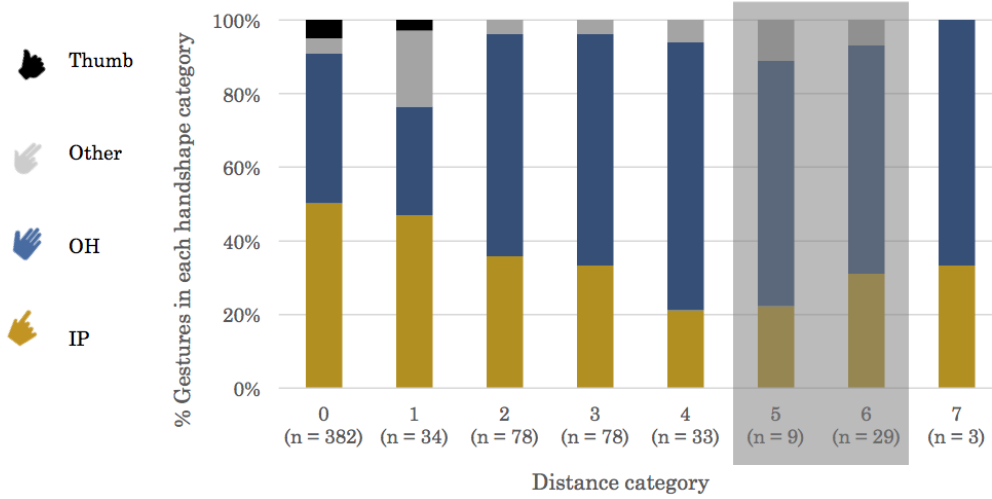


Figure 4.18: Handshake by distance category: dominant hand gestures

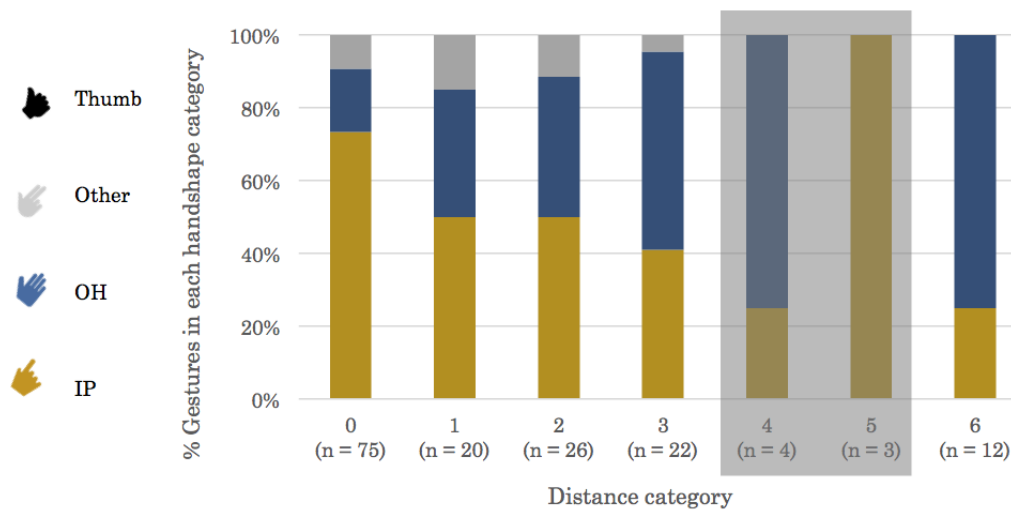


Figure 4.19: Handshake by distance category: non-dominant hand gestures

To examine the effects of hand dominance and distance on the selection of indicating gesture handshape, a mixed-effects linear regression model was constructed with handshape as the dependent variable, target distance and hand dominance as fixed effects, and person as a random effect. There was a main effect of hand dominance ( $p < 0.01$ ): while holding distance constant, gesturers were more likely to use the OH handshape on their non-dominant hand ( $SE = 0.25$ ). There was a main effect of distance ( $p < 0.001$ ): While holding distance constant, gesturers were 50% less likely to have an open hand shape when using their non-dominant hand compared to when using their dominant hand ( $SE = 0.06$ ). Results of the analysis are presented in Table 4.7. An additional model looked for an interaction between the factors of distance and hand dominance. No significant interaction was found, though the interaction trended towards significance ( $p < 0.08$ ), as the target distance increased, the odds of using an OH handshape became greater for gestures performed using the non-dominant hand.

| Fixed effects      | OR       | SE   | Pr(> t ) |
|--------------------|----------|------|----------|
| (Intercept)        | 0.56     | 0.19 | <0.05    |
| Distance           | 1.43     | 0.08 | <0.001   |
| Hand Dom.          |          |      |          |
| Dom.               | (ref)    |      |          |
| Non-Dom.           | 0.50     | 0.13 | < 0.01   |
| Random effects     | Variance |      |          |
| Person (Intercept) | 2.59     |      |          |

Table 4.10: Mixed effects logistic regression analysis of distance and hand dominance effects on handshape

#### 4.5.2.5 Discussion

**Direction** The hypotheses for this study related to indicating gestures with a true locative function, i.e., gestures in which the direction feature (the direction of the extended articulators and the projected pointing beam) is systematically modulated to reflect the idealized direction of the target relative to the gesturer. Participants did modulate the direction of their gestures to indicate the spaces where they believed the landmarks, towns, and routes under discussion to be located.

Participants also modulated two additional features of their indicating gestures systematically: elbow height and handshape.

**Elbow Height** The elbow height feature was systematically modified to convey the distance of the pointing target. Gestures with a low elbow height were frequently used to indicate nearby targets, and, as the distance of the target increased, the elbow height of the gestures reliably increased across the dataset. Participants frequently exploited the elbow height feature when comparing the distance of multiple locations, indicating an initial target with a low elbow height and then raising their arms to indicate a second, more distant target. This behavior was especially common when a set of route directions involved a progression from one landmark or town to the next, each farther from the site of the interview. While the height feature could be exploited for the purposes of comparison, the elbow height feature was also used informatively when no comparison between distances was being expressed. Participants frequently talked about targets at a moderate or great distance without making reference to other locations, and did so while gesturing with a moderately or fully elevated elbow.

While participants could have used the elbow height feature to convey multiple types of information—conveying target distance and target altitude relative to the interview location—they did not do systematically across the dataset. Participants certainly raised their elbows to indicate objects at a higher elevation on occasion: one participant, for example, produced an elevated gesture to indicate her neighbor’s home, built well above the elevation of her own home on a steep mountain slope. However, participants did not reliably perform this behavior across gesture tokens. The elbow height feature, then, was primarily though not exclusively mapped to information about referent distance.

As anticipated, the elbow height feature was used to convey distance information for both gesture types: pointing and *go* gestures. The feature evidently operates as a meaningful signal that can be abstracted from a given gesture complex (e.g., pointing) and combined with other features to produce a gesture of a different type (e.g., the *go* gesture). This is not a characteristic that has been attributed to the features of locative pointing gestures, which have been described as ‘holistic,’ i.e., non-decomposable into reusable, meaningful elements.

**Handshape** The handshape feature of pointing was also used to mark the distance of the indicated target: an IP (extended index finger) handshape marked nearby targets and, as the distance between the gesturer and the target increased, the odds of using an OH (open hand) handshape systematically increased. Some participants exploited the meaningful handshape mappings to mark a distance contrast between two locations, indicating the nearby location with an IP handshape and immediately afterward indicating a more distant location with the OH handshape.

Notably, one of the predictions in the hypotheses was not borne out: participants did not use the handshape feature to mark target distance with both points and *go* gestures. Rather, they showed the anticipated distance marking pattern only on the handshape of points, and showed a strong preference to use the OH handshape for *go* gestures regardless of the distance of the indicated goal of motion. This finding may not be so surprising, after all, given the existence of a *go* emblem in the community that describes forward motion without indicating the location of the goal of motion (see discussion in §4.3 and corresponding image in Figure 4.4). The citation form of this gesture (the one used by SJQ speakers when asked about the existence of a gesture meaning ‘to go’) is produced reliably with an OH handshape, suggesting that there is a well-formedness standard for the production of the emblem that requires the use of the OH handshape. If this is the case, then it may be more remarkable that the *go* gesture is ever produced *without* the OH handshape. It appears that speakers are taking a stable emblem and abstracting away the characteristic arc movement that conveys forward motion. They are evidently treating the arc as a discrete, meaningful element that can be recombined with the distance-marking features of elbow height and handshape.

It remains to be determined why elbow height feature would be used more reliably than the handshape feature to mark distance on indicating *go* gestures. The key to this distinction may well lie with the manner in which the two features convey the distance information: the analog signal of elbow height may be more readily abstracted and re-used than the discrete signal of handshape. Why an analog signal would be more amenable to abstraction, however, is unclear.

**Minimal effects of hand dominance** As predicted, the use of a participant’s dominant or non-dominant hand to articulate an indicating gesture had

little effect on the instantiation of the distance-marking features. One result trending toward significance suggested that participants might use the elbow height and handshape to mark distance more reliably on the non-dominant hand (§4.5.2.4.3). This result may be due to (the lack of) co-articulation effects on the non-dominant hand. Participants often produced multiple gestures in sequence on the dominant hand: the instantiation of both the elbow height and handshape features were likely affected by the instantiation of the features on the immediately adjacent gesture(s). The occurrence of multiple, adjacent gestures was not coded in the dataset, and so possible co-articulation effects between gestures cannot be explored at this stage.

**On the noise in the patterned distance-marking signals** The distance-marking patterns observed in the elbow height and handshape features of indicating gestures are strong but by no means exceptionless. Participants could, and did, use an elevated elbow or OH handshape to indicate nearby referents, and a lowered elbow and IP handshape to mark distal ones. Are we to conclude that in these cases, the elbow height and handshape features did not convey meaning? To the contrary, this result suggests that indicating gestures are put to multiple functions beyond those explored in this study. Indicating gestures are, of course, often blended with other gesture types: they are pressed into service to mark the tempo of speech (a function of so-called ‘beat’ gestures), and employed to mark features of information and discourse structure in the multimodal communication of which they are a part. They are also modulated in deference to culturally-specific codes of politeness. Any and all of these factors may influence the instantiation of features that, in most contexts, are used to mark target distance.

A further contributor to the noise in the dataset may be the fact that notions of distance are necessarily scaled by the participants with each articulation of an indicating gesture. ‘Near’ in one context may be ‘far’ in another, and participants most likely shifted between multiple distance scales in a single interview. The topic of the interview—landmarks and routes inside and outside of the community—was revealed to each participant at the outset of the interview, and was intended to prompt participants to conceive of distance in terms of landscape-level scales. Even at the landscape level, many distance scales may be applied. One participant, for example, moved strikingly between scales by first indicating a location approximately 2.5km away using a lowered elbow and an IP handshape—the markers commonly

used by participants to indicate items within the municipality. She then described the difficulty of walking to the same location, commenting that it is ‘all the way over there,’ and indicated the same location with an elevated elbow and an IP handshape. The participant’s spoken language description, combined with her shift in elbow height, provides evidence that she has shifted from one scale to another between articulating the two indicating gestures. With or without explicit verbal signals, this type of re-scaling must have taken place countless times during the 6 hours of interviews. At least some of the ‘noise’ in distance-marking signal is therefore attributable to a measurement device for distance that could not be scaled to suit each discourse context in the dataset.

Finally, the factor of co-articulation may play a role in shifting the forms of distance-marking features. Gestures are articulated before and after other gestures, as observed above. They are also articulated before and after non-communicative manual behaviors. Hands touch the body—they pat hair, scratch an itch, smooth the wrinkles in a dress—and this was certainly a feature of the participants’ behaviors in the dataset. Hands also move to touch objects in the world: some participants spontaneously placed their hands on tabletops, bench seats, and the heads of their small children. Movement to and from these locations may have affected the instantiation of elbow height and handshape features that might otherwise have adhered more closely to the attested distance-marking patterns. For the current study, movement from locations other than the neutral space in front of the signer were not coded. A coding schema that takes this factor into account might shed light on the degree to which co-articulation effects introduce noise into the distance-marking signals.

## 4.6 Conclusion

This chapter presented the first of three linked studies investigating the use of indicating gestures in the Quiahije municipality. It examined the use of indicating gestures—points and *go* gestures that convey the notion of forward movement—in the gestures of hearing, non-signing people in the San Juan Quiahije municipality. An analysis of the elbow height and handshape features of indicating gestures used by participants in Local Environment Interviews revealed that these gesture features, as well as the feature of gesture direction, are systematically modulated to convey information about the distance and direction of the indicated target. The three



gesture features were shown to operate as distinct meaning-encoding elements that could be productively re-combined with other features to produce pointing gestures and the *go* gesture.

The current study considered gestures that participants produced alongside speech. It did not account for the features of the co-occurring speech, or investigate the relationship between gestures and speech in the multimodal talk of interview participants. Critically, it did not examine the potential effect that features of speech might have on the instantiation of the distance and direction-marking features of indicating gestures. A second study was performed to address this issue: using the same dataset, this study examines the relationship of participants' indicating gestures to their co-occurring speech. This study is presented in Chapter 5.

## Chapter 5

### Study 2: Multimodal Reference in San Juan Quiahije

#### 5.1 Overview

This chapter is the second of a three-part exploration of indicating gestures in the Quiahije municipality. The aim of the study is to compare the indicating gesture use of hearing non-signers in the municipality with that of deaf people developing a signed language in the same region. The similarities and differences between two groups' uses of indicating gestures may shed light on how ambient conventions for gesture use contribute to the development of visual-manual languages. In Chapter 4, the indicating gestures of hearing non-signers were shown to systematically encode not only the direction of an indicated target, but also its rough distance from the gesturer. A study of 29 hearing, non-signing residents of the Quiahije municipality showed this encoding pattern to be robust. The current chapter takes information-rich indicating gestures as a point of departure, and explores the relationship of these gestures to the speech that often accompanies them. The chapter considers two questions: (1) are the forms of indicating gestures determined in any significant sense by features of the speech that they accompany? and (2) does the speech accompanying indicating gestures alter their interpretation? By addressing these questions, the chapter facilitates a closer exploration of what information deaf people access, and what information they do not, when observing the indicating practices in the local community.

Section 5.2, 'Two indicating scenes, revisited,' returns to the examples that grounded the Chapter 4 study of indicating gestures in San Juan Quiahije. The relationship of gestures to speech is now explored, with a focus on the contributions

to spatial reference that are made in each modality. Section 5.3, ‘Gesture and speech in multimodal referring acts,’ reviews the claim that the form of an indicating gesture is determined by, or reflective of, the structure of the co-occurring speech. It also reviews the literature on how the messages of gestural and speech signals are integrated in multimodal referring acts. Section 5.4, ‘A study of multimodal reference in San Juan Quiahije,’ presents a second study of the dataset originally used to analyze gesture morphology in Chapter 4. In this study, the relationship between gesture forms and speech forms is examined, and ways that speech refines, reinforces and supplements the gestural message are considered. The study finds little evidence that the form of indicating gestures is determined by the type of speech that accompanies them. It finds that the locative information conveyed by indicating gestures (information about the distance and direction of the target) is not refined or recast by the accompanying spoken message. Speech, however, provides the only information about the figure (the object to be located) in the space that the gesture indicates. For an exclusively visual perceiver, then, this information is missing from the accessible visual signal. Section 5.5, ‘Conclusion,’ connects the findings from this chapter to the final study of the dissertation, an investigation of deaf signers’ use and adaptation of the indicating system that will be presented in Chapter 6.

## 5.2 Two indicating scenes, revisited

Talya sits on her back porch, facing her interviewer, and considers the question that has been posed to her: while she *can* take any path to reach the church, are there paths that she prefers? She points toward a footpath around 20 meters to her left, and indicates its location with a demonstrative pronoun: ‘that one’. She then points to a path around 60 meters to her right and adds another demonstrative pronoun, one that indicates proximity: ‘...or this one’ (Ch. 4 ex. 1, reprinted below as ex. 4). Talya’s demonstrative expressions provide no information about the nature of her referent, and only limited clues to its location relative to the speech site. Much like the indicating gestures that they accompany, the demonstrative expressions prompt Talya’s interlocutor to search in the space surrounding the speech site for some item relevant to the discourse. The similar functions of Talya’s demonstratives and indicating gestures, and the fact that they are produced simultaneously, suggest that

they operate in concert, combining information from two modalities to produce a unified search prompt for her addressee.

- (4) no4 kwa24 qo1 no4 nde2  
 NOM DEM3 CONJ NOM DEM1  
 ‘that one or this one’

LEI14-CF13, 00:27.0

A few minutes later, the interview topic has turned to farming sites where Talya lives during the planting season. “You live at a plot by Green Plain?” the interviewer asks, using the name of a outlying farming community that she anticipates Talya will recognize. Talya responds affirmatively. Talya then turns to extend a indicating gesture high above her right shoulder, while adding “and also by Ash Mountain here, (where) we grow corn” (Ch. 4 ex. 2, reprinted below as ex. 5). Once again, Talya has joined a indicating gesture with the demonstrative form, *kwa24*. In this case, however, she has also named the target of the indicating gesture. Her use of a place name signals to the interviewer that the target is a recognizable local landmark, and while the community of Ash Mountain is too distant to be viewed, the interviewer can now shift her attention to the identified region.

- (5) qo1 kwiq24 te20 qya2 ji42 re2 ntyji14 jyan3 qwa42  
 CONJ also LOC mountain ash DEM1 HAB:find cornfield POSS:1EXCL  
 ‘and also towards Ash Mountain here (where) we grow corn’

LEI14-CF13, 02:49.0

In both pointing scenes described here, the interviewer is faced with the same task: to focus her attention on a particular object or region that Talya indicates. Talya’s messages in the two scenes equip her addressee for this task, as they direct the interviewer’s attention to a delimited region in space, and, in one case, inform the interviewer about the entity to be located within that space. Talya distributes this information across spoken and gestural signals, joining the signals to produce a unified, composite message.

This chapter is concerned with the combination of indicating gestures and spoken language to produce multimodal referring expressions. Acknowledging that

these signals are designed to be comprehended simultaneously by hearing, sighted addressees, the chapter first considers the types of information that each modality contributes to a unified message. It then focuses on the unique circumstances of perceivers who are constrained to access only the visual component of the message—namely, the deaf addressees/observers in the Quiahije municipality who are tasked with interpreting multimodal talk while accessing only its gestural component.

### 5.3 Gesture and speech in multimodal referring acts

Utterances like Talya’s in the pointing scenes above refer to entities in the world—that is, they present the entities in question to an addressee to make them the focus of attention (Clark & Wilkes-Gibbs, 1986). Crucially, Talya’s referring acts present her intended referents using signals performed in two modalities: speech and gesture. This type of multimodal message is the norm, rather than the exception, in face to face interaction: referring acts in particular have long been observed to combine speech with indicating gestures such as pointing, gaze direction, and holding out or touching focal objects (Bühler, 1934; Clark, 2003; Fillmore, 1982; Hanks, 1990; Lyons, 1977). Some types of spoken language referring expressions have been said to *require* an accompanying indicating gesture (Hellwig, 2010, p. 263; Senft, 2004, p. 62). Even in cases where the gesture-speech connection is not seen as strictly obligatory, the frequent pairing of indicating gestures with spoken language expressions—prototypically, but not exclusively, demonstrative expressions (e.g., English *this, that, here, there*)—suggests that they share a privileged connection (Levinson, 2004, p. 482; Diessel, 2006, p. 121). The connection is observable in the earliest referring behaviors in children, who begin to combine and coordinate pointing and speech as soon as they develop the requisite motor abilities to signal in each modality (Rodrigo, González, de Vega, Muñetón, & Rodríguez, 2004). This fact suggests that pointing and speech are not only linked in the child’s development (Butterworth & Morissette, 2007; Colonnaesi, Stams, Koster, & Noom, 2010; Pettito, 1992), but that learning to co-organize the signals in the two modalities is fundamental to learning to refer.

How are gestural and spoken behaviors co-organized to produce multimodal referring acts? A first component is temporal sequencing: not only do indicating gestures tend to co-occur with speech, the timing of the two signals is tightly inte-

grated. For indicating gestures in particular, the signals in the two modalities have been shown to be co-ordinated with speech so that the apex of the indicating gesture (the moment of fullest arm extension) occurs with the onset of speech (Levelt et al., 1985) or of stressed syllables within the speech stream (Krivokapic, Tiede, & Tyrone, n.d.). This finding suggests that indicating gestures and speech are planned and organized jointly.

Multimodal referring acts are not just temporally coordinated: their semantic content is co-organized as well. Historically, writings on reference acknowledge this fact but fail to account for the semantic contributions of co-speech gesture. An exception to this rule, Roberts (1993, pp. 18–19) proposed one of the few theories of reference that isolates and describes the semantic contributions of speech and indicating gestures. Drawing on theories of perceptual grouping developed in gestalt psychology, and combining these with philosophical models of referring, his *figure-ground model* of reference proceeds in three steps.

1. The use of an indicating behavior—whether spoken or gestural—alerts the addressee that a referent can be found in “the physical surroundings of the speech act. This introduces the notion that there is a *ground* (a relevant search space) in which a *figure* (a salient object) can be located.
2. Cues from an indicating gesture—whether pointing, gaze direction, or some other behavior—identify a relevant search area, delimiting the ground in which a search can take place.
3. “Descriptive content from speech characterizes the figure that can be located within the ground.

On the figure-ground model, gesture and speech make distinct contributions to a multimodal referring act: gesture locates a relevant search space, and speech both contributes to the locating act and describes the item to be sought. Work on multimodal reference that builds on the figure-ground model observes that not all place-referring expressions identify an object: many simply direct the addressees attention to a region of space, providing, in effect, a ground with no corresponding figure. (Kranstedt et al., 2006; Kranstedt & Wachsmuth, 2005, p.75). The core contribution of the figure-ground model remains, however: multimodal referring acts locate a region and (in many cases) specify objects to be sought within the

region, and the contributions that gesture and speech make to this unified referring act are distinct.

### 5.3.1 How gesture and speech establish a ground

Indicating gestures serve to draw attention to locations, or, in the terminology of the figure-ground model, establish a ground in the physical surroundings of the speech location. Although indicating gestures can occur in isolation, the figure-ground model seeks to explain how they are paired with spoken language that serves the same function (drawing attention to locations) or a distinct function (describing a figure to be found in the indicated location). Two types of spoken language expressions have long been observed to co-occur with pointing, and to share its indicating function: *demonstrative expressions* and *direction expressions*.

*Demonstrative expressions* prompt the addressee to locate an object or region in the physical surrounds of the speech site.<sup>1</sup> Nearly all documented demonstrative systems contain multiple terms that encode distance oppositions, so that the choice of a particular demonstrative expression conveys information about the rough distance of the search area relative to (one or all) speech act participants (Diessel, 2005; Himmelman, 1996). The scale at which these oppositions are applied is highly dependent on discourse context, so that the rough notions of ‘nearness’ or ‘farness’ they convey are not reducible to absolute measures of distance (see discussions in Kemmerer, 2006; Talmy, 1988). Moreover, the rough distance distinctions encoded in demonstrative paradigms are often functionally repurposed in face-to-face interaction, with proximal forms developing a function of “intensive” attention (re)-direction (vs. “neutral” attention direction for distal forms) (Brown, 2006; Cooperrider, 2015; Piwek, Beun, & Cremers, 2008) or being used to encode psychological or social proximity rather than physical proximity (Enfield, 2003; Jarbou, 2010; Peeters, Hagoort, & Özyürek, 2015; Peeters & Özyürek, 2016). These facts in combination suggest that, while demonstratives function as highly successful ‘search

---

<sup>1</sup>Reference to the physical location of entities, or *exophoric* reference, is the primary function of demonstratives. Often, these expressions develop secondary, *endophoric* functions, i.e., the ability to refer to entities introduced in the preceding or following talk (anaphoric reference) or to refer to expressions or stretches of talk in the discourse (discourse deixis). The discussion here will concern only the exophoric functions of demonstratives; see Diessel (1999) for a review of the historical development of related, endophoric functions.

prompts' for a relevant region or object, they do little to delimit the search space for the relevant entity (De Mulder, 1996). This may explain why demonstrative expressions are so often combined with indicating gestures: just as Roberts' *figure-ground* model predicts, pointing is a more successful strategy than spoken indicating expressions for delimiting the ground in which a search can take place.

Multiple studies have shown that, in face-to-face conversation, pointing is more likely to be combined with proximal demonstrative terms than with their neutral or distal counterparts. This finding recurs across laboratory experiments (see, e.g., Cooperrider, 2015; Piwek et al., 2008), and observational studies of direction-giving in face-to-face conversation (see, e.g., Blythe, Mardigan, Perdjert, & Stoakes, 2016; Brown, 2006). Brown (2006) suggests that both indicating gestures and proximal demonstratives convey a sense of the referent's "immediacy" rather than its physical distance from the speech site (p. 240). Cooperrider (2015) echoes this interpretation, observing that demonstratives and indicating gestures are frequently combined for "intense indicating" (p. 22). If and when this is the case, the distance-indicating contribution of the demonstrative expression will be minimal, and distance-marking information in the accompanying gesture will be crucial for directing the addressee's attention to a relevant search space.

*Direction expressions* provide information about the rough direction of an object or region relative to some origin point, or *origo*. In face to face interaction the origo is often the speech site: when this is the case, direction terms serve a similar function to demonstratives in indicating the a delimited area of (relatively) local space in which the addressee must focus their attention. Direction terms are anchored to features of the physical world that speakers can locate relative to the origo: in many cases, these are salient geographic features such as bodies of water or land prominences, which are invoked in such terms as 'river-ward' or 'hill-ward' (Widlock, 2008; Ross, 2003; Levinson, 2003). More often, however, direction terms relate the origo to set of conceptual axes overlaid on the earth's surface. The most familiar such axis underlies the cardinal direction system, in which the direction terms *north*, *south*, *east* and *west* (or their crosslinguistic equivalents) are used to label the endpoints of two intersecting, idealized axes. A speaker who refers to an item as 'north of' a particular origo is making reference to the physical environment in the same way as a speaker using an expression like 'river-ward,' though the relevant physical features in this case are predictable celestial cues,



and in some environments, wind-based cues (Brown, 1983). A common type of axial direction system attested in the Meso-american linguistic area is the *slope-based direction* system, which originates when speakers identify a salient slope along which the community rests, and abstract an axis with endpoints labeled ‘up(hill)’ and ‘down(hill)’. The system expands when an intersecting axis is joined to it, with both ends given an identical label: ‘side(hill)’. Brown & Levinson (1999) first documented this type of slope-based direction system in use among Tseltal Maya speakers in Chiapas, Mexico, and multiple additional studies have investigated slope-based systems used in Meso-America (see, e.g., Brown, 2006; O’Meara & Pérez Báez, 2011; Polian & Bohnemeyer, 2011; Soto, 2011) and beyond (Cooperrider, Slotta, & Núñez, 2016).

Like demonstrative expressions, direction expressions are frequently combined with indicating gestures in face to face interaction (see discussions in Le Guen, 2011; Levinson, 2003; Haviland, 1998). Haviland (2005) suggests a reason for the co-occurrence of direction terms and indicating gestures. Direction expressions, he observes, provide course-grained information, referring to a quadrant of space centered on one of the four vectors in the conceptual axis. A paired indicating gesture, then, provides more than simply redundant information: it reinforces the message that a particular region is in focus, and designates an even narrower search space within the region.

Understood through the lens of the *figure-ground* model of multimodal referring acts, demonstrative and direction expressions work alongside indicating gestures to serve the same function: identifying a ground (search space) in which a salient referent may be found. Since the signals in the two modalities share a function, they might be imagined to provide redundant information. Closer inspection reveals that this is not the case: the signals in the two modalities evidently provide complementary information to accomplish the function of grounding. The spoken language expressions direct attention to ground by providing course-grained information about the region’s distance and/or direction relative to the speech site.<sup>2</sup> Indicating gestures direct attention to an even narrower ‘beam’ or cone-shaped region of space

---

<sup>2</sup>Levinson (2003) reviews a small set of spoken languages that encode information about both distance and direction in a single expression type. Expressions of this kind will, of course, serve the same function in the *figure-ground* model as those that narrow the search space by providing information about distance or direction alone.

projecting out from the gesturing articulator (Kranstedt et al., 2006; Kranstedt & Wachsmuth, 2005).

Importantly, even though indicating gestures narrow the search space more than demonstrative or direction expressions, they are still relatively imprecise indicators in cases where the speaker is not touching or holding out the referent. This imprecision increases as the item increases in distance from the speaker or as the item is crowded by nearby potential referents (Bangerter, 2004; Cooperrider, 2011, 2015). An indicating gesture, even when combined with a demonstrative or direction expression, will almost never be sufficient to uniquely identify a single object within a region. This, on the *figure-ground* model, is where spoken language that describes the figure makes its necessary contribution.

### 5.3.2 How gesture and speech establish a figure

In the figure-ground model of multimodal reference, *figures*—objects of interest within the ground space—are picked out by “descriptive” expressions. We may assume that these expressions label the object in one of two ways: (1) attributing to the object membership in some class of items in the world or (2) naming the object. Both approaches to labeling are accomplished using a bedrock of spoken language reference, the noun phrase.

Common nouns like *tortilla*, *school* or *stream*, label items by ascribing to them membership in a class of like entities. The speaker of a pointing-accompanied sentence such as ‘I cross the stream’ anticipates that their interlocutor will not only focus their attention on the rough location indicated through the indicating gesture, but will apply their understanding of the term *stream* to identify a corresponding entity in the indicated search region. In contrast with common nouns, proper nouns (names) select a unique referent through a through the conventional association of the name with a single entity. By labeling the referent with a name, the speaker treats the referent as a recognizable entity—one that the addressee can or should know (Blythe et al., 2016; Sacks & Schegloff, 1979; Schegloff, 1997) If the speaker anticipates that the referent is unknown to the addressee, she may use a proper name in combination with a descriptive noun phrase in order to introduce the name and associate it with the appropriate entity: a (pointing-accompanied) sentence such as ‘I cross the stream (called) Pure River’ establishes the naming convention in the

discourse and allows for the use of the name alone in later talk (Blythe et al., 2016; Searle, 1997, p.133)

The frequency with which noun phrases occur alongside indicating gestures, and the contributions they make in different speech contexts, have not yet been explored. A small set of laboratory studies come closest to asking about the contributions of noun phrases to multimodal referring expressions. These studies focus on the quantity of language produced alongside pointing in various contexts, rather than on the type of language used by the speakers. Pfeiffer (2012) and Lücking, Pfeiffer, and Rieser (2015), for example, found that speakers used pointing alongside an average of 3 spoken words to characterize items within reach of the speaker (between 8 and 24 cm from the speaker). The number of words combined with pointing increased as the distance of the referent increased, so that items out of reach of the speaker (between 50 and 70 cm from the speaker) were indicated with twice as many words: an average of six per pointing-linked phrase. The authors conclude that speakers are aware of the imprecision of their indicating gestures to select relatively distant items, even in small-scale space, and compensate “by producing a more elaborated verbal expression” to identify these distant items (Lücking et al., 2015, p. 65). Since multimodal referring acts often identify items at some distance from the speaker, pairing the component gestures with ‘elaborate’ descriptive expressions may be the norm in face-to-face interaction, and descriptive expressions may be even more frequent when describing distal items in large-scale space. Noun phrases may be assumed to anchor the speech in these expressions.

In the figure-ground model, the indicating gestures produced in multimodal referring acts do not provide descriptive information that characterizes the referent. This approach to indicating gestures may not attribute enough descriptive power to them: some documented indicating gestures do in fact describe the referent, if only minimally. Wilkins (2003) observes that for Arrernte speakers, the handshape of indicating gestures encodes number information, alerting the addressee to whether the referent is a single item or multiple items. Moreover, when Arrernte speakers use gesture to indicate a goal of motion, they produce the gesture with a ‘horned’ handshape and modify the gesture’s palm orientation to depict the incline of the land at the goal location (p.142). In these cases, at least, the indicating gesture not only directs the addressee’s attention to a rough location in space, but also characterizes a landscape feature of this location. The frequency with which indicating gestures

serve this additional function is as yet unknown.

### 5.3.3 Might gesture forms reflect features of linked speech?

Indicating gestures are temporally and semantically integrated with the speech that occurs alongside them. Might the forms of the messages in the two modalities be interrelated, as well? Little research has been performed to answer this question. In a study on pointing in Italian speaker-gesturers, Kendon and Versante (2003) and Kendon (2004) found that features of the discourse context affected the handshape of pointing gestures. Points with an extended index finger handshape accompanied talk that introduced and individuated the indicated object, and points with an open handshape accompanied talk in which the indicated object was “not the primary focus or topic of the discourse” (Kendon, 2004, p. 208). Kendon and Versante (2003) observed that the discourse functions of introducing and individuating an object were frequently performed with spoken demonstrative and locative expressions. These expression types might, then, be correlated with the use of index finger points. The authors’ study focused on a small set of examples, however, and provided no quantitative evidence that could shed light on just how often specific expression types (demonstratives, locatives) or speech functions (discourse introduction) co-occur with points of a particular form.

Discourse features have been found to affect the degree of elbow extension and raising in pointing gestures, as well. In a study on Lao speaker-gesturers, Enfield et al. (2007) found that ‘big’ points with greater elbow height and extension were produced alongside talk about objects in discourse focus (again, often objects being introduced or individuated), while lower elbow height and a lesser degree of elbow extension characterized ‘small’ points towards items not in discourse focus (objects already under discussion or familiar to the interlocutor).

Neither Kendon and Versante (2003) and Kendon (2004) nor Enfield et al. (2007) investigated the effects of distance on the form of pointing gestures: the study of Italian speaker-gesturers considered points towards nearby locations, and the study of Lao speakers primarily considered points toward relatively distant landmarks. The authors of Enfield et al. (2007) do observe that distant locations were indicated with both big and small points, and conclude that discourse focus is the feature that is tied to elbow height and extension. The authors do not systematically

control for distance or consider it as a factor in their analysis, however.

### **5.3.4 Summary and connection to the current research**

Roberts' (1993) figure-ground model of multimodal reference provides a framework for understanding how speech and gesture combine to indicate narrow regions in physical space (and, in many cases, objects within these regions). The model emphasizes that the contributions of speech and gesture are not only distinct, but also integrated: a spoken demonstrative or direction expression draws attention to a delimited search area, which an indicating gesture crucially narrows. A spoken descriptive expression further directs attention to a particular object within the indicated location. The conclusion to be drawn is clear: indicating gestures can be fully understood only in the context of the speech with which they are semantically integrated.

Kendon and Versante (2003), Kendon (2004) and Enfield et al. (2007) provide further evidence that gestures are designed to be understood alongside the speech with which they are integrated. They show that features of discourse context can affect the morphology of the indicating gestures in multimodal referring acts. Some types of variation in an indicating gesture's shape might be meaningful only when understood in the context of the accompanying speech.

What happens, then, when a perceiver has access to only the visual component of a multimodal referring act? The message they receive will be incomplete, but not uninformative. Chapter 4 considered the case of indicating gestures used by speakers in the San Juan Quiahije municipality: the morphology of these gestures encodes information about the direction and distance of the referent—a fact that is apparent when the gestures are considered in isolation. The current chapter builds on the study in Chapter 4, asking first whether the morphology of indicating gestures can also be said to depend on the structure of the speech that they accompany, and second whether the spoken language message refines the message from the indicating gestures in a way that is inaccessible to exclusively visual perceivers.

## **5.4 A study of multimodal reference in San Juan Quiahije**

The present study considers the multimodal referring acts that San Juan Quiahije Chatino (SJQ) speakers produce during conversations about local landmarks and

the paths taken to reach them. The study was conducted in service of a larger goal: to investigate whether the gesturing conventions of the SJQ speakers in the Quiahije municipality are (1) accessible to deaf people in the municipality, and (2) mirrored in the conventions of their emerging signed language. This study investigates the relationship of indicating gestures to speech in the multimodal referring acts of non-signers. The study considers the following questions:

1. Are the forms of indicating gestures determined in any significant sense by features of the speech that they accompany?
  - (a) What are the types of spoken SJQ expressions that occur alongside points and *go* gestures in multimodal referring acts?
  - (b) Does the use of particular spoken SJQ expressions affect the selection of handshape or elbow height features in the accompanying indicating gestures?
2. Does the speech accompanying indicating gestures change their interpretation?
  - (a) How is the message of indicating gestures are reinforced, supplemented, or refined by the accompanying speech?
  - (b) How much of the composite message may be understood when the addressee has access to visual information alone?

#### 5.4.1 Data and analysis

To complete this study of pointing-accompanied speech, the author performed a second analysis of the original dataset collected for the study presented in Chapter 4. Since the dataset comprised annotated video recordings of *Local Environment Interviews* (LEIs) in which indicating gestures were identified, and co-occurring spoken language was transcribed and translated (Chapter 4, §4.5.1.6), it was possible to investigate the types of expressions that accompany indicating gestures in face-to-face interaction, as well as the conditions under which speakers combine these gestures with particular expressions. All of the features of the original study (participants, materials and procedure, equipment and software, transcription and translation, gesture coding, target identification, and geospatial coding) were unaltered, since

the footage and coding from the original study were used again the current one. The prior study is described in Chapter 4, §4.5.1 Additional coding of the Local Environment Interviews is described in §5.4.1.1.

Of special interest for this study were demonstrative expressions and slope-based direction terms, two spoken language strategies for conveying information about the distance and direction of entities under discussion. These expressions recurred throughout the LEIs and their presence or absence from gesture-accompanying talk was coded to support an analysis of the speech-gesture combinations found in the interviews. To account fully for the forms and functions of demonstratives and slope-based direction terms used alongside indicating gestures, the author conducted METALINGUISTIC INTERVIEWS with six Spanish-SJQ bilinguals. In these interviews the participants discussed the forms and functions of demonstratives and slope-based direction terms; their comments helped to generate examples of prototypical use cases for each form.

#### **5.4.1.1 Local environment interviews**

During the transcription process for the prior study, 873 indicating gestures with determinate geospatial referents were identified in 6 hours and 37 minutes of video-recorded Local Environment Interviews. The spoken language that co-occurred with these gestures, and in many cases the talk occurring immediately before or after a gesture, was transcribed and translated into Spanish (Chapter 4, §4.5.1).

To facilitate an analysis of the talk that co-occurred with indicating gestures, the following coding was completed for Study 2. Every indicating gesture was coded as a MONOMODAL REFERRING ACT (i.e., a silent gesture) or as a component of a MULTIMODAL REFERRING ACT (i.e., a composite of speech and gesture) on the basis of whether a stretch of speech fully or partially overlapped with the articulation of the gesture.

For all speech in multimodal referring acts, the stretch of (typically clause-length) talk in SJQ that fully or partially overlapped with the indicating gesture was coded for the presence of three expression types, classified using functional (rather than syntactic or morphological) categories. DEMONSTRATIVE EXPRESSIONS and DIRECTION EXPRESSIONS indicated a region of space that could function as a ground in a figure-ground construction. DESCRIPTIVE EXPRESSIONS identified

a figure as a member of a class of entities (e.g., *twen3*, ‘(a) road’; *qan4=xla10*, ‘school’) or by naming it, typically through the use of a toponym (e.g., *qya2 nkqa42*, ‘Green Plain’). OTHER expressions neither indicated a ground nor described a figure. Coding was completed by the author in consultation with three research assistants. Demonstrative and direction expressions in particular were initially identified with one research assistant and subsequently reviewed with a second assistant. This practice was put into place to prevent mis-identification of these expressions, which are often distinguished through minimal contrasts of tone or of consonantal place of articulation. A dataset containing the speech coding has been made available in the Texas Data Repository.<sup>3</sup>

#### 5.4.1.2 Metalinguistic interviews

Although multiple studies have examined SJQ common nouns and place names (E. Cruz, 2017, Manuscript submitted for publication; H. Cruz, 2009, 2014), the demonstrative system of SJQ has been only minimally documented (E. Cruz & Sullivant, 2012) and the language’s direction system has not been described. For this reason, a set of metalinguistic interviews were designed to investigate the semantic properties of the SJQ demonstrative and direction terms.

Six SJQ-Spanish bilinguals from the Quiahije municipality participated in interviews as linguistic consultants. Four female consultants were interviewed individually. Two male consultants were interviewed together at their suggestion, allowing them to explicitly discuss areas in which their intuitions about the semantics of particular terms differed. The four female consultants responded to a modified version of the Wilkins (2001) demonstrative questionnaire. All six participants responded to questions from the author probing the semantics of slope-based direction terms. For each slope-based direction term, the author asked in Spanish for:

1. A translation of the term into Spanish, and/or an explanation of the difficulties of translation
2. An example of how the speaker might use the term

---

<sup>3</sup>Mesh, Kate, 2017, “Local environment interview data for Points of Comparison: What Indicating Gestures Tell Us About the Origins of Signs in San Juan Quiahije Chatino Sign Language,” doi:10.18738/T8/PJXZJI



3. An assessment of at least four invented uses of the term that the author anticipated speakers to deem acceptable based on the locations of the speaker and a focal object (the location of which was described by the term) at speech time
4. An assessment of at least four invented uses of the term that the author anticipated speakers to deem unacceptable based on the same criteria
5. An assessment of whether there was disagreement over the use of the term

All metalinguistic interviews were performed off-camera and were recorded exclusively in notes typed throughout the interview. Participants were encouraged to treat the interviews as informal discussions and to correct the author's language use or assumptions about the target expressions at any stage. Many participants suggested additional contexts in which to test the term's applicability, and these were recorded as well. The two questionnaires, as well as all participant responses, have been made available in the Texas Data Repository <sup>4</sup> All metalinguistic interview notes were aggregated and areas of disagreement and disagreement for the participants were highlighted. An early description of the demonstrative system and slope-based direction term system are presented in sections 5.4.2.3.1 and 5.4.2.4.1.

## **5.4.2 Results**

### **5.4.2.1 Introduction to the study results**

This results presented here are primarily derived from the analysis of Local Environment Interviews. Information derived from the metalinguistic interviews will be marked as such in the discussion to follow.

A total of 873 indicating gestures were analyzed. Of these, 49 were produced without accompanying speech and were identified as monomodal referring acts. These silent gestures were often preceded or followed by multimodal referring acts and might, with a different set of coding criteria, have been treated as disjoint components of these referring acts. It is notable that, even when employing coding

---

<sup>4</sup>Mesh, Kate, 2017, "Metalinguistic interview data for Points of Comparison: What Indicating Gestures Tell us About the Origins of Signs in San Juan Quiahije Chatino Sign Language," doi:10.18738/T8/RJP2JR, Texas Data Repository Dataverse.

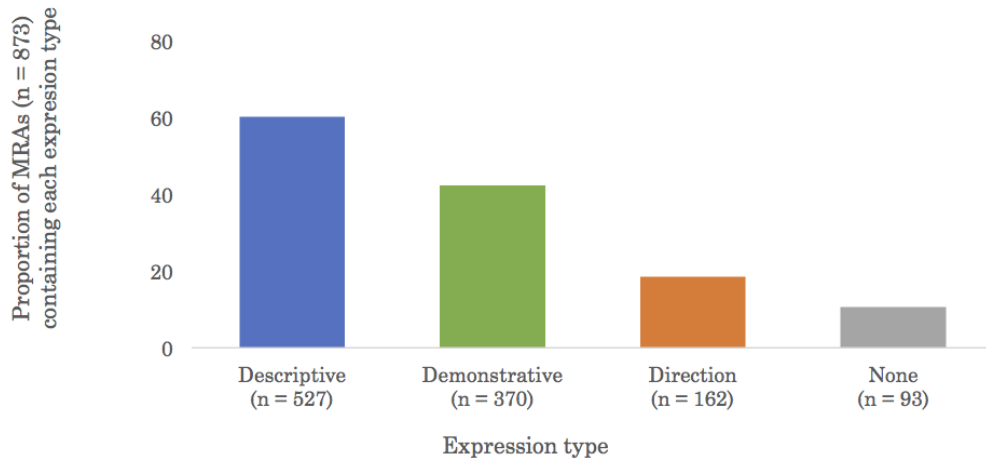


Figure 5.1: Proportion of MRAs ( $n = 873$ ) containing each expression type

criteria that maximized the number of classifiable monomodal referring acts, there were few such acts to identify: only 6% of indicating gestures in the dataset were produced without overlapping speech.

A total of 873 indicating gestures were identified as components of multi-modal referring acts (MRAs). Of these, 93 (10%) contained spoken expressions that neither indicated a ground nor described a figure. Many such expressions were verb phrases that conveyed some notion of an actor’s movement, but supplied no information about the direction or distance of the goal of motion. The remaining 743 MRAs contained some combination of demonstrative expressions, direction expressions, and descriptive expressions. The proportion of the MRAs that contained each expression type is presented in figure 5.1. Notably, the count of the combined expression tokens (1152) is higher than the number of MRAs (873), reflecting the fact that multiple expression types frequently co-occurred within a single MRA.

Each of the expression types co-occurred with indicating gestures of a variety of elbow heights and handshapes. There were few evident correspondences between any one morphological feature of the indicating gestures and the three functionally-defined spoken language expression types identified in MRAs. A raised elbow occurred more frequently with descriptive expressions, a fact that will be discussed in Section 5.4.2.2. The distribution of elbow height features in MRAs containing each expression type is presented in Figure 5.2. The distribution of handshape features

in MRAs containing each expression type is presented in Figure 5.3.

In section 5.4.2.2, the lack of evidence for a correspondence between indicating gesture forms and the functions of the accompanying speech is briefly reviewed. In the sections to follow, the results related to demonstrative, direction and descriptive expressions are all reviewed in greater detail, and a case is made that these expression types do not fundamentally alter the interpretation of the indicating gestures' messages: descriptive expressions alone augment, rather than refine, the message of the MRA, identifying objects and entities to be sought in the space indicated by the gesture.

#### **5.4.2.2 Relationship between speech and gesture forms**

Indicating gestures with the two predominant handshapes in the dataset—extended index finger and open hand—occurred with equal frequency alongside the three coded expression types (demonstrative, direction, and descriptive). There was no evidence to link the use of demonstrative expressions to the use of the IP handshape as was found by Kendon and Versante (2003), Kendon (2004) for Italian speaker-gesturers. This result tells us little about the larger claim made about handshape selection and discourse context: demonstrative expressions and locative terms may simply not reliably mark the discourse-introduction feature that was claimed to prompt the use of the index finger handshape. Additional research will be necessary to determine whether the use of the extended index finger handshape is affected by features of discourse structure in the talk of SJQ speakers. For the present, we can simply observe that the handshape feature of points in particular reliably provides information about the distance of the indicated target, and at least one feature of speech—the expression type accompanying the gesture—does not appear to have a similar effect on the handshape feature of points.

Indicating gestures with a variety of elbow heights also occurred with near-equal frequency alongside the three coded expression types. Notably, however, a considerable proportion of indicating gestures with a fully elevated elbow occurred in MRAs containing descriptive expressions. Two explanations present themselves: (1) there is a relationship between the height of the indicating gesture and the speaker's choice to describe the referent, or (2) there is a factor that prompts the speaker to both elevate their indicating gesture and provide descriptive information

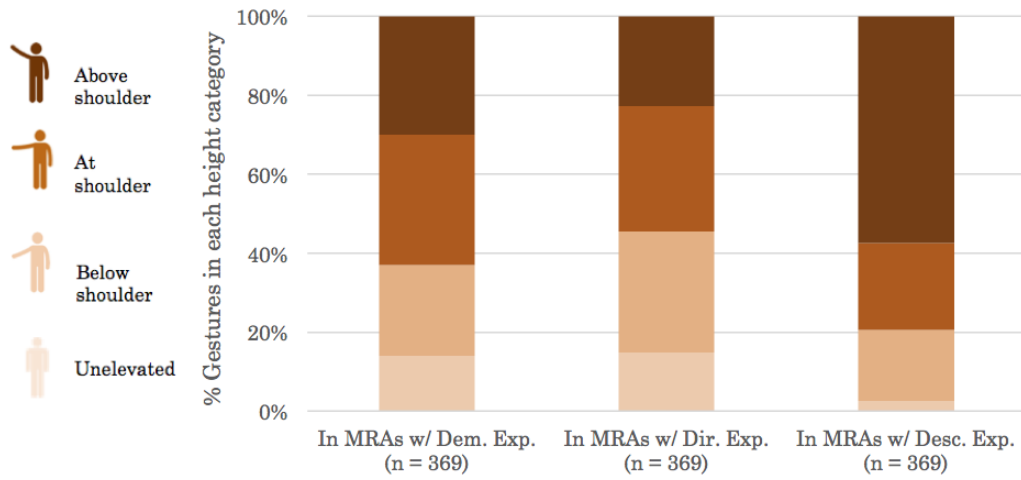


Figure 5.2: Proportion of gestures with each elbow height occurring in MRAs containing three spoken language expression types

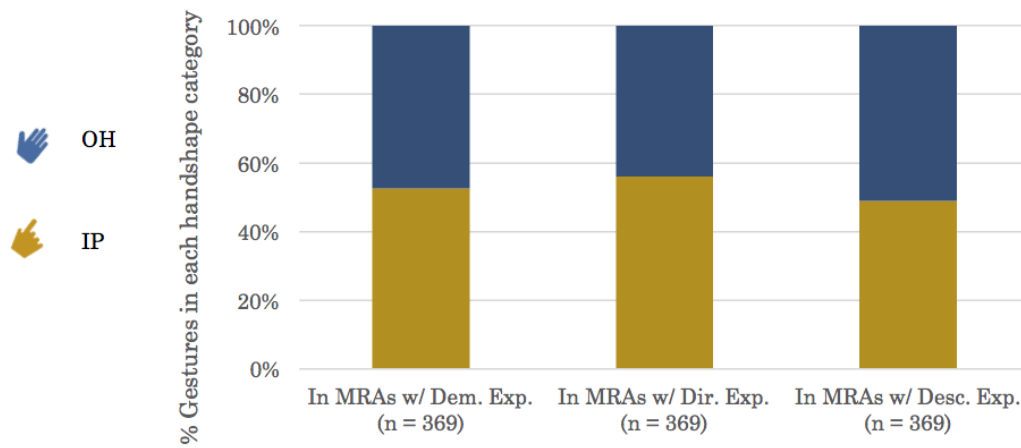


Figure 5.3: Proportion of gestures with each handshape occurring in MRAs containing three spoken language expression types

about the referent. The latter explanation is, of course, the one that comports with the established facts about indicating gestures and descriptive speech: indicating gestures with a fully elevated elbow reliably mark targets that are distant from the gesturing site (Chapter 4, §4.5.2.3), and speakers use more descriptive expressions when referring to distant referents (current chapter, §5.3.2). It is the distance of the referent, then, that influences features of both speech and gesture in MRAs.

### 5.4.2.3 Demonstrative expressions with indicating gestures

Demonstrative expressions were the primary spoken language means of directing attention to a ground, or search space, in the LEI interview dataset. They occurred in 42% of MRAs, an anticipated outcome given the privileged relationship claimed for demonstratives and indicating gestures cross-linguistically (see Table 5.1). This section reviews the results related to the demonstrative system in greater detail. The formal and semantic oppositions of the demonstrative system are presented, followed by a discussion of the use of demonstratives in MRAs. This section closes by discussing the relative informativeness of indicating gestures in MRAs when they are perceived without the demonstrative expressions that accompany them.

#### 5.4.2.3.1 The SJQ demonstrative system

The four demonstrative terms in SJQ form a closed system, with terms distinguished through semantic and formal oppositions. The semantic categories invoked by the demonstrative oppositions include of distance and speech act participant. The four SJQ demonstrative terms are listed in Table 5.1.

All four demonstrative terms are all used for exophoric reference—i.e., to locate objects in the physical surrounds of the speaker. Minimally, the *kanq42* form can be used for endophoric reference—i.e., to refer to entities or introduced in the preceding or following talk (anaphoric reference) or to refer to expressions or stretches of talk in the discourse (discourse deixis).<sup>5</sup> The discussion and analysis of demonstratives in this chapter is concerned exclusively with their exophoric function. For examples of endophoric uses of the SJQ demonstrative *kanq42*, see Cruz & Sullivant (2012).

---

<sup>5</sup>Other demonstrative forms may additionally be used for anaphoric and endophoric reference; these functions were not observed in the dataset and have not yet been explored.

| Demonstrative | Distance/Presence<br>Encoding | Speech Act Participant<br>Anchoring |
|---------------|-------------------------------|-------------------------------------|
| re2/nde2      | proximal                      | speaker-anchored                    |
| kwa3          | proximal                      | addressee-anchored                  |
| kwa24         | unmarked                      | n/a                                 |
| kanq42        | absent/invisible              | speaker-anchored                    |

Table 5.1: The demonstrative expressions of SJQ

The following descriptions of the SJQ demonstratives are based on speaker intuitions expressed in the metalinguistic interviews described in §5.4.1.2. The complete set of speaker judgements on which these summaries draw has been made available in the Texas Data Repository.

**re2/nde2:** Speaker-anchored proximal marker. *re2* is prototypically used when the speaker is touching the referent. The space that speaker conceptualizes as relevantly near, and characterizable with *re2*, has flexible boundaries that can be significantly expanded when ‘near’ is being contrasted with a more distant location. For instance, the proximal space can encompass an entire village, many regions of which are distant from the speaker, provided that a contrast is being drawn between the village and a location at an even greater distance from the speaker.

**kwa3:** Addressee-anchored proximal marker. *kwa3* is prototypically used when the addressee is touching the referent. The concept of the addressee’s proximal space has flexible boundaries that can be broadened, but within limits: a boundary expansion that incorporates the space in which the speaker is located would be too great, since the ‘near’ space occupying both the speaker and the interlocutor should be described using the speaker-anchored demonstrative.

**kwa24:** Unmarked. Folk definitions of this term appeal to a distance scale: *kwa24* is said to describe a space ‘farther away’ than the proximal space of the speaker or that of the listener. E. Cruz and Sullivant (2012) treat this form as a distal

marker. However, *kwa24* may be used to indicate proximal items equidistant to the speaker and addressee. An analysis that accounts for this function treats *kwa24* as the unmarked demonstrative form.<sup>6</sup>

**kanq42:** Absence marker. Again, folk definitions of this form center on a distance scale: referents characterized by *kanq42* are said to be so distant as to be absent from the speech location. An item may be absent, however, from a local space (e.g., a small room in which the speaker is located) and nevertheless be only a short distance from the speaker. Visual access to the referent makes it present to the speaker and renders the use of *kanq42* infelicitous. Notably, the use of this form does not require that the object be absent for the addressee. A speaker may, for example, use *kanq42* to indicate a referent outside of the room in which she sits, and co-present with the interlocutor in an adjoining room.

#### 5.4.2.3.2 SJQ demonstratives in use: is distance information conveyed through demonstrative choice?

Of the four SJQ demonstrative terms, three combine to produce a rough binary distance distinction, with *re2/nde2* and *kwa3* marking two ‘near’ categories (anchored to the speaker and the addressee), and *kwa24* designating a ‘non-near’ category. Only the absence marker *kanq42* does not participate in this binary distance-marking system. Since speakers of multiple languages have been shown to functionally repurpose the distance distinctions of demonstrative paradigms (see §5.3.1), the question arises: do SJQ speakers’ demonstrative term choices in fact reflect the distance of their referents?

It was possible to investigate this question for the set of MRAs in the dataset that contained demonstrative expressions. A total of 380 such MRAs existed: for each one, the referents had been identified and mapped, and the distance between the referent and the speaker measured, in order to perform the analyses in Study 1 (see Chapter 4, §6.5.1.8). Referent distance had been classed in terms of 7 rough distance categories, ranging from 1 (inside the speaker’s home village or town) to 7 (locations in the United States). The current analysis accordingly considers the demonstrative forms selected to indicate referents in each of these 7 distance categories.

---

<sup>6</sup>This analysis parallels and draws from the Enfield (2009) treatment of Lao demonstratives, in which ‘near’ is contrastive with ‘unmarked’.

Figure 5.4 displays the proportion of uses of *re2/nde2*, *kwa3*, *kwa24* and *kanq42* in each of the 7 distance categories. As was the case in Chapter 4, the findings from distance categories 4 and 5 are included but offset in a grey box. This is a reminder to the reader that the referents in these categories were lengthy stretches of highway, rather than landmarks or short segments of roads, and that the speakers indicating these referents appeared to be performing a slightly different task, namely, giving formulaic route directions rather than indicating landmarks or precisely describing the contours of paths. It is notable that participants' spoken language behaviors differed when they indicated referents in these two distance categories, just as their gestural behaviors had done. Again, this suggests that the findings here may be related to the functionally distinct activity of direction-giving.

With the exception of distance categories 4 and 5, the participants' demonstrative choices in MRAs were remarkably uniform across distance categories. Participants most frequently paired indicating gestures with the speaker-anchored proximal form, *nde2*. Gestures were never paired with the addressee-anchored proximal form, *kwa3*, a consequence of the fact that all referents at the landscape scale were equidistant to the addressee and the speaker and would necessitate the use of the more inclusive speaker-anchored form. Indicating gestures were less frequently paired with the unmarked demonstrative form *kwa24*, and very infrequently paired with the demonstrative marking absence/invisibility, *kanq42*.

The consistent distribution of multiple demonstrative forms in all distance categories (excluding categories 4 and 5) makes it evident that speakers do not reliably convey information about the distance of the referent through their demonstrative choices. This suggests that the gestural components of MRAs bear much of the communicative load in conveying referent distance—a load that they are evidently designed to bear, given their robust mapping of elbow height and handshape features to features of referent distance (see Chapter 4, §4.6).



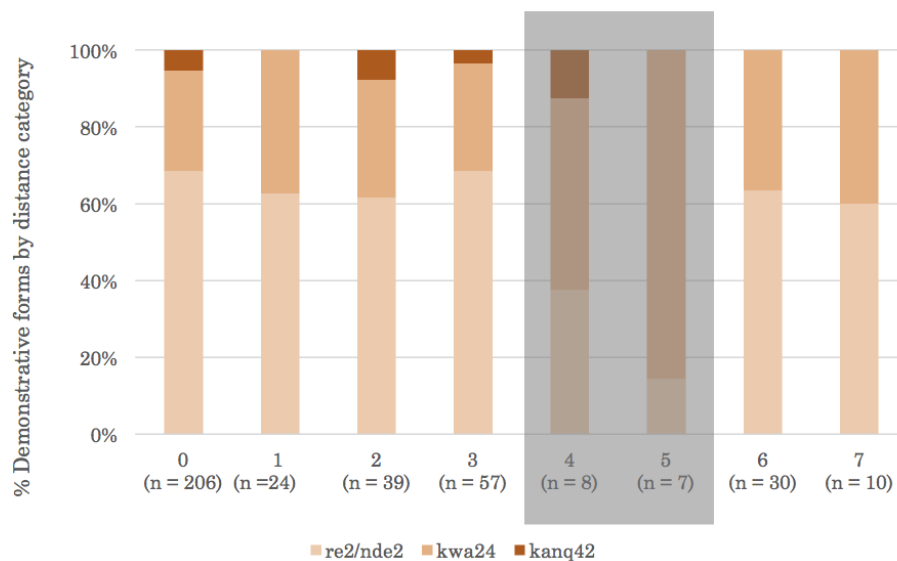


Figure 5.4: Demonstrative choice by distance category

#### 5.4.2.3.3 How SJQ demonstratives contribute to MRAs: examples from the LEI task

Participants in the Local Environment Interviews used gesture-linked demonstrative expressions to direct addressee’s attention to relevant regions in the surrounding physical space. The fact that speakers typically produced the proximal demonstrative *re2/nde2* in MRAs, and did not increase their use of the unmarked form *kwa24* as referent distance increased, suggests the choice of demonstrative term could not help the addressee to narrow the search space by invoking even rough distance categories like ‘near’ and ‘far.’ Rather, demonstratives appeared to function as bare search prompts, to which a paired indicating gestures provided relevant information about the distance and direction of the indicated region.

In many MRAs, speakers paired demonstrative expressions and indicating gestures without describing a reference object: that is, they directed attention to a ground location without placing a figure within this ground. In example 6, the speaker describes walking toward a location as part of a longer set of route directions. She does not identify a landmark as a goal of motion; instead she simply joins a *go*

gesture to the comment that the first leg of the journey goes ‘towards there’.<sup>7</sup>

- (6) ti20 kwa2 tyqon24  
LOC DEM3 HAB:depart:3p  
‘we head out towards there’

LEI27-SF05, 22:51.5

Lack of a figure description in an given MRA did not guarantee that the addressee could not identify a relevant figure. To the contrary: in many cases a figure was not described in an MRA because a relevant figure had already been introduced in a prior stretch of talk and did not need to be introduced again. In these cases the demonstrative expression provided explicit grounding information and figure was unexpressed but recoverable from the discourse context. This type of omission based on recoverability is found in example 7, where the speaker answers the interviewer’s question, ‘where is Oaxaca (city)?’ with the succinct, pointing-linked reply, ‘towards here’. The name of the city is eminently recoverable in this case and therefore omitted. In example 8, the speaker uses a demonstrative expression (‘there’) without defining the referent under discussion. She does so because the referent—a local road—has already been introduced into the discourse in the immediately prior stretch of talk and is recoverable by all parties to the discourse.

- (7) ti20 nde2 no1 ne2, ti20 nde2  
LOC DEM1 NOM now LOC DEM1  
‘towards here, is where it is now, towards here’

LEI07-CF06, 03:15.5

- (8) ngyan24an20 ndya4 kwa3 ngyan24an20  
HAB:go.away:1INCL all DEM3 HAB:go.away:1INCL  
‘we go over there, we go’

LEI14-CF13, 02:25.0

---

<sup>7</sup>The speaker’s choice of indicating gesture type here—the *go* gesture, rather than a indicating gesture—supplies the information that the indicated location is a goal of motion. It suggests, as does the bare demonstrative form in the accompanying speech, that there is no relevant figure to place in this region.

While speakers could and did use demonstrative expressions without descriptive expressions, it was much more common to combine the two expression types to provide a complete figure-ground array in an MRA. In example 9, the speaker locates the church using an indicating gesture and a demonstrative expression. He characterizes the figure as a church using a common noun, and clarifies that the church in question is at the indicated location ‘now’ as part of a larger discussion of buildings that were moved in the community over time. In example 10, the speaker locates the area in which the mestizo (non-indigenous) town of Vidrio is found, using an indicating gesture and a demonstrative expression. He identifies Vidrio as the figure to be located in this region by using its Spanish language place name—a name that he anticipates that his interviewer will recognize.

- (9) ti20 kwa2 ndwa14 la42 ne2  
 LOC DEM3 exist:3S.HAB church now  
 ‘now the church is that way’

LEI48-CM06 12:31.5

- (10) xni4 wa42 carro no4 ntyjin14 ti20 vidrio kwa2  
 take3P.HAB EXCL car LOC go:3S.HAB LOC Vidrio DEM3  
 ‘we take a car that goes towards there, towards Vidrio’

LEI49-CM07 13:09.5

#### 5.4.2.3.4 What is stripped from the message of the MRA when demonstratives are inaccessible?

A crucial question to ask when considering the situation of deaf observers in the Quiahije municipality is this: how much of the message in MRAs would remain if the spoken language components were stripped away? For demonstrative expressions, it appears that little to no information would be lost in their absence: the expressions provide a search prompt that indicating gestures not only duplicate but also refine, adding information about the distance and direction of the referent. In the rare cases where no figure descriptive information is joined to demonstratives in speech, then the complete message conveyed through the gesture-linked demonstrative could be recovered from the gesture alone. Importantly, however, gesture-linked

demonstrative expressions are rarely produced in isolation: they are typically placed alongside descriptive talk that identifies an indicated figure, and in the absence of this talk they are produced within a larger discourse in which a figure is recoverable because it has already been introduced through spoken language expressions.

#### **5.4.2.4 Direction expressions with indicating gestures**

Direction expressions were the second spoken language approach to establishing a ground, or search space, in the LEI interview dataset. They occurred in 19% of the identified MRAs (see Table 5.1). This section reviews the results related to the direction system in greater detail: after outlining the formal and semantic oppositions of the direction system, it reviews the use of direction terms in MRAs. It closes by considering the relative informativeness of indicating gestures in MRAs when they are perceived without direction expressions.

##### **5.4.2.4.1 The SJQ slope-based direction system**

Speakers of SJQ employ a slope-based direction system: a common feature of languages in the Meso-American linguistic area (see §5.3.1). An anchoring ‘uphill-downhill’ axis is fitted to a given reference slope—typically the most salient slope in the local topography, though any salient slope may anchor the axis. Two terms meaning ‘across’ are used to label the ends of an orthogonal axis. The entire bi-axial system, with an uphill-downhill axis and a transecting axis, can be rotated and fitted to any salient slope, though it is used with overwhelming frequency by SJQ speakers to characterize the inclines along which the two communities in the municipality are built. The two communities of the municipality are built along distinct slopes, so that the directional axes systems of the two communities have conspicuously different orientations (see Figure 5.5).<sup>8</sup>

The following descriptions of the SJQ direction terms are based on speaker intuitions provided in the metalinguistic interviews described in §5.4.1.2. Areas of disagreement between speakers are highlighted here, and the complete set of speaker

---

<sup>8</sup>Base map sources for Figure 5.5: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, ©OpenStreetMap contributors, and the GIS User Community.

judgements on which these summaries draw has been made available in the Texas Data Repository.

**kyaq14:** Denoting ‘uphill’ or ‘on the mountain,’ this term is used to refer to the upward direction of the uphill-downhill axis. When the slope is abstracted from the incline of the mountainside along which the San Juan town was built, the ‘uphill’ direction is approximately 177° SSE as located on a compass. When the slope is abstracted from the gentle valley incline underlying the village of Cieneguilla, the ‘uphill’ direction is approximately 302° WNW as located on a compass.

**qya4:** Denoting ‘downhill,’ this term is used to refer to the downward direction of the uphill-downhill axis. When the slope is abstracted from San Juan’s overall topography, the ‘downhill’ direction is approximately 357° NNW as located on a compass. When the term is abstracted from overall incline of Cieneguilla, the ‘downhill’ direction is approximately 122° ESE as located on a compass.

**tsuq32:** Denoting ‘along the side’ or ‘across,’ this term is used to label either end of an axis transecting the slope-derived ‘uphill-downhill’ axis. While there is another term used to refer to the two directions of the transverse axis, *tsuq32* is the unmarked lexical item.

**qne1:** Denoting ‘ahead,’ *qne1* is an alternative term for identifying directions on the transecting axis. Some speakers report that *qne1* is available only when the speaker is facing in a direction on the transecting axis, and may only be used to describe the direction in which the speaker is facing. Other speakers report that *qne1* may be used independent of the speaker’s orientation, and is used to refer to distal referents on the transecting axis. Still other speakers report that the term may be used independently of the speaker’s orientation and is used to refer to proximal referents on the transecting axis.

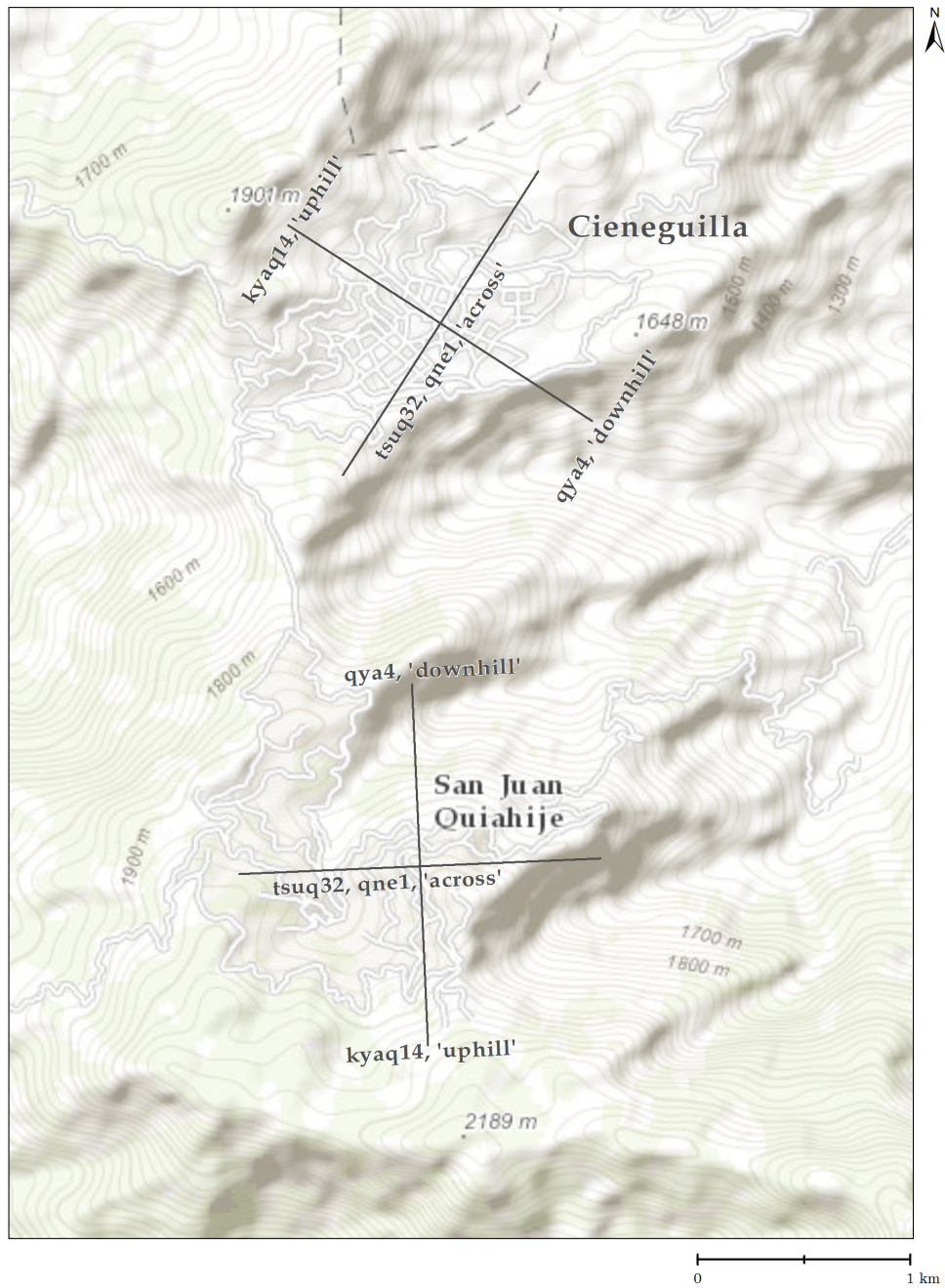


Figure 5.5: Slope-based direction axes in Cieneguilla & San Juan

#### 5.4.2.4.2 What is the meaning of SJQ direction terms in use?

Direction expressions like ‘uphill,’ ‘downhill’ and ‘across’ are part of a geomorphic spatial reference system: one in which the positions of entities are described relative to local inclines in the surrounding topography (Bohnenmeyer, 2017; Bohnemeyer et al., 2015; O’Meara & Pérez Báez, 2011). In communities where a single slope is especially salient, speakers may begin to associate the terms ‘uphill’ and ‘downhill’ with the endpoints of a vector abstracted from this slope alone. The association of the direction terms with this a fixed set of compass bearings allows speakers use the terms in a manner entirely abstracted from the local topography, such that they may characterize the position of items along a horizontal plane using the direction terms (e.g., referring to the positions of two bowls atop a flat table as ‘uphill’ and ‘downhill’). This specialized, abstracted use of the terms in a ‘fixed bearing system’ has been attested in some linguistic communities in Meso-America (Brown, 2008; Polian & Bohnemeyer, 2011), though in other communities, only the more flexible, geomorphic use is reported (De León, 1994). Importantly, speakers who develop a ‘fixed bearing’ reading for slope-based direction terms retain the ability to use the terms with a geomorphic reading: that is, they retain the flexibility to fit the uphill-downhill axis to any local slope. This fact has practical consequences for addressees, who must determine which reading is intended by the speaker, and which slope is at play, in order to interpret any token of a direction term. (see discussion in Brown & Levinson, 1993, pp. 63–65).

It is an open question whether SJQ speakers use the direction terms with exclusively geomorphic readings, or whether they have developed (or are in the process of developing) a ‘fixed bearing’ system abstracted from the local topography.

<sup>9</sup> No matter what the answer to this question, speakers have and will continue to

---

<sup>9</sup>In the Metalinguistic interviews, SJQ speakers did not produce or accept descriptions of items on the ‘uphill’ or ‘downhill’ side of a horizontal tabletop, which would have given evidence for an abstracted use of the terms. Their dispreference for this use context was related to scale: they described a desire to point and use demonstrative expressions to locate items at the tabletop scale, and to use the direction terms to locate items at the landscape scale. Whether an abstracted use context could be found at the landscape scale was not pursued. Local Environment Interviews did not shed light on this question, either: speakers tended to use the terms when describing items along the salient slopes in each of the municipality’s two communities—an apparent geomorphic use of the terms—but this did not rule out the possibility that speakers could use the terms in an abstracted sense to locate items well beyond the bounds of the communities’ salient slopes. Further

use geomorphic readings for the direction terms, a fact which ensures that they must consider the salient slopes in the physical surround in order to interpret each token of a direction term.

Gestures that indicate the direction of a referent provide an efficient means of cueing the addressee to the direction that the speaker intends through their use of a slope-based direction term. While indicating gestures are not *required* to reach an interpretation of a direction term, they quickly and effectively resolve any ambiguity between competing interpretations of a direction term. Indicating gestures do more than simply disambiguate the interpretation of a direction term: they also refine the message that it conveys. While a direction terms indicates an entire quadrant in the 360-degree arc surrounding a location (usually the speech site), an indicating gesture identifies a much narrower ‘beam’ of space. It indicates a direction, in other words, with greater precision than does a direction expression (see discussion in Haviland, 2005). The information provided by indicating gestures, then, both reinforces and complements the message of the direction term.

#### **5.4.2.4.3 How SJQ direction terms contribute to MRAs: examples from the LEI task**

Participants in the Local Environment Interviews used direction expressions much as they did demonstrative expressions, to draw attention to regions in the surrounding physical space. They did so with and without the accompaniment of additional spoken language expressions identifying a figure in the indicated ground.

As was the case with demonstratives, speakers often placed directions expressions in MRAs that did not describe a reference object, effectively drawing attention to a ground location without placing a figure within this ground. In example 11, the speaker describes walking to the center of San Juan from her nearby home. She does not identify a destination for her walk but simply indicates the direction in which she travels, joining an indicating gesture to the succinct report, ‘I walk uphill’. The speaker in example 12 provides a similar description of his walk to visit his godparents: although he identifies a explains that the trip is taken on a highway, but does not explain where the highway leads, saying simply, ‘along the highway that goes across, here’.

---

research, then, is necessary to determine whether speakers have developed a ‘fixed bearing’ system in the Quiahije municipality.



- (11) ti20 kyaq24 kqan24  
 LOC DIR1 POT:walk:1S  
 ‘I walk uphill’

LEI41-SF12 00:49.5

- (12) ngya24 twen3 qne1 re2  
 PROG:go.away:3S road DIR4 DEM1  
 ‘the road goes across, here’

LEI48-CM06 07:52.5

Again as was the case for demonstrative expressions, speakers frequently omitted information about a relevant figure from an MRA because that information was recoverable from the surrounding discourse context. In example 13, the speaker explains locates his seasonal farming site for the interviewer. The interviewer has already asked about this site explicitly, introducing the topic of farming, and the participant’s farm land in particular, into the discussion. The participant points toward the farm site and produces a spoken explanation containing both a demonstrative and a direction term: ‘it’s this way, on the side (across) here’. He does not explicitly introduce the figure, since his intended referent is recoverable from the prior stretch of talk.

- (13) nde2 nga24 kanq42 ne2 janq20, ti20 tsuq32 re2  
 DEM1 3S.HAB:go:3S DEM4 now well LOC DIR3 DEM1  
 ‘well now it’s this way, on the side (across) here’

LEI43-CM02 05:34.5

Speakers were most likely to produce direction expressions in MRAs that not only located a ground area, but identified a figure in that ground. In example 14, the speaker describes how one of her grandchildren walks to school. She points and uses a direction term to direct attention to a region ‘across’ (i.e., on the axis intersecting the uphill-downhill axis), and uses a common noun to identify a figure (a road) saying, ‘Eduardo goes on this road on the side’. The speakers in examples 15 – 16 similarly produce complete figure-ground arrays in which the ground information

is provided by pointing-linked demonstrative and direction expressions. In example 15 these expressions produce a ground, and common nouns describe two figures, a fork in the road and the stretch of road that leads to it: ‘we go from here to the turn-off uphill, we just o on this one highway.’ In example 16, demonstrative and direction expressions locate a ground in which a common noun locates a figure, the community’s evangelical church: ‘it goes toward the side where the church is’.

- (14) var=tu ntyqan4 twen2 ti20 nde2  
 Eduardo HAB:go:3S road LOC DEM1  
 ‘Eduardo goes on this road on the side (across)’

LEI24-SF04 03:26.0

- (15) nde2 qin20 tyqan14 tu2=kchin2 kyaq14 kwa2 ska4 ti4 carretera14  
 DEM1 from HAB:go:1EXCL turn-off DIR1 DEM3 one only highway  
 ‘we go from here to the turn-off uphill, we just go on this one highway’

LEI50-CM08 04:15.5

- (16) ngya4 tsuq32 wa2, kwa2 ndwa14 la42  
 HAB:go:3S DIR3 DEM3 exist.3S.HAB church  
 ‘it goes toward the side where the church is’

LEI14-CF13 00:27.5

#### 5.4.2.4.4 What is stripped from the message of the MRA when direction terms are inaccessible?

Again, the vital question when considering deaf observers in the Quiahije municipality is: how much of the multimodal message in an MRA remains when the spoken component is inaccessible? It appears that little information is lost in the absence of direction expressions in particular: the indicating gestures that accompany them in MRAs provide precise direction information—even more precise, in fact, than the information the direction terms convey. But just like demonstrative expressions,

direction expressions are rarely produced alone. Instead, they are coordinated with talk that provides crucial information about the objects to be found in the space that they indicate. Even when direction expressions occur in MRAs without descriptive talk, they usually invoke information about a figure that is recoverable only to parties to the prior spoken language discourse.

#### **5.4.2.5 Descriptive expressions with indicating gestures**

Descriptive expressions were the most common expression type to occur in MRAs in the dataset. They occurred in a 60% of MRAs (see Figure 5.1). This section reviews the results related to the descriptive expressions in greater detail: it briefly reviews the literature on common nouns and place names—the bedrock of descriptive expressions in SJQ—then discusses the use of descriptive expressions in MRAs. It closes by considering the relative informativeness of indicating gestures in MRAs when they are perceived without the information provided by descriptive expressions.

##### **5.4.2.5.1 Nouns and Place Names in SJQ**

A small literature considers the syntactic, morphological and semantic features of nouns in SJQ. H. Cruz (2009) and H. Cruz (2014) discuss the use of noun phrases in political oratory and verbal art. The discussion is supported with a grammatical sketch of the SJQ noun phrase, focused in particular on the use of the nominalizer *no4*—a particle that changes the part of speech of adjectives and verbs, converting them to nouns (H. Cruz, 2014, p. 125). Of particular interest for the current study is H. Cruz’s discussion of the rich lexicon of nouns that describe the local topography. H. Cruz (2014) provides examples of such nouns, including *kyqya2 tlyu2*, ‘big mountain,’ *sa4 kwi4 tlyu2*, ‘steep slope,’ and *ntenq3*, ‘valley’. She observes the frequent and formulaic use of these expressions in verbal art (p. 392). This phenomenon leads to their acquiring status as place names in the community (H. Cruz, personal communication, May 30, 2017).

E. Cruz (2017, Manuscript submitted for publication) provides a fuller account of contemporary place names, and place naming practices, in the Quiahije municipality. In a short grammatical sketch, E. Cruz (Manuscript submitted for publication) outlines the use of noun classifiers and relational nouns in place names. The primary contribution of her writing on place names is a discussion of the origin

| Chatino Place Name         | Gloss                        | Name Type          |
|----------------------------|------------------------------|--------------------|
| loA kchinI ntenqF          | on flat land                 | landform           |
| tuC kchiC neqC ykaE kyjinB | place of the kyinB tree      | inhabiting species |
| tykuE tsaJ                 | well-founded well            | community stories  |
| kA qoC                     | sacred rock                  | religious sig.     |
| sqweF                      | (name for the district seat) | nontransparent     |

Table 5.2: A sample of place names from E. Cruz (2017), orthography adapted

of place names, and a contextualization of their use within the larger set of Chatino naming practices. E. Cruz (Manuscript submitted for publication) identifies four types of place names: those based on landform, inhabiting species (flora and fauna), community stories about the place, and religious significance of the place (6). She observes that some place names have nontransparent origins and meanings, most likely as a result of historical sound changes that have obscured the component morphemes in the names (7). E. Cruz (2017) provides a list of place names comprising all four identified types. A selection of these names is excerpted in Table 5.2.

For speakers familiar with the naming practices of the Quiahije municipality, place names serve as recognitional: cues that the location under discussion is knowable to insiders on the basis of its physical features, local history, and/or religious import. These names provide an efficient means of uniquely identifying referents within the municipality and beyond.

#### 5.4.2.5.2 How descriptive expressions contribute to MRAs: examples from the LEI task

Participants in the LEI interviews very frequently identified figures in regions of physical space indicated by their gestures and speech in MRAs. This was most frequently accomplished using common nouns that characterized the figure as a member of a set of like objects. In example (17), the speaker continues a description of changes to the formal education system in the municipality. He comments that when he and his wife were children, there was a single school in the municipality. He then points in the direction of the original school and identifies it as: ‘the school that sits in front of the church there’. His use of the nouns ‘school’ and ‘church’

identify two figures in his MRA.

- (17) qan4=xlyal no4 kwa14 ti20 twa4 la42 kwa24  
school NOM HAB:sit:3S LOC face church there  
'The school that sits in front of (lit. *at the face of*) the church there'

LEI27-SM02, 06:31.5

Participants rightly understood their SJQ-speaking interviewers to be familiar with local place names, and frequently used such place names to efficiently identify figures in complete figure-ground arrays. In example (18), the speaker describes the last leg of a multi-leg journey to the district seat. Her indicating gesture indicates the origin point of the journey's leg, and traces through space to indicate the route direction and the end point of the journey. She simultaneously identifies the destination through a place name, saying 'well, in just half an hour we arrive in Juquila.' The speaker in example (19) uses a place name in a similar description of travel, observing that the final leg of a trip to the state capital is directed 'towards Oaxaca city'.

- (18) neq2 sa2 qwe24 ti20 ra1 klan14 sqwe2  
inside one half just hour POT:arrive:1INCL Juquila  
'in just half an hour we arrive in Juquila'

LEI31-SF05, 22:09.5

- (19) ti20 lo4=ntqa14  
LOC Oaxaca  
'towards Oaxaca [city]'

LEI08-CF07, 08:54.5

In some MRAs, speakers introduced place names in Spanish alongside a common noun in Chatino, providing the addressee with information about the type of object bearing the name. In example 20, the speaker locates and describes a road while providing its name in Spanish: 'the road that is [called] Porfirio Diaz'. In example 21, the speaker introduces the Spanish noun *auditorio*, 'auditorium,' treating it as a place name and characterizing it as a building using a common noun in SJQ: 'it's where the large building is that they call, *auditorio*'.

- (20) ca2=ye0 no4 nga24 porfirio diaz  
road REL name.3S Porfirio Diaz  
‘the road that is [called] Porfirio Diaz’

LEI35-SM08, 15:05.5

- (21) sqen4 no4 ndwa14 qan4 tlu2 no4 na32 auditorio kwa24  
where NOM PROG:exist.3S building big REL name.3P auditorium DEM3  
it’s where the big building is that they call [in Spanish], *auditorium*’

LEI34-SM07, 03:31.0

What is most notable about descriptive expressions in the Local Environment Interviews is their frequency: more than any other expression type, descriptive expressions occurred alongside gestures in MRAs. This fact is hardly surprising given the role of descriptive expressions in MRAs: to identify a figure for the addressee to recognize and attend to within the ground space where they are shifting their attention. The prevalence of descriptive expressions in the data set, then, speaks to the frequency with which speakers direct attention not merely to locations, but to objects within them.

#### 5.4.2.5.3 What is stripped from the message of the MRA when direction terms are inaccessible?

For deaf observers in the Quiahije municipality, two types of information are almost entirely irrecoverable from an MRA absent its descriptive speech component: (1) information about whether a speaker is indicating a region or an object within that region (i.e., discussing a ground alone or picking out a figure within that ground), and (2) information about the type of figure object under discussion. The gesture type used in an MRA may provide the deaf observer with some information from the first category: speakers who use the *go* gesture are representing motion in a given direction, and there is a greater chance in these cases that the accompanying speech will not provide information about the goal of motion (i.e., there is a greater chance that the speaker is saying ‘this way’ rather than ‘towards [goal]’). But speakers can and do use the *go* gesture in MRAs in which a goal of motion is explicitly introduced

as the figure in a figure-ground construction. In these cases, the figure is introduced exclusively in speech and is inaccessible to a deaf observer. Furthermore, deaf observers will find information of the second type, i.e., information characterizing the figure object itself, entirely unrecoverable from the MRA. The indicating gestures that constitute the accessible component of MRAs in this case neither reinforce nor supplement information about the figure that are provided in speech.

### 5.4.3 Discussion

The current study was performed to consider a set of research questions presented in §5.4. This section will discuss the pivotal questions in turn, drawing the study results to answer each question.

**What are the types of spoken SJQ expressions that occur alongside points and *go* gestures in multimodal referring acts?** Three spoken language expression types dominated in the MRAs produced in local environment interviews: demonstrative expressions, direction expressions, and descriptive expressions. Demonstrative and direction expressions served the function of cueing the addressee to search for a relevant space in their physical surroundings, and in the case of direction expressions, provided some information about direction in which to look relative to local inclines. In the terms of the Roberts (1993) figure-ground theory of multimodal reference, these terms directed attention to the physical space that serves as a ground in figure-ground arrays. The descriptive expressions characterized objects in the world—primarily landmarks, roads, and related physical entities in and around the Quiahije municipality—and directed attention to these objects. In the terms of Roberts (1993), they provided information about the types of figures that could be located within the indicated ground in figure-ground constructions.

**Does the use of particular spoken SJQ expressions affect the selection of handshape or elbow height features in the accompanying indicating gestures?** Handshape features were not shown to be determined by the use of particular spoken SJQ expressions. One elbow height feature—elevation above the shoulder level—occurred more reliably with descriptive expressions than with other expression types. This could be explained by an additional factor—target/referent distance—that conditioned both the elbow height of the pointing gesture and the

speaker's choice to describe the a figure object in speech. There was no clear sense, then, that the forms of indicating gestures were conditioned by the features of the accompanying speech.

**How is the message of indicating gestures reinforced, supplemented, or refined by the accompanying speech?** The message of both demonstrative and direction expressions was course-grained, and provided either a bare search prompt (with no information that could be used to locate the indicated region) or a cue to look in a rough direction. It was indicating gesture accompanying these terms in the MRA that did the work of refining the message. Indicating gestures provided perhaps the only information about the distance of the indicated region in the MRA. And indicating gestures refined the message of direction expressions in two ways: (1) they resolved any interpretation ambiguity when a direction expression might refer to vectors on one of multiple local slopes, and (2) they provided more precisely focused direction information than did the direction expressions.

It was only alongside descriptive expressions that the indicating gesture was relatively less informative. Here the disparity in informativeness was great: descriptive expressions efficiently directed attention to objects in the world, identifying them by their characteristics. By contrast, indicating gestures appeared to provide no information about the objects to found in the locations they indicated. Neither the spoken nor the gestural component served a refining purpose in these situations, then: the spoken descriptive expression simply provided information that the gesture neither reinforced nor refined.

**How much of the composite message may be understood when the addressee has access to visual information alone?** It would appear that indicating gestures, by virtue of their precise encoding of distance and direction information, are adequate to convey that information when they serve as the sole accessible signal in an MRA. Deaf observers in Quiahije may be therefore assumed to receive the relevant information about an indicated location when accessing only the visual component of an MRA. The story is quite different, however, for the message conveyed through spoken descriptive expressions. Here spoken language alone conveys information about the nature of an indicated object. Deaf observers may be assumed to receive none of this information in the absence of the spoken



language signal in an MRA.

It is vital here to distinguish between information that is recoverable from the MRA—that is, through a multimodal set of communicative expressions—and information that a deaf perceiver may glean based on their social and geographic knowledge of the municipality and its citizens. A deaf observer in San Juan may well see their neighbor point toward the northwest and, based on their knowledge of the neighbor’s land ownership and agricultural practices, surmise that the neighbor is discussing their farm site. Deaf adults, who socialize and work alongside their neighbors, are not only likely to make these conjectures, but likely to guess correctly in many if not most cases. The message of this chapter, then, is not that deaf observers are prevented from engaging with, and extrapolating information from, the MRAs that they interpret through a lens of rich social and geographic information. Rather, the argument here is that a greater burden is placed on the deaf signer precisely because this information is available only through extralinguistic context, as it is not communicated through an accessible signal within the MRA.

## 5.5 Conclusion

In Chapter 4, the indicating gestures of hearing non-signers were shown to systematically encode not only the direction of an indicated target, but also its rough distance from the gesturer. The gesture features of handshape and elbow height were shown to systematically co-vary with the distance of the target, providing a robustly patterned, visually accessible distance encoding system. The current chapter took information-rich indicating gestures as a point of departure, considering how these gestures are integrated with speech in multimodal referring acts (MRAs). The study showed that the type of spoken language expression paired with an indicating gesture in an MRA had little to no effect on the gesture’s form, suggesting that the meaningful morphological patterns explored in Chapter 4 are instantiated independently from speech. A careful investigation of the semantic contributions of gesture and speech to the MRA showed that while the messages in the two modalities are designed to be simultaneously perceived by hearing, sighted addressees, much of the locative information conveyed multimodally in an MRA is recoverable when the visual component alone is accessible. The descriptive information in the MRA, by contrast, is presented exclusively in speech and therefore inaccessible to

exclusively visual perceivers. With the facts about the meaningful morphological patterning of indicating gestures in place, and a clear idea of what deaf observers can derive from these gestures in the absence of speech, we can at last begin an exploration of the indicating behaviors of deaf signers in San Juan Quiahije. Chapter 6 will present the third and final study in the dissertation, an investigation of the indicating gesture features that two deaf signers adopt and adapt as they develop indicating systems in their emerging family signs.

## Chapter 6

### Study 3: Indicating Signs in SJQCSL

#### 6.1 Overview

This chapter is the third installment of a three-part exploration of indicating gestures in the Quiahije municipality. It examines the use of indicating gestures by two deaf signers who are developing fully visual-manual languages within the municipality. Chapter 4 took as its object the indicating gestures of hearing non-signers in the municipality, showing that these gestures have a compositional internal structure, with features encoding not only the direction of an indicated item, but also its rough distance from the gesturer. Chapter 5 demonstrated that, while the semantic content of indicating gestures is typically integrated with the content of co-occurring speech, the information that the gestures convey about the distance and direction of the referent are accessible even without the accompaniment of speech. The current chapter takes both of these findings into consideration and examines how indicating gestures are used by the deaf people developing a signed language in the Quiahije municipality. It compares the indicating gestures of non-signers with those of two deaf signers in the municipality, asking what features are common across the gestures of these two groups, and where and why the deaf signers have modified the indicating gesture system.

Section 6.2, 'Indicating scenes in a developing sign language,' grounds the chapter in examples drawn from interviews with the focal deaf signers. Section 6.3, 'Background: Indicating gestures in signed languages,' reviews the literature on indicating gestures generally, and pointing specifically, in signed languages. It discusses the claim that pointing gestures are borrowed into signed language from ambient co-speech gesture systems, and considers the small set of studies that have

collected evidence bearing on this claim. Section 6.4 ‘Introduction to the focal deaf signers,’ introduces the two deaf men whose indicating signs are the object of analysis in the current study. This section reviews the contexts in which the men were likely to have been exposed to the ambient indicating gesture system. Section 6.5, ‘A study of indicating signs in SJQCSL,’ presents the central study of the chapter: a comparison of the features of deaf signers’ indicating signs the features of indicating gestures used in the broader community. The study finds that the two deaf signers adopt the conventions for the use and combination of the analog signals in indicating gestures (direction of extended articulator, elbow height), and do not adopt the conventions for using the digital signal (handshape). Section 6.6, ‘Conclusion,’ reviews the findings of this final study on indicating gestures and on their role as input to a developing signed language.

## 6.2 Indicating scenes in a developing signed language

Koyu sits next to his wife Julya and looks over her shoulder while she shuffles a set of printed papers. Julya at last settles on a paper with a photo of a nearby landmark and shows it to her husband. Because Koyu is deaf, Julya signs rather than speaks her question (example 22):<sup>1</sup> ‘have you seen this?’ Koyu considers the photo, signing ‘wait’ to Julya. ‘It’s there,’ he concludes, pointing towards the village of Cieneguilla 2.5 km away (example 23). Koyu promptly elaborates on his first reply. He repeats a description of the location while waiting for the gaze of his wife, and upon receiving her attention he again points toward Cieneguilla (example 24): ‘it’s a school, it’s a school, it’s a school, look, it’s there.’ In each case, Koyu points with an extended index finger. He raises his elbow to around shoulder height, and bends his elbow so that his elevated hand can point behind him towards the village of Cieneguilla (Figure 6.1a).

- (22) SEE ((nods head with raised brows))  
‘have you seen this?’

LEI20-INT, 03:17.5

---

<sup>1</sup>For this and all other examples, see video clips made available at: Mesh, Kate, 2017, “Video examples for Points of Comparison: What Indicating Gestures Tell Us About the Origins of Signs in San Juan Quiahije Chatino Sign Language,” doi:10.18738/T8/CEWOEX, Texas Data Repository Dataverse. All videos are labeled with chapter and example numbers from the dissertation.

- (23) PT[Cieneguilla]  
'it's there'

LEI20-KO, 03:22.5

- (24) PT[photo] SCHOOL, PT[photo] SCHOOL, PT[photo] SCHOOL  
((taps for attention)) PT[Cieneguilla]  
'it's a school, it's a school, it's a school, look, it's there.'

LEI20-KO, 03:31.0

A few minutes later, Julya shows Koyu a photo of Puerto Escondido, a beach town approximately 30 km from their home. Koyu quickly locates and identifies the town for his wife. He then turns to the other party to the interview—the author operating the camera—and gives an abbreviated set of route directions. He makes reference to a well-known landmark along the highway that leads to Puerto Escondido: 'the hospital is to one side; you go (directly from there).' To describe the route from the hospital Koyu produces a form of the *go* gesture, using the characteristic arc movement that conveys forward motion (see Ch. 4, §4.3). When indicating a distant region as the goal of motion, Koyu forms the *go* gesture with an open handshape, sweeping his arm upward to raise his elbow well above his shoulder (Figure 6.1b).

- (25) HOSPITAL TO-ONE-SIDE GO[Puerto Escondido]  
'the hospital is to one side; you go (directly from there).'

LEI20-KO, 18:03.5



(a) Koyu: ‘It’s a school, it’s there’

(b) Koyu: ‘You go (directly from there)’

Figure 6.1: Koyu indicates near and far locations

Two months later a similar interview takes place in a home in Cieneguilla. Xka, a hearing woman, discusses local landmarks with Sendo, her deaf husband. After a discussion of the basketball court where Sendo spends many afternoons, Xka signs the question: ‘do you walk (to get there)?’ (example 26). Sendo replies succinctly, making reference to the photograph of the basketball court that the two have been using as an interview prompt: ‘I walk to what is pictured there’ (example 27). Both Sendo and Xka produce a form of the *go* gesture to describe the action of walking to the nearby basketball court. Their gestures are subtle, produced in the space in front of their torsos with their arms barely elevated. Sendo and Xka use the same handshape, extending their index and middle fingers in an inverted v-shape and moving their fingers to evoke a pair of walking legs (Figure 6.2a).

- (26) GO WH  
 ‘do you walk (there)?’

LEI33-INT, 00:35.0

- (27) PT[self] GO PT[photo]  
 ‘I walk (to what is pictured) there’

LEI33-SE, 00:36.0



(a) ‘I walk to what is pictured there’

(b) ‘It’s a beach, there’

Figure 6.2: Sendo indicates near and far locations

When Xka asks Sendo about the town of Puerto Escondido a few minutes later, Sendo takes the photograph from her and turns it to show the author operating a camera nearby. ‘It’s a beach,’ he explains for the benefit of the author. ‘There’ he adds, pointing in the direction of the beach town (example 28). Sendo produces the point toward the distant beach town with an extended index finger. He holds his pointing hand high in the air, raising his elbow well above his shoulder (Figure 6.2).

(28) PT[photo] BEACH PT[Puerto Escondido]  
 ‘It’s a beach, there’

LEI33-SE, 07:32.5

In both interviews, the deaf signers and their wives use the familiar indicating gestures of San Juan Quiahije—pointing and the *go* gesture—to locate landmarks and to describe travel towards these landmarks within the community. Many of the features of the gestures involved appear to be parallel those of indicating gestures used in the municipality: an anticipated outcome of contact between the signers and

the larger community. Not all features of the community-wide system are present in the pointing behaviors of the signers, however, and certain of the signers' gestures appear to be innovations building on, but diverging from, community-wide gesturing conventions.

### 6.3 Indicating in signed languages

In signed languages, points are used first and foremost to direct attention to locations in physical space and to the objects and entities in these locations, a function that is frequently labeled *locative* in the literature on signed languages (see, e.g., Cormier, Schembri, & Woll, 2013; Johnston, 2013) and that has been called *spatial indicating* throughout this dissertation. Points also serve to indicate persons by directing attention to the space that they currently occupy, or to a space that can be associated with the person, a function that has been called *pronominal* (see, e.g., McBurney, 2002; Meier, 1990; Meier & Lillo-Martin, 2010) though some researchers question whether these points truly differ from locative points in form or function (for related discussions, see Cormier et al., 2013; Liddell & Metzger, 1998). Finally, points serve a *determining* function in signed languages when they occur alongside nouns, either introducing a referent into the discourse or referring back to a known or knowable referent (Bahan, Kegl, MacLaughlin, & Neidle, 1997; Johnston, 2013; Wilbur, 1979).

Determiner points in particular serve a function unique to signed languages: abstract reference. An initial determiner point towards an arbitrary location in the sign space establishes or 'anchors a given referent in the discourse, and subsequent points to the same space serve a referent-tracking function. Although co-speech points have been shown to accomplish reference tracking in multimodal language (Kendon & Versante, 2003; Marslen-Wilson, Levy, & Komisarjevsky Tyler, 1982), researchers have argued that only points in signed language are directed towards truly arbitrary spaces (rather than spaces in which an imagined entity is placed within a spatial array), so that only in signed languages are points entirely decoupled from a spatial indicating function (Barberà & Zwets, 2013; Zwets, 2014). When points no longer indicate areas in physical space, they can take on additional grammatical functions in signed languages, serving as relative pronouns (Cecchetto, Geraci, & Zucchi, 2006; Liddell, 1978; Pfau & Steinbach, 2005), verb agreement markers (Rathmann, 2000) and ultimately developing into auxiliary verbs (Stein-



bach & Pfau, 2007). The humble point, then, comes to serve a variety of functions in signed languages, many of them grammatical. But how do all of these functions arise?

Pfau and Steinbach (2006) argue that all signed language pointing functions evolve from locative pointing. They theorize that locative points, the first to occur in emerging signed languages, are borrowed (perhaps with modifications) from co-speech gesture, and that they undergo an ordered series of changes to take on additional functions. The proposed grammaticalization path from locative points to (in some cases) auxiliary verbs is presented in Figure 6.3. Two studies have considered the development of pointing gesture functions in signed languages, and provide evidence supporting Pfau & Steinbach’s claims. The first study tracks the development of arbitrary pointing in the emerging Nicaraguan Sign Language (NSL), while the second study speculates about an earlier stage in the process—the borrowing of locative signs from co-speech gesture—in a developed signed language, Kata Kolok.

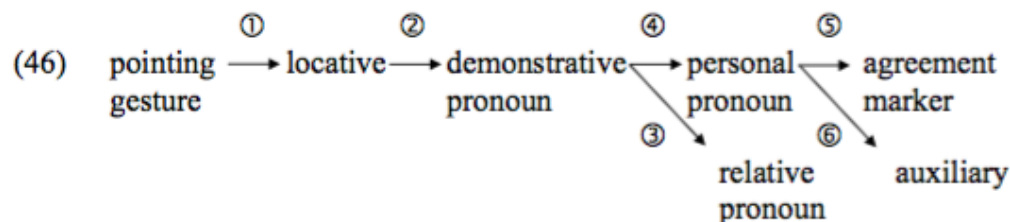


Figure 6.3: Grammaticalization path for pointing gestures, reprinted from Pfau & Steinbach (2006)

Senghas and Coppola (2011) studied the development of pointing functions in Nicaraguan Sign Language (NSL), a young signed language dating to the 1970s that has emerged in a deaf day school in Mangua. Participants were signers from 3 cohorts of students who were exposed to NSL at different stages in the language’s development, as well as a group of homesigners from remote areas of Nicaragua who had never been exposed to NSL. The study considered how all four groups of signers used pointing gestures during the re-telling of a cartoon—a task that required participants to refer to multiple characters and to describe their movements in space. Two types of points toward empty space were tracked for the study: (1) points introducing and referring back to non-present event participants, and (2) points

referring to locations in an imagined spatial array in front of the signer. While none of these points indicated real-world locations, the authors understood points toward imagined spaces to have a locative function (albeit a ‘displaced’ rather than ‘direct’ one), while points introducing and tracking characters were understood to exemplify truly arbitrary reference. Signers in all four groups produced displaced locatives at around the same rate: there was no evidence, then, that the use of this type of locative point changed over time. By contrast, the number of abstract points increased significantly across each of the NSL signing cohorts. The authors interpreted this result, and changes in the syntactic distribution of abstract points only over time, as evidence that a new grammatical function—the anchoring and tracking of referents—was conventionalizing for pointing gestures as they were decoupled from their locative function.

Importantly, Senghas and Coppola (2011) did not begin by looking at the kind of spatial indicating that is accomplished by points to real world referents. Instead, the study began with ‘displaced’ locative points that were already one level of remove from spatial indicating, and looked for evidence of further abstraction as a new function for pointing developed. By contrast, the second study related to Pfau and Steinbach’s proposed grammaticalization pathway for pointing gestures—a study of locative pointing in the developed signed language, Kata Kolok—considered points with the spatial indicating function believed to appear first in emerging signed languages.

de Vos (2014) performed a study of pointing in Kata Kolok, a village signed language of Bali that has been transmitted through at least five generations of signers. A total of 352 examples of points with a spatial indicating function were collected in spontaneous Kata Kolok conversation. These signs were observed to encode a binary proximal-distal distance distinction in their form, with distal value signaled through some combination of five features: upward fingertip orientation (i.e, finger pointed towards the sky rather than straight out from the signer or down towards the ground), straight movement towards the apex of the point, a lifted upper-arm (i.e, pointing with the arm and hand rather than with the hand alone), vertical elevation (a feature labeled as elbow height in this dissertation), and pursed lips. The frequency with which the features marked distance was not reported, nor was any variation in the forms of the features. de Vos (2014) considered examples of locative points: the gestures that were likely to enter Kata Kolok via borrowing

from the surrounding co-speech gestures, and which might or might not have been changed—either in their forms, or in the meaning mapped to these forms—as they were incorporated into the spatial indicating system of the signed language (an incorporation process that de Vos labels, ‘morphemization’). This work opens the possibility of making a systematic comparison between the forms and meanings of Balinese co-speech indicating gestures and the locative gestures of Kata Kolok, a project that de Vos (2014) advocates, but which has not yet been performed.

While multiple studies have considered the functions of displaced and direct locative points in signed languages, and have even charted the changes to the functions of points over time, no research to date has compared the features of locative points in a signed language with the features of the gestures that are assumed to serve as input to the deaf creators of emerging languages. The current study seeks to address this gap, systematically comparing the features of Chatino indicating gestures with related signs used in the emerging family sign languages of SJQCSL.

## 6.4 Introduction to the focal deaf signers

The focus of the present chapter is on two deaf signers in the Quiahije municipality and the pointing conventions they have developed within their family-based signing systems.<sup>2</sup> Here the men are introduced, and their roles in developing the emerging signed systems (categorized together as San Juan Quiahije Chatino Sign Language, or SJQCSL) are described.

Koyu is a 51-year-old man from the town of San Juan.<sup>3</sup> A lifelong resident of the Quiahije Municipality, Koyu was born to parents whose home near a set of caves at a high elevation in the San Juan town earned them the family name *neq4*

---

<sup>2</sup>Of the 5 deaf signers interviewed for the study, 2 performed the landmark- and route-identifying behaviors that recurred in interviews with hearing gesturers. The data from these two deaf participants were selected for analysis because they could be fruitfully compared with the data collected from hearing participants for Study 1. Data from the remaining 3 deaf participants were excluded for reasons that are reviewed in Chapter 3, §3.4.

<sup>3</sup>In this chapter participants’ names are used rather than pseudonyms to call attention to their contribution to the study of Chatino languages. Deaf participants gave permission for their photo/video images to be used, and their hearing family members gave permission for all family members’ names to be used. Participants’ ages are reported as they were at the time of data collection in 2015.

*tu3-ke4*, ‘people of the caves.’ Koyu was born deaf, and was the second deaf child in his family: his sister Stina was around 9 years old at the time of his birth and had never had a deaf co-signer until her brother arrived. Stina and her hearing family members had developed a set of signs that they used to communicate, and after the birth of Koyu, the two deaf siblings continued to develop this system. Together they originated a family sign language that persists and is shared to varying extents with their parents and siblings. Neither of the two siblings was sent to school so that they were very likely one another’s chief social companions throughout childhood. Today Koyu and Stina live in separate homes: Koyu has moved to a lower elevation on the mountain and established a homestead for himself, his wife, and their daughter. Stina remains in the home ‘among the caves’ and often makes the 20-minute walk to the center of town and to her brother’s nearby house. Stina remains one of Koyu’s frequent interlocutors. Koyu additionally signs with his wife Julya, who learned to sign after meeting Koyu, and with their daughter Tomasa, who has been exposed to signing from birth. Koyu’s other co-signers include members of Julya’s family as well as neighbors throughout San Juan who know Koyu and have established communicative routines with him with functions ranging from exchanging greetings to discussing local events. Koyu and his sister Stina appear in Figure 6.4. Koyu, his wife Julya, and his daughter Tomasa are pictured in Figure 6.4.



Figure 6.4: Two deaf siblings: Koyu and his older sister Stina, with their hearing father Tasyu in the background



Figure 6.5: Koyu with his wife Julya and daughter Tomasa

Sendo is a 30-year-old man from the village of Cieneguilla. He was born and raised in the nearby town of San Juan, where he was the sole deaf member of his family. Sendo reports that he was born hearing but suffered near-total hearing loss as a result of a fall while he was still an infant; other community members report that Sendo was born deaf. On either account, Sendo is pre-lingually deaf and has had little or no access to speech sounds in his life. Like Koyu, Sendo was not sent to school, and it is likely that his hearing siblings were his primary companions. Members of his extended family observe that he is an extraordinarily intelligent and gifted communicator with an ability to convey complex messages to his almost exclusively hearing interlocutors. The linguistic system that facilitates this communication is the primary communicative system of Sendo alone, but it is shared with a group of co-signers who have adopted many of Sendo's signs and grammatical structures, and may therefore be categorized as family sign. As an adult, Sendo moved from San Juan to Cieneguilla in order to marry into a family with a homestead there. Over multiple years of courting, Sendo's wife learned the signing system that Sendo had developed with his family. Today Sendo signs with his wife, Xka, their hearing daughters Rosa, Blanca, and Esther, as well as hearing members of his wife's family—siblings, a stepson Tonyo, nieces and nephews. When he visits San Juan, Sendo signs with his mother, as well as with his siblings and with their spouses and children. An avid basketball player, Sendo also signs with the men in the municipality who play pick-up basketball in the centers of San Juan and Cieneguilla. Their conversations range over topics present and concrete (e.g., basketball scores) and topics distant and abstract (e.g., community affairs and planned events). Sendo and his daughter Rosa appear in Figure 6.6.



Figure 6.6: Sendo with his daughter Rosa

Koyu and Sendo are friendly acquaintances. However, the two men report that they did not meet until adulthood. This report is consistent with patterns of socialization in the municipality: Chatino social life is built around the immediate and extended family, and two unrelated men are unlikely to be introduced or considered potential social companions—even taking into account their shared deafness and their use of signed language—if they do not share a kinship relation. The two deaf men report that they now encounter one another when completing errands or playing basketball in San Juan and Cieneguilla, and while doing part-time work on municipal road maintenance projects.

The contact between the two men has led to some shared vocabulary: Koyu now shows a preference for some of their shared signs even over the signs produced by his sister, Stina. The two men developed their signing practices in separate families, and many of their signing conventions differ as a consequence. The two men prefer different signs to characterize many objects and activities, although they appear to have no difficulty understanding one another's preferred signs, most likely

because of the high degree of iconicity of their chosen signs. In addition, the signing of the two men exhibits different patterns of sign order (Mesh & Hou, 2018).

The focus of this chapter is on a fundamental component of both Koyu and Sendo's signing practices: the use of indicating signs to draw an interlocutor's attention to objects or regions in space. Foundational to this investigation is the assumption that the two men were exposed to roughly similar indicating gestures throughout their childhood. The men can be assumed to have 'overseen' (a parallel expression to 'overheard' as used by Schreiber, 2001) speech-linked indicating gestures in observed conversations between family members, neighbors, and community members. These conversations would have been visually available to Koyu and Sendo from early childhood as they watched interactions in their homes, and their opportunities to observe indicating gestures in 'overseen' conversation would have increased as the men aged and spent increasing amounts of time in the social centers of the municipality: local government centers, religious spaces, the homes of relatives, and the roads that people frequently travel together to reach farming sites.

More importantly, indicating gestures would have been the cornerstone of visual-manual talk designed for, and directed to, the two deaf men. Koyu and Sendo's interlocutors, as hearing community members, can be assumed to have familiarity with the gesturing system that we saw evidenced in Chapters 4 and 5. These interlocutors likely maintained many, if not all, of the features of the community-wide indicating gesture system when interacting with the two deaf men. It is of course possible that some frequent co-signers of the deaf men used non-standard gesture features when conversing with them. Importantly, if this happened, the influence of these co-signers might have been considerable, but it would not have been the only influence on the two men's developing family signs. The men would, after all, continue to 'oversee' multimodal conversations throughout the community. For this reason, the current investigation assumes that both men were exposed with more or less regularity to the patterned pointing system presented in Chapter 4, and that they observed indicating gestures that were designed to be interpreted in the linguistic context described in Chapter 5. It is this set of assumptions that underlies the study performed in the current chapter: one which asks whether Koyu and Sendo adopted the community-wide conventions for producing indicating gestures as they developed fully visual-manual indicating systems in their family sign languages.



## 6.5 A study of indicating signs in SJQCSL

The present study considers the indicating signs that two deaf SJQCSL signers use during conversations about local landmarks and the paths taken to reach them. The study was conducted in service of a larger goal: to investigate whether the gesturing conventions of the SJQ speakers in the Quiahije municipality are (1) accessible to deaf people in the municipality, and (2) mirrored in the conventions of their emerging signed language. As the third and final phase of this larger research project, the current study compares the indicating gestures of non-signers with those of two deaf signers in the municipality, asking what features are common across the gestures of these two groups, and where and why the deaf signers have modified the indicating gesture system. The study addresses the following questions:

1. What components of the ambient indicating gesture system are present in the signer's indicating signs?
  - (a) Are both indicating gesture types (pointing and *go* gestures) used by the signers?
  - (b) Do the signers incorporate the elbow height, handshape, and hand selection patterns found in the ambient indicating gesture system?
2. What changes, if any, does the signer impose on the indicating system?
  - (a) Do the signers convey new meanings using the indicating gesture features (direction, elbow height, handshape)?
  - (b) Have the signers developed new indicating gesture features?
  - (c) Do the signers use the gesture types (points, *go* gestures) with different functions?

### 6.5.1 Methods

#### 6.5.1.1 Participants.

Two deaf people in the Quiahije municipality participated in the Local Environment Interview (LEI) task analyzed in this chapter: Koyu, a 51-year-old man, and Sendo, a 30-year-old man. Both men were introduced in §6.4.

### **6.5.1.2 Materials and procedure**

The LEI scripts used with hearing participants for a prior study were adapted into picture stimuli. Where possible, 2 photographs of each landmark or city were presented in order to encourage the signers to describe the location itself, rather than the perspective presented in any given photograph. One destination from the original LEI interview was changed: the city of San Miguel Panitxlahuaca was omitted from the photo stimuli for lack of a representative photograph, and the town of Puerto Escondido was added in order to provide another familiar destination outside of the municipality. For Koyu, some of the selected locations for the interview were very near to the interview site. To keep the distance of referents balanced across the two interviews, two photographs of Sendo's neighbors' homes were added to the LEI stimuli for Sendo alone. A complete set of photo stimuli are provided in Appendix D.

Interviews were conducted by the wives of the deaf participants. An explanation of the goal of the interview, and instructions about how to ask the interview questions, were provided to each interviewer using the communicative practice that had already been established with the author: Xka, the wife of Sendo, received the instructions in SJQ via a Spanish-SJQ interpreter. Julya, the wife of Koyu, received instructions directly from the author in Spanish. Both interviewers were instructed to show the photo stimuli to the participant and to ask: (1) where to find the pictured landmark or city, and (2) how to reach this destination. When interviewers asked for clarification about the second question, they were instructed to ask: 'can you walk or drive to get there?'

### **6.5.1.3 Equipment and software**

Interviews were recorded with a Canon HF G10 camcorder. Recordings were produced in MP4 format with an interlaced frame rate of 60i. Footage was annotated using the ELAN video annotation software (available online: <http://www.lat-mpi.eu/tools/elan/>).

### **6.5.1.4 Data selection**

The entirety of the filmed discussion between the interviewer and interviewee was analyzed for both local environment interviews. This resulted in a total of 31:18 of

analyzed footage, 22:06 from Koyu and 9:12 from Sendo.

#### **6.5.1.5 Glossing signed language**

For both interviews, every signed utterance was given a sentence-level translation and world-level gloss. Most signs were glossed using English-language words or phrases with roughly equivalent meanings to the signs in question. Glosses were printed in capital letters (CHURCH, SCHOOL, and phrasal glosses for a single sign were hyphenated (ALL-AROUND-HERE)). Indicating signs were glossed as PT, ‘point’ or GO, ‘go gesture’ and where a referent was identifiable, it was labeled in square brackets after the sign gloss (PT[*Puerto Escondido*]). Negative signs were glossed using labels that described their formal features, following Mesh and Hou (in press).

Since the family members of deaf signers were unfamiliar with the task of translating from their family signs into spoken language, the author largely glossed the deaf participants’ signed utterances without assistance. The author used her knowledge of Koyu and Sendo’s family signs to complete this task and frequently asked Lynn Hou, the other member of the SJQCSL Documentation Project, to review her glossing choices. When neither of the two project members could gloss a sign, the author asked family members of the signer in the video to:

1. Provide a sentence-level gloss for the utterance containing the sign or pointing gesture.
2. For lexical signs, provide a gloss for the sign after watching it performed in multiple utterances in a single video.

Family members were able to identify the meaning of the sign in all cases brought forward by the author. Thus every sign received a gloss in the 31:18 of LEI video footage.

#### **6.5.1.6 Coding indicating signs**

All indicating signs produced in each interview were coded for morphological features and following the coding conventions described in Chapter 4, §4.5.1.7. Where a participant turned sharply, blocking the camera’s view of their arm and/or hand with their torso, only those features of the indicating sign that were visible were coded.

### **6.5.1.7 Identifying referents of indicating gestures**

Research assistants who performed translation and transcription tasks also identified the targets of the participants' pointing gestures and corresponding speech. Referent identifications performed by one research assistant were reviewed with a second assistant. Referents were marked as INDETERMINATE when neither the author nor multiple research assistants could identify the object's location.

### **6.5.1.8 Geospatial coding**

All identifiable target locations were marked with placemarks using the Google Earth software. The distance and difference in altitude between each referent and the interview site were determined and coded using the methods outlined in Chapter 4, §6.5.1.8.

### **6.5.1.9 Experimental design and statistical analysis**

This study was designed to provide naturalistic signing data to compare with the data collected from gesturers in the Quiahije municipality. Like the original study on gesture forms, the current study was approached as a quasi-experiment investigating the influence of referent distance and altitude on indicating gesture form. The mixed-effects linear and logistic regression models were constructed in R (RStudio 0.99.903) for the original study were fitted, where possible, to the data collected from deaf signers. Additional information on the models can be found in Chapter 4, §4.5.1.10. All models used to analyze signer data, and the datasets on which they were run, have been made available at the Texas Data Respository.<sup>4</sup>

## **6.5.2 Results**

Results for each of the signers will be presented and summarized separately in Sections 6.5.2.1 and 6.5.2.2. In order to make a clear comparison between each signer and the hearing gesturer data collected in Chapter 4, results from the analyses run for gesturers are presented side-by-side with each signer's results. The detailed results for each signer are presented first, followed by a brief summation for each signer

---

<sup>4</sup>Mesh, Kate, 2017, "Local environment interview data for Points of Comparison: What Indicating Gestures Tell Us About the Origins of Signs in San Juan Quiahije Chatino Sign Language", doi:10.18738/T8/PJXZJI, Texas Data Repository Dataverse.

in Sections 6.5.2.1.8, ‘Koyu results: interim summary’ and 6.5.2.2.8, ‘Sendo results: interim summary’. Two discussion sections follow, paralleling the structure of the original study questions: Section 6.5.3, ‘Adopting an available system,’ discusses the common features of the ambient indicating gesture system and the indicating signs used by each deaf participant. Section 6.5.4, ‘Adapting while adopting,’ considers the changes the signers imposed on the gesture system when incorporating it into their own family sign languages.

### **6.5.2.1 Results: Koyu**

#### **6.5.2.1.1 Introduction to the results: Koyu**

Data for Koyu were collected in a Local Environment Interview in his home in the town of San Juan. Koyu’s hearing wife Julia served as the interviewer, and frequently addressed comments to the author during the interview. Koyu followed suit: he often answered Julia’s question and repeated and/or elaborated his answer in statements directed to the author. This resulted in informative, and also highly repetitive, answers to each interview prompt.

During an interview lasting 22 minutes and 6 seconds, Koyu produced a total of 864 signs. Of these, 349 of were indicating signs: 331 were plain points, while only 17 were *go* gestures. The overwhelming majority of these indicating gestures were produced on Koyu’s dominant hand (the right hand). Of the indicating signs, a total of 164 indicated determinate locations: these gestures were analyzed for the current study. The number of indicating gestures targeting objects, people and locations, and their production on the dominant and non-dominant hand, are presented in Table 6.6.

#### **6.5.2.1.2 Koyu: Elbow Height**

##### **6.5.2.1.3 Does elbow height show meaningful patterning in Koyu’s indicating gestures?**

Elbow height is a starting-place for the comparison of Koyu’s indicating behaviors with those of hearing gesturers. Hearing participants in the Local Environment Interviews were shown to indicate referents near the gesturer using gestures with a low elbow height. As the distance between the gesturer and the target increased,

|                        | Dom. Hand | Non-Dom. Hand | Total |
|------------------------|-----------|---------------|-------|
| Total Signs            | 668       | 167           | 835   |
| Total Points           | 304       | 27            | 331   |
| to locations/landmarks | 138       | 8             | 147   |
| to stimulus photos     | 73        | 12            | 85    |
| to people              | 67        | 1             | 68    |
| indeterminate ref.     | 9         | 6             | 15    |
| Total Go Gestures      | 17        | 0             | 17    |
| to locations/landmarks | 17        | 0             | 17    |

Table 6.1: Indicating signs produced in the LEI task: Koyu

the elbow height of the gesture also increased: elbow height, then, served as a meaningful signal, conveying distance in an analog manner (Chapter 4, §EH). Did Koyu modulate the elbow height of his indicating signs to convey information about referent distance in this way?

Koyu did in fact mark referent distance through the elbow height feature of his indicating signs. The elbow heights of Koyu’s indicating gestures for referents across all distance values are presented in Figure 6.7. They are presented alongside the results of hearing gesturers from Chapter 4 (originally Figure 4.15, here Figure 6.8). Notably, where hearing participants’ gestures marked distance in an analog fashion, Koyu’s distance-marking pattern appeared more categorical, with a distinction made between referents inside the municipality (distance categories 0 and 1) and outside the municipality (categories 2–6). When indicating locations within the municipality, Koyu used a variety of elbow heights. When indicating locations outside of the municipality, however, Koyu nearly always gestured with a high elbow, with exceptions in the farthest distance category comprising gestures to Oaxaca city.

The variation in elbow height for gestures in distance categories 1 and 2 suggested that an additional factor might influence the form of Koyu’s indicating signs. Referent altitude, which had no significant effect on the gestures of hearing participants, appeared to influence the elbow height of Koyu’s indicating signs toward referents inside the municipality. For only those gestures towards referents in the municipality, the mean elbow heights of Koyu’s indicating gestures for referents

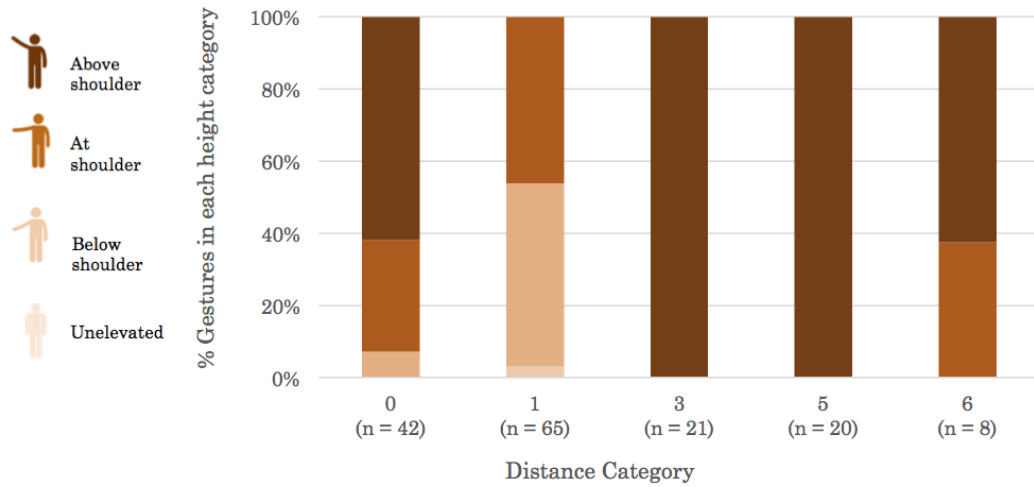


Figure 6.7: Elbow height by distance category: all indicating signs, Koyu

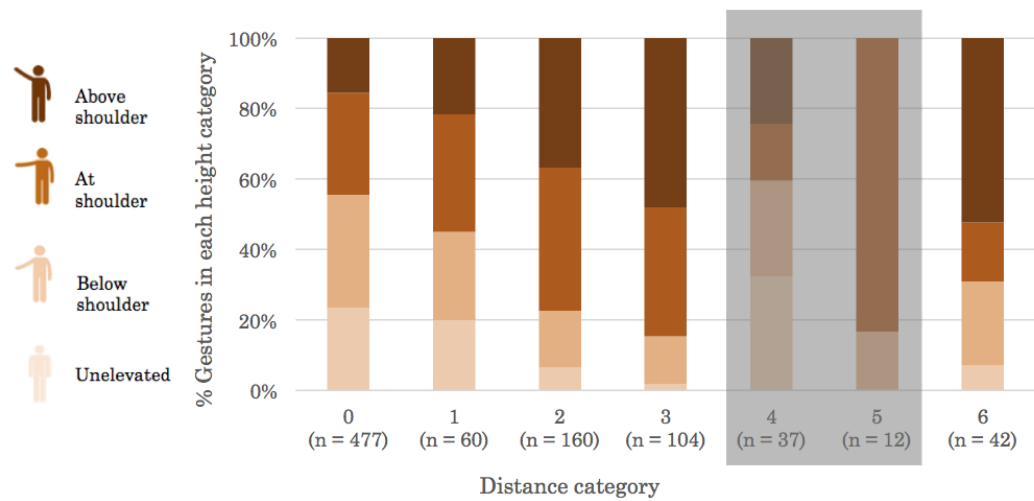


Figure 6.8: Elbow height by distance category: all indicating gestures, hearing participants

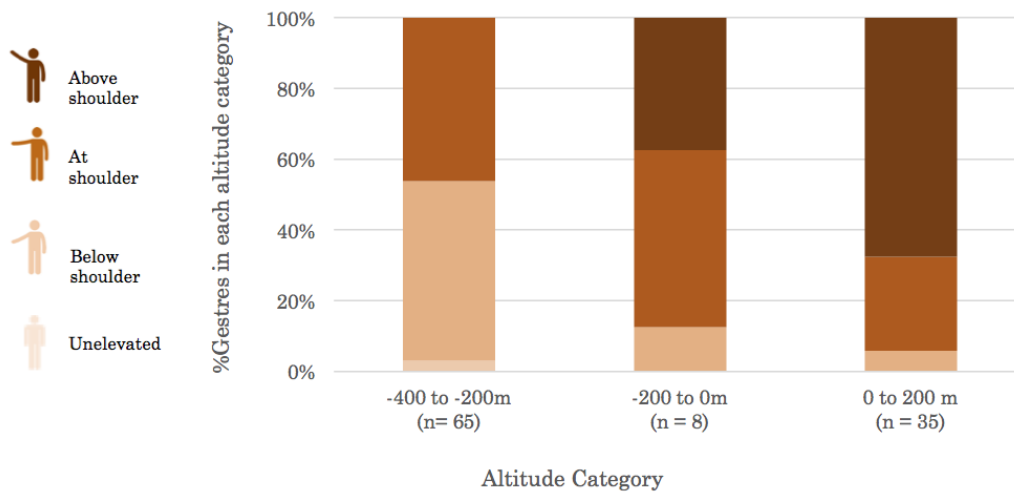


Figure 6.9: Elbow height by altitude category for targets in the Quiahije municipality: Koyu

across all altitude values are presented in Figure 6.9. No comparative figure from Chapter 4 is included here, since there was not a clear influence of referent altitude on the elbow height of hearing participants' gestures.

A statistical analysis was performed to determine whether there was a significant effect of referent distance and/or referent altitude on the elbow height of Koyu's aggregated indicating gestures: a linear regression model was constructed with elbow height as the dependent variable and with target distance and target altitude as fixed effects. A main effect of distance was found when altitude was held constant ( $p < 0.001$ ). The mean elbow height was 1.91 when the target distance value was zero ( $SE = 0.23$ ) and increased by an average of 0.19 with every increase in distance category ( $SE = 0.04$ ). There was no significant effect of altitude when distance was held constant ( $p = 0.59$ ) Results of the mixed model are provided in Table 6.2.

One possible reason for the lack of a significant altitude effect could be that the factors of altitude and distance interacted—that is, that there was an effect of altitude on elbow height, but that the effect changed across distance categories. A linear regression model was created that looked for an interaction between the



| Fixed effects | Estimate | SE   | Pr(> t ) |
|---------------|----------|------|----------|
| (Intercept)   | 1.87     | 0.09 | < 0.001  |
| Distance      | 0.18     | 0.03 | < 0.001  |
| Altitude      | -0.01    | 0.02 | 0.59     |

Table 6.2: Koyu: Linear regression analysis of distance and altitude effects on elbow height

two factors, and a significant interaction was found ( $p < 0.001$ ). A look at the distribution of elbow height values in the dataset made it evident that altitude must have an effect in gestures toward referents in distance categories 1 and 2, where most of the variation in elbow height was found (see visualization in Figure 6.7). For this reason, a subset of the data comprising only gestures toward referents in distance categories 1 and 2 (i.e., gestures toward referents within the municipality) was used for a subsequent analysis of altitude effects on elbow height.

A linear regression model was constructed with elbow height as the dependent variable and with target altitude as a fixed effect. This model was run on subset of the data from distance categories 1 and 2. A main effect of altitude was found ( $p < 0.001$ ): the mean elbow height averaged to 1.42 when the referent elevation value was -400m (for referents in Cieneguilla, located in the valley below Koyu's home,  $SE = 0.07$ ) and increased by an average of 0.58 with every 200m increase in altitude ( $SE = 0.07$ ). Results of the mixed model are provided in Table 6.3.

| Fixed effects | Estimate | SE   | Pr(> t ) |
|---------------|----------|------|----------|
| (Intercept)   | 1.42     | 0.23 | < 0.001  |
| Altitude      | 0.58     | 0.07 | 0.59     |

Table 6.3: Koyu: Linear regression analysis of distance and altitude effects on elbow height

To review: when all of Koyu's indicating gestures were analyzed, there was a main effect of distance on elbow height. The distance of the referent did have

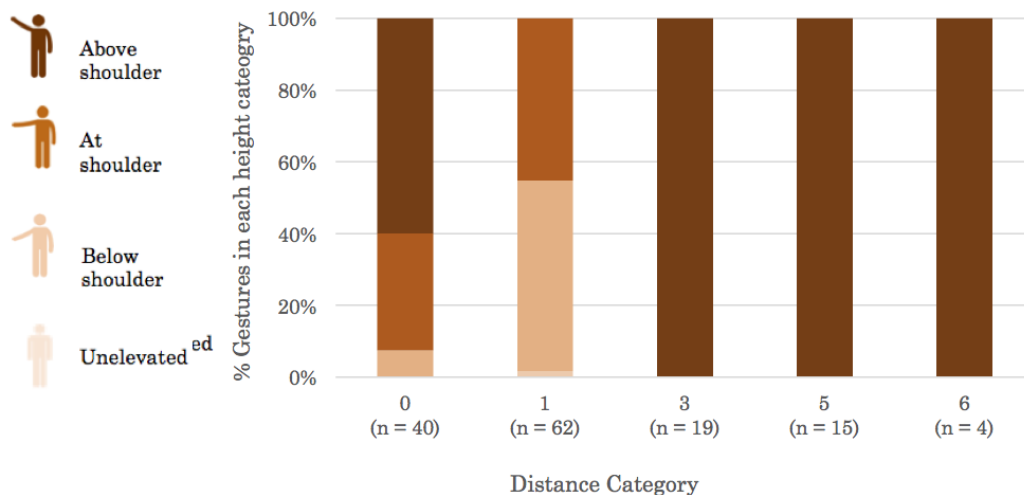


Figure 6.10: Elbow height by distance category: pointing, Koyu

an effect on his overall use of the elbow height feature. When a subset of the data comprising only nearby referents was considered there was a main effect of altitude on elbow height. For just those signs indicating items within the municipality, referent altitude affected Koyu’s elbow height.

#### 6.5.2.1.4 Is the elbow height pattern robust regardless of the indicating gesture type used (pointing vs go gestures)?

Just as hearing participants produced two types of indicating gestures—points and *go* gestures—so did Koyu, though he used a greater proportion of pointing gestures. The data from the hearing gesturers showed the same elbow height effects regardless of gesture type: was this also the case for Koyu?

Koyu did appear to show the same rough elbow height pattern in gestures of both types. Elbow height data for Koyu’s pointing gestures are presented in Figure 6.10, with comparable data for hearing gesturers in Figure 6.11. Elbow height of Koyu’s *go* gestures are presented in Figure 6.12, and for hearing participants’ *go* gestures in 6.13.

A statistical analysis was performed to determine whether the gesture type used (pointing or *go* gesture) influenced the elbow height of Koyu’s indicating gestures when distance was taken into account. A mixed-effects linear regression model

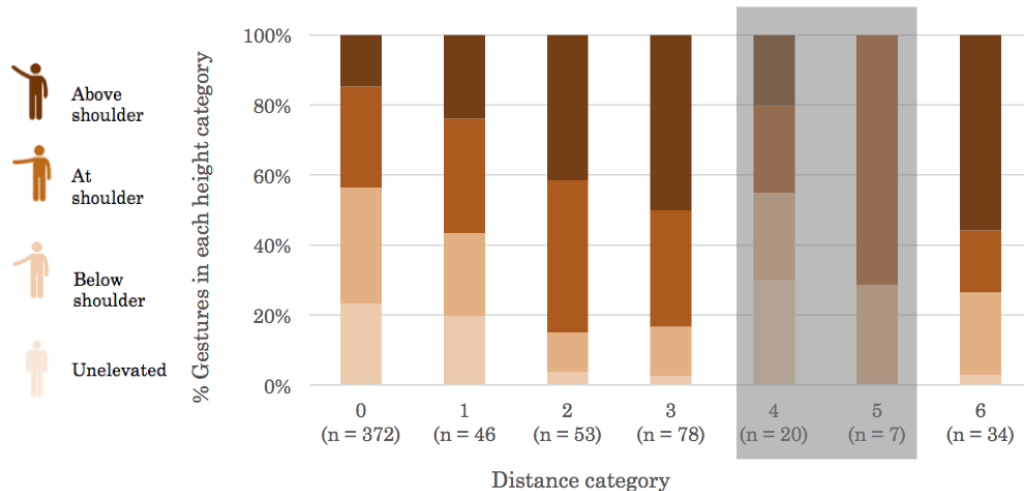


Figure 6.11: Elbow height by distance category: pointing, hearing participants

was constructed with elbow height as the dependent variable, and with referent distance and gesture type as fixed effects. While distance was held constant, there was no significant effect of gesture type on elbow height ( $p = 0.39$ ): that is, gesture type did not affect the average height of Koyu’s indicating gestures. A main effect remained for distance ( $p < 0.001$ ): while gesture type was held constant, the mean elbow height of indicating gestures averaged to 1.62 when the target distance value was zero ( $SE = 0.22$ ), and increased by an average of 0.21 with every increase in distance category ( $SE = 0.03$ ). Results of the analysis are presented in Table 6.4

| Fixed effects     | Estimate | SE   | Pr(> t ) |
|-------------------|----------|------|----------|
| (Intercept)       | 1.62     | 0.22 | < 0.001  |
| Distance          | 0.21     | 0.03 | < 0.001  |
| Gesture Type      |          |      |          |
| Pointing          | (ref)    |      |          |
| <i>Go</i> Gesture | 0.17     | 0.20 | 0.39     |

Table 6.4: Koyu: Linear regression analysis of distance and gesture type effects on elbow height

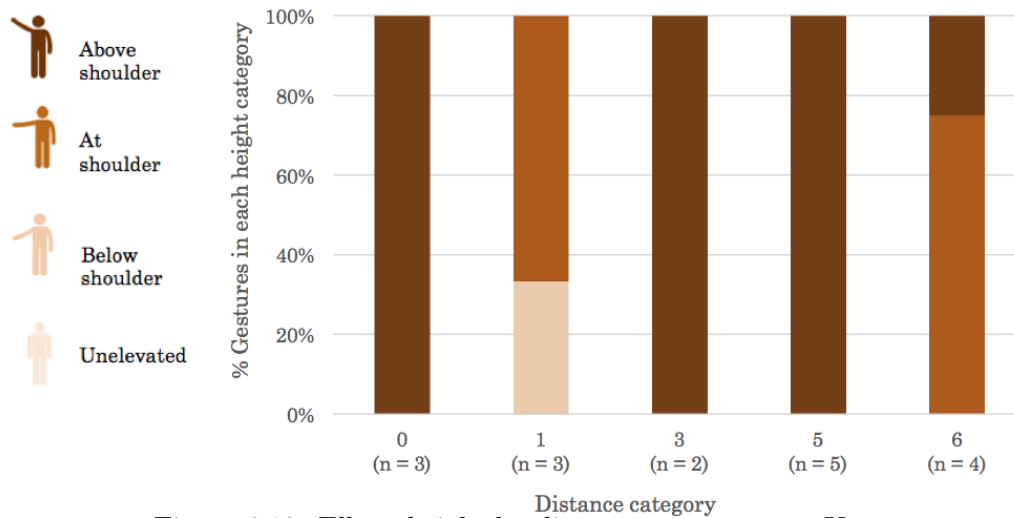


Figure 6.12: Elbow height by distance category: *go*, Koyu

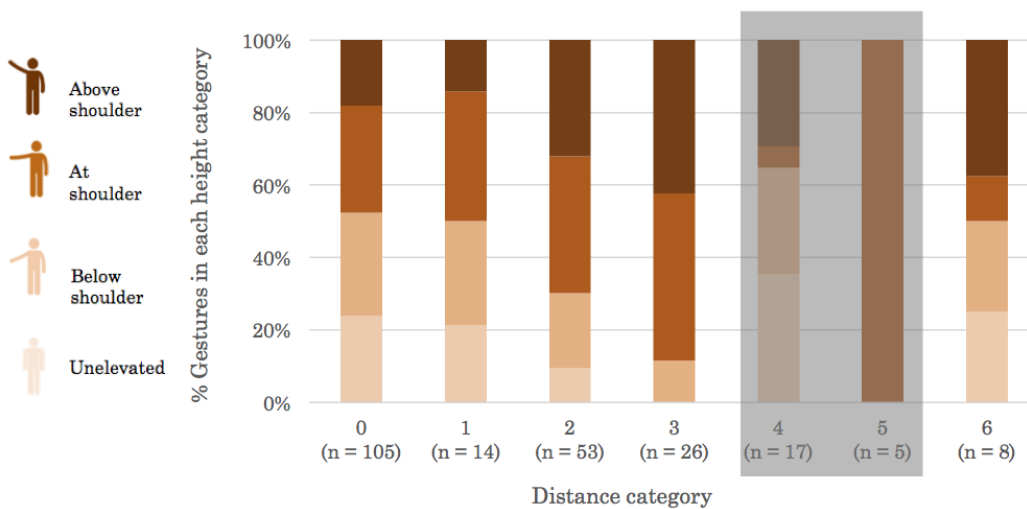


Figure 6.13: Elbow height by distance category: *go*, hearing participants

#### **6.5.2.1.5 Koyu: Is the elbow height pattern robust regardless of the hand used to gesture?**

While hearing gesturers in the LEI task frequently used both their dominant and non-dominant hands to produce indicating gestures, this was not the case for Koyu, who showed a strong dispreference for using his non-dominant (left) hand. Just 9 of his indicating gestures (5%) were produced on his non-dominant hand. These gestures were typically produced when Koyu had turned away from the camera to facilitate pointing behind him and to his left, so that the view of his hand and arm was obscured the pointing signs could not be coded for handshape and elbow height patterning. Just two of the nine indicating signs on the non-dominant hand could be coded for morphological features: both were toward targets in the nearby village of Cieneguilla, both were produced with an extended index finger handshape, and both were produced with a relatively high elbow height (2 and 3). Without additional data to compare with these tokens, it is impossible to discern whether the distance-marking patterns in the larger dataset were reflected in Koyu's gestures on the non-dominant hand.

#### **6.5.2.1.6 Do Koyu's results differ from hearing non-signers due to repetition effects?**

Koyu's interviews differed substantially from those of hearing participants in one aspect: repetitiveness. Koyu typically answered a question multiple times for the interviewer, and then repeated his answer one or more times to the author who was also present in the interview. This was not a characteristic of the interviews with hearing participants. To ensure repetition did not have an effect on Koyu's elbow height that might account for any differences from hearing participants, an analysis was performed that considered the effect of repetition on elbow height. A mixed-effects linear regression model was constructed with elbow height as the dependent variable and with repetition of utterance as a fixed effect. While distance was held constant, there was no significant effect of repetition on elbow height ( $p = 0.79$ ): that is, repetition did not affect the average height of Koyu's indicating gestures. A main effect remained for distance ( $p < 0.001$ ): while repetition was held constant, the mean elbow height of pointing gestures averaged to 1.76 when the target distance value was zero ( $SE = 0.17$ ), and increased by an average of 0.19 with every increase

in distance category (SE = 0.03). Results of the analysis are presented in Table 6.5.

| Fixed effects | Estimate | SE   | Pr(> t ) |
|---------------|----------|------|----------|
| (Intercept)   | 1.76     | 0.17 | < 0.001  |
| Distance      | 0.20     | 0.03 | < 0.001  |
| Repetition    |          |      |          |
| Rep.          | (ref)    |      |          |
| Non-Rep.      | 0.04     | 0.18 | 0.79     |

Table 6.5: Koyu: Linear regression analysis of distance and hand dominance effects on elbow height

#### 6.5.2.1.7 Koyu: Handshape

The handshape feature of pointing gestures provides a second area of comparison between Koyu and the set of hearing gesturers. Did Koyu behave like hearing gesturers in: (1) preferring to use the open handshape when producing the *Go* gesture' and (2) encoding the distance and/or demonstrability of the referent through handshape selection for pointing gestures alone? (See Chapter 4, §4.5.2.4.1).

In fact, Koyu did not adopt the handshape pattern shown by the hearing signers. For both gesture types, he showed a preference for using an extended index finger handshape. The distribution of Koyu's handshapes across pointing signs and *go* signs is presented in Table 6.6. Two patterns are notable in these results: first, while Koyu showed a preference to produce *go* signs with an extended index finger—a pattern opposite of the one attested in hearing gesturers—he produced a much greater proportion of open handshapes in *go* signs than in pointing signs. Twenty-nine percent of his *go* signs had an open handshape, while just 2% of his pointing signs had an open handshape. Second, for the pointing gestures only, Koyu produced a small number of thumb and other handshapes—a pattern mirroring the behavior of hearing gesturers.

Apart from the greater likelihood of gesturing to nearby objects behind him using a thumb handshape, there appeared to be no distance-marking pattern observable in the handshape of Koyu's indicating signs that could be considered parallel to the pattern found in hearing gesturers. To make the comparison evident, results

| Gesture Type | IP  | OH | Thumb | Other | Indeterminate | Total |
|--------------|-----|----|-------|-------|---------------|-------|
| Point        | 119 | 3  | 5     | 13    | 7             | 146   |
| Go           | 12  | 5  | 0     | 0     | 0             | 17    |

Table 6.6: Handshapes by Gesture Type: Koyu

for hearing gesturers (reprinted from Chapter 4, §??) and for Koyu are presented in Figures 6.14 through 6.19.

The proportions of all indicating gestures with IP, OH, Thumb and Other handshapes across all distance values are shown for in Figures 6.14 and 6.15. Parallel charts with results for pointing gestures only are provided in Figures 6.16 and 6.17. Parallel charts with results for *go* gestures only are provided in Figures 6.18 and 6.19. Since no distance-marking pattern was evident in the use of handshape, no statistical analyses were performed investigating the relationship of distance to handshape.

#### 6.5.2.1.8 Koyu results: interim summary

Koyu’s indicating signs patterned like the indicating gestures of hearing non-signers in two respects: First and foremost, they conveyed information about the direction of the referent through the direction of the outstretched arm, hand, and projected ‘pointing beam’—that is, the gestures he used in discussions of locations and landmarks were true locatives, and not abstract pointing signs. Second, Koyu’s indicating signs conveyed information about the distance of the target via modulations to elbow height. While hearing gesturers mapped elbow height to distance in a gradient, analog signal, Koyu’s elbow height patterns appeared more categorical. Distal referents were consistently marked with a fully elevated elbow or an elbow raised to the height of the shoulder. Unlike distal referents, which were distinguished through a fully raised elbow height, proximal referents were indicated with a variety of elbow heights, suggesting that Koyu uses the height of indicating gestures to mark a binary distal/non-distal distinction.

Koyu’s indicating patterns did not map perfectly to those of hearing non-signers: they differed in two respects. First, Koyu used elbow height to mark the altitude of nearby referents (i.e., referents within 3 km distance of the interview site). This was not attested in the aggregated hearing dataset, nor was it attested in any

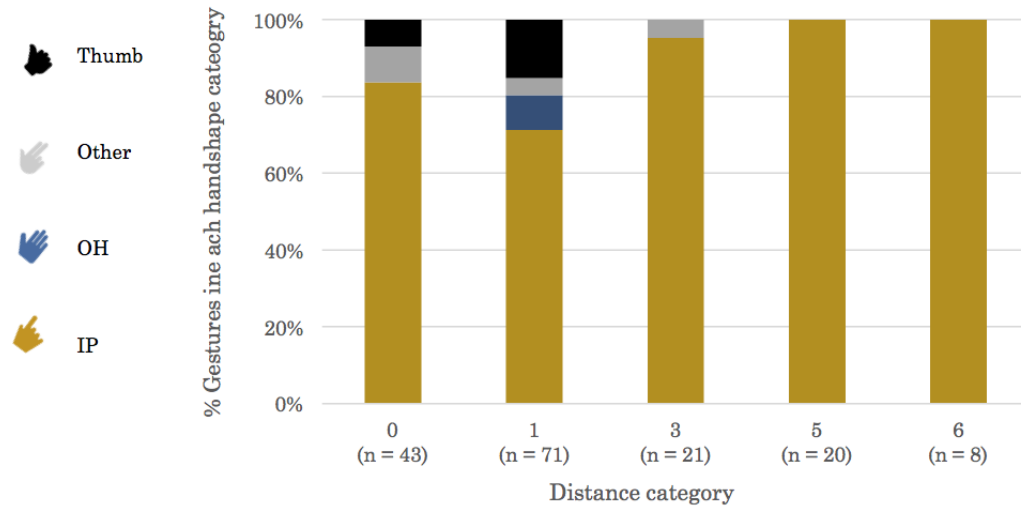


Figure 6.14: Handshape by distance category: all indicating signs, Koyu

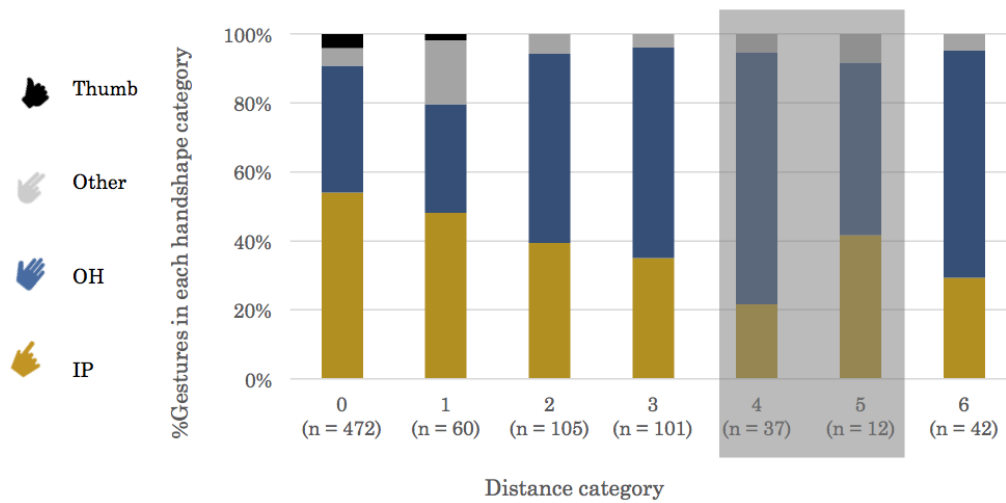


Figure 6.15: Handshape by distance category: all indicating gestures, hearing participants



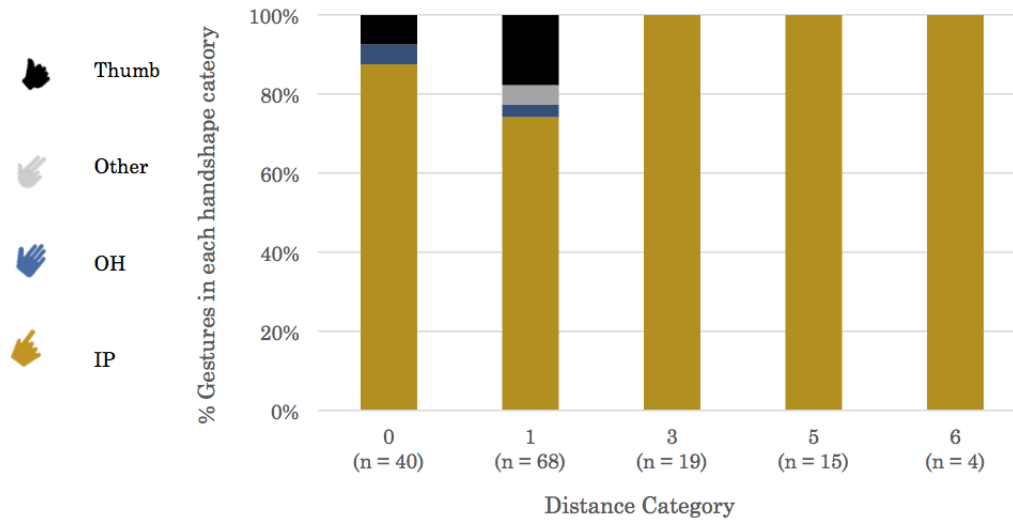


Figure 6.16: Handshape by distance category: points, Koyu

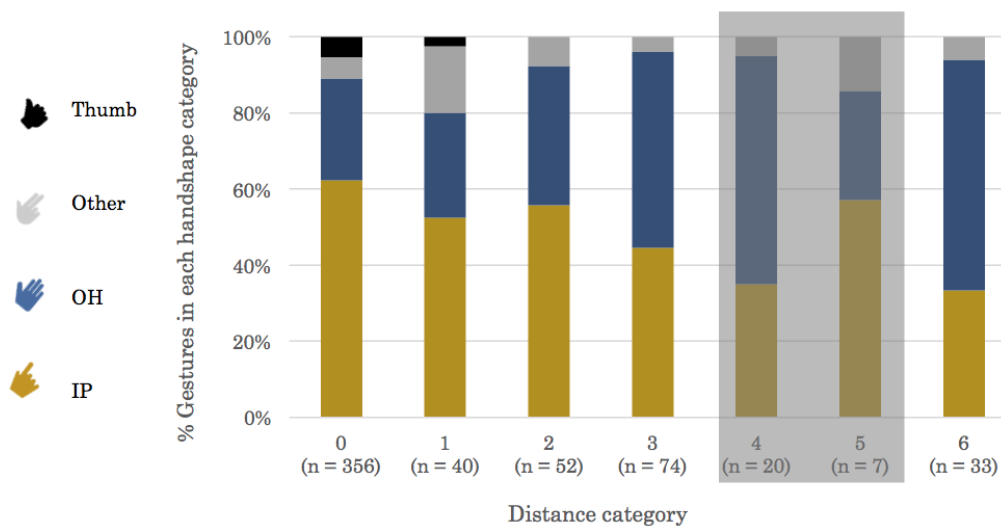


Figure 6.17: Handshape by distance category: points, hearing participants

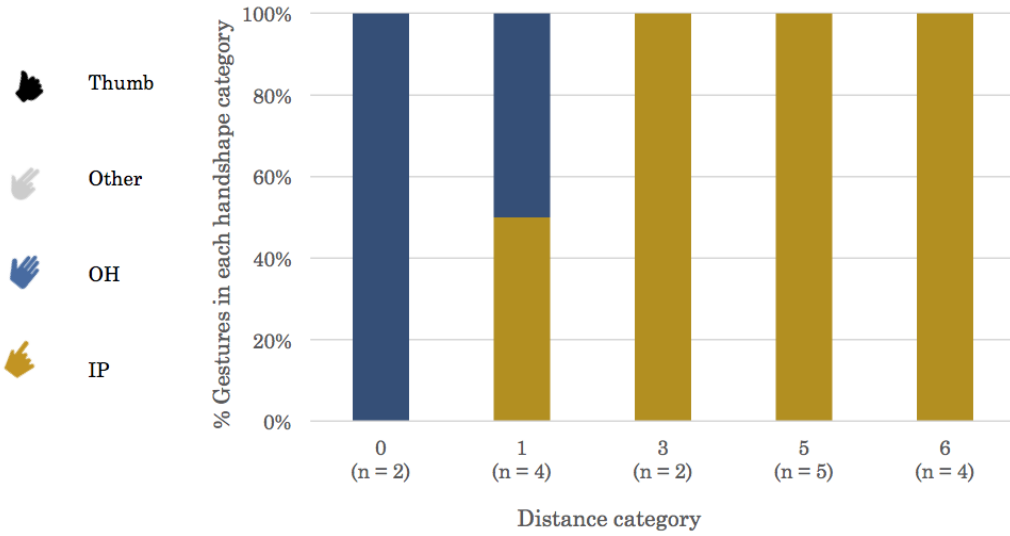


Figure 6.18: Handshape by distance category: *go*, Koyu

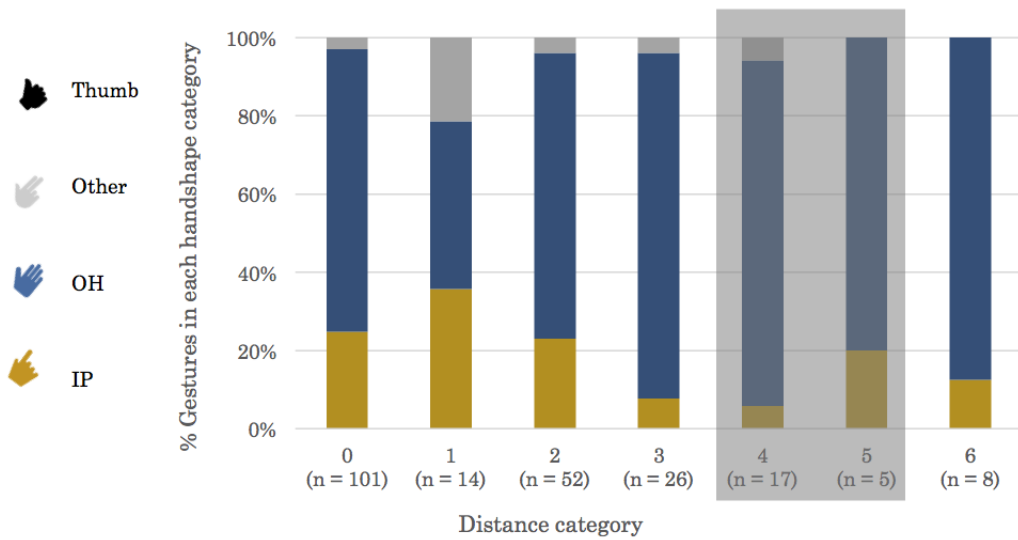


Figure 6.19: Handshape by distance category: *go*, hearing participants

individual hearing gesturer’s elbow height patterns. Second, Koyu showed a strong preference to use an extended index finger to produce both points and *go* gestures to targets at all distances—a markedly different pattern from that of hearing gesturers, who used an extended index finger handshape to point to nearby/individuable targets, and an open handshape to mark target distance and/or individuability.

It is evident from these results that Koyu did not adopt the ambient indicating gesture system of Quiahije wholesale, incorporating it into his family sign without alteration. Rather, he adapted the system—most likely in concert with his main childhood interlocutor, his sister Stina—to create a related but non-identical indicating system in his developing family sign. The components of the local gesture system that were retained in Koyu’s indicating signs will be discussed at greater length in §6.5.3: ‘Adopting an available system.’ The adaptations that the gestures underwent when entering Koyu’s family sign will be discussed in Section 6.5.4, ‘adapting while adopting: how signers changed the Quiahije indicating system’.

### **6.5.2.2 Results: Sendo**

#### **6.5.2.2.1 Introduction to the results: Sendo**

Data for Sendo were collected in a Local Environment interview conducted in his home in Cieneguilla. Sendo’s wife Xka, a hearing SJQ speaker and SJQCSL signer, conducted the interviews. As was the case with Koyu, Sendo initially addressed answers to both his wife and to the author who was present for the interview. Sendo quickly altered the format of the interview, however, by taking on one task of Xka’s: turning the stimulus image toward the author and camera at the outset of each question. Sendo adopted a practice of acknowledging the photos presented by his wife, holding out the photo for the author, and then addressing his response solely to the author. This resulted in a shorter interview, since most answers were typically only provided once and repeated or elaborated only when the author asked clarifying questions about walking and driving possibilities in roughly the style of Xka.

During an interview lasting 9 minutes and 12 seconds, Sendo produced a total of 428 signs. Of these, 164 of signs indicated locations: 154 were points, and 10 were *go* gestures. The overwhelming majority of these indicating gestures were produced on Sendo’s dominant hand (the right hand). The number of indicating gestures

|                     | Dom. Hand | Non-Dom. Hand | Total |
|---------------------|-----------|---------------|-------|
| Total Signs         | 380       | 48            | 428   |
| Total Points        | 166       | 8             | 174   |
| locations/landmarks | 72        | 3             | 75    |
| stimulus photo      | 43        | 4             | 47    |
| people              | 24        | 0             | 24    |
| Indeterminate       | 9         | 1             | 10    |
| Total Go Gestures   | 10        | 0             | 10    |
| locations/landmarks | 10        | 0             | 10    |

Table 6.7: Indicating signs produced in the LEI task: Sendo

targeting objects, people and locations, and their production on the dominant and non-dominant hand, are presented in Table 6.7.

#### 6.5.2.2.2 Sendo: Elbow Height

##### 6.5.2.2.3 Does elbow height show meaningful patterning in Sendo’s indicating gestures?

As was the case for Koyu, elbow height provided a primary area of comparison between Sendo and the set of hearing gesturers. Did Sendo behave like hearing gesturers, indicating targets nearby using a low elbow height and increasing the elbow height of the gesture as the distance between himself and the target increased?

Sendo did in fact mark referent distance through the elbow height feature of his indicating signs. The elbow heights of Sendo’s indicating gestures for referents across all distance values are presented in Figure 6.20. To facilitate the comparison with hearing participants, the parallel results for all hearing participants are reprinted in Figure 6.21. Sendo, more than Koyu, showed an elbow height pattern similar to that of the hearing gesturers. For Sendo, just as for the hearing gesturers, the odds of gesturing with an elevated elbow increased with each increase in the distance category. Sendo’s elbow height pattern did not show evidence of a categorical ‘distal/non-distal’ distinction in the way that Koyu’s did.

A statistical analysis was performed to determine whether there were significant effects of referent distance and referent altitude on the elbow height of Sendo’s

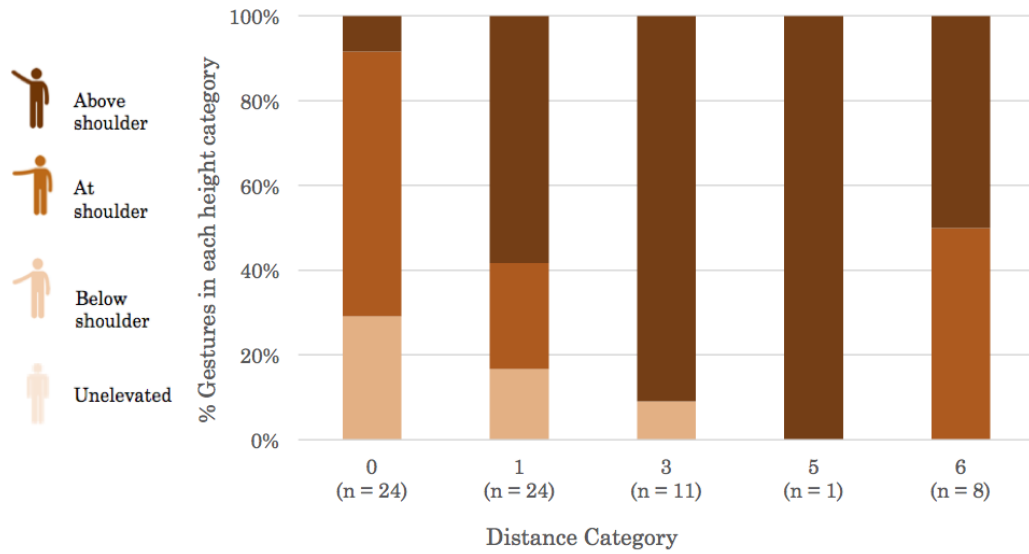


Figure 6.20: Elbow height by distance category: all indicating signs, Sento

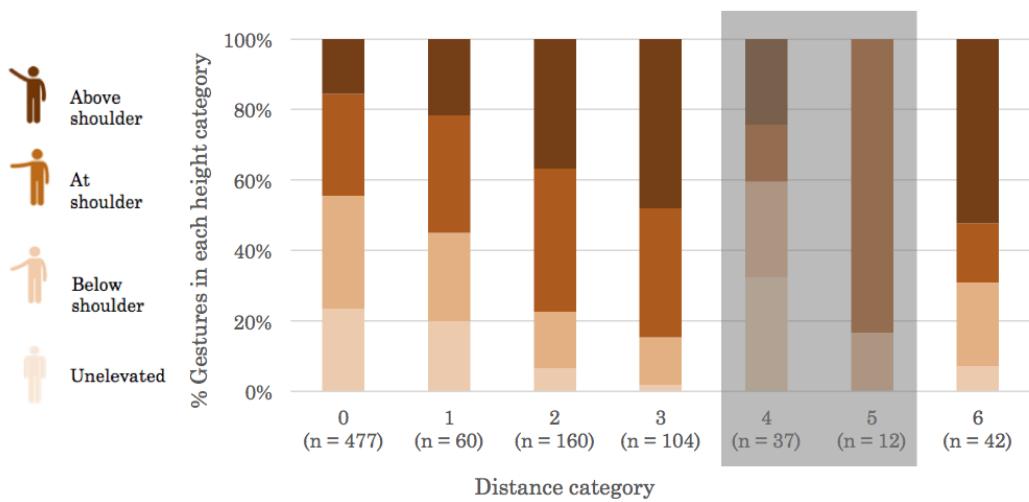


Figure 6.21: Elbow height by distance category: all indicating gestures, hearing participants

pointing gestures. A linear regression model was constructed with elbow height as the dependent variable, and with target distance and target altitude fixed effects. A main effect of distance was found while holding altitude constant ( $p < 0.01$ ): the mean elbow height averaged to 1.25 when the target distance value was zero ( $SE = 0.11$ ) and increased by an average of 0.15 with every increase in distance category ( $SE = 0.05$ ). There was no significant effect of altitude while accounting for distance ( $p = 0.3$ ). Results of the mixed model are provided in Table 6.8. An additional model looked for an interaction between distance and altitude. No significant interaction was found ( $p = 0.15$ ). There was no reason to believe, then, that an altitude effect was present in a subset of the data.

| Fixed effects | Estimate | SE   | Pr(> t ) |
|---------------|----------|------|----------|
| (Intercept)   | 1.25     | 0.11 | < 0.001  |
| Distance      | 0.14     | 0.04 | < 0.01   |
| Altitude      | 0.07     | 0.07 | 0.3      |

Table 6.8: Sendo: Linear regression analysis of distance and altitude effects on elbow height

#### 6.5.2.2.4 Sendo: Is the elbow height pattern robust regardless of the indicating gesture type used (points vs go gestures)?

Sendo patterned with both Koyu and the hearing gesturers in maintaining his elbow height patterning across points and *go* gestures. The distribution of elbow height values across distance categories for points is shown for Sendo in Figure 6.22 and is reprinted for hearing gesturers in 6.23. The parallel distributions for *go* gestures for Sendo are printed in Figure 6.24 and are reprinted for gesturers in Figure 6.25.

To determine whether there was a significant effect of gesture type on elbow height, a statistical analysis was performed. A mixed-effects linear regression model was constructed with elbow height as the dependent variable, and with referent distance and gesture type as fixed effects. While distance was held constant, there was no significant effect of gesture type on elbow height ( $p = 0.52$ ): that is, gesture type did not affect the average height of Sendo's indicating gestures. A main effect

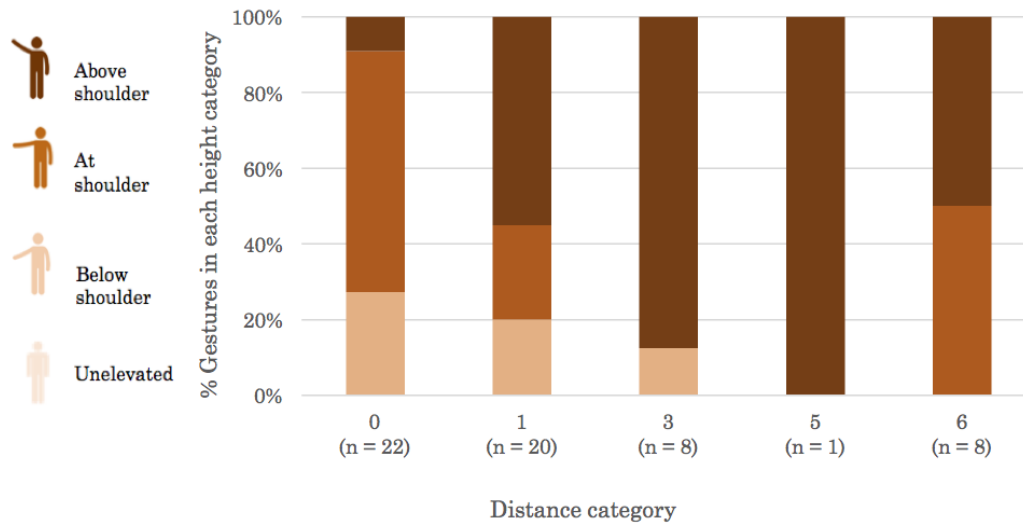


Figure 6.22: Elbow height by distance category: pointing, Sento

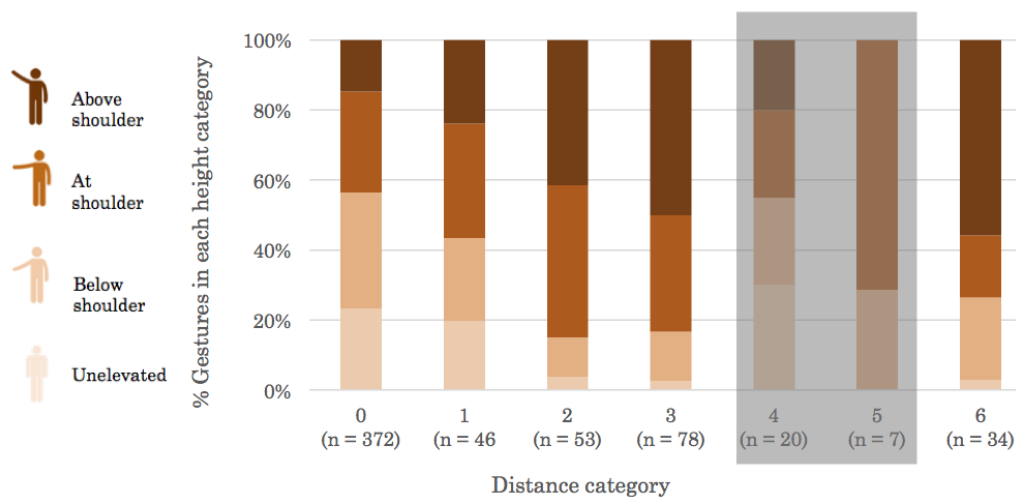


Figure 6.23: Elbow height by distance category: pointing, hearing participants

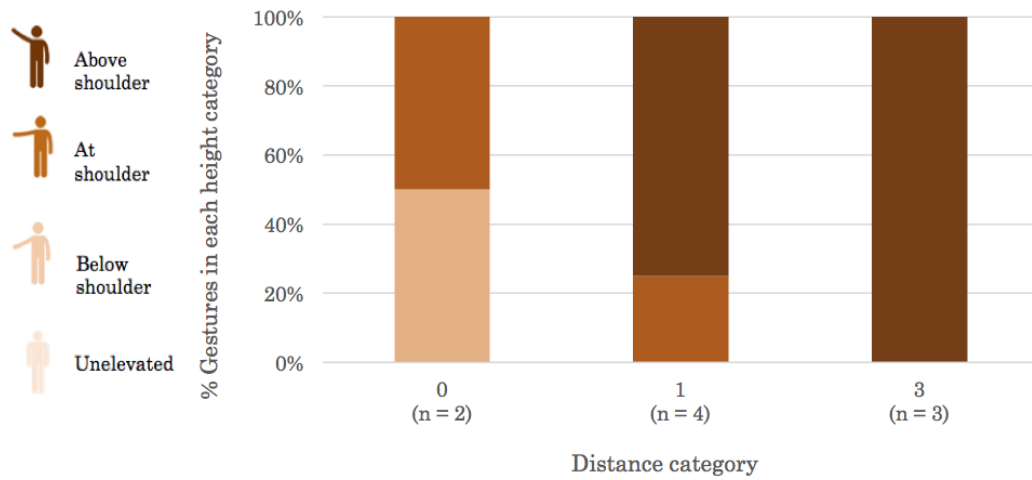


Figure 6.24: Elbow height by distance category: *go*, Sento

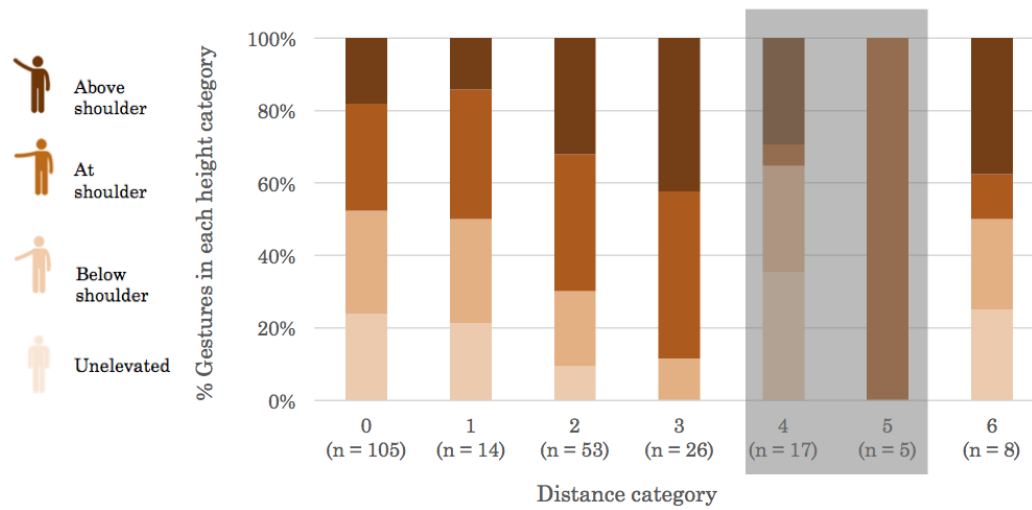


Figure 6.25: Elbow height by distance category: *go*, hearing participants



remained for distance ( $p < 0.001$ ): while gesture type was held constant, the mean elbow height of indicating gestures averaged to 2.17 when the target distance value was zero ( $SE = 0.22$ ), and increased by an average of 0.14 with every increase in distance category ( $SE = 0.04$ ). Results of the analysis are presented in Table 6.9

| Fixed effects | Estimate | SE   | Pr(> t ) |
|---------------|----------|------|----------|
| (Intercept)   | 2.17     | 0.22 | < 0.001  |
| Distance      | 0.14     | 0.04 | < 0.01   |
| Gesture Type  | -0.14    | 0.23 | 0.52     |

Table 6.9: Sendo: Linear regression analysis of distance and gesture type effects on elbow height

#### 6.5.2.2.5 Sendo: Is the elbow height pattern robust regardless of the hand used to gesture?

Like Koyu, Sendo showed a strong dispreference for using his non-dominant (left) hand. Just 3 of his indicating gestures (2%) were produced on his non-dominant hand. All four indicating gestures on the left hand were to items within Sendo's home community of Cieneguilla (distance category 1), and all four were produced with an elbow height of 2 (at shoulder level, a common elbow height for marking nearby referents). Without comparative data from gestures toward targets in other distance categories it is impossible to discern whether the distance-marking patterns in the larger dataset were reflected in Sendo's gestures on the non-dominant hand.

#### 6.5.2.2.6 Do Sendo's results differ from hearing non-signers due to repetition effects?

Although Sendo repeated his answers to interview questions less frequently than did Koyu, his interview was still marked by repetition. A statistical analysis was performed to look for effects of repetition on the elbow height of Sendo's gestures. A mixed-effects linear regression model was constructed with elbow height as the dependent variable and with repetition of utterance as a fixed effect. While distance was held constant, there was no significant effect of repetition on elbow height ( $p$

= 0.27): that is, repetition did not affect the average height of Koyu's indicating gestures. A main effect remained for distance ( $p < 0.001$ ): while repetition was held constant, the mean elbow height of pointing gestures averaged to 1.94 when the target distance value was zero ( $SE = 0.14$ ), and increased by an average of 0.13 with every increase in distance category ( $SE = 0.04$ ). Results of the analysis are presented in Table 6.10.

| Fixed effects | Estimate | SE   | Pr(> t ) |
|---------------|----------|------|----------|
| (Intercept)   | 1.94     | 0.14 | < 0.001  |
| Distance      | 0.13     | 0.04 | < 0.01   |
| Repetition    | 0.20     | 0.18 | 0.27     |

Table 6.10: Sendo: Linear regression analysis of distance and repetition effects on elbow height

#### 6.5.2.2.7 Sendo: Handshape Patterning

Sendo did not behave like hearing gesturers when it came to handshape patterning: he did not use handshape to systematically encode distance and/or demonstrability of the referent, and he did not show a preference to use an open handshape when producing the *go* gesture. Instead, Sendo showed a strong preference for using an extended index finger for points, and he used a variety of handshapes to produce the *go* gesture, showing no clear handshape preference. The distribution of Sendo's handshapes across points and *go* signs is presented in Table 6.11.

There was no distance-marking pattern observable in the handshape of Sendo's indicating signs that could be considered parallel to the pattern found in hearing

| Gesture Type | IP | OH | Thumb | Other | V | Indeterminate | Total |
|--------------|----|----|-------|-------|---|---------------|-------|
| Point        | 51 | 1  | 1     | 2     | 0 | 2             | 114   |
| Go           | 6  | 2  | 0     | 1     | 1 | 0             | 10    |

Table 6.11: Handshapes by Gesture Type: Sendo

gesturers. To make the comparison evident, results for hearing gesturers (reprinted from Chapter 4) and for Sendo are presented in Figures 6.26 through 6.31. The proportions of all indicating gestures with IP, OH, Thumb and Other handshapes across all distance values are shown for in Figures 6.26 and 6.27. Parallel charts with results for points only are provided in Figures 6.28 and 6.29. Parallel charts with results for *go* gestures/signs only are provided in Figures 6.30 and 6.31. Since no distance-marking pattern was evident in the use of handshape, no statistical analyses were performed investigating the relationship of distance to handshape.

#### 6.5.2.2.8 Sendo results: interim summary

Like Koyu, Sendo showed evidence of adopting two patterns from the indicating gesture system of hearing non-signers. First, his indicating gestures conveyed information about the true direction of the referent—he produced signs with a true locative function, and did not point to empty space when referring to landmarks and routes. Second, Sendo’s indicating gestures reliably conveyed information about target distance through modulations of elbow height. Sendo, unlike Koyu, patterned with gesturers in using elbow height as an analog signal reflecting distance in gradient fashion: he showed no signs of developing a categorical distance marking system using elbow height. And Sendo’s indicating signs patterned with the hearing participants’ gestures in not showing any effects of referent altitude on elbow height. The components of the ambient gesture system that were retained in Koyu and Sendo’s indicating signs will be discussed in §6.5.3: ‘Adopting an available system.’

Sendo’s indicating handshapes differed from those of the hearing gesturers just as Koyu’s did. Both signers showed a preference for using an extended index finger to produce points. While Koyu showed a preference for the extended index finger shape for *go* gestures, as well, the small set of *go* gesture tokens from Sendo revealed no strong handshape preference.

It is clear from Sendo’s results, and from Koyu’s, that neither of the two focal signers in the study adopted the ambient indicating gesture system of Quiahije wholesale. Each signer altered the system in a slightly different way, Koyu no doubt doing so in concert with his deaf sister, and Sendo doing so without reliable contact with another deaf individual. The changes that the two signers imposed on the ambient indicating gesture system will be discussed at greater length in Section 6.5.4, ‘adapting while adopting: how signers changed the Quiahije indicating

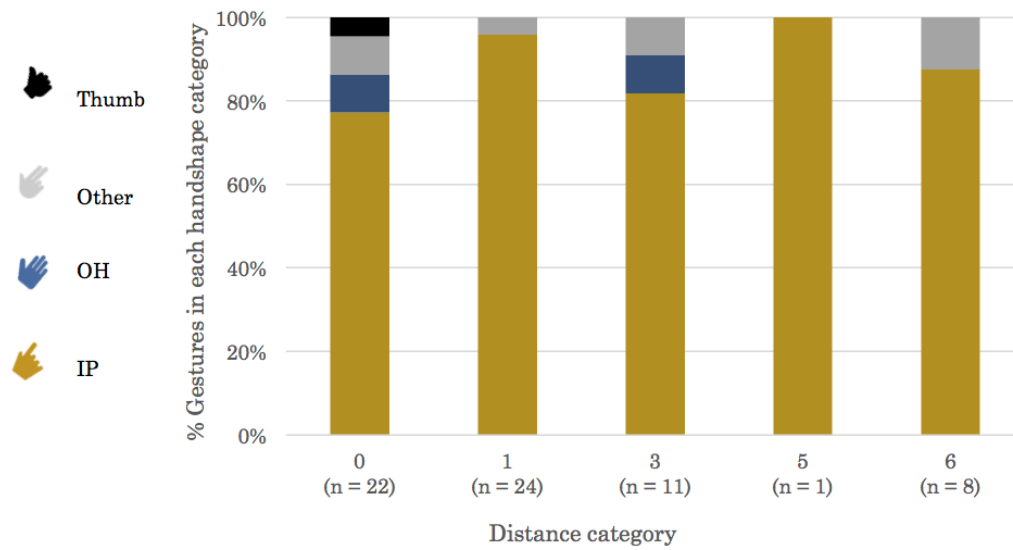


Figure 6.26: Handshape by distance category: all indicating signs, Sendo

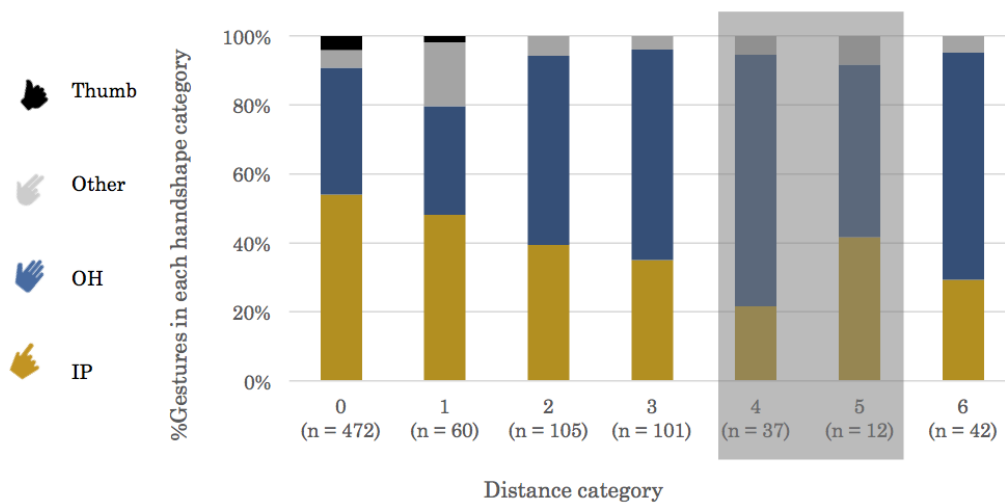


Figure 6.27: Handshape by distance category: all indicating gestures, hearing participants

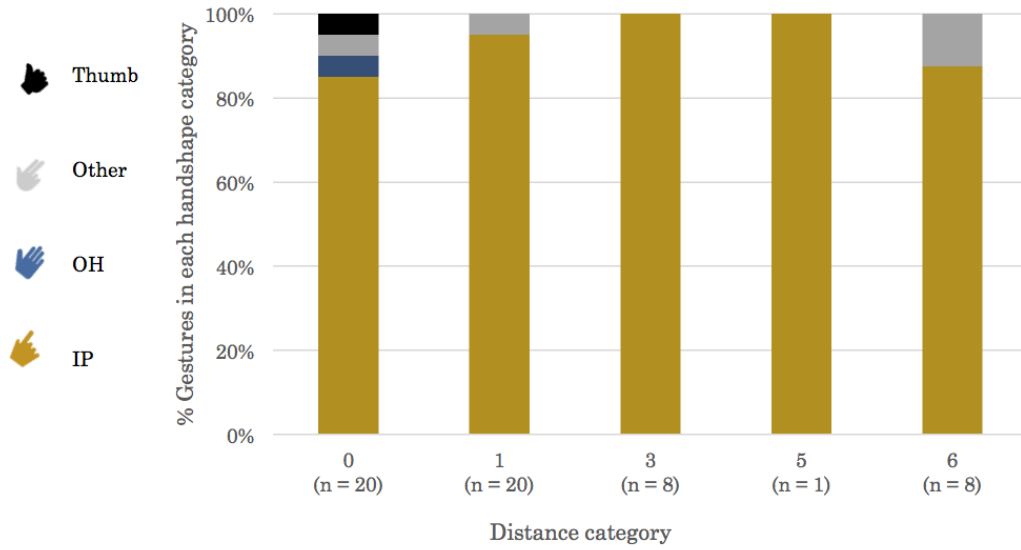


Figure 6.28: Handshape by distance category: points, Sendo

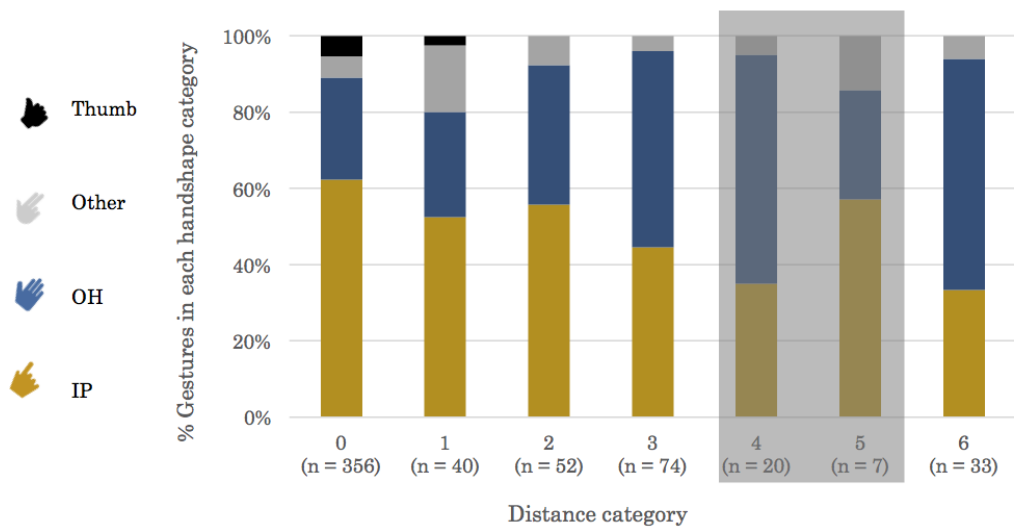


Figure 6.29: Handshape by distance category: points, hearing participants

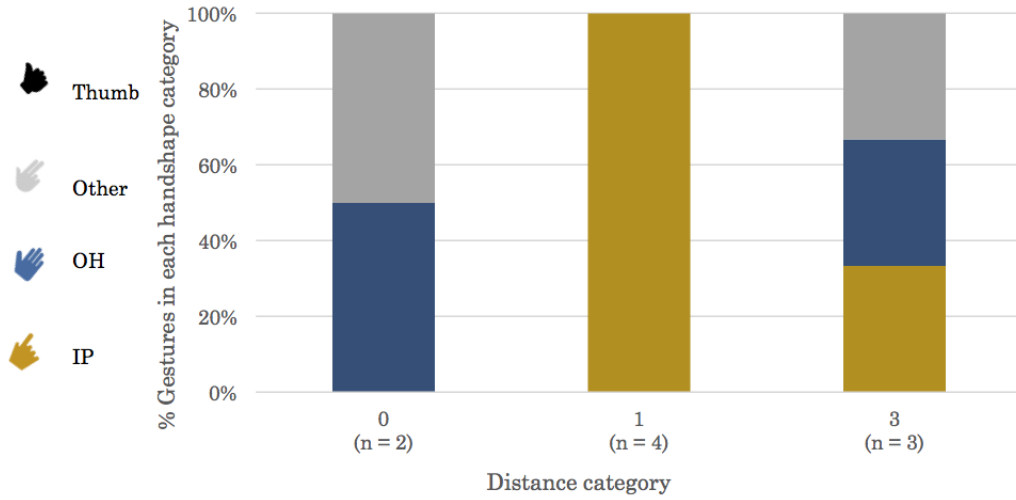


Figure 6.30: Handshape by distance category: *go*, Sendo

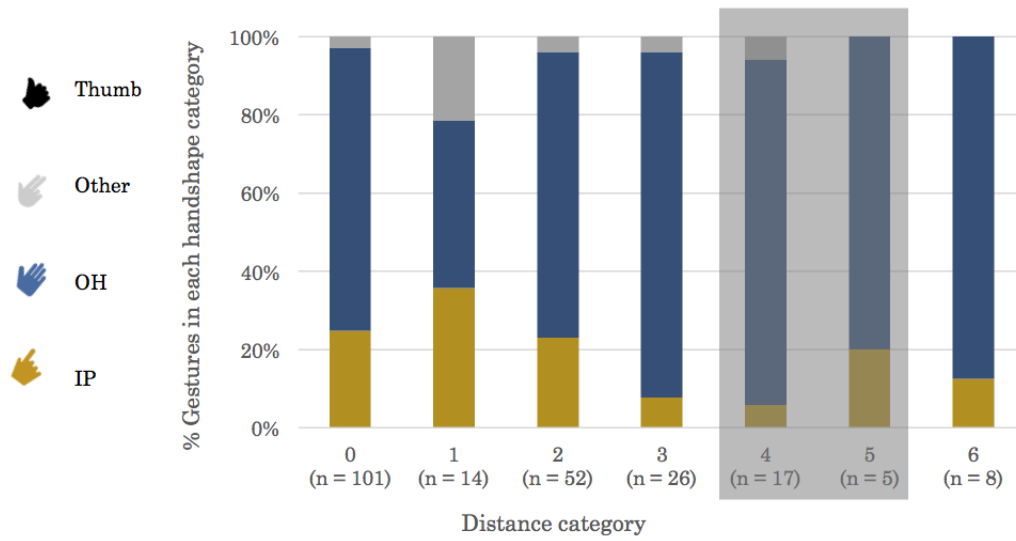


Figure 6.31: Handshape by distance category: *go*, hearing participants

system’.

### 6.5.3 Adopting an available system: what components of the ambient indicating gesture system are present in the signers’ indicating signs?

Here the first two research questions for the study are reviewed, and answers are provided based on the results of the study.

**Are both indicating gesture types (pointing and *go* gestures) used by the signer?** Both signers used points pervasively throughout the LEI interview, an anticipated result given the centrality of pointing to both spoken-gestural and signed communication. Evidence that the signers are borrowing from the available indicating system, rather than re-inventing such a system, comes from their inclusion of the *go* gesture: a community-specific gesture that maps a characteristic arc movement to a narrow meaning (forward movement). The arc motion of the gesture is preserved in the exaggerated, distance marking *go* signs of Koyu (example 25) and in the subtle arc movements of Sendo and his wife as they use *go* signs to discuss travel inside their own community (examples 26 and 27). The signers used fewer *go* forms than the hearing gesturers did, a fact that will be discussed in §6.5.4.

**Do the signers incorporate the elbow height, handshape, and hand selection patterns found in the ambient indicating gesture system?** Both signers used **elbow height** to mark referent distance in their indicating signs, though they did with different distance-marking patterns. Sendo’s system appeared most like that of the hearing nonsigners. He indicated targets nearby using a low elbow height and increased the elbow height of the gesture as the distance between himself and the target increased. That is, he mapped elbow height to distance in a gradient manner, retaining the use of elbow height as an analog signal.

Koyu, by contrast, appeared to use elbow height to mark a categorical distance contrast: targets outside of the community were marked with a high elbow, and targets inside the community were marked with a variety of elbow heights. The pattern emerging from Koyu’s data must be interpreted with caution, since it occurred in just 49 signs indicating distal referents. It suggests, however, that Koyu is shifting an analog signal to a digital one, with a clear distance marking form that

is stable across instances. In time, this shift could result in a pointing paradigm with clear distal and proximal forms, like the one described for the Balinese signed language, *Kata Kolok* (de Vos, 2013). Such a system is not yet attested in *Koyu*'s indicating system, however, since there is no single form marking proximal referents.

As was the case with hearing gesturers, the deaf signers exhibited a strong but not exceptionless pattern of using elbow height to mark referent distance. The most notable break from the trend could be observed in signs indicating the distant city of Oaxaca: both signers produced some points toward Oaxaca with lower elbow height. For *Koyu*, co-articulation effects may account for this break from an otherwise exceptionless distance-marking trend: every token with a lower elbow height occurred in example (30), where the relevant *go* gestures took place before and/or after negative signs to convey the message that *Koyu* had never been to Oaxaca city. The negative signs are typically produced with the hand at the height of the signer's face or upper torso: this place of articulation may effect the height of the immediately adjacent signs.

- (29) GO NEG:TWIST-Y GO NEG:TWIST-Y GO NEG:TWIST-5  
 PT[self] NEG:TWIST-5 GO NEG:WAG-1  
 'haven't gone there, haven't gone there, haven't  
 gone there, I haven't gone there, no'

LEI20-KO, 17.15.0

*Koyu*'s use of elbow height differed from hearing gesturers in a second way: for signs indicating targets within the Quiahije municipality, he modified the elbow height feature to reflect the altitude of the targets. This apparent shift in function for the elbow height feature will be discussed further in §6.5.4 below.

Neither of the two deaf signers used the **handshape** feature of indicating signs to mark target distance and/or individuability as hearing speaker-gesturers had done. Instead, both signers showed a preference for using an extended index finger to indicate, regardless of the distance of the referent. When comparing the signers' use of the elbow height and handshape features to mark distance, the question arises: why would the signers adopt the elbow height patterning alone when both elbow height and handshape patterns were robustly displayed by hearing speaker-gesturers? One possibility is that, while the two distance-marking patterns were



visually accessible to the signers, the meaning conveyed by the handshape feature was less transparent than the meaning conveyed through elbow height modulation. The open hand, after all, does not represent the concept of distance in a visually motivated fashion. Compare this with the facts about elbow height: a raised elbow represents the location of a distant target by exaggerating a feature of optics, namely, the higher appearance of distal objects in the visual field (Chapter 4, §4.4.2). A raised elbow, in other words, represents the perceptual features of distal objects in a manner that is transparently visually motivated, whereas an open handshape does not.

It is certainly possible that the signers understood the extended index finger handshape to represent the concept of singularity. The challenge for the two deaf men, however, would be to interpret the more abstract meaning of the open handshape and connect it with concept of distance. Hearing speaker-gesturers evidently make this connection, and do so reliably enough to consistently map the open handshape to distal targets. They do so, however, in the context of speech that may make the connection between the handshape and the spoken language function apparent. A plausible interpretation of the signers' failure to treat the handshape variable as a marker of distance is that speakers' handshape use patterns simply are not meaningful when perceived as uniquely visual signals. The signer's behavior recalls the Newport (1999) and Singleton and Newport (2004) studies of "Simon" a deaf child acquiring ASL verbs from a degraded model. When Simon's parents mapped a meaning to a form in a transparently visually motivated manner, the child adopted the form-meaning mapping in his own morphological system. When his parents mapped a meaning to a form in a manner that was not transparently visually motivated, Simon did not incorporate the mapping into his morphology: even in cases where the pattern was robust in the input. Koyu and Sendo appear to be behaving like Simon in their approach to the handshape feature of indicating gestures: the signers may not have adopted the distance-marking function for handshape because the OH shape in particular is not mapped to meaning in a visually motivated (hence accessible) manner.

A final area of comparison between hearing gesturers and deaf signers related to hand dominance. Hearing interview participants produced an average of 16% of their indicating gestures on their non-dominant hands, and showed the same distance-marking patterns regardless of the hand they used to gesture. Deaf partic-

ipants, by contrast, showed a nearly exceptionless tendency to produce one-handed signs (including both points and *go* signs) on their dominant hands. The signers produced so few indicating gestures on their non-dominant hands that it was impossible to ascertain whether they marked referent distance in the same way on their dominant and non-dominant hands.

#### 6.5.4 Adapting while adopting: how signers changed the Quiahije indicating system

**Do the signers convey new meanings using the indicating gesture features (direction, elbow height, handshape)?** Only Koyu appeared to map a new meaning to a formal component of the indicating gesture system. He used the elbow height feature to convey information about target altitude for a subset of the total targets, namely, those above and below his home which is located at the midpoint of a steep slope along the side of San Juan. In example 30, Koyu points with an elevated elbow to the elementary school that is at the top of a steep stairway ascending from his home: ‘there, (it’s a) school, there’ (Figure 6.32).

- (30) PT[school] SCHOOL PT[school]  
‘there, (it’s a) school, there’

LEI33-KO, 11:41.5



Figure 6.32: Koyu: ‘there, (it’s a) school, there’

Koyu’s altitude-marking behavior may be a unique innovation, or it may simply reflect the constraints on meaningful pointing towards real-world locations from the steep slope where he was interviewed. Whether Sendo and the hearing gesturers would behave similarly to Koyu if interviewed at his exact interview site (his home) remains an open question: two hearing people were interviewed at that site, but neither gestured during their LEI interviews and their data were not included in the analysis from Chapter 4. Still other hearing participants were interviewed at sites located on other steep slopes in San Juan, and these participants did not reliably modulate their pointing gestures to reflect target altitude. It is unclear, then, whether to interpret Koyu’s altitude-marking as a unique innovation to the indicating system. If it is a true innovation, it is not one that converts an analog signal to a digital one. It does not, in other words, move the indicating system closer to encoding a set of distinct concepts using discrete forms, as his systematic use of the elevated elbow to mark distant targets apparently does (§6.5.3).

**Did the signers develop new indicating gesture features?** By definition, indicating gestures are produced by extending or tracing an articulator in a determinate direction: for the gestures investigated in the current study, the requisite extension could be performed by moving the arm and hand in a straight line

to reach the apex of the gesture (for a point), or by sweeping the arm and hand forward to produce the characteristic arc movement of the *go* gesture. To these two movement types, Sendo added a third: an arc movement, distinct from the *go* arc, which occurred on some points to distant targets. To produce this modified arc, Sendo did the following: orienting his palm inwards (towards his torso), he rotated his wrist to produce an arc movement towards himself (the converse form of the *go* arc) while he moved his hand into position for the pointing gesture. The arc movement was optionally doubled, with the first iteration forming a reduced ‘wind-up’ and the second a larger arc ending with the hand pointing in the direction of the target. In example 31, Sendo exhibits a pointing form with the linked set of distance-marking behaviors, followed by a pointing form produced with only the distance-marking arc. He holds out an image of a Oaxaca City street scene and describes it for the author: ‘There, a road, there (is what is pictured) here’ (Figure 6.33). In example 32, Sendo indicates the town of Juquila, simply holding out the photo with his non-dominant hand and producing an arc-inflected point with his dominant hand: ‘there’ (Figure 6.34).

- (31) PT[Oaxaca] ROAD PT[Oaxaca] PT[photo]  
‘there, a road, there (is what is pictured) here’

LEI33-SE, 06:54.0

- (32) PT[Juquila]  
‘there’

LEI33-SE, 06:03.0



Figure 6.33: Sendo: 'there, a road, there (is what is pictured) here'



Figure 6.34: Sendo: 'there'

While Sendo was the only interview participant to use the distance-marking arc productively, the form did not originate in his signing system: a similar form was observed among hearing gesturers in a handful of cases during the local environment interviews. In these cases, an arc-inflected point was produced alongside a comment about the United States. The gesture appears to be acquiring status as an emblem representing a distant region, and not to be functioning consistently as an indicating gesture with a true locative function. This fact is evidenced by the low elbow height used to produce the gesture and by variation in the direction of the gesture: some speakers directed the point northward when discussing the U.S. (the true direction of the country); others produced the gesture in other directions, seemingly without the intent to indicate a region in space. In example 33, the speaker lists her children for the interviewer. She produces the arc-inflected gesture in the true direction of North while speaking the borrowed Spanish word ‘norte’ as she says: ‘Bryan, Juve, Alma (who is in the) north. . .’ (Figure 6.35

- (33) Bryan, Juve, Alma, nor=te  
Bryan Juve Alma north  
‘Bryan, Juve, Alma, (who is in the) north’

LEI06-CF05, 03:21.0



Figure 6.35: ‘Bryan, Juve, Alma, (who is in the) north’

The arc form may be visually motivated, though the visible feature invoked—travel forward, perhaps, or a leap breaching the gap between proximal and distal space—has not been analyzed.<sup>5</sup> That the movement is mapped to the meaning ‘distant’ must have been transparent to Sendo, who incorporated the palm orientation and arc motion of the gesture into points indicating the city of Oaxaca and to the towns of Juquila and Puerto Escondido: all locations outside of the municipality. Sendo treated the arc motion as a separable meaning-bearing component that could be productively combined with other pointing features. Though in some cases he produced distance-marking arcs on points with a relatively low elbow height, retaining the feature combination displayed by hearing gesturers (example 31), in other cases he produced the arc with a raised elbow, combining the two distance markers in a single sign (example 32). Sendo’s innovation, then, was to treat the arc form as a discrete, meaning-bearing feature that can be combined with the distance-marking elbow height signal in a pointing sign.

Sendo modified the form of the *go* gesture when incorporating it into his signing system, as well. In two cases in his local environment interview, Sendo articulated a recognizable *go* sign with its characteristic outward arc, but used a new handshape unattested in the behaviors of hearing gesturers—a V handshape in which two extended fingers, pointing towards the ground, moved in the manner of walking legs (see example 27). Both Sendo and his wife Xka used the v-handshape form of the *go* sign to characterize the action of walking: they thus modified the handshape feature of the sign to convey information not only about the path along which an one could travel, but also the manner of travel (walking). While Sendo used this form only twice during his interview, he was observed using the form in spontaneous conversation on other occasions, as well. Sendo’s hearing wife Xka used the V-shape form once when interviewing Sendo (example 26) She was not observed to use the form as a co-speech gesture while talking with other hearing users of SJQ, however. This fact, and the notable absence of a V-handshape form of the *go* sign in Koyu’s signing, suggests that the V-handshape innovation is one specific to Sendo’s family sign.

---

<sup>5</sup>Notably, arcs with slightly different contours have been reported to mark target distance in the pointing signs of two developed signed languages: German Sign Language (Pfau, 2011) and Sign Language of the Netherlands (van der Kooij, 2002).

**Do the signers use the gesture types (points, *go* gestures) with different functions?** It has already been observed that both Koyu and Sendo used the *go* sign relatively infrequently. The deaf men also restricted the use of the *go* sign, employing it nearly exclusively to describe the contours of roads. Setting aside Sendo's use of the *go* form to convey notion of walking, all other *go* signs by deaf signers during the LEI task described the extension and contours of local roads. In example 34, Koyu describes the contours of a road while giving a simple set of route directions to reach an elementary school in Cieneguilla. He first produces a version of the *go* gesture that traces the road leading from his own town, San Juan Quiahije, to the village of Cieneguilla. He then explains that the school is located on the side of this road (ex 25): *Go on the road, it's to the side of it, the school, it's to the side*. In example 35, Sendo indicates the local graveyard, and uses the *go* gesture to represent the contours of the winding road that is taken to reach it: 'a graveyard, it's there, the road leads up like this, it's there' (Figure 6.37).

- (34) GO(2H) TO-ONE-SIDE SCHOOL TO-ONE-SIDE  
 'go on the road, it's to that side of it,  
 the school, it's to that side'

LEI20-KO, 03:38.5

- (35) DIG BURY, PT[Graveyard] GO PT[Graveyard]  
 'a graveyard, it's there, the road leads up like this, it's there'

LEI20-KO, 01:09.0





Figure 6.36: 'Go on the road, it's to that side of it...'



Figure 6.37: 'A graveyard, it's there, the road leads up like this...'

Why would Koyu in particular, and Sendo (apart from his specialized ‘walk’ form of the gesture) use *go* sign for describing route contours, and not (primarily) to describe the movements of entities through space? The answer here must again relate to the form-meaning mappings available to exclusively visual perceivers. Hearing interview participants produced *go* gestures alongside descriptions of travel, and in many cases they modulated the movement of the gesture to provide information about the path motion of a traveling entity. In the resulting multimodal referring act, the *go* gesture functioned to provide information about the direction and distance of the goal of motion. Descriptive information was provided in speech alone, with descriptions largely centering on the manner of traveling (in a car or on foot), and the goal of travel. Koyu and Sendo, with exclusively visual access to the such referring acts, can be assumed to have reliably gained information about forward motion, yes, but also about the contours of local roads while observing the *go* gesture. Little wonder, then, that the two deaf signers attended to this information as encoded in the *go* gesture, and used the form almost exclusively to convey information about the contours of local roads. Here again, the visual motivation for a gesture feature’s form apparently influenced its adoption by a deaf signer. Whereas the handshake feature had no visually motivated meaning mapping, and was not incorporated into the family sign languages, the frequently spatially modified arc motion feature conveyed information about forward motion and route contours in a transparently visually motivated manner, and was adopted to indicate the shapes of local roads in both family sign languages.

## 6.6 Conclusion

This chapter presented the last of three linked studies exploring the use of indicating gestures in the Quiahije municipality. It investigated how deaf signers developing family sign languages in the municipality adopted and modified the indicating gesture system that was visually accessible to them in the surrounding community. Signers incorporated the meaningful direction and elbow height signals of indicating gestures more or less directly into their emerging morphological systems. One signer may have shifted the analog elbow height feature to a discrete one encoding distance categories of ‘near’ and ‘far’—a change that could ultimately make the system more like those spoken and signed languages that mark distance information

in a paradigm of formal and semantic oppositions. Signers did not incorporate the meaningful handshape signal into their morphological systems, most likely because one of the two handshape forms does not mark distance information meaningfully, so that the ‘far’ component of the ‘near’–‘far’ binary marking system used by speaker-gesturers is inaccessible to signers.

Signers innovated components of the indicating system, as well. One signer took a distance-marking arc motion from an emblem used by hearing gesturers and began using it as a discrete, recombinable marker of distance, which he used productively in his pointing signs. The same signer introduced a new meaning-mapped form—a handshape encoding the concept, ‘to walk’—and combined it with other indicating gesture features to create a predicate describing the act of walking. Both signers attended to the tracing movement that was often combined with the forward-motion-marking arc of the *go* gesture, and used this tracing-inflected arc exclusively to describe the shapes of local roads—a semantic reduction compared to the hearing co-speech gesturer’s uses of the form to mark the routes of moving entities, whether or not they followed the contours of particular roads.

Overall, the signers showed a tendency to adopt forms that were mapped to meanings in a transparently visually motivated manner, and reject form-meaning mappings when there was no clear visual motivation for the mapping. Signers also moved beyond the available form-meaning mappings modeled to them, mapping available forms to new meanings and even inventing new form-meaning mappings to increase the number of discrete, recombinable elements in their morphological systems.

The following chapter is the final one in the dissertation. It links the findings described here to the larger questions posed in the body of research on home/family sign languages. It focuses in particular on the visual motivation for some form-meaning mappings in indicating gestures, considering the influence of visual motivation on the signer’s adoption and rejection pattern for indicating gesture features.

## Chapter 7

### Conclusion

#### 7.1 Overview

This chapter reviews the findings of the dissertation and presents promising areas for future research. Section 7.2, ‘General discussion and research directions,’ reviews each of the dissertation’s linked studies, discussing findings from each study and their implications. Several directions for continued research are reviewed, including an expansion of the project to consider indicating gestures/signs in a wide variety of research communities. Section , ‘Conclusion,’ closes the dissertation with a summation of the contents of this final chapter.

#### 7.2 General discussion and research directions

This dissertation presented three linked studies investigating: (1) whether ‘indicating gestures’ such as pointing are structured at the level of the gesture; (2) whether the meaningful elements of these gestures are fully accessible to deaf perceivers; and (3) whether the elements that are accessible, and the meaning complexes into which they are organized, are incorporated directly into emerging family sign languages. All three studies were performed in a single community in Oaxaca, Mexico, where users of spoken San Juan Quiahije Chatino (SJQ) and signers of the multiple, emerging family sign languages classed as San Juan Quiahije Chatino Sign Language (SJQCSL), live, work, and socialize together.

Two studies investigated the conventions governing the forms of indicating gestures used by hearing non-signers. These conventions may be assumed to predate the birth of the oldest deaf signer in the community almost six decades ago. The

first study, presented in Chapter 4, found that indicating gestures are formed from three recombinable elements—DIRECTION, HANDSHAPE and ELBOW HEIGHT—and that each element conveys information about the direction or distance of the indicated location through systematic modulations in form. The features are combined (and joined in some cases by additional gesture features) to produce the pointing and *go* gestures that are the bedrock of indicating in Quiahije. The second study, presented in Chapter 5, examined the relationship of the indicating gesture forms to features of the speech that frequently accompanies them in multimodal messages. The study found little evidence that indicating gesture forms are determined by features of the co-occurring speech. Moreover, the message of indicating gestures was found to persist independent of the speech with which they co-occur. Indicating gestures, then, convey meaning in a manner that is accessible to exclusively visual perceivers. The final study, presented in Chapter 6, compared the indicating gestures of hearing non-signers with those of two deaf signers developing family sign languages in Quiahije. The two signers were found to use the two types of indicating gestures documented in the broader community, and to modulate the direction and elbow height features of the gestures following the community conventions. The signers did not, however, use the handshape feature of indicating gestures in the manner found in the broader community. These findings suggest that regular form-meaning mappings that occur in co-speech gesture are not all equal: some appear to be more amenable to adoption into emerging signed languages. Whether a feature will be directly incorporated into a signed language may depend on whether its form is motivated by a visible feature of the object/region it indicates, a topic that will be discussed further below.

The dissertation project makes two contributions to research on gesture and its role as input for the deaf creators of home/family sign languages. The first is to challenge the claim that speech-linked gestures (*gesticulations*) are idiosyncratic, global representations that are neither internally structured nor meaningful without the speech they accompany. Researchers in psychology have long understood gesticulations to be ad hoc creations, with forms reflecting features of the accompanying speech (see literature review in Chapter 2). By contrast researchers in linguistic anthropology have described speech-linked indicating gestures as compositional in structure and as meaningful without co-occurring speech (see literature review in Chapter 4). The current dissertation brings the literature from psychology and lin-

guistic anthropology into dialogue, examining the claims about indicating gestures in particular and considering empirical evidence that bears on them. It presents findings that validate the claims made in linguistic anthropology, namely, that indicating gestures are complexes of recombinable elements that convey stable meanings across use contexts. This study represents the first quantitative analysis to support these claims, and does so with a sizable dataset of spontaneous, speech-accompanying gestures.

The second contribution of this research is a systematic comparison of gesture and sign features in a communicative ecology where a signed language is emerging. A growing body of research observes that home/family signers borrow and adapt gestures used in the ambient speech community (see discussions in Chapters 2 and 6), yet little work has been done to compare the forms and functions of gestures with those of related signs in emerging home/family sign languages. Without such a comparison, it is impossible to determine how signers make use of the meaningful elements of gestures, and the conventions for combining them, that are present in the visual input they receive. In this dissertation, the use and combination of the meaningful elements of indicating gestures were investigated in hearing, non-signing community members and in deaf family signers. A systematic comparison of their usage patterns found that signers used many, though not all, of the meaningful elements of indicating gestures used in the larger community, and that they combined them into meaning complexes with structures parallel to those found in the broader community. This finding suggests that deaf home/family signers innovate, rather than invent, the indicating systems found in their emerging signed languages.

There is another plausible interpretation of these results: signers may independently create indicating systems without making use of the gestural input they receive. That humans gesturally indicate in similar ways across cultures (see discussion in Chapter 4) suggests that there are strong external motivations shaping the form of indicating gestures. It may therefore be the case that deaf home/family signers need not adopt features from a behavioral model in order to develop indicating systems that share gestural features with those of hearing non-signers. One fact in particular speaks against this interpretation of the Quiahije case study results: gesturers and signers in Quiahije share indicating features that are limited in their geographic distribution. Both gesturers and signers indicate using the *go* arc: a movement associated with the concept of forward motion in many regions of

Latin America, but not associated with this meaning worldwide (see discussions in Chapters 4 and 6). That signers incorporate a community-specific feature into their indicating systems may be taken as evidence that they are indeed drawing from the surrounding indicating conventions to develop indicating signs. Whether cultural transmission, external motivation, or a combination of both factors accounts for gesturers' and signers' shared use of other indicating features remains to be determined.

A vital area of expansion for the current research project will be to collect comparative data from hearing gesturers and deaf signers in a variety of communities. de Vos (2013, 2014) calls for exactly this type of comparative work, and begins the process with a thorough account of indicating gestures in the Balinese signed language, *Kata Kolok*. This work has not, as of yet, been joined with research on the co-speech indicating conventions of hearing Balinese gesturers. A systematic investigation of speakers' and gesturers' indicating conventions across communities will shed light not only on the variation in meanings mapped to indicating gesture features, but also on the factors influencing when and how home/family signers incorporate gesture features into their emerging languages.

An area of particular interest for this line of research will be to distinguish the types of gesture features that are most amenable to incorporation into a signed language. In the current study, the indicating gesture features that were adopted by signers—gesture direction and height—convey information in a manner that is transparently visually motivated by features of the target. Gesture direction extends the articulator towards of the target, and is modulated according to the target's true and often visible direction. Elbow height reflects (though exaggeratively) the differences in the perceived height of distal and proximal targets in the visual field. By contrast, the feature that was not adopted—handshape—is not transparently motivated by a feature of the target. The IP handshape that indicates nearby targets in *Quiahije* may visually represent the singularity of the target through the use of a single extended finger, but the OH handshape that indicates distal targets is not formed in a way that mirrors features of perceptual experience (see discussion in Chapter 6). Signers may, then, have shown sensitivity to the visual motivation of indicating gesture features, and adopted only those with transparently visually motivated form-meaning mappings. This behavior would make the *SJQCSL* signers similar to the child signer “Simon” who acquired ASL verbs of motion from his late-

signing parents' degraded linguistic model. Singleton and Newport (2004) report that Simon did not acquire the handshape feature modeled in his parents' verbs of motion, and observe that this feature was not visually motivated, whereas the location and movement features that Simon did adopt were visually motivated (see discussion, p. 30). The authors considered this to be one of several factors that might account for Simon's rejection of his parents' modeled behaviors. Whether the presence of a transparent visual motivation for a given form-meaning mapping is indeed a factor that affects signers' likelihood of adopting gestural forms is a question that can be addressed only after further research documents both the gestural features available to home/family signers, as well as the features that they ultimately adopt.

Research that expands the current project will need to take an additional gestural feature into consideration that was not investigated here: palm orientation. The feature has been shown to distinguish points to people from points to locations in multiple signed languages, including Australian Sign Language (Hindmarsh & Heath, 2000), American Sign Language (Meier & Lillo-Martin, 2013), Kata Kolok (de Vos, 2008) and Danish Sign Language (Engberg-Pedersen, 1993). In a study of points toward people in Sign Language of the Netherlands (NGT), van der Kooij, Crasborn, and Ros (2006) found that these points showed variability in palm orientation. Pfau (2011) suggested that this finding might result from palm orientation being used to mark information structure in Sign Language of the Netherlands. Whether meaningful changes in orientation originate in co-speech gesture, and when and how they are incorporated into emerging signed languages, remains to be explored.

A final area for future research involves nonmanual gestures (i.e., gestures of the face, head, and torso). Gestures of the face in particular, including gaze direction and 'lip pointing'—the meaningful extension of the chin to indicate regions in space—have been found to be crucial to a full account of indicating practices (Butterworth & Itakura, 2000; Sherzer, 2008). In the dataset collected for the current study, lip-pointing was found in both speakers of SJQ and signers of SJQCSL. The forms of lip-pointing (e.g., with and without lip protrusion) and the ways in which it is co-organized with speech have yet to be explored in SJQ speakers. Moreover, the question remains whether signers use the forms and functions of lip-pointing in a way that is parallel to the use of speakers. Gestures of the mouth are an addi-



tional area of interest for the study of non-manual indicating strategies. In a study of Ban Khor Sign language (BKSL), Nonaka (2015) found that deaf and hearing signers alike join deictic points to a mouthing movement “similar to the mouthing phoo, a Nyoh word meaning ‘there’ or ‘over there’ that has been grammaticized in BKSL” (p. 72). The mouthing behavior has become a distance marker in the signed language: one with clear origins in spoken language models in the community. The data collected for the current project found little evidence of mouthings accompanying deaf signers’ indicating gestures. However, the possibility that such mouthings occur, and that they contribute meaning to indicating messages, remains to be systematically explored.

### **7.3 Conclusion**

This chapter reviewed the findings of the dissertation’s three linked studies, namely: (1) indicating gestures are complexes of discrete meaningful elements, (2) these elements reliably convey meaning in the absence of the speech that often accompanies them, and (3) deaf creators of signed languages incorporate many, though not all, conventional elements of indicating gestures into their emerging languages, possibly incorporating or rejecting elements based on whether there is a transparent visual motivation for their form-meaning mappings. The chapter reviewed multiple directions for further research, including an expansion of the project to document indicating gesture conventions, and the adoption and adaptation of these conventions by signed language users, in multiple research communities. The discussion in this final chapter highlighted the contributions of the current project to research on gesture and its role as input for the deaf creators of home/family sign languages.

## Appendix A

### List of abbreviations

|        |   |
|--------|---|
| 1INCL  | first person plural inclusive           |
| 1EXCL  | first person plural exclusive           |
| 1S     | first person singular                   |
| 2P     | second person plural                    |
| 2S     | second person singular                  |
| 3P     | third person plural                     |
| 3S     | third person singular                   |
| COM    | completive aspect                       |
| CONJ   | conjunction                             |
| DEM    | demonstrative                           |
| DIR    | direction term                          |
| ESE    | east-southeast                          |
| HAB    | habitual aspect                         |
| LOC    | locative                                |
| NOM    | nominalizer                             |
| NNE    | north-northeast                         |
| PRG    | progressive aspect                      |
| POT    | potential aspect                        |
| REL    | relativizer                             |
| SSW    | south-southwest                         |
| SJQ    | San Juan Quiahije Chatino               |
| SJQCSL | San Juan Quiahije Chatino Sign Language |
| SSE    | south-southeast                         |
| WNW    | west-northwest                          |

## Appendix B

### Interview codes

All data described in this document will be identified with a citation of the type, [activity code]-[participant code]. The activity code is composed of an activity type and token number. The participant code reflects an assigned participant ID composed of home village code, gender code (reflecting participants' self-identification), and assigned number.

Activity Type Codes:

LEI Local Environment Interview

Village Codes:

S San Juan Quiahije

C Cieneguilla

Abbreviations for Signer Interview Participants:

KO Koyu

SE Sendo

INT Interviewer (hearing spouse)

Gender Codes:

M Male

F Female

## Appendix C

### Script for Local Environment Interviews

This is a script for a set of Local Environment Interviews conducted in the San Juan Quiahije Municipality of Oaxaca, Mexico, between February and August of 2015. The script was designed following the protocol in: Kita, Sotaro. (2001). Locally-anchored spatial gestures, version 2: historical description of the local environment as a gesture elicitation task. In Stephen C. Levinson & N.J. Enfield (eds.), *Manual for the field season 2001*, 132-135. Nijmegen: Max Planck Institute for Psycholinguistics.

The Spanish version of this script was provided to Spanish/San Juan Quiahije Chatino bilingual research assistants performing Local Environment Interviews. Assistants translated the questions into colloquial San Juan Quiahije Chatino and prepared to depart from the script at designated conversational points.

1. IGLESIA/CHURCH

- (a) ¿Dónde esta la iglesia católica?  
Where is the Catholic church?
  
- (b) ¿Hay otras iglesias en la comunidad?  
Are there other churches in the community?
  
- (c) ¿Cuántos iglesias hay en total?  
How many churches are there in total?
  
- (d) ¿Cómo va usted desde aquí a la iglesia?  
How do you go to the church from here?
  
- (e) ¿Hay otros rumbos para ir a la iglesia?  
Are there other routes for going to the church?
  
- (f) ¿Usa usted todas los rumbos?  
Do you use all of the routes?
  
- (g) ¿Hay rumbos que no prefiere? ¿Por qué?  
Are there routes that you do not prefer? Why?

## 2. ESCUELA/SCHOOL

- (a) ¿Asistió usted a una escuela primaria?  
Did you go to a primary school?
- (b) ¿Cuál era su escuela?  
Which was your school?
- (c) ¿Hay otras escuelas en la comunidad?  
Are there other schools in the community?
- (d) ¿Cómo fue usted desde aquí a la escuela?  
How did you get from here to the school?
- (e) ¿Hay más que un rumbo para ir a la escuela?  
Is there more than one route to get to the school?
- (f) ¿Usaba usted todas los rumbos?  
Did you use all of the routes?
- (g) ¿Hay rumbos que no prefería? ¿Por qué?  
Were there routes that you did not prefer? Why?

*El entrevistador/la entrevistadora puede apartarse del guión para hablar con el/la participante acerca de la introducción de nuevas escuelas en la comunidad en los últimos 50 años.*

*The interviewer may depart from the script to talk to the participant about the introduction of new schools into the community in the past 50 years.*

### 3. RANCHO/FARM

- (a) ¿Tiene su familia un rancho?  
Does your family have a farm?
- (b) ¿Cada cuánto va usted al rancho?  
How often do you go to the farm?
- (c) ¿qué hace usted allá?  
What do you do there?
- (d) ¿Cómo va usted desde aquí al rancho?  
How do you get from here to the farm?
- (e) ¿Hay más que uno rumbo para ir al rancho?  
Is there more than one route to get to the farm?
- (f) ¿Usa usted todas los rumbos?  
Do you use all of the routes?
- (g) ¿Hay rumbos que no prefiere? ¿Por qué?  
Are there routes that you do not prefer? Why?

*El entrevistador/la entrevistadora puede apartarse del guión para hablar con el/la participante acerca de su vida diaria en el rancho.*

*The interviewer may depart from the script to talk to the participant about their daily life at the farm.*

#### 4. SANTA CATARINA JUQUILA

(a) ¿Dónde está (la ciudad de) Juquila?

Where is (the city of) Juquila?

(b) ¿Visita usted Juquila (con frecuencia)? ¿Por qué?

Do you (often) visit Juquila? Why?

(c) ¿Prefiere andar en taxi o en pasajera? ¿Por qué?

Do you prefer to go (there) in a taxi or in a shared truck? Why?

*El entrevistador/la entrevistadora puede apartarse del guión para hablar con el/la participante acerca de sus tareas que exigen que visita la ciudad.*

*The interviewer may depart from the script to talk to the participant about the tasks that require her to visit the city.*



5. SAN MIGUEL PANIXLTAHUACA

(a) ¿Dónde está (la ciudad de) Panix?

Where is (the city of) Panix?

(b) ¿Visita usted Panix (con frecuencia)? ¿Por qué?

Do you (often) visit Panix? Why?

(c) ¿Prefiere andar en taxi o en pasajera? ¿Por qué?

Do you prefer to go (there) in a taxi or in a shared truck? Why?

*El entrevistador/la entrevistadora puede apartarse del guión aquí para hablar con el/la participante acerca de sus tareas que exigen que visita la ciudad.*

*The interviewer may depart from the script here to talk to the participant about the tasks that require her to visit the city.*

6. OAXACA DE JUÁREZ

- (a) ¿Dónde est (la ciudad de) Oaxaca?  
Where is (the city of) Oaxaca?
  
- (b) ¿Visita usted Oaxaca (con frecuencia)?  
Do you (often) visit Oaxaca?
  
- (c) ¿Cómo va usted a Oaxaca?  
How do you get to Oaxaca?

*El entrevistador/la entrevistadora puede apartarse del guión aquí para hablar con el/la participante sobre cómo la gente caminaba a Oaxaca antes de que se instalaron los caminos pavimentados.*

*The interviewer may depart from the script here to talk to the participant about how people walked to Oaxaca before paved roads were installed.*

7. HIJOS/CHILDREN

- (a) ¿Tiene usted hijos?  
Do you have children?
- (b) ¿Cuántos hijos tiene?  
How many children do you have?
- (c) ¿Dónde viven ellos?  
Where do they live?

*El entrevistador/la entrevistadora puede apartarse del guión para hablar con el/la participante sobre lo que hacen sus hijos en los Estados Unidos, si esto es aplicable.*

*The interviewer may depart from the script to talk to the participant about what her children do in the United States, if applicable.*

8. PADRINOS DE COMUNION/COMMUNION GODPARENTS

- (a) ¿Tiene usted padrinos de comunión?  
Do you have communion godparents?
- (b) Si no, tienen sus hijos a padrinos de comunión?  
If not, do your children have communion godparents?
- (c) ¿Dónde viven?  
Where do they live?
- (d) ¿Visita usted a ellos?  
Do you visit them?
- (e) ¿Cómo va usted desde aquí a su casa?  
How do you go to their home from here?
- (f) ¿Hay más que un rumbo para ir a su casa?  
Is there more than one route to get to their house?
- (g) ¿Usa usted todas los rumbos?  
Do you use all of the routes?
- (h) ¿Hay rumbos que no prefiere? ¿Por qué?  
Are there routes you do not prefer? Why?

*El entrevistador/la entrevistadora puede apartarse del guión para hablar con el/la participante sobre la tradición Chatina de tener padrinos para varios eventos de la vida.*

*The interviewer may depart from the script to talk to the participant about the Chatino tradition of designating godparents for various life events.*

## Appendix D

### Photo stimuli for Local Environment Interviews

This is a set of photo stimuli used Local Environment Interviews conducted with deaf family sign language users in the San Juan Quiahije Municipality of Oaxaca, Mexico, between February and August of 2015. The photo stimuli and interviewers' instructions were designed following the protocol in: Kita, Sotaro. (2001). Locally-anchored spatial gestures, version 2: historical description of the local environment as a gesture elicitation task. In Stephen C. Levinson & N.J. Enfield (eds.), *Manual for the field season 2001*, 132-135. Nijmegen: Max Planck Institute for Psycholinguistics. The original protocols were adapted to support exclusively visual-manual communication. The adaptation process is described in Chapter 6, §6.5.

The photo stimuli were provided to the hearing family members of deaf signers of San Juan Quiahije Chatino Sign Language (SJQCSL). These family members served as interviewers, using SJQCSL to ask deaf participants to identify the pictured landmarks and to describe routes to reach the landmarks.



**Location:** Cieneguilla: Agencia/: City Hall  
**Latitude/Longitude:** 16.3238379, -97.31763385  
Photo courtesy of Adrian Cruz, Secretary of Cieneguilla, 2015



**Location:** Cieneguilla: Iglesia Católica/Catholic Church  
**Latitude/Longitude:** 16.30182575, -97.31628732  
Photo courtesy of Adrian Cruz, Secretary of Cieneguilla, 2015  
199



**Location:** Cieneguilla: Panteón/Graveyard  
**Latitude/Longitude:** 16.32843439, -97.31271763





**Location:** Cieneguilla: Iglesia Evangélica/Evangelical Church  
**Latitude/Longitude:** 16.3217703, -97.31867033



**Location:** Cieneguilla: Escuela Telesecundaria/Tele-secondary School  
**Latitude/Longitude:** 16.3238379, -97.31763385



**Location:** Cieneguilla: Escuela Prescolar “Niños Héroes” /  
“Niños Héroes” Preschool  
**Latitude/Longitude:** 16.29982588, -97.31571158



**Location:**Cieneguilla: Parada de Pasajeras/Transport Stop  
**Latitude/Longitude:**16.32145472, -97.32029455



**Location:** Cieneguilla: Casa del Vecino de Sendo/Home of Sendo's Neighbor  
**Latitude/Longitude:**16.32426755, -97.32126001  
Image used only in Sendos Local Environment Interview



**Location:** San Juan: Municipio/City Hall  
**Latitude/Longitude:** 16.30192464, -97.3167928



**Location:** San Juan: Panteón/Graveyard  
**Latitude/Longitude:** 16.29895327, -97.31648816



**Location:** San Juan: Iglesia Evangelica/Evangelical Church  
**Latitude/Longitude:** 16.29864013, -97.32134529





**Location:** San Juan: Escuela Primaria "Emiliano Zapata" /  
Emiliano Zapata Primary School  
**Latitude/Longitude:** 16.29849376, -97.31945896



**Location:** San Juan: Escuela Telesecundaria/Tele-Secondary School  
**Latitude/Longitude:** 16.29982588, -97.31571158



**Location:** Santa Catarina Juquila  
**Latitude/Longitude:** 16.23708033, -97.29115858



**Location:** Oaxaca de Juárez  
**Latitude/Longitude:** 17.06790152, -96.72160269



**Location:** Puerto Escondido  
**Latitude/Longitude:** 16.3258627, -97.31633064

## References

- Bahan, B., Kegl, J., MacLaughlin, D., & Neidle, C. (1997). Convergent evidence for the structure of determiner phrases in American Sign Language. In L. Gabriele, D. Hardison, & R. Westmoreland (Eds.), *FLSM VI: Proceedings of the sixth annual meeting of the formal linguistics society of mid-america* (Vol. 2, pp. 1–13). Bloomington, IN: Indiana University Linguistics Club.
- Bangerter, A. (2004). Using pointing and describing to achieve joint focus of attention in dialogue. *Psychological Science*, *15*(6), 415–419.
- Barberà, G., & Zwets, M. (2013). Pointing and reference in sign language and spoken language: Anchoring vs. identifying. *Sign Language Studies*, *13*(4), 491–515.
- Blythe, J., Mardigan, K. C., Perdjert, M. E., & Stoakes, H. (2016). Pointing out directions in Murrinhpatha. *Open Linguistics*, *2*(1), 1–28.
- Bohnemeyer, J. (2017). Organization of Space. In J. Aissen, N. C. England, & R. Zavala Maldonado (Eds.), *The Mayan Languages* (pp. 327–347). New York, NY: Routledge.
- Bohnemeyer, J., Donelson, K. T., Moore, R. E., Benedicto, E., Capistran Garza, A., Eggleston, A., ... Romero-Méndez, R. (2015). The contact diffusion of linguistic practices: Reference frames in Mesoamerica. *Language Dynamics and Change*, *5*(2), 169–201.
- Boixander, A. (2002). *The making of a transnational community: A case study of chatinos in north carolina*. (Unpublished bachelor's thesis.) University of North Carolina at Chapel Hill, Chapel Hill, NC.
- Brentari, D., & Goldin-Meadow, S. (2017). Language Emergence. *Annual Review of Linguistics*, *3*, 363–388.
- Brown, P. (2006). A sketch of the grammar of space in Tzeltal. In S. Levinson (Ed.), *Grammars of space: Explorations in cognitive diversity* (pp. 230–272).

- Cambridge, England: Cambridge University Press.
- Brown, P. (2008). Up, down, and across the land: landscape terms, place names, and spatial language in Tzeltal. *Language Sciences*, 30(2-3), 151–181.
- Brown, P., & Levinson, S. C. (1993). “Uphill” and “downhill” in Tzeltal. *Journal of Linguistic Anthropology*, 3(1), 46–74.
- Bühler, K. (1934). *Sprachtheorie: Die Darstellungsfunktion der Sprache [Language theory: The representational function of language]*. Jena: Fischer.
- Butterworth, G., & Itakura, S. (2000). How the eyes, head and hand serve definite reference. *British Journal of Developmental Psychology*, 18, 25–50.
- Butterworth, G., & Morissette, P. (2007). Onset of pointing and the acquisition of language in infancy. *Journal of Reproductive and Infant Psychology*, 14(3), 219–231.
- Campbell, E. (2013). The internal diversification and subgrouping of Chatino 1. *International Journal of American Linguistics*, 79(3), 395–420.
- Campbell, L., Kaufman, T., & Smith-Stark, T. C. (1986). Meso-America as a linguistic area. *Language*, 62(3), 530–570.
- Cecchetto, C., Geraci, C., & Zucchi, S. (2006). Strategies of relativization in Italian Sign Language. *Natural Language & Linguistic Theory*, 24(4), 945–975.
- Clark, H. H. (1996). *Using Language*. Cambridge, England: Cambridge University Press.
- Clark, H. H. (2003). Pointing and placing. In S. Kita (Ed.), *Pointing: where language, culture and cognition meet* (pp. 243–261). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- Clark, H. H., & Bangerter, A. (2004). Changing ideas about reference. In I. Noveck & D. Sperber (Eds.), *Experimental pragmatics* (pp. 25–49). London, England: Palgrave MacMillan.
- Clark, H. H., & Wilkes-Gibbs, D. (1986). Referring as a collaborative process. *Cognition*, 22(1), 1–39.
- Cochet, H., & Vauclair, J. (2012). Hand preferences in human adults: Non-communicative actions versus communicative gestures. *Cortex*, 48(8), 1017–1026.
- Colonnesi, C., Stams, G. J. J. M., Koster, I., & Noom, M. J. (2010). The relation between pointing and language development: A meta-analysis. *Developmental Review*, 30(4), 352–366.

- Cooperrider, K. (2011). *Reference in action: Links between pointing and language* (Unpublished doctoral dissertation). University of California at San Diego, San Diego, CA.
- Cooperrider, K. (2015). The co-organization of demonstratives and pointing gestures. *Discourse Processes*, 53(8), 632–656.
- Cooperrider, K., Slotta, J., & Núñez, R. (2016). Uphill and downhill in a flat world: The conceptual topography of the Yupno house. *Cognitive Science*, 41(3), 768–799.
- Coppola, M. (2002). *The Emergence of Grammatical Categories in Home Sign: Evidence from Family-based Gesture Systems in Nicaragua* (Unpublished doctoral dissertation). University of Rochester, Rochester, NY.
- Coppola, M., & Newport, E. L. (2005). Grammatical Subjects in home sign: Abstract linguistic structure in adult primary gesture systems without linguistic input. *Proceedings of the National Academy of Sciences*, 102(52), 19249–19253.
- Cormier, K., Schembri, A., & Woll, B. (2013). Pronouns and pointing in sign languages. *Lingua*, 137, 230–247.
- Cruz, E. (2011). *Phonology, tone and the functions of tone in San Juan Quiahije Chatino* (Unpublished doctoral dissertation). The University of Texas at Austin, Austin, TX.
- Cruz, E. (2017). Names, naming & person reference in Quiahije Chatino. In *Legacies of space and intangible heritage* (pp. 163–188). University Press of Colorado.
- Cruz, E. (Manuscript submitted for publication). *Narratives of a hike in San Juan Quiahije*.
- Cruz, E., & Sullivant, J. R. (2012). Demonstrativos próximos y distales: un estudio comparativo del uso de demostrativos en el chatino de Quiahije y Tataltepec. In *Talk presented at the coloquio de lenguas otomangués y vecinas*. Oaxaca, Mexico. April 20–22..
- Cruz, E., & Woodbury, A. C. (2014). Finding a way into a family of tone languages: The story and methods of the Chatino Language Documentation Project. *Language Documentation Conservation*, 8, 490–524.
- Cruz, H. (n.d.). *The notion of base in some motion verbs in San Juan Quiahije Chatino*. unpublished manuscript, The University of Texas at Austin. Austin, TX.



- Cruz, H. (2009). *Persuasive Speeches of San Juan Quiahije Governmental Authorities* (Unpublished master's thesis). The University of Texas at Austin, Austin, TX.
- Cruz, H. (2014). *Linguistic poetics and rhetoric of Eastern Chatino of San Juan Quiahije* (Unpublished doctoral dissertation). The University of Texas, Austin, TX.
- De León, L. (1994). Exploration of the acquisition of location and trajectory in Tzotzil. *Linguistics*, 32(4), 857–884.
- De Mulder, W. (1996). Demonstratives as locating expressions. In M. Pütz & R. Dirven (Eds.), *The construal of space in language and thought* (Vol. 8, pp. 29–48). New York, NY: Mouton de Gruyter.
- de Vos, C. (2008). Positionality in Pointing Signs. In *Talk presented at the amsterdam center for language and communication (aclc)*. Amsterdam, the Netherlands. November 28..
- de Vos, C. (2013). *Sign-Spatiality in Kata Kolok: How a village sign language of Bali inscribes its signing space*. (Dissertation.) Utrecht, the Netherlands: LOT.
- de Vos, C. (2014). The Kata Kolok Pointing System: Morphemization and Syntactic Integration. *Topics in Cognitive Science*, 7(1), 150–168.
- Diessel, H. (1999). *Demonstratives*. Amsterdam: John Benjamins Publishing.
- Diessel, H. (2005). *Distance contrasts in demonstratives*. World atlas of language structures. Retrieved from <http://wals.info/chapter/41>
- Diessel, H. (2006). Demonstratives, joint attention, and the emergence of grammar. *Cognitive linguistics*, 17(4), 463–489.
- Ola Orié, d. (2009). Pointing the Yoruba way. *Gesture*, 9, 237–261.
- Eco, U. (1976). *A theory of semiotics*. Bloomington, IN: Indiana University Press.
- Efron, D. (1972). *Gesture, race and culture*. New York, NY: Walter de Gruyter.
- Emmorey, K. (1999). Do signers gesture? In L. S. Messing & R. Campbell (Eds.), *Gesture, speech, and sign*. New York, NY: Oxford University Press.
- Enfield, N. J. (2001). ‘Lip-pointing’—A discussion of form and function with reference to data from Laos. *Gesture*, 1, 185–212.
- Enfield, N. J. (2003). Demonstratives in space and interaction: Data from Lao speakers and implications for semantic analysis. *Language*, 79, 82–117.
- Enfield, N. J. (2009). *The anatomy of meaning*. Cambridge, England: Cambridge

University Press.

- Enfield, N. J., Kita, S., & de Ruiter, J. P. (2007, October). Primary and secondary pragmatic functions of pointing gestures. *Journal of Pragmatics*, 39(10), 1722–1741.
- Engberg-Pedersen, E. (1993). *Space in Danish Sign Language: The semantics and morphosyntax of the use of space in a visual language*. Hamburg, Germany: Signum.
- Feldman, H. (1975). *The development of a lexicon by deaf children of hearing parents or, there's more to language than meets the ear* (Unpublished doctoral dissertation). University of Pennsylvania, Philadelphia, PA.
- Fill, A., & Mühlhäusler, P. (Eds.). (2006). *The ecolinguistics reader: Language, ecology and environment*. New York, NY: Bloomsbury Publishing.
- Fillmore, C. J. (1982). Towards a descriptive framework for spatial deixis. In K. Buhler, R. J. Jarvella, & W. Klein (Eds.), *Speech, place, and action: Studies in deixis and related topics* (pp. 31–59). John Wiley & Sons.
- Franklin, A., Giannakidou, A., & Goldin-Meadow, S. (2011). Negation, questions, and structure building in a homesign system. *Cognition*, 118(3), 398–416.
- Frishberg, N. (1987). Homesign. In J. V. Van Cleve (Ed.), *Gallaudet encyclopedia of deaf people and deafness* (pp. 128–131). New York, NY: McGraw Hill Professional.
- Gibson, J. J. (1950). *The perception of the visual world*. Boston: Houghton-Mifflin.
- Goldin-Meadow, S. (2006). *How children learn language: A focus on resilience*. Oxford, UK: Blackwell Publishing Ltd.
- Goldin-Meadow, S. (2007). The challenge: Some properties of language can be learned without linguistic input. *The Linguistic Review*, 24(4), 1–5.
- Goldin-Meadow, S. (2013). Homesign: When gesture is called upon to be language. In C. Müller, A. Cienki, & E. Fricke (Eds.), *Body, language, communication: an international handbook on multimodality in human interaction* (Vol. 1, pp. 113–125). De Gruyter.
- Goldin-Meadow, S., & Feldman, H. (1977). The development of language-like communication without a language model. *Science*, 197(4301), 401–403.
- Goldin-Meadow, S., & Mylander, C. (1983). Gestural communication in deaf children: Noneffect of parental input on language development. *Science*, 221(4608), 372–374.

- Goldin-Meadow, S., & Mylander, C. (1984). Gestural communication in deaf children: The effects and noneffects of parental input on early language development. In *Monographs of the society for research in child development* (Vol. 49, pp. 1–151).
- Goldin-Meadow, S., & Mylander, C. (1990). The role of parental input in the development of a morphological system. *Journal of Child Language*, *17*(3), 527–563.
- Goldin-Meadow, S., Mylander, C., & Butcher, C. (1995). The resilience of combinatorial structure at the word level: Morphology in self-styled gesture systems. *Cognition*, *56*, 195–262.
- Goldin-Meadow, S., Mylander, C., & Franklin, A. (2007). How children make language out of gesture: Morphological structure in gesture systems developed by American and Chinese deaf children. *Cognitive psychology*, *55*(2), 87–135.
- Goldin-Meadow, S., Özyürek, A., Sancar, B., & Mylander, C. (2009). Making language around the globe: A crosslinguistic study of homesign in the United States, China, and Turkey. In J. Guo, E. Lieven, N. Budwig, S. Ervin-Tripp, K. Nakamura, & c. Özcalışkan (Eds.), *Crosslinguistic approaches to the psychology of language: Research in the tradition of dan isaac slobin* (pp. 27–39). New York, NY.
- Greenberg, J. B. (1981). *Santiago's sword: Chatino peasant religion and economics*. Berkeley, CA: University of California Press.
- Hanks, W. (1990). *Referential practice: Language and lived space among the Maya*. Chicago, IL: University of Chicago Press.
- Hanna, B. E. (1996). Defining the emblem. *Semiotica*, *112*(3/4), 289–358.
- Haviland, J. B. (1998). Guugu Yimithirr cardinal directions. *Ethos*, *26*(1), 25–47.
- Haviland, J. B. (2003). How to point in Zinacantán. In S. Kita (Ed.), *Pointing: where language, culture and cognition meet* (pp. 139–170). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- Haviland, J. B. (2005). Directional precision in Zinacantec deictic gestures: (cognitive?) preconditions of talk about space. *Intellectica*, *2*(3), 25–54.
- Haviland, J. B. (2009). Pointing, gesture spaces, and mental maps. In D. McNeill (Ed.), *Language and gesture* (pp. 13–46). Cambridge, England: Cambridge University Press.
- Heath, S. B. (1972). *Telling tongues: Language policy in Mexico, colony to nation*.

- New York, NY: Teachers College Press.
- Hellwig, B. (2010). Different types of data: A case study of Goemai demonstratives. *The Journal of West African languages*, 37(1), 7–22.
- Himmelman, N. (1996). Demonstratives in narrative discourse: A taxonomy of universal uses. In B. Fox (Ed.), *Studies in anaphora*. Amsterdam, the Netherlands: John Benjamins.
- Hindmarsh, J., & Heath, C. (2000). Embodied reference: A study of deixis in workplace interaction. *Journal of Pragmatics*, 32(12), 1855–1878.
- Hou, L. Y.-S. (2016). “Making hands”: *Family sign languages in the San Juan Quiahije community* (Unpublished doctoral dissertation). The University of Texas at Austin, Austin, TX.
- Hunsicker, D., & Goldin-Meadow, S. (2012). Hierarchical structure in a self-created communication system: building nominal constituents in homesign. *Language*, 88(4), 1–33.
- Instituto Nacional de Estadística y Geografía. (2017). *Mexico en Cifras: Información Nacional, Por Entidad Federativa y Municipios*. Retrieved from [http://scholar.google.com/scholar?q=related:0qR\\_qY9fNa0J:scholar.google.com/&hl=en&num=20&as\\_sdt=0,5](http://scholar.google.com/scholar?q=related:0qR_qY9fNa0J:scholar.google.com/&hl=en&num=20&as_sdt=0,5)
- Jarbou, S. O. (2010). Accessibility vs. physical proximity: An analysis of exophoric demonstrative practice in Spoken Jordanian Arabic. *Journal of Pragmatics*, 42, 3078–3097.
- Johnston, T. (2013). Towards a comparative semiotics of pointing actions in signed and spoken languages. *Gesture*, 13(2), 109–142.
- Joyce, A. A. (2011). *Mixtecs, Zapotecs, and Chatinos: Ancient Peoples of Southern Mexico*. West Sussex, UK: John Wiley & Sons.
- Kegl, J., Senghas, A., & Coppola, M. (1999). *Creation through contact: Sign language emergence and sign language change in Nicaragua*. Cambridge, MA: MIT Press.
- Kemmerer, D. (2006). The semantics of space: Integrating linguistic typology and cognitive neuroscience. *Neuropsychologia*, 44(9), 1607–1621.
- Kendon, A. (1980). A description of a deaf-mute sign language from the Enga Province of Papua New Guinea with some comparative discussion: Parts I–II. *Semiotica*, 32(1/2).
- Kendon, A. (2004). *Gesture: Visible action as utterance*. Cambridge, England:

Cambridge University Press.

- Kendon, A., & Versante, L. (2003). Pointing by hand in Neapolitan. In S. Kita (Ed.), *Pointing: where language, culture and cognition meet* (pp. 109–137). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- Kimura, D. (1973a). Manual activity during speaking—II. Left-handers. *Neuropsychologia*, *11*(1), 51–55.
- Kimura, D. (1973b). Manual activity during speaking—I. Right-handers. *Neuropsychologia*, *11*(1), 45–50.
- Kita, S. (2001). Locally-anchored spatial gestures, version 2: Historical description of the local environment as a gesture elicitation task. In *Manual for the field season 2001* (pp. 132–135). Nijmegen, the Netherlands: Max Planck Institute for Psycholinguistics.
- Kranstedt, A., Lücking, A., Pfeiffer, T., Rieser, H., & Wachsmuth, I. (2006). Deixis: How to determine demonstrated objects using a pointing cone. In S. Gibet, N. Courty, & J.-F. Kamp (Eds.), *Gesture in human-computer interaction and simulation* (pp. 300–311). Berlin, Germany: Springer.
- Kranstedt, A., & Wachsmuth, I. (2005). Incremental generation of multimodal deixis referring to objects. In *Proceedings of the the European workshop on natural language generation (ENLG 2005)* (pp. 75–82). Aberdeen, UK.
- Krivokapic, J., Tiede, M., & Tyrone, M. E. (n.d.). Speech and manual gesture coordination in a pointing task. *Proceedings of Speech Prosody 2016*.
- Lausberg, H., & Kita, S. (2003). The content of the message influences the hand choice in co-speech gestures and in gesturing without speaking. *Brain and Language*, *86*(1), 57–69.
- Le Guen, O. (2006). *L'organisation et l'apprentissage de l'espace chez les Maya Yucatèques du Quintana Roo, Mexique* (Unpublished doctoral dissertation). Université de Paris X, Paris, France.
- Le Guen, O. (2011). Modes of pointing to existing spaces and the use of frames of reference. *Gesture*, *11*(3), 271–307.
- Levelt, W., Richardson, G., & La Heij, W. (1985). Pointing and voicing in deictic expressions. *Journal of Memory and Language*, *24*(2), 133–164.
- Levinson, S. C. (2003). *Space in language and cognition: Explorations in cognitive diversity*. Cambridge, England: Cambridge University Press.
- Levinson, S. C. (2004). Deixis. In L. Horn & G. Ward (Eds.), *The handbook of*

- pragmatics* (pp. 97–121). Oxford, England: Blackwell Publishing.
- Liddell, S. K. (1978). Nonmanual signals and relative clauses in American Sign Language. In P. Siple (Ed.), *Understanding language through sign language research* (pp. 59–90). Cambridge, MA: Academic Press.
- Liddell, S. K., & Metzger, M. (1998). Gesture in sign language discourse. *Journal of Pragmatics*, *30*(6), 657–697.
- Lücking, A., Pfeiffer, T., & Rieser, H. (2015). Pointing and reference reconsidered. *Journal of Pragmatics*, *77*, 56–79.
- Lyons, J. (1977). Cambridge, England: Cambridge University Press.
- Marsaja, I. G. (2008). *Desa Kolok: A deaf village and its sign language in Bali, Indonesia*. Nejmegen, the Netherlands: Ishara Press.
- Marslen-Wilson, W., Levy, E., & Komisarjevsky Tyler, L. (1982). Producing interpretable discourse: The establishment and maintenance of reference. In R. J. Jarvella & W. Klein (Eds.), *Speech, place and action* (pp. 1–40). New York, NY: Wiley.
- McBurney, S. L. (2002). Pronominal reference in signed and spoken language: Are grammatical categories modality-dependent? In R. P. Meier, D. Quinto-Pozos, & K. Cormier (Eds.), *Modality and structure in signed and spoken languages* (pp. 329–369). Cambridge, England: Cambridge University Press.
- McNeill, D. (1992). *Hand and mind: What gestures reveal about thought*. Chicago, IL: University of Chicago Press.
- McNeill, D., Cassell, J., & Levy, E. T. (1993). Abstract deixis. *Semiotica*, *95*(1/2), 5–19.
- Meier, R. P. (1990). Person Deixis in American Sign Language. In S. D. Fischer & P. Siple (Eds.), *Theoretical issues in sign language research* (Vol. 1, pp. 175–190). Chicago, IL: University of Chicago Press.
- Meier, R. P., & Lillo-Martin, D. (2010). Does spatial make it special? On the grammar of pointing signs in American Sign Language. In *Hypothesis a/hypothesis b: Linguistic explorations in honor of david m. perlmutter*. (pp. 345–360). Cambridge, MA: MIT Press.
- Meier, R. P., & Lillo-Martin, D. (2013). The points of language. *Humana Mente Journal of Philosophical Studies*, *24*, 151–176.
- Mesh, K., & Hou, L. (in press). Negation in San Juan Quiahije Chatino Sign Language. In O. le Guen, M. Coppola, & J. Safar (Eds.), *Emerging sign*

*languages of the americas*. de Gruyter.

- Morford, J. P. (1996). Insights to language from the study of gesture: A review of research on the gestural communication of non-signing deaf people. *Language and Communication*, 16(2), 165–178.
- Morford, J. P., & Kegl, J. A. (2009). Gestural precursors to linguistic constructs: How input shapes the form of language. In D. McNeill (Ed.), *Language and gesture*. Cambridge, England: Cambridge University Press.
- Mühlhäusler, P. (2011). Ecolinguistics, linguistic diversity, ecological diversity. *The postcolonial science and technology studies reader*, 198–210.
- Newport, E. L. (1999). Reduced input in the acquisition of signed languages: contributions to the study of creolization. In *Language creation and language change* (pp. 161–178).
- Newport, E. L., & Meier, R. P. (1986). The acquisition of American Sign Language. In D. I. Slobin (Ed.), *The crosslinguistic study of language acquisition* (Vol. 3, pp. 881–938). New York, NY: Lawrence Erlbaum Associates, Inc.
- Nonaka, A. M. (2015). Toponyms in Ban Khor Sign Language. *Learning Communities: International Journal of Learning in Social Contexts [Special Issue: Indigenous Sign Languages]*, 16, 66–91.
- Nyst, V. (2012). Shared sign languages. In M. Steinbach & B. Woll (Eds.), *Sign language: An international handbook* (pp. 552–574). de Gruyter.
- O’Meara, C., & Pérez Báez, G. (2011). Spatial frames of reference in Mesoamerican languages. *Language Sciences*, 33(6), 837–852.
- Osugi, Y., & Webb, T. S. R. (1999). The use of word elicitation to identify distinctive gestural systems on Amami Island. *Sign Language & Linguistics*, 2(1), 87–112.
- Peeters, D., Hagoort, P., & Özyürek, A. (2015). Electrophysiological evidence for the role of shared space in online comprehension of spatial demonstratives. *Cognition*, 136, 64–84.
- Peeters, D., & Özyürek, A. (2016). This and that revisited: A social and multimodal approach to spatial demonstratives. *Frontiers in psychology*, 7(222).
- Peirce, C. (1955). *Philosophical writings of Pierce* (J. Buchler, Ed.). New York, NY: Dover Publications.
- Pérez Rodríguez, V. (2013). Recent advances in Mixtee archaeology. *Journal of Archeological Research*, 21(1), 1–48.

- Perniss, P., & Zeshan, U. (2008). *Possessive and Existential Constructions in Sign Languages*. Nejmegen, the Netherlands: Ishara Press.
- Pettito, L. A. (1992). Modularity and constraints in early lexical acquisition. In M. Gunnar & M. Maratsos (Eds.), *Modularity and constraints in language and cognition* (pp. 95–126). New York, NY: Lawrence Erlbaum Associates, Inc.
- Pfau, R. (2011). A point well taken. In G. Mathur & D. Napoli (Eds.), *Deaf around the world: The impact of language* (p. 144-163). New York, NY: Oxford University Press.
- Pfau, R., & Steinbach, M. (2005). Relative clauses in German Sign Language: Extraposition and reconstruction. In L. Bateman & C. Ussery (Eds.), *Proceedings of the north east linguistic society nels* (pp. 507–521). Amherst, MA.
- Pfau, R., & Steinbach, M. (2006). *Modality-independent and modality-specific aspects of grammaticalization in sign languages*. Potsdam, Germany: Universitätsverlag.
- Pfeiffer, T. (2012). Interaction between speech and gesture: Strategies for pointing to distant objects. In E. Efthimiou, G. Kouroupetroglou, & S.-E. Fotinea (Eds.), *Gestures in embodied communication and human-computer interaction, 9th international gesture workshop* (pp. 238–249). Athens, Greece: Springer-Verlag.
- Piwek, P., Beun, R.-J., & Cremers, A. (2008). ‘Proximal’ and ‘distal’ in language and cognition: Evidence from deictic demonstratives in Dutch. *Journal of Pragmatics*, 40(4), 694–718.
- Polian, G., & Bohnemeyer, J. (2011). Uniformity and variation in Tseltal reference frame use. *Language Sciences*, 33(6), 868–891.
- Rathmann, C. (2000). *The optionality of agreement phrase: Evidence from signed languages* (Unpublished master’s thesis). The University of Texas at Austin, Austin, TX.
- Roberts, L. D. (1993). *How reference works: Explanatory models for indexicals, descriptions, and opacity*. Albany, NY: SUNY Press.
- Rodrigo, M. J., González, A., de Vega, M., Muñetón, M., & Rodríguez, G. (2004). From gestural to verbal deixis: A longitudinal study with Spanish infants and toddlers. *First Language*, 24(1), 71–90.
- Sacks, H., & Schegloff, E. A. (1979). Two preferences in the organization of reference to persons in conversation and their interaction. In G. Psathas (Ed.), *In*



- everyday language: Studies in ethnomethodology* (pp. 15–21). New York, NY: Irvington.
- Schegloff, E. A. (1997). Practices and actions: Boundary cases of other-initiated repair. *Discourse Processes*, 23(3), 499–545.
- Schreiber, F. C. (2001). The deaf adult's point of view. In L. Bragg (Ed.), *Deaf world: A historical reader and primary sourcebook* (pp. 188–192). New York, NY: New York University Press.
- Searle, J. R. (1997). Proper Names. In P. Ludlow (Ed.), *Readings in the philosophy of language* (pp. 585–592). Cambridge, MA: MIT Press.
- Senft, G. (2004). Introduction. In *Deixis and demonstratives in oceanic languages* (pp. 1–13). Pacific Linguistics.
- Senghas, A. (2005). Language emergence: Clues from a new bedouin sign. *Current Biology*, 15(12), R463 - R465.
- Senghas, A., & Coppola, M. (2011). Getting to the point: Development of a linguistic device in Nicaraguan signing. In G. Mathur & D. Napoli (Eds.), *Deaf around the world: The impact of language* (p. 144-163). New York, NY: Oxford University Press.
- Shephard, R. N., & Hurwitz, S. (1984). Upward direction, mental rotation, and discrimination of left and right turns in maps. *Cognition*, 18, 161–193.
- Sherzer, J. (2008). Verbal and nonverbal deixis: The pointed lip gesture among the San Blas Cuna. *Language in Society*, 2(1), 117.
- Singleton, J. L., Goldin-Meadow, S., & McNeill, D. (1995). The cataclysmic break between gesticulation and sign: Evidence against a unified continuum of gestural communication. In K. Emmorey & J. Reilly (Eds.), *Language, gesture and space* (pp. 287–311). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.
- Singleton, J. L., & Newport, E. L. (2004). When learners surpass their models: The acquisition of American Sign Language from inconsistent input. *Cognitive psychology*, 49(4), 370–407.
- Smith Aguilar, A. E. (2017). *Paisaje ritual y fragmentación del territorio en San Juan Quiahije, Oaxaca* (Unpublished master's thesis). Universidad Nacional Autónoma de México, Mexico City.
- So, W. C., Coppola, M., Licciardello, V., & Goldin-Meadow, S. (2005). The seeds of spatial grammar in the manual modality. *Cognitive Science*, 29(6), 1029–1043.

- Soto, V. V. (2011). The “uphill” and “downhill” system in Meseño Cora. *Language Sciences*.
- Steinbach, M., & Pfau, R. (2007). The grammaticalization of auxiliaries in sign languages. In P. Perniss, R. Pfau, & M. Steinbach (Eds.), *Visible variation: Comparative studies on sign language structure*. Berlin, Germany: Mouton de Gruyter.
- Streeck, J. (2009). *Gesturecraft: The manu-facture of meaning*. Amsterdam: John Benjamins.
- Sullivant, J. R. (2015). *The phonology and inflectional morphology of Cháknyá, Tataltepec de Valdés Chatino, a Zapotecan language* (Unpublished doctoral dissertation). The University of Texas at Austin, Austin, TX.
- Talmy, L. (1988). The relation of grammar to cognition. In B. Rudzka (Ed.), *Topics in Cognitive Linguistics* (pp. 165–206). Amsterdam, the Netherlands: John Benjamins Publishing.
- Tucci, D. L., Merson, M. H., & Wilson, B. S. (2010). A summary of the literature on global hearing impairment. *Otology & Neurotology*, 31(1), 31–41.
- van der Kooij, E. (2002). *Phonological categories in sign language of the the Netherlands* (Vol. 55). Utrecht, the Netherlands: LOT Publications.
- van der Kooij, E., Crasborn, O., & Ros, J. (2006). Manual prosodic cues: palm-up and pointing signs. In *Poster presented at the 9th theoretical issues in sign language research meeting*. Florianopolis, Brazil. December 6–9..
- Vauclair, J., & Cochet, H. (2013). Hand preference for pointing and language development in toddlers. *Developmental Psychobiology*, 55, 757–765.
- Voegelin, C. F., & Voegelin, F. M. (1964). Languages of the world: native America fascicle one. *Anthropological Linguistics*, 6(6), 2–45.
- Volterra, V., Beronesi, S., & Massoni, P. (1994). How does gestural communication become language? In V. Volterra & C. J. Erting (Eds.), *From gesture to language in hearing and deaf children* (pp. 205–216). Berlin, Germany: Springer-Verlag.
- Washabaugh, W. (1986). *Five Fingers for Survival*. Ann Arbor, MI: Karoma Publishers, Inc.
- Wilbur, R. B. (1979). *American Sign Language and Sign Systems*. Baltimore: University Park Press.
- Wilkins, D. (2001). The 1999 demonstrative questionnaire: “This” and “that” in

- comparative perspective. In *Manual for the field season 2001* (pp. 149–163).  
Nejmegen, the Netherlands: Max Planck Institute for Psycholinguistics.
- Wilkins, D. (2003). Why pointing with the index finger is not a universal (in  
sociocultural and semiotic terms). In S. Kita (Ed.), *Pointing: where language,  
culture and cognition meet* (pp. 171–215). Mahwah, NJ: Lawrence Erlbaum  
Associates, Inc.
- Wolf, E. R. (1957). Closed corporate peasant communities in Mesoamerica and  
Central Java. *Southwestern Journal of Anthropology*.
- Wolf, E. R. (1986). The vicissitudes of the closed corporate peasant community.  
*American Ethnologist*, 13(2), 325–329.
- Zeshan, U., & de Vos, C. (2012). *Sign languages in village communities: Anthro-  
pological and linguistic insights*. Boston, MA: Walter de Gruyter.
- Zwets, M. (2014). *Locating the difference: A comparison between Dutch pointing  
gestures and pointing signs in Sign Language of the the Netherlands*. (Disser-  
tation.) Utrecht, the Netherlands: LOT.

## Vita

Kathryn Mesh goes by Kate. She was raised in Lake Wales, Florida, the daughter of Ronald and Barbara Mesh and the sister of Aaron Mesh. She received a Bachelor of Arts degree with a concentration in Philosophy and Religion from New College of Florida in 2006, and a Master of Arts in Applied Linguistics from Boston University in 2011.

ORCID identifier: <https://orcid.org/0000-0002-0904-6449>

Permanent Address: [kmesh@utexas.edu](mailto:kmesh@utexas.edu)

This dissertation was typeset with  $\text{\LaTeX} 2_{\epsilon}$ <sup>1</sup> by the author.

---

<sup>1</sup> $\text{\LaTeX} 2_{\epsilon}$  is an extension of  $\text{\LaTeX}$ .  $\text{\LaTeX}$  is a collection of macros for  $\text{\TeX}$ .  $\text{\TeX}$  is a trademark of the American Mathematical Society. The macros used in formatting this dissertation were written by Dinesh Das, Department of Computer Sciences, The University of Texas at Austin, and extended by Bert Kay, James A. Bednar, Ayman El-Khashab, and Nicholas Gaylord.