MODAL SIGNS AND COOCCURRING NONMANUAL MARKERS IN TURKISH SIGN LANGUAGE (TİD)

by

Serpil Karabüklü

A Dissertation

Submitted to the Faculty of Purdue University

In Partial Fulfillment of the Requirements for the degree of

Doctor of Philosophy

Department of Linguistics

West Lafayette, Indiana

December 2022

THE PURDUE UNIVERSITY GRADUATE SCHOOL
STATEMENT OF COMMITTEE APPROVAL

Dr. Ronnie B. Wilbur, Chair

Department of Linguistics

Department of Speech, Language, and Hearing Sciences

Dr. Lori Czerwionka

Department of Spanish and Portuguese

Dr. Elaine J. Francis

Department of English

Dr. Daniel Hole

Stuttgart University - Department of Linguistics

Approved by:

Dr. Olga Dmitrieva

Babacık'a

To daddy and to all who are beyond the assumed normalcy

ACKNOWLEDGMENTS

No words will do enough justice to express my gratitude to everyone who has been with me during all the process of this journey. I am humbled to accept to be surrounded with all the support and love even during the times when I questioned if I can see the finish line. If we follow the traditional layout, I should start with my dear advisor, Ronnie, who honestly deserves a separate acknowledgement. Everyone in the sign language field knows Wilbur, but a couple will be lucky to know Ronnie. You will be free to choose, explore, enjoy, fail and redo in your path. She will be there when you feel stuck and cannot move further. She has a great vision to guide you to the direction that you want to follow or sometimes to show that you should go through sideways. She will bring a new question or perspective and you will find a new path. She is the most open-minded person who loves learning from different people no matter their background, age, or level. Everyone in the field already knows that she is a great researcher, but she is also the most humanistic advisor who I could have asked for. She checks in if you are also taking time for yourself. She has been always there during the difficult times to support and the best times to celebrate. She showed that it is possible to be both a great researcher and human. She is the embodiment of fox's phrase to Little Prince 'You become responsible, forever, for what you have tamed.' Thank you Ronnie from the bottom of my heart for everything you have taught about research and life, all your support, celebrations, and understandings during both the best times and most stressful times. I am forever grateful to have you as an advisor.

I am also thankful to have such a great committee. I was so lucky to also take classes from Elaine and Lori. Elaine's questions have always made me clearly see what I have, gloss over, and pay attention in my research designs. She showed me that I also need to think about how to handle the data from the initial design of the study. Lori showed me how to reorganize my questions and indeed my million questions fall under one big question, and restructure my studies. Daniel has been always there when I think my analysis was stuck and could not be improved. He has such an immense analytical perspective that always brought new predictions. While I was lost in my questions and data, he just looked at the data and directed me to the path where I needed to have a new perspective in all our meetings.

Many thanks also to the professors who I had the chance to take classes from: Lori Czerwionka, Olga Dmitrieva, Elaine Francis, Mary Niepokuj, John Sundquist. I have learned a lot but all showed me that other perspectives and explanations are always possible. I may not have time to explain everything but the crucial point is if I have data and justification to explain the analysis that I choose. They taught me that theories do change, evolve, or extinguish, and they are for data. Thank you also for teaching and showing me that writing takes time and everyone struggles, but it is doable with a good plan. I was also lucky to have one of the best cohorts: Amy Hutchinson, John Nielsen, Kailey Preston, Josh Weirick, and Mai Yamamoto. I also had a great chance to have fun and good discussion with my dear labmates and departmentmates: Ruth M. Crabtree, Jenna Conklin, Bruno Garcia, Jian Jiao, Ye-Jee Jung, Ashley Kentner, Leah Nodar, Maria Prichett, and Vanessa Sheu. Thank you all for all academic and non-academic discussions and your friendship through my Purdue years.

I couldn't pass without thanking the ones who seeded the curiosity for linguistics in me. I am so grateful to have started this journey with all my professors and friends back home at Boğaziçi University. I am grateful especially for Aslı Göksel, Meltem Kelepir, Sumru Özsoy, and Sign Language Linguistics Lab. They introduced me to sign language linguistics during my masters and opened their doors during all summers whenever I went back. I also want to thank all members of our informal Turkish Sign Language Workshop group: Aslı Göksel, Meltem Kelepir, Sumru Özsoy, Kadir Gökgöz, Süleyman Taşçı, Aslı Özkul, Emre Hakgüder, Demet Kayabaşı, Hande Sevgi, Noyan Dokudan, Semra Özdemir, Burcu Saral, Oya Tanyeri and Bahtiyar Makaroğlu for listening to my project in its different stages and giving me feedback.

I am beyond grateful for my informal mentors and friends who I gained through sign language research. Derya Nuhbalaoğlu became a best friend who I first met in my first sign language linguistics class. I always envied and looked up to you when I was first met with signing, saw your interaction with the Deaf community, and how you prioritize them. Thank you for taking that little inexperienced undergraduate and explaining everything in the lab, sometimes in life, and being a constant in my life even if we live on different continents. My other gain through sign language research is Aslı Gürer who has witnessed

the good amount of ups and downs of this research. Thank you for listening my questions, complaints, excitements, and introducing me to information structure. Thank you both for all your support, academic and non-academic advice.

I could not do all the research without the endless support from the Turkish Deaf community. Thank you, Elvan Tamyürek Özparlak and Gül Köroğlu Yiġit for introducing me to TİD and answering my countless questions. I also want to thank all my participants who gave so much of their time and energy for this project, answered my endless questions: Özgür Akbulut, Yağmur Akbulut, Bšşra Dilsiz Uysal, Írem Karakaya, Ílyas Kavalcı, Fırat Kırmızıgül, Nevzat Kırkıç, Nuriye Köroğlu, Seval Nazlı, Kuntay Özparlak, Esra Öztürk, Mesut Öztürk, Demet Terzi, Yasin Yiğit, and Buse Yörükoğlu. I could not have done this alone. I also want to thank Okan Kubus who has been there for all my questions during different stages over emails or at conferences. Thank you for all your patience and help. I was also so lucky to take ASL classes at Purdue and meet with great instructors. Thank you Robin Shay, Sharon Borkowski, and Ray Olson for introducing me to ASL and discussing it with me. I have also gained great friendships through sign language linguists: Chuck Bradley, Fabian Bross, Julia Krebs, Guilherme Lorenço, and Nik Nikolai. Thank you all for rereading different phases of manuscripts, discussing ideas, and having fun while taking roadtrips to conferences. I also want to thank Jeremy Kuhn, Keir Moulton, and Aaron White for taking the time and discussing my research. I have been also lucky to have Keir as my LSA mentor, thank you for all your help and advice during the difficult phases. This dissertation could not happen without the help that I received for statistics from Josh Weirick, Yuhyeon Seo, and Lily Assaad. Especially Lily adopted me as a naive researcher who knew barely anything about statistical analysis. She walked me through all steps, answered all my questions again and again while she was writing her own dissertation, getting married, and moving from one coast to another. Thank you from the bottom of my heart, dear friend.

I have a note from my first meeting with Lily for stats: 'I have power' :) I have power not only in stats but also in life with her and also my friends, Becca Nixon and Zeynep Mutlu. I am beyond thankful to have these three as my family here who have been with me during all ups and downs, and witnessed every bit and piece. Thank you always for being there to support during difficult times when I doubted myself and also for celebrating all good news

with me. This journey would have been so dull without you. Thank you also for bringing your puppies in my life, Luna and Pumpkin, and helping to find my own boy, Oscar. They have been definitely the best additions of this journey with fun and laughter. Arpita Nag, I met you a bit late but you became a dear friend in a short time. I wish to spend more time with you. Thank you for being there and becoming one of Oscar's aunties.

I am also so lucky to have friendships rooted back in Turkey that have lasted so long. Merve Gizem Cevheroğlu and Abdullah Açar have been always so generous to let me crash in their place whenever I am back in Istanbul visiting or doing research. Thank you for being family in Istanbul and Bursa all the time. The Açar family is definitely one of the unofficial funding sources of my academic career. Ceyda Yaba, thank you, for always feeding me with delicious food wherever we are in Istanbul, Clemson, or Virginia. Merve Saraç, thank you for always meeting, finding and visiting me wherever I am.

I couldn't also come this far without all my family's endless love and support. Thank you mom, dad, and brother for always being there and supporting me even though academia is so foreign to you. Thank you mom for your endless support and love even though you miss me a lot and have been waiting all the time for me to be back home. Thank you brother for always being there even though staying at school seems a crazy idea to you. Thank you dad for everything, this little girl did it. I know you see all of this from somewhere and keep cheering for me. I have been always so lucky to be your daughter.

TABLE OF CONTENTS

LIST OF TABLES 14

LIST OF FIGURES 17

ABBREVIATIONS 20

ABSTRACT 23

1 INTRODUCTION 25

1.1 Modal Notions in Spoken and Sign Languages 25

1.2 Realizations of Modals in TİD 27

1.3 Roadmap 30

2 REALIZATIONS OF MODAL NOTIONS 33

2.1 Modal Notions 33

2.1.1 Semantic Components of Modals 34

2.2 Modal Typology: Which Semantic Part Lexicalized 37

2.2.1 Varying Modal Force 37

2.2.2 Varying Modal Force and Flavor 39

2.2.3 Specified Modal Force and Flavor 41

2.3 Modals in Sign Languages 44

2.3.1 Bodily Mapping Hypothesis 45

2.3.2 Sign languages that have modal base duality 47

2.3.3 Sign languages that don't have modal base duality 51

2.3.4 Role of nonmanual markers 55

Nonmanual Markers Conveying Epistemic Modal 55

Nonmanual Markers Conveying Epistemic Commitment 57

2.4 Modals in TİD 59

2.4.1 Manual Signs 60

Modals with specified modal flavor 61

Modals with unspecified flavors . . . 62
Epistemic flavor of LAZIM: Further restrictions . . . 64
2.4.2 Nonmanual markers . . . 65
Nonmanual markers are not lexically required . . . 66
Nonmanual markers are not structurally required . . . 68
2.4.3 Nonmanual markers have their own function . . . 70
Squint: Uncertainty Marker . . . 71
Head Movements: More Uncertainty or Another Function? . . . 76
2.5 Conclusion . . . 80

3 METHODOLOGY . . . 82
3.1 Studies in Dissertation . . . 82
3.2 Participants . . . 82
3.2.1 Procedure . . . 85
Stimuli Preparation . . . 85
Data Collection . . . 86
3.3 Analysis: Statistical Framework . . . 88

4 MANUAL MODAL SIGNS IN TİD . . . 90
4.1 Modal Force: Mutually Exclusive Propositions . . . 90
4.1.1 Stimuli . . . 91
4.1.2 Design . . . 93
4.1.3 Procedure . . . 93
4.1.4 Data Analysis . . . 95
Data Coding . . . 96
4.1.5 Results . . . 97
Descriptive Results . . . 97
Multilevel (MLM) Analysis . . . 97
4.1.6 Discussion: Why are there three groups in modal force? . . . 101
Other usages of YAP . . . 103
Possible reasons for OLUMLU's difference . . . 105

4.2 Modal Flavor . . . 106
4.2.1 Production Task . . . 108
Stimuli . . . 108
Design . . . 108
Procedure . . . 109
Data Analysis . . . 110
Results . . . 111
4.2.2 Acceptability Rating Task . . . 113
Stimuli . . . 113
Design . . . 114
Procedure . . . 114
Data Analysis . . . 116
Data Coding and Cleaning . . . 116
Results . . . 117
4.2.3 Discussion: Where does the difference come from? . . . 120
4.3 Semantics of modals with circumstantial base . . . 122
4.3.1 SERBEST: Specified force and flavor . . . 123
4.3.2 MECBUR: Specified force and unspecified flavor . . . 125
4.3.3 Attempt to explain OLUMLU . . . 127
4.4 Conclusion . . . 130

5 EVIDENTIAL RESTRICTION ON EPISTEMIC SIGNS . . . 132
5.1 Epistemic and Evidentiality . . . 133
5.1.1 Cuzco Quechua: Epistemic and evidentiality are encoded separately . . . 135
5.1.2 English *must*: Evidentiality is a requirement . . . 136
5.2 Evidential Restriction Study . . . 140
5.2.1 Stimuli . . . 140
5.2.2 Design . . . 142
5.2.3 Procedure . . . 143
5.2.4 Data Analysis . . . 143

Data Coding and Cleaning . . . 145
5.2.5 Results of Acceptability Ratings . . . 145
Descriptive Results . . . 145
Multilevel (MLM) Analysis . . . 146
5.2.6 Results of Command-Guess Ratings . . . 151
Descriptive Results . . . 151
Multilevel Model (MLM) Results . . . 151
5.3 What do results show in terms of epistemics and evidentiality? . . . 154
5.3.1 Puzzle of LAZIM and OL LAZIM . . . 157
Why do we need OL? . . . 158
Possible function of OL . . . 158
5.3.2 Semantics of LAZIM . . . 162
5.4 Semantics of Epistemic Signs . . . 165
5.4.1 Semantics of ACABA . . . 165
5.4.2 Semantics of OLABILIR . . . 166
Kinship between OL and OLABILIR . . . 166
5.4.3 Puzzle in the analysis of OLABILIR . . . 169
5.5 Conclusion . . . 170

6 ROLE OF NONMANUAL MARKERS . . . 172
6.1 Nonmanual Markers Rating Study . . . 173
6.1.1 Stimuli . . . 173
6.1.2 Design . . . 174
6.1.3 Procedure . . . 174
6.1.4 Data Analysis . . . 177
Data Coding and Cleaning . . . 177
6.1.5 Results . . . 178
Descriptive Results . . . 178
Multilevel Model (MLM) Results . . . 181
6.2 Interaction of Manual Signs and Nonmanual Markers . . . 186

6.3 Head Nod: Information Structure . . . 189
6.3.1 Brief Background on Focus in TİD . . . 190
6.3.2 Certainty Effect Due to Focus . . . 193
6.4 Eye squint: Uncertainty Marker . . . 194
6.4.1 Krifka's Layers of Assertion . . . 195
6.4.2 Where may squint live? . . . 197
6.5 Conclusion . . . 202

7 CONCLUSION . . . 204
7.1 TİD Modal Signs in Modal Typology . . . 204
7.2 Role of Nonmanual Markers . . . 205
7.3 Future Studies . . . 207

REFERENCES . . . 209

A ATTITUDE VERBS IN TİD . . . 216

B BACKGROUND QUESTIONNAIRE . . . 217

C TEST ITEMS IN THE MUTUALLY EXCLUSIVE PROPOSITIONS TEST . . . 220
C.1 Trial Items . . . 220
C.2 Set 1 . . . 220
C.3 Set 2 . . . 221

D TEST ITEMS IN THE MODAL FLAVORS CONTEXT TEST . . . 223
D.1 Trial Items . . . 223
D.2 Set 1 . . . 223
D.3 Set 2 . . . 225

E TEST ITEMS IN THE EVIDENTIAL RESTRICTION TEST . . . 229
E.1 Trial Items . . . 229
E.2 Set 1 . . . 229
E.3 Set 2 . . . 234

F TEST ITEMS IN THE NONMANUALS RATING TEST 240
F.1 Trial Items 240
F.2 Set 1 240
F.3 Set 2 248

G MULTILEVEL MIXED EFFECTS RESULTS FOR EACH NONMANUAL MARKER WITH EACH SENTENCE TYPE 256

LIST OF TABLES

2.1 Proposed modal force and base correlations in Rullmann et al. (2008) 39

2.2 Updated correlations proposed by Rullmann et al. (2008) 41

2.3 Reupdated correlations proposed by Rullmann et al. (2008) 44

2.4 Modal base and force correlations in sign languages 54

2.5 Sign language typology of modals in terms of manual signs and nonmanual markers 59

2.6 Nonmanuals with SERBEST, OLUMLU, OLABILIR and LAZIM in Karabüklü et al.'s (2018) study* 67

2.7 Nonmanuals with SERBEST, OLUMLU, OLABILIR, LAZIM, MECBUR and YAP in Karabüklü and Wilbur's (2020) data* 68

3.1 Language Usages in Participants' Schools 83

3.2 Participants' Demographic and Language Information 84

3.3 Participant and Task Distributions 87

4.1 Factors of Mutually Exclusive Propositions Test 93

4.2 Predictions for the mutually exclusive propositions test 95

4.3 Descriptive Statistics of Acceptability Ratings 98

4.4 Descriptive Statistics of Acceptability Ratings Based on Modal and Negation Order 98

4.5 Covariates in Acceptability Ratings Based on Independent Variables 99

4.6 Effects of Variables in Level Three on Acceptability Ratings 101

4.7 Main Effect of Modal Force on Acceptability Ratings 101

4.8 Results of Modals Compared to Modal Force Group Members 101

4.9 Factors of Modal Flavors Contexts Test 108

4.10 Covariates in Production of LAZIM 112

4.11 Covariates in Production of MECBUR 112

4.12 Covariates in Production of GEREK 112

4.13 Fixed Effects on Modal Signs in Production Data 113

4.14 Factors of Modal Flavors Contexts Test 116

4.15 Descriptive Statistics of Modal Flavors Acceptability Ratings 117

4.16 Descriptive Statistics of Acceptability Ratings Based on Modal in Contexts . . . 118

4.17 Covariates in Modal Flavor Acceptability Ratings 118

4.18 Effects of All Independent Variables on Acceptability Ratings in Modal Flavors 119
4.19 Difference Between Modal Signs . . . 120
4.20 Covariates Between Modal Signs . . . 122
4.21 TİD modals typological features . . . 131
5.1 Factors of Evidential Restrictions Test . . . 141
5.2 Descriptive Statistics of Evidential Restriction Acceptability Ratings . . . 146
5.3 Descriptive Statistics of Evidential Restriction Acceptability Ratings Based on Modal in Contexts . . . 147
5.4 Covariates in Evidential Restriction Acceptability Ratings . . . 148
5.5 Effects of All Independent Variables on Acceptability Ratings in Evidential Restriction . . . 148
5.6 Effect of Evidential Contexts on Acceptability Ratings of Modals . . . 149
5.7 Acceptability Ratings of Modals in Each Context . . . 150
5.8 Descriptive Statistics of Target Sentences Command-Guess Ratings . . . 151
5.9 Covariates in Command-Guess Ratings . . . 152
5.10 Results of Independent Variables in Command-Guess Ratings . . . 153
5.11 Results of Independent Variables in Command-Guess Ratings . . . 154
5.12 TİD modals typological features . . . 171
6.1 Factors of Nonmanual Markers Rating Test . . . 175
6.2 Descriptive Statistics of Certainty Ratings Based on Sentence Types . . . 178
6.3 Descriptive Statistics of Certainty Ratings Based on Nonmanual Markers . . . 179
6.4 Descriptive Statistics of Certainty Ratings Based on Nonmanual Markers and Sentence Types . . . 180
6.5 Covariates in Certainty Level Ratings . . . 181
6.6 Effects of All Independent Variables on Acceptability Ratings in Evidential Restriction . . . 182
6.7 Effects in Certainty Level Ratings . . . 182
6.8 Effects of Nonmanual Markers and Sentence Types on Certainty Ratings - Part 1 184
6.9 Effects of Nonmanual Markers and Sentence Types on Certainty Ratings - Part 2 185
6.10 Descriptive Statistics of Naturalness Ratings Based on Nonmanual Markers . . . 188

G.1 Effects of Nonmanual Markers and Sentence Types on Certainty Ratings - Part 1 - Detailed 260

G.2 Effects of Nonmanual Markers and Sentence Types on Certainty Ratings - Part 2 - Detailed 261

LIST OF FIGURES

1.1 Manual modal signs in TİD: OLABILIR 'possible', SERBEST 'free', OLUMLU 'positive', YAP 'do', LAZIM 'necessary', MECBUR 'obligatory', and GEREK 'required', respectively. . . . 29

2.1 Mouth corners down and eye squint in ZEI (Siyavoshi, 2019) . . . 54

2.2 Nonmanual markers when the signer is certain about the proposition in TSL (Lin & Chang, 2011) . . . 56

2.3 Nonmanual markers when the signer is uncertain about the proposition in TSL (Lin & Chang, 2011) . . . 56

2.4 Modification of head tilt along with the probabilty (Akahori et al., 2013) . . . 58

2.5 Manual modal signs in TİD: OLABILIR 'possible', SERBEST 'free', OLUMLU 'positive', YAP 'do',LAZIM 'necessary', MECBUR 'obligatory', and GEREK 'required' respectively. . . . 60

2.6 Squint is more intensified with more uncertainty (Karabüklü and Wilbur, 2020, p.198) . . . 73

2.7 Percentages of intensified squint based on certainty levels . . . 74

2.8 THINK(GUESS) and THINK(IMAGINE) in TİD (Makaroglu & Dikyuva, 2017) . . . 75

2.9 Head nod is more intensified with more certainty (Karabüklü and Wilbur, 2020, p. 200) . . . 77

2.10 Percentages of intensified head nod based on certainty levels . . . 78

2.11 Correlation of squint and head nod . . . 79

2.12 Head nod in commands (Özsoy et al., 2018) . . . 80

2.13 Head tilt in commands (Özsoy et al., 2018) . . . 80

3.1 Planned Data Collection Process . . . 88

4.1 The left picture is the ability sign OLUMLU 'positive' and the right picture is its suppletive form OLUMSUZ 'negative'. . . . 92

4.2 Manual sign ACABA 'perhaps, maybe' . . . 92

4.3 Acceptability Judgement Task in Mutually Exclusive Proposition Study . . . 94

4.4 Multilevel Structure of Study . . . 96

4.5 Means of Acceptability Ratings of Modal Signs . . . 97

4.6 Acceptability Ratings Based on Modal Negation Order . . . 99

4.7 Acceptability Ratings Compared for DoH and DoD Groups . . . 100

4.8 Three Level Structure of Data . . . 100
4.9 Acceptability Ratings Affected By Modal Force . . . 102
4.10 Acceptability Ratings Affected By Modal Force . . . 103
4.11 Two YAP signs in TİD (Makaroglu & Dikyuva, 2017) . . . 104
4.12 Both signs used as YAP (make/do) . . . 105
4.13 Production Task in Modal Flavors Context Study . . . 109
4.14 4 Level Hierarchical Structure of Modal Flavor Data . . . 110
4.15 Template Used to Annotate Modal Flavors Production Task . . . 111
4.16 Percentages of Modal Signs across Context Types . . . 113
4.17 Percentages of Modal Signs When Signed First . . . 114
4.18 Significant Difference of Modal Signs in Production Task . . . 115
4.19 Acceptability Rating Task in Modal Flavors Study . . . 117
4.20 Acceptability Ratings of Modal Signs Across Contexts . . . 119
4.21 Significant Difference of Modal Signs in Rating Task . . . 120
4.22 Participant commented that GEREK is not native TİD sign. . . . 121
5.1 Manual sign ACABA 'perhaps' . . . 142
5.2 Rating Task in Evidential Restriction Study . . . 144
5.3 4 Level Hierarchical Structure of Evidential Restriction Data . . . 145
5.4 Ratings of Modals as Command or Guess . . . 152
5.5 Effects of Contexts on Modals' Acceptability Ratings . . . 155
5.6 Acceptability Ratings of Modals in Each Context . . . 157
5.7 Sign OL taken from Makaroglu and Dikyuva (2017) . . . 159
5.8 OL in the left two frames (Makaroglu & Dikyuva, 2017) and OLABILIR in the right two frames . . . 167
6.1 Nonmanual Markers Rating Study . . . 176
6.2 4 Level Hierarchical Structure of Nonmanual Markers Rating Data . . . 177
6.3 Effects of Sentence Types on Certainty Ratings . . . 187
6.4 Effects of Nonmanual Markers on Certainty Ratings . . . 188
6.5 Effects of Head Nod and Repetitive Head Nod on Different Sentence Types . . . 189
6.6 Effects of Head Tilt and Squint on Different Sentence Types . . . 190

6.7 Effects of Sentence Types and Nonmanual Markers Together on Certainty Ratings 191
6.8 Squint appears with negative yes/no questions 198
6.9 Negation of possibility 199
6.10 Head forward tilt and squint in re-introduced topics (COST IS 1006 TİD corpus) 201
6.11 Forward head tilt in yes/no questions (Göksel & Kelepir, 2013) 202
6.12 Backward head tilt and head shake in wh-questions (Göksel & Kelepir, 2013) . . 203
A.1 Attitude verbs that have and do not have squint 216

ABBREVIATIONS

ACC	accusative
ActP	Act Phrase
AOR	aorist
CI	confidence interval
CIRC	circumstantial
CL	classifier
COUNTER	counterfactual
ComP	Commitment Phrase
COP	copula
CP	complentizer phrase
DEON	deontic
DET	determiner
DEF	definite
DEM	demonstrative
DIR	directive
DoD	Deaf of Deaf
DoH	Deaf of Hearing
EPIST	epistemic
EVID	evidential
F	focus
FOC	focus morpheme
FUT	future
ICC	intra-class correlation
INFER	inference
IMPF	imperfective
IND	independent
INTR	intransitive
InflP	inflectional phrase

IP	Intonational phrase
IX	index
JP	judge phrase
LOC	locative
MOD	modal
NEC	necessity
NEG	negation
NOM	nominative
NP	noun phrase
OOC	out of control
PhP	Phonological Phrase
PL	plural
POSS	possessive
PREP	preposition
PROG	progressive
REL	relative clause marker
Q	question
SG	singular
SUBJ	nominative subject
SR	switch reference
TOP	Topic
TP	Tense Phrase
Sign Languages:	
ASL	American Sign Language
DGS	German Sign Language
ISL	Israeli Sign Language
IS	International Sign
JSL	Japanese Sign Language
NGT	Netherlands Sign Language

LSE	Spanish Sign Language
PSL	Palestinian Sign Language
TİD	Turkish Sign Language
TSL	Taiwan Sign Language
ZEI	Iranian Sign Language
Nonmanual Markers:	
bf	brow frown
br	brow raise
bs	brow scrunch
ec	eyes closed
eo	eyes open
hb	head back
hbt	head back tilt
hn	head nod
ht	head tilt
hs	head shake
lt	left
lp	lips pursed
nw	nose wrinkle
nmm	nonmanual marker
pc	puffed cheeks
rhn	repetitive head nod
rt	right
sq	squint
Person:	
1	1st person
2	2nd person
3	3rd person

ABSTRACT

Modal notions have been an intriguing topic in terms of capturing their crosslinguistic behaviors which have been analyzed as quantifiers (Hacquard, 2006; Kratzer, 1977), free choice items (Rullmann et al., 2008), or degrees (Lassiter, 2017). These typological patterns become more interesting when the simultaneous nature of sign languages have been added to the typology. By adding another dimension to the crosslinguistic patterns, sign languages have been reported to have different realizations for modals. Some of them have nonmanual markers alone for epistemic modals (Bross, 2018; Herrmann, 2013) while some have both manual signs and nonmanual markers (Karabüklü et al., 2018; Shaffer, 2004).

Bringing new data for the modal typology in spoken and sign languages, this dissertation analyzes the functions of modal signs and cooccurring nonmanual markers in Turkish Sign Language (TİD). Even though manual signs and nonmanual markers appear together in modal sentences, nonmanual markers are shown to be neither lexical nor structural parts of modal signs. Manual signs are analyzed for their modal force and flavor with experimental studies. Results have shown that TİD shows two typological patterns in its modal system: modals with specified modal force and flavor, and modals with specified force and unspecified flavor.

One of manual signs, LAZIM 'necessary', along with epistemic signs were further investigated for their evidential requirement in epistemic contexts. Results showed that LAZIM requires a strong inference to be felicitous in epistemic contexts. Different than other languages, LAZIM in TİD requires not only the right kind of context, but also the right morphological combination. It is interpreted as a deontic sign when it appears after verb by itself. In order to be interpreted as epistemic, it needs to appear after another sign OL which encodes the change of state.

Effects of nonmanual markers are investigated on perception of the signer's certainty with an experimental study. Signer certainty is rated lower when the squint accompanies the sentence. In contrast, it is rated higher when head nod accompanies the sentence. The effect of increased perception of certainty with head nod is argued to result from the focus on the verb or the modal, yielding verum focus. Squint is analyzed as the uncertainty marker which

can be anchored to the signer, the subject, or the addressee based on the structure in which it appears. Systematic analysis of nonmanual markers brings a new piece of evidence to the long-lasting discussion on where nonmanual markers function in sign languages' grammars.

1. INTRODUCTION

Humans are capable of expressing things or situations that exist or occur beyond the immediate moment and location. For example, when you read this dissertation if I manage to finish it, my writing time will be past, or hopefully if you want to mention this study to somebody else, you will do it in the future. Language uses tense to express displacement in time and modalilty to express non-existent and non-current possibilities, desires, wishes, or necessities. The main focus of this dissertation is the second tool, modality in a visual modality based language Turkish Sign Language (TİD). I will briefly introduce how modal notions are realized in spoken and sign languages, then modals in TİD and the research questions on TİD modals in the dissertation. I will conclude this chapter with the roadmap of the dissertation.

1.1 Modal Notions in Spoken and Sign Languages

Modal notions show typologically distinct features in both spoken and sign languages. These features are affected by which semantic core part is lexicalized in spoken languages. In terms of quantificational framework, modals are analyzed as having three core parts: modal force, modal base, and ordering source, which will be further discussed in Chapter 2. Briefly, English modals have lexicalized modal force (universal or existential) but their interpretations (flavors) change based on the context that they appear in (1.1-1.3) (Hacquard, 2006; Kratzer, 1977). In contrast, St'amt'icets modals have a specified flavor but their modal force changes in the context (1.4-1.5) (Rullmann et al., 2008).

(1.1) *Epistemic:* (In view of the available evidence, or what the speaker knows or infers,) John *must/might/may* be home.

(1.2) *Deontic:* (In view of city regulations or rules,) Mary *may* park here, but she *must* leave in two hours.

(1.3) *Ability:* (In view of her physical abilities,) Jane *can* swim 100 in under a minute.

(1.4) Context: You have a headache that won't go away, so you go to the doctor. All the tests show negative. There's nothing wrong, so it must be tension.

nilh ***ka*** *lh(el)-(t)-en-s-wá(ʔ)-(a)* *ptinus-em-sút*
FOC **INFER** PREP-DET-1SG.POSS-NOM-IMPF-DET think-INTR-OOC
'It **must** be from my worrying.'

(universal, Rullmann et al., 2008)

(1.5) Context: Maybe that's why he's not here.

waʔ ***ka*** *séna7* *qwenúxw*
IMPF **INFER** COUNTER sick
'He **may** be sick.'

(existential, Rullmann et al., 2008)

Modals in some sign languages have been reported to behave like modals in English with unspecified flavor, which can have different interpretations based on the context that they appear in. For example, American Sign Language (ASL) SHOULD can have deontic (1.6) or epistemic interpretation (1.7) (Shaffer & Janzen, 2016). Some sign languages have been reported not to have this dual nature of modals. To illustrate, MUST in German Sign Language (DGS) is only used as deontic (1.8) and not in epistemic contexts (1.9). Even though it is unknown if modals show variation in their modal force based on the context in sign languages, the literature clearly shows that they show distinctions in the lexicalization of modal flavor.

(1.6) IX_2 SHOULD WRITE ORDER $[\text{WRITE}]_{\text{TOP}}$ 'IX_1 WANT PLEASE PUT-DOWN M-E-D MEDIUM CHILE'
'You should write down your order. Write 'I want medium (hot) chile please..."

(ASL deontic, Shaffer and Janzen, 2016, p.8)

(1.7) $[\text{LIBRARY HAVE DEAF LIFE}]_{\text{TOP}}$ $\overset{\text{hn, bf}}{\overline{\text{SHOULD}}}$
'The library should have Deaf Life (magazine)/I think the library has Deaf Life.'

(ASL epistemic, Shaffer and Janzen, 2016, p.10)

(1.8) Context: Paul's parents are strict.

PAUL MUST LEAVE 8-O'CLOCK

'Paul must leave at 8 o'clock.'

(DGS, Bross, 2018, p. 219)

(1.9) INDEX$_{3a}$ LIGHT THERE *PETER AT-HOME MUST (epistemic; hn+ec)

'The light is on, Peter must be at home.'

(DGS, Bross, 2018, p.194)

Modals have different realizations in sign languages also due to the simultaneous nature of sign languages. The realization of epistemic in DGS is nonmanual markers spreading over the epistemic sentence 'Peter must be at home' (1.10). In addition to whether modals have different flavors, ASL and DGS show a difference in how epistemic is realized. ASL has both manual signs and nonmanual markers for epistemic while DGS has only nonmanual markers for epistemics. With regard to modals expressing non-epistemic meanings, all languages have been uniformly reported to have both manual signs and nonmanual markers in all sign languages.

(1.10) INDEX$_{3a}$ LIGHT THERE PETER AT-HOME (epistemic; hn+ec)

'The light is on, Peter must be at home.'

(DGS, Bross, 2018, p.194)

1.2 Realizations of Modals in TİD

Thus, sign languages can be categorized into two groups in terms of the realization of epistemic: (i) only nonmanual markers, and (ii) manual signs and nonmanual markers. TİD belongs to the second category with manual epistemic signs ACABA 'maybe, likely', OLABILIR 'possible'[1] and nonmanual markers squint and head movements (head nod or tilt) (1.11) (Karabüklü et al., 2018) and TİD has separate signs for most of modal flavors

[1]↑I will gloss modal signs in their Turkish gloss to avoid misleading of their meaning through English translations.

(1.12-1.16). Studies also reported non-epistemic signs in TİD as LAZIM 'necessary', SERBEST 'free', OLUMLU 'positive', YAP 'do', MECBUR 'obliged', and GEREK 'required' all of which are shown in Figure 1.1.

(1.11) LIGHT-ON EXISTENTIAL, $\overline{\text{MOM HOME EXISTENTIAL OLABILIR}}^{\text{ht, sq}}$

'The light is on, mom might be at home.'

(epistemic, Karabüklü et al., 2018, p.86)

(1.12) THURSDAY COME $\overline{\text{LAZIM}}^{\text{br}}$

'He must/should come on Thursday.'

(deontic, Karabüklü et al., 2018, p.87)

(1.13) NIGHT $_{\text{a}}\text{IX}_{\text{b}}$ HANG-OUT SERBEST

'He can hang out till midnight.'

(deontic, Karabüklü et al., 2018, p.88)

(1.14) KADIR MAGIC OLUMLU/YAP

'Kadir can perform magic.'

(ability, Karabüklü et al., 2018, p.88)

(1.15) MEDICINE DRINK MECBUR

'I have to take medicine.'

(deontic, Yildirim, 2015)

(1.16) YES SAFETY^BELT WEAR GEREK

'Yes, everyone has to wear a safety belt.'

(deontic, Gökgöz, 2009)

As seen in sentences above, modal signs can appear with nonmanual markers, but nonmanual markers are not obligatory. Then, the question is what is their function in modal sentences. Non-occurrence eliminates one of the possible answers, which is that they are part of the lexical modal signs. In Chapter 2, I will also show that nonmanual markers do not correspond to the semantic parts of modals as force, base, or ordering source. The last

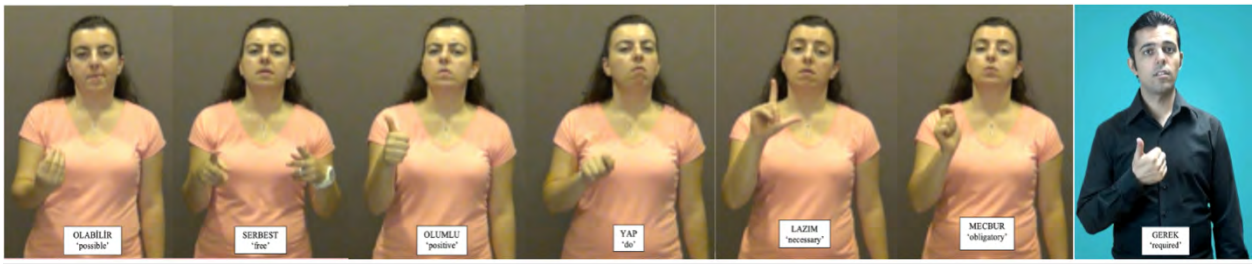

Figure 1.1. Manual modal signs in TİD: OLABILIR 'possible', SERBEST 'free', OLUMLU 'positive', YAP 'do', LAZIM 'necessary', MECBUR 'obligatory', and GEREK 'required', respectively.

option is that they have their own semantics as distinct morphemes which will be further analyzed in Chapter 6.

As for the dual nature of modals possibly having different modal bases, only LAZIM is reported to appear in both non-epistemic (1.12) and epistemic interpretations (1.17) (Karabüklü et al., 2018, Özkul, 2019). Yet, it does not appear in just any epistemic context (1.18)[2] and requires the signer to have previous information about the situation or the subject (1.17) (Karabüklü et al., 2018). This requirement of strong inference will be further investigated in Chapter 5.

(1.17) Context: You want to see Sumru and you know that it is her office hour. She should be in her office during the office hour. You say:

SUMRU ROOM NON-EXISTENTIAL, IX$_3$ TIME ROOM $\overline{\text{OL LAZIM}_{deontic}}^{\text{eo}}$ PALM-UP, SECRETARY $\overline{\text{WORK ROOM GO OL LAZIM}_{epistemic}}^{\text{sq}}$

'Sumru is not in her office, she should be in her office at this time, she must have gone to the secretary's office.'

(epistemic, Karabüklü et al., 2018)

(1.18) Context: When you go home, you see that light is on and you're guessing:

LIGHT-ON EXISTENTIAL, MOM HOME EXISTENTIAL ?LAZIM/OLABILIR

[2]↑I will use ? notation to show infelicitous or unacceptable sentences in contexts to separate it from ungrammaticality * since # notation is used to show fingerspelling in sign language glossing. I will follow the original notation for the cited examples.

'The light is on, mom must be at home.'

(epistemic, Karabüklü et al., 2018)

Studies have not reported modal force for these signs and usually reported one modal flavor for them. Yet, naturalistic data show that LAZIM and MECBUR can have non-deontic interpretations where the subject is not obliged to anything via the rules or regulations. As seen in (1.19), the signer uses MECBUR to express his own love of motorbikes where nobody forces him to ride a motorbike. Similarly, LAZIM is used to express the signer's own desire to find a job in (1.20). Thus, both signs seem to have other modal flavors like teleological or bouletic, which will be further addressed in Chapter 4.

(1.19) MOTORBIKE LEAVE IMPOSSIBE $\overline{\text{MECBUR}}^{\text{bf,hn}}$ RIDE++

'I can't stop riding the motorbike. I must ride a bike. [I can't help riding a motorbike.]

(bouletic, Makaroglu and Dikyuva, 2017)

(1.20) IX_1 JOB EMPTY-NO $\overline{\text{JOB ENTER LAZIM}}^{\text{bf, nw}}$

'I don't have a job; I should find a job.'

(teleological, Makaroglu and Dikyuva, 2017)

Patterns of modal signs in TİD that have been reported in the literature raise the following questions that will be the backbone of the discussions in this dissertation:

1. What are the modal force of modal signs?
2. Other than deontic, which other modal flavors do LAZIM, MECBUR, and GEREK have?
3. What kind of evidential restriction do OLABILIR and LAZIM require in epistemic contexts?
4. What are the functions of squint and head movements (nods and tilts)?

1.3 Roadmap

I will address these questions in four studies: the Mutually Exclusive Propositions Study for modal force, the Modal Flavors Study for the flavors of LAZIM, MECBUR, and GEREK,

the Evidential Restriction Study for the acceptabilities of OLABILIR and LAZIM in epistemic contexts, and the Nonmanual Markers Rating Study for their functions.

In Chapter 2, I will present the background on the semantic analysis of modal notions in terms of the quantificational framework. Then, I will present crosslinguistic patterns of modals in sign languages based on which semantic part is lexicalized. I will follow with the crosslinguistic patterns of modals in sign languages and what they bring into the typological picture. I will show that nonmanual markers are neither lexical nor structural parts of modal signs by reporting the findings in the literature.

I will present the overall methodological framework in all studies in Chapter 3 while leaving the details of each study in its relevant chapter. I will present the studies on modal force of modal signs and modal flavors of LAZIM, MECBUR, and GEREK in Chapter 4. Based on the results, I will analyze SERBEST, OLABILIR, and ACABA as having existential force while LAZIM and MECBUR have universal force. As for modal flavor, LAZIM and MECBUR are analyzed as having different ordering sources based on the contexts that they appear in.

I will continue the analysis of manual signs with the evidential restriction study in Chapter 5. I will briefly present the notion of evidentiality and theoretical perspectives on its analysis, but leave the extended literature and discussions to the reader to enjoy in her free time. I will analyze LAZIM as being compatible with both epistemic and non-epistemic modal bases while it is lexically specified for the strong inference in the conversational background following Matthewson's (2015) analysis. Other epistemic signs do not require any evidentiality in the epistemic contexts to be acceptable in pure possibility contexts, yet they are lexically specified for only epistemic modal base.

In Chapter 6, I will show that squint and head movements affect the certainty levels by interacting with sentence types. I will analyze them by building on the information structure and layers of assertion. Again, the literatures on both information structure and speech act will be briefly introduced by leaving the amusements of the extended literatures to the reader's free time. I will show that head nod belongs to the information structure domain based on its patterns in focus structure. Thus, the higher certainty effect is due to the interaction of information structure with modal sentences. As for squint, I will analyze it as an uncertainty marker that can be anchored to the signer, the subject, and the addressee

by following Krifka's (2021) analysis. I will present the implications of findings on modal typology in spoken and sign language, and the role of nonmanual markers in Chapter 7.

2. REALIZATIONS OF MODAL NOTIONS

Modal notions are analyzed in different theoretical frameworks as quantifiers (Hacquard, 2006), free choice items (Rullmann et al., 2008), or degrees (Lassiter, 2017). To understand the patterns of modals in TİD, I will analyze them in the quantificational framework. Spoken languages have been reported to show different patterns in the realization of modals. First, I present the modal semantics and typology based on spoken languages. Then, I show how modal notions are realized in sign languages where simultaneous nature intervenes. That is, both manual signs and nonmanual markers are used in the realization of modals, which is distinct from the modal concord in spoken languages (Anand & Brasoveanu, 2010).

2.1 Modal Notions

When we talk about non-actual events or situations, we express the possibility or necessity of that event occurring in terms of logic, that is 'modal force'. Yet, natural language modals do differ on another dimension rather than only possibility or necessity. We can express these possibilities and necessities based on information or evidence available to us on a proposition as in (2.1). *Epistemic* modality is where the speaker expresses the possibility of John's being home, based on what she knows or infers. Epistemics are tied to the speaker's knowledge worlds and also closely tied to the available evidence to the speaker, which will be discussed in detail in Chapter 5.

(2.1) *Epistemic:* (In view of the available evidence, or what the speaker knows or infers,) John *must/might/may* be home.

While epistemics are about the speaker's knowledge world, *deontic* modality expresses what the subject is required to do under given rules, regulations, or laws. As in (2.2), it expresses the permissions and obligations that Mary should follow. Similar to deontic, *ability* modality is also tied to the subject but in terms of abilities, capabilities, and given circumstances for an event to occur in a given possible world. As in (2.3), swimming 100 in under a minute depends on Jane's physical capacity.

(2.2) *Deontic:* (In view of city regulations or rules,) Mary *may* park here, but she *must* leave in two hours.

(2.3) *Ability:* (In view of her physical abilities,) Jane *can* swim 100 in under a minute.

At a glance, *teleological* and *bouletic* modality seem to be deontic, but teleological and bouletic express the possibilities and necessities given goals and desires of the subject, respectively. More clearly, it is not a rule to get a PhD (2.4) or go on a vacation early (2.5) in the first place. These are the subjects' own goal (getting a PhD) and desire (going on a vacation early). Writing a dissertation or finishing all the work is a requirement to achieve this desire or goal.

(2.4) *Teleological:* (In view of her goal to get a PhD,) Serpil *must* write her dissertation.

(2.5) *Bouletic:* (In view of his desire to go on a vacation early,) Josh *should* finish all the work.

In terms of theoretical accounts to capture various interpretations of modals, distinct analyses have been proposed: quantifiers (Kratzer, 1977), degrees (Lassiter, 2017), quantifiers with anchors (Hacquard, 2006; **kratzer2020**), free choice items (Rullmann et al., 2008), among others. Some of these analyses resulted from the distinct typological behaviour of modal notions due to the distinct lexicalization of different semantic parts as modal force and flavor. I will follow the analysis that treats modal notions as quantifiers to capture the typological behaviour of TİD modals.

2.1.1 Semantic Components of Modals

When modal notions are treated as quantifiers quantifying over possible worlds that are projected by the conversational background, modal semantics consist of three main parts: (i) modal force (quantificational force), (ii) accessibility relation yielding modal base (first conversational background), and (iii) ordering source yielding further restrictions over modal base (second conversational background). Modal force affects whether a modal expression

should hold in all possible worlds (universal quantification) or in some possible worlds (existential quantification). To exemplify, the proposition 'He might be home' in (2.6) is true when it holds in some (at least one) possible worlds whereas the proposition 'He must be home' in (2.7) needs to be true in all possible worlds. Existential and universal modal forces yield different results with mutually exclusive propositions (Vander Klok, 2013). As in (2.8), *might* is acceptable when it scopes over the proposition 'He is home' and the proposition 'He is not home'. This is because John is home in some projected possible worlds; he is in a supermarket in some possible world; in a gym in others. Since *might* has an existential force, it does not yield a contradiction when it scopes over these exemplified possible worlds. In contrast, *must* yields contradiction when it scopes over these possible worlds. Since it has a universal force, it requires the proposition 'He is home' to hold in all possible worlds.

(2.6) (John is not in his office.) He might be home. *epistemic*
In some worlds w compatible with what is known in w (e.g. the fact that he is not in his office), John is home in w.

(2.7) (John is not in his office.) He must be home. *epistemic*
In all worlds w compatible with what is known in w (e.g. the fact that he is not in his office), John is home in w.

(2.8) (John is not in his office.) He might be home; he might not be home. *existential*

(2.9) (John is not in his office.) *He must be home; he must not be home. *universal*

Another difference between *must* and *might* is that *might* has only epistemic interpretation (2.6) while *must* has multiple interpretations: epistemic (2.10), deontic (2.11) or teleological (2.12) (called modal flavor). The flavors of *must* are theoretically accounted for via the semantic functions of accessibility relations (modal base) and ordering source. A general distinction among flavors is the epistemic (2.10) vs. non-epistemic ones (2.11-2.12) due to the modals' quantificational interactions and syntactic distinctions (Kratzer, 1977; Hacquard, 2006).

(2.10) (John is not in his office.) He must be home. *epistemic*

In all worlds w compatible with what is known in w (e.g. the fact that he is not in his office), John is home in w.

(2.11) (John parked illegally.) He must pay a fine. *deontic*

In all most ideal worlds w, given the law in w, among those compatible with the circumstances in w (e.g. the fact that he parked illegally), John pays a fine in w.

(2.12) (John wants to get a PhD.) He must write a dissertation. *teleological/goal-oriented*

In all most ideal worlds w in which John gets a PhD, among those compatible with the circumstances in w, John writes a thesis in w.

This difference is modelled via modal bases. The epistemic modal base (2.6-2.10) is an accessibility relation picking up possible worlds that are compatible with the speaker's information status. On the other hand, non-epistemic ones (2.11-2.12) have a circumstantial modal base that is an accessibility relation picking up the possible worlds that are compatible with the circumstances, regulations, rules, or the subject's aims or goals.

Modal bases can capture the distinctions between epistemic and non-epistemic flavors, yet they cannot capture the different flavors in (2.11) and (2.12) because both modal bases are circumstantial in Kratzer's (1977) model. To capture this difference, she uses 'ordering source' induced on the possible worlds that the accessibility relation picks out. The ordering source in (2.11) is rules or regulation in that specific area while in (2.12) it is the subject's aims or goals. Different than Kratzer's model, this difference and the interaction of modals with events are modelled based on three different accessibility relations, epistemic, deontic, and circumstantial in Hacquard (2006), see the reference for further discussion.

As a summary, modal semantics is built on these three parts in terms of quantificational analysis: modal base, accessibility relation, and ordering source. As seen in examples (2.6-2.12), modal force is lexicalized in modal expressions in English whereas modal flavor is derived from the conversational background. Even though most studied languages show patterns like English modals where modal force is lexicalized and modal flavor is derived from context, recent studies also showed that modals crosslinguistically lexicalize different seman-

tic parts in a modal expression. The following section will present the attested typology in modals in spoken languages.

2.2 Modal Typology: Which Semantic Part Lexicalized

2.2.1 Varying Modal Force

Most European languages have modal force not changing across the context but modal flavor changing with different conversational backgrounds. Yet, it is not uncommon to have modal expressions that have both lexicalized force and flavor like *might* in English (2.6). Unlike *must*, it is not possible to have *might* in different contexts and derive different flavors. Semantics of *might* can still be captured a la Kratzerian model. The challenge comes with data from St'amt'icets (Salishan) (Rullmann et al., 2008). The epistemic morpheme *k'a* in St'amt'icets is always interpreted as epistemic but it can have either a universal force (2.13) or an existential force (2.14). Similar pattern also exists in deontic modal morpheme *ka* as seen in (2.15-2.16).

(2.13) Context: You have a headache that won't go away, so you go to the doctor. All the tests show negative. There's nothing wrong, so it must be tension.

nilh	***k'a***	*lh(el)-(t)-en-s-wá(7)-(a)*	*ptinus-em-sút*
FOC	**INFER**	PREP-DET-1SG.POSS-NOM-IMPF-DET	think-INTR-OOC

'It **must** be from my worrying.'

Epistemic Universal - St'amt'icets

(2.14) Context: Maybe that's why he's not here.

wa7	***k'a***	*séna7*	*qwenúxw*
IMPF	**INFER**	COUNTER	sick

'He **may** be sick.'

Epistemic Existential - St'amt'icets

(2.15) *qwatsáts-kacw* ***ka***
leave-2SG.SUBJ **DEON**
'(Maybe) you should leave.'

Deontic Existential - St'amt'icets

(2.16) *lán-lhkacw* ***ka*** *áts'x-en* *ti* *kwtámst-sw-a*
already-2SG.SUBJ **DEON** see-DIR DET husband-2G.POSS-DET
'You must/can/may see your husband now.'

Deontic Universal - St'amt'icets

Unlike English modals, St'amt'icets modals' behavior cannot be captured with a Kratzerian model where the modal force is lexicalized and modal flavor is derived from the conversational background. In contrast, St'amt'icets modals have the mirror image of English modals by lexicalizing the modal flavor and varying modal force. Varying modal force is analyzed in the same way as the distributive indefinites by proposing that universal interpretation is the default and it is weakened to the existential reading by the implicit domain restriction on quantifiers (Rullmann et al., 2008). Other studies also reported modals with variable force as in Nez Perce (Deal, 2011), Gitksan (Matthewson, 2013; Peterson, 2010), and Old and Middle English (Yanovich, 2013). Unlike Rullmann et al. (2008), other authors argued that these modals are possibility modals (existential) that can be strengthened to derive necessity readings (universal).

Rullmann et al. (2008) also discussed the crosslingustic implications for modals by suggesting that English and St'amt'icets modals differ along two complementary dimensions force and flavor. As seen in Table 2.1, they categorize English under specified force and unselective modal base, and St'amt'icets under selective modal base and unspecified force. They leave the other two combinations with '?' due to the unknown typological behaviours in understudied languages. They propose that if a language has the combination of selective modal base and specified force, it would have 'overspecified' modals lexically encoding both the force and base. The mirrored version of this proposed language would be the one where neither force nor base is specified and yields 'underspecification'.

Table 2.1. Proposed modal force and base correlations in Rullmann et al. (2008)

	selective modal base	unselective modal base
specified force	?	English
unspecified force	St'amt'icets	?

2.2.2 Varying Modal Force and Flavor

Later studies showed there are both languages with underspecified modals as in Washo (Bochnak, 2015) and overspecified ones as in Paciran Javanese (Vander Klok, 2013). First, Bochnak (2015) shows a morpheme *-eʔ* is acceptable in both epistemic (2.17-2.18) and deontic contexts (2.19-2.20). Furthermore, the same morpheme *-eʔ* also has varying modal force as interpreted as universal in (2.17-2.19) and existential in (2.18-2.20).

(2.17) Context: You're planning to drive over the mountains. It has started to snow, and you know that whenever it snows, the road over the mountain is closed.

déʔesʰ-ʔáŋaw-i-esʰ *yéwesʰ* *gum-beyéc'ig-i-gi* ***k'-éʔ-i***
snow-good-IND-SR road REFL-close-IND-REL 3-MOD-IND
'It's snowing a lot, so the road must be closed.'

Epistemic Necessity - Washo

(2.18) Context: You hear a knock at the door. You can't see through the window who it is, and you're not expecting anyone, but you can make out that the person looks about the same height as Beverly.

bévali *k'éʔ-hel-i-gi* ***k'-éʔ-i***
Beverly 3-be-SUBJ-IND-REL 3-MOD-IND
'It might be Beverly.'

Epistemic Possibility - Washo

(2.19) Context: A friend comes to visit, and brings her dog along. You don't want the dog to come inside.

súku *baŋáya* *ʔ-éʔ-i-s̄-gi* ***k'-éʔ-i***
dog outside 3-be-IND-SR-REL 3-MOD-IND
'The dog has to stay outside.'

Deontic Necessity - Washo

(2.20) Context: Mary's friends come over to ask her to come play. She isn't allowed, because she hasn't finished all her chores. Later, her friends return.

wádiŋ *hé:s̄* *ʔum-p'áyt'ɨ̃ʔ-gis̄-uweʔi* ***k'-éʔ-i***
now Q 2-play-along-hence 3-MOD-IND
'Now are you allowed to come play?'

Deontic Possibility - Washo

Following Rullmann et al. (2008), Bochnak (2015) also analyzes the morpheme *-eʔ* as universal that is weakened to have existential interpretation by showing that possibility reading is no longer compatible in downward entailing environments. One example for downward entailing environment is conditionals where the proposition needs to hold in all possible worlds. The morpheme *-eʔ* is obligatory in conditionals as seen in (2.21).

(2.21) Context: We're wondering whether Steven will come to the party. You hope he comes.

ʔ-íbiʔ-i-s̄ *ʔáŋaw-i-s̄-gi* ***k'-éʔ-i***
3-come-IND-SR good-IND-SR-REL 3-MOD-IND
'If he comes, that would be good.'

Modal flavor in Washo is analyzed similar to English modals where flavor is derived through accessibility relations in conversational background. Modal force and flavor are taken to be presupposed by the context in the case of Washo modals. If we update the proposed pattern (Table 2.1) by Rullmann et al. (2008), modal in Washo will fill in the fourth cell with varying modal force and flavor as in Table 2.2. Furthermore, data from Paciran Javanese will show that full pattern holds for spoken languages (Vander Klok, 2013).

Table 2.2. Updated correlations proposed by Rullmann et al. (2008)

	selective modal base	unselective modal base
specified force	?	English
unspecified force	St'amt'icets	Washo

2.2.3 Specified Modal Force and Flavor

Paciran Javanese modals depict all typological patterns in one language system, that is, it has modals *mesthi* 'epistemic necessity', *oleh* 'deontic possibility', and *iso* 'circumstantial possibility' with specified modal force and flavor, a modal *kudu* 'root necessity' with specified force but varying flavor, and a modal *paleng* 'epistemic' with specified flavor but varying force (Vander Klok, 2013). Modal force was tested with the mutually exclusive propositions as in (2.22) and (2.23). That is, two opposing possibilities are conveyed by propositions 'Maybe she's taking a nap' and 'Maybe she's not taking a nap'. While negation is used to yield mutually exclusive propositions in (2.22), similar effect could be created by using opposing events like 'sleep over' or 'go home' in (2.23). *Mesthi* is unacceptable in this situation (2.23) because its universal force yields a contradiction.

(2.22) Context: Bu Zum is not at home, I think.

> ***Paleng*** *bu Zum lagek turu awan,* ***paleng*** *bu Zum gak lagek turu awan.*
> EPIST Mrs. Zum PROG sleep noon, EPIST Mrs. Zum NEG PROG sleep noon
> 'Maybe Bu Zum is taking a nap; maybe she's not taking a nap.'

(2.23) Context: You know that Titin is at Devi's house. You say:

> **Mesthi* *Titin ape nginep utowo* ***mesthi*** *Titin ape muleh.*
> EPIST.NEC Titin FUT Av.stay.over or EPIST.NEC Titin FUT go.home
> 'Certainly Titin will sleep over or certainly Titin will go home.'

In contrast to *mesthi, paleng* is acceptable with two contradictory propositions as in (2.22). Before concluding that *paleng* has existential force, we should also consider its behaviour in (2.25). Given context clearly requires an epistemic necessity interpretation by

eliminating other possibility in the conversational background. Since *paleng* is acceptable with mutually exclusive propositions and in the epistemic necessity context, it, similarly to St'amt'icets modals, has varying force that is specified through the context.

(2.24) Context: 'Jono and Siti can't be hiding in the box.' says the policeman. 'It's too small, and they can't be hiding under the bed. It's too low...'

mesthi	*nek*	*ngguri-ne*	*selambu.*
EPIST.NEC	at	behind-DEF	curtain

'...[they] must be behind the curtain.'

(2.25) Context: 'Jono and Siti can't be hiding in the box.' says the policeman. 'It's too small, and they can't be hiding under the bed. It's too low...'

trus	*oooh*	***paleng***	*nek*	*ngguri-ne*	*selambu.*
then	oooh	EPIST	at	behind-DEF	curtain

'...then...oooh, [they] might be behind the curtain.'

Vander Klok (2013) also tests *paleng* in a downward entailing environment where only the possibility reading is available (2.26). Based on its behaviour with universal quantifier and conditionals, she analyzes *paleng* as having existential as default and the universal is derived by strengthening the modal force via restricted quantification domain. She analyzes *mesthi* as lexically specified for both the modal force and modal flavor, like *might* in English.

(2.26)

Nek	*dokter-e*	***paleng***	*ape*	*mrene,*	*dewe'e*	*ape*	*mrekso*	*Tata.*
if	doctor-DEF	EPIST	FUT	AV.come	3SG	FUT	AV.examine	Tata

'If the doctor will possibly come over, he will examine Tata. /(*If the doctor must come over [in the future], he will examine Tata.)'

Paciran Javanese also has a modal that has different flavors but specific modal base. *Kudu* is acceptable in deontic (2.27), circumstantial (2.28), and teleological contexts (2.29). At a glance, it looks similar to English modals with varying flavor, yet it is not acceptable in epistemic context (2.30). In the Kratzerian model, modal base is the one distinguishing epistemic and non-epistemic flavors. Some English modals can have both epistemic modal

base and circumstantial modal base whereas based on data, *kudu* has only circumstantial modal base. Then, the different flavors, deontic, circumstantial, and teleological, are derived through different ordering sources. This is why Vander Klok (2013) keeps modal base and flavor lexically specified for *kudu*, but derives the ordering source through the conversational background.

(2.27) Deontic Context: Her mother says she can't go out to play until she has done her three chores. ... At 2 p.m. her friends come over again and ask if she can come out to play. Mary says:

Aku	*gak*	*iso*	*aku*	*sek*	***kudu***	*nyapu*	*nyapu*	*sek*
1SG	NEG	CIRC.POSS	1SG	still	ROOT.NEC	AV.sweep	AV.sweep	still

suwi.
long
'I can't...I still have to sweep for a while.'

(2.28) Circumstantial Context: Normally at ngaji [Holy Qu'ran reading], it is a time to be serious. But then bu Yeni fell asleep with her mouth wide open.

Bu	*Siti*	***kudu***	*ngguyu.*
Mrs.	Siti	ROOT.NEC	Av.laugh

'Mrs. Siti had to laugh.'

(2.29) Teleological Context: After isya' (fifth prayer), there are no public cars or horse carriages available. The only way is to travel by rickshaw, if you are luck to find one.

Nek	*gelem*	*muleh*	*mari*	*isya',*	*sampeyan*	***kudu***	*numpak*
if	agree	AV.go.home	AV.finish	isya'	2SG	ROOT.NEC	AV.ride

becak.
rickshaw
'If you want to go home after isya' (fifth prayer), you have to travel by rickshaw.'

(2.30) Epistemic Context: You have a headache that won't go away, so you go to the doctor. You were examined but no sickness whatsoever is revealed. So...

Iku ***mesthi/*kudu*** *kake-an* *piker-an.*
DEM EPIST.NEC/ROOT.NEC KE-many-AN think-AN
'It must be from stress. (lit. too much thinking.)'

As seen through modals in Paciran Javanese, a language can encode all typological variety proposed by Rullmann et al. (2008) in its modal system. In fact, similar argumentation can hold for English modals where *might* has specified force and flavor; others like *can* or *must* have specified force but varying flavor. If we update Table 2.2, I would put Paciran Javanese in specified modal force and flavor cell as in Table 2.3 to show that it is possible to find all patterns crosslinguistically. With current findings, if we take Rullmann et al. (2008)'s question a step further, it would be if there is any single language which has four way distinction in its system. To our knowledge, Paciran Javanese is the closest one with three-way distinction.

Table 2.3. Reupdated correlations proposed by Rullmann et al. (2008)

	selective modal base	unselective modal base
specified force	Paciran Javanese	English
unspecified force	St'amt'icets	Washo

The sections so far presented the modal typology in spoken languages and the rest of this chapter will present how modal notions are realized in sign languages where the role of nonmanual markers will be crucial due to the simultaneous nature. I will also show that sign languages divide the labor between manual signs and nonmanual markers differently in terms of modals. It is crucial to know which part of modal semantics is packed in manual signs and nonmanual markers to propose a complete typological picture.

2.3 Modals in Sign Languages

In the sign language literature, attitude verbs like THINK, KNOW, GUESS, or DOUBT are also reported as epistemic modals. Even though attitude verbs can convey the signer's (speaker's) commitment to the proposition like epistemic modals, they are used in that sense when they only have the first person pronoun as their subject. In essence, attitude verbs are the reports of the subject's attitudes to the embedded proposition. As in (2.31), Mary's

being a thief is John's attitude and as a speaker I only report that attitude, but do not necessarily hold it. In contrast, in (2.32), as a speaker, I infer or assign a possibility for John to be home even though the subject is the third person with epistemic *might*. This is why I only review the epistemic modals as *may, might, possible,* or *certain* that are reported in the literature in this section.

(2.31) John thinks that Mary is the thief.

(2.32) John might be home.

Before reviewing the findings in the literature, I will present Bross and Hole's (2017) bodily mapping hypothesis within modals (Section 2.3.1) since their hypothesis will make understanding the typological patterns and their interactions in sign languages easier. When modal notions are investigated in sign languages, two patterns with modals having duality for a couple of modal signs (Section 2.3.2) and non-duality (Section 2.3.3) appear in sign languages. Additionally, we also get another distinction in sign languages based on whether epistemic modals are expressed via only nonmanual markers (Section 2.3.4) or via both nonmanual markers and manual signs (Section 2.3.4).

2.3.1 Bodily Mapping Hypothesis

Based on hierarchical categories in DGS, Bross and Hole (2017) proposed the Bodily Mapping Hypothesis and the recent publication of Bross (2020) presented its updated version, which I will be referencing here. The hypothesis is that Cinque's cartography is reflected by articulators and scopal relations in sign languages. In other words, if a category has a wider scope, it will be realized by an articulator which is higher or at least at the same height with the lower scope. The scopal order will be reflected on the realization of articulators for these categories in terms of height (2.3.1a). Secondly, based on language's features, categories below TP are more likely to use left-to-right concatenation. More clearly, an operator appearing on the left will take scope over an operator on the right. In similar respect, lower categories are more likely to use right-to-left concatenation. In other words, an operator on the right will take scope over an operator on the left (2.3.1b). The third

component is another crucial point that I will revisit in the discussion of nonmanual markers. If a clausal category is above TP level, its core marker is more likely to appear as a nonmanual marker. It can also have a manual sign together but nonmanual markers will contribute to the not-at-issue content while manual signs will contribute to the at-issue content (2.3.1c). The last component of the hypothesis is that categories below the VoiceP level are expressed by manipulating the movement path of the verb sign, such as inflections due to habituality or distributivity.

(2.33) **Bodily Mapping Hypothesis (Bross, 2020, p275):**

a. Clausal categories with higher scope expressed by articulators which are higher than, or at least have the same height as, categories with lower scope.

b. Categories below tense are expressed by manual concatenation - starting with a left-to-right concatenation strategy and finally switching to concatenation from right to left.

c. The split between categories above tense being expressed nonmanually and categories expressed below tense being produced by manual signs is a general split between not-at-issue and at-issue meanings.

d. The VoiceP-internal modulation hypothesis: categories below the VoiceP level are expressed by manipulating the movement path of the verb sign.

Their hypothesis is based on the whole clausal spine of the Cinque hierarchy, yet modals also provide a good environment to observe and test these hypotheses. This is because epistemic modals are CP level operators in their highest category and the prediction is that epistemic modals can be expressed via nonmanual markers either alone or together with manual signs. Deontic modals sitting at TP-level are in an intermediate category. If the language allows phrasal heads to appear on either right or left, or participate in movement, deontic modals can show left-to-right concatenation strategy. Lastly, root modals are in the lower category and they can show right-to-left concatenation strategy. In the following subsections, we will see that sign languages indeed use some of these strategies alone or together to disambiguate modal flavors even if they have modal base duality.

2.3.2 Sign languages that have modal base duality

Some sign languages have been reported to have modals whose flavors are unspecified, like English. Though, when the syntax and co-occurring nonmanual markers are compared for different flavors, some languages have different syntactic position mappings for flavors or use distinct nonmanual markers to distinguish the flavors. While contextual background is crucial in modal flavors in spoken languages, sign languages benefit from further tools in disambiguation.

When modal signs were studied in American Sign Language (ASL) SHOULD/MUST [1] was reported to be interpreted as deontic (2.34) and epistemic (2.35) (Shaffer & Janzen, 2016). Similarly, CAN/POSSIBLE is also used as a deontic modal where the subjects are permitted to sign (2.36) or an ability modal (2.37). CAN/POSSIBLE is also used as an epistemic modal as in (2.38).

Participants in Shaffer and Janzen's (2016) study commented that SHOULD in (2.35) would be acceptable in preverbal position with deontic reading and it would not have these nonmanual markers in that case. The same nonmanual markers (head nod - hn and brow frown - bf) in (2.35) also appeared when CAN/POSSIBLE is used as epistemic in (2.38), but not with deontic (2.34, 2.36, and 2.39) or root modals (2.37) no matter their syntactic position.

(2.34) IX_2 SHOULD WRITE ORDER $[\text{WRITE}]_{\text{TOP}}$ 'IX_1 WANT PLEASE PUT-DOWN M-E-D MEDIUM CHILE'

'You should write down your order. Write 'I want medium (hot) chile please..."

(ASL deontic, Shaffer and Janzen, 2016, p.8)

(2.35) $[\text{LIBRARY HAVE DEAF LIFE}]_{\text{TOP}}$ $\overset{\text{hn, bf}}{\overline{\text{SHOULD}}}$

'The library should have Deaf Life (magazine)/I think the library has Deaf Life.'

(ASL epistemic, Shaffer and Janzen, 2016, p.10)

[1]↑Authors noted that CAN and POSSIBLE, and MUST and SHOULD are the same signs but they differ in terms of repetition of the internal movement. I will follow their convention while glossing these examples.

(2.36) POSS$_1$ MOTHER TIME TEACH, TEACH CAN SIGN BUT ALWAYS FINGERSPELL

'In my mother's time teaching, the teachers were permitted to sign, but they always fingerspelled.'

(ASL deontic-permission, Shaffer and Janzen, 2016, p.456)

(2.37) [CAN LIP-READ #R-E-A-D-L-I-P-S EMPHASIZE LIP READ]$_{\text{TOP}}$ LATER CAN PICK-UP SPEAK, SOUND

'If you could read lips, which they (the school) emphasized, then you could learn to talk.'

(ASL ability, Shaffer and Janzen, 2016, p.456)

(2.38) [SAME SIGN BECAUSE BAD TRANSLATE, FALSE C-O-G-N-A-T-E]$_{\text{TOP}}$ $\overset{\text{hs, bf}}{\overline{\text{DOUBT}}}$ $\overset{\text{hn}}{\overline{\text{POSSIBLE}}}$

'I doubt that the two concepts share the same sign (now) because of a problem with translation, or because of a false cognate, but, well, I suppose it could be true.'

(ASL, Shaffer and Janzen, 2016, p. 457)

At first glance, there seems to be a correlation between the modal flavor and syntactic position. Epistemic flavors (2.35-2.38) are in the sentence final position while deontic (2.34-2.36) and root (2.37) modals appear in pre-verbal position. Yet, deontic SHOULD is also reported to appear in sentence final position as in (2.39) (Shaffer, 2004). The different syntactic positions are explained based on if the signer presents his perspective on the embedded p (Shaffer, 2004; Shaffer and Janzen, 2016). The authors explained the pre-verbal modals as being agent-oriented and sentence-final ones carrying the signer's perspectives. To illustrate, spending money more on people is signer's advice or perspective in (2.39) rather than being a rule or a regulation. Since epistemic modals are tied to the speaker, it is expected for them to appear sentence finally based on this prediction. If these cases hold for non-topicalized sentences, the pattern in ASL needs to be further tested in terms of syntactic and scope ordering.

(2.39) $\overset{\text{rt}}{\overline{\text{IGNORE}}}$ FOCUS D-E-F-E-N-S-E DEFENSE BIG LIMIT LIMIT $\overset{\text{rt}}{\overline{\text{MORE SPEND}}}$ IX-PL$_1$ PEOPLE SHOULD

'We ignore them. We spend our time and money focused on defense. We should spend more on the (poor) people.'

(ASL, Shaffer, 2004, p.187)

Similar to ASL, Spanish Sign Language (LSE) also has a modal sign CAN that has root flavor (2.40) or epistemic flavor (2.41). Different than ASL, LSE seems to have modal signs always at the post-verbal position and does not syntactically distinguish the flavors. The authors also did not mention any specific nonmanual markers for different flavors, so LSE seems to pattern like English where different flavors come from the conversational background.

(2.40) BROTHER MINE TELEVISION REPAIR CAN

'My brother can repair the television.'

(LSE, Herrero-Blanco and Salazar-Garcia, 2010, p.24)

(2.41) TOMORROW RAIN CAN

'It is possible/probable that it will rain tomorrow. / It may rain tomorrow.'

(LSE, Herrero-Blanco and Salazar-Garcia, 2010, p.31)

Palestinian Sign Language (PSL) is also reported to have MUST as a deontic (2.42-2.44) or an epistemic modal (2.43). Different than ASL and LSE, PSL has an additional restriction on the epistemic usage and the authors explained that the epistemic context in which it was found acceptable requires the knowledge of the signer about the situation (party) and the subject (Ahmad). The signer knows that Ahmad is a close friend of the groom and based on this knowledge, almost certainly infers that he must be at the wedding. In this regard, MUST in PSL seems to require an evidential restriction in its epistemic usage in a similar fashion to *must* in English requiring evidential restriction in epistemic contexts to be acceptable (von Fintel and Gillies, 2010; Matthewson, 2015).

(2.42) YOU MUST STUDY GOOD

'You must study hard.'

(PSL, Abdel-Fattah and Alawnah, 2020, p. 11)

(2.43) AHMAD MUST EXISTING

'Ahmad must be there.'

(PSL, Abdel-Fattah and Alawnah, 2020, p. 13)

The authors also highlighted that epistemic MUST has raised eyebrows and spread lips while deontic MUST has narrow eyebrow frown and rounded and firm lips. Thus, different flavors are derived not only by the contexts in which the sign appears, but also by the nonmanual markers accompanying the signs. Similarly, LAZIM (necessary) in TİD is distinguished by nonmanual markers and requires strong inference in the contextual background for its epistemic reading (Karabüklü et al., 2018) which is further investigated in Chapters 5 and 6.

Even though the authors did not present the linguistic tests for different positions, PSL, similar to ASL, seems to be able to have modal signs in different positions, as pre-verbal in (2.42-2.43) or clause-initial (2.44). Sentence (2.44) is presented as dynamic necessity where the authority is external and not the speaker. In this respect, PSL also seems to distinguish the signer's (speaker) standpoint from the external sources, yet this mapping looks like the mirror image of ASL where signer-oriented modals appear in clause final position.

(2.44) MUST YOU WASH HAND BEFORE AFTER FOOD BECAUSE DISEASE

'You should wash your hands before and after the meals to avoid catching the virus.'

(PSL, Abdel-Fattah and Alawnah, 2020, p. 14)

Taiwan Sign Language (TSL) is another one patterning with the rest by having MUST as deontic (2.45) and epistemic modal (2.46) (Lin & Chang, 2011). Epistemic usages of MUST can also co-occur with other modals like UNABLE where epistemic scopes over the ability modal. This shows that TSL also reflects the scope order in its syntax, yet it, unlike ASL or PSL, does not change the syntactic position of the modal. The authors highlighted that epistemic meaning can be conveyed via only nonmanual markers without the epistemic sign as seen in Figure 2.2. Similar to ASL, the signer can use different nonmanual markers to convey their certainty on the proposition as in Figure 2.2 and 2.3. I will discuss in more detail which role the nonmanual markers carry in different sign languages in Section 2.3.4.

(2.45) NIGHT DRIVE MUST LIGHT

'Driving in the night, you must turn on the light.'

(TSL, Lin and Chang, 2011, p.252)

(2.46) HE DRIVE MUST UNABLE

'I am sure he is unable to drive.'

(TSL, Lin and Chang, 2011, p.252)

Even though the authors did not provide the examples for a clear comparison, Netherland Sign Language (NGT) and Brazilian Sign Language (Libras) are also reported to have modals MUST in NGT and CAN in Libras that have both deontic and epistemic flavors (Klomp, 2021, Ferreira Brito, 1990).

In terms of the modal typology of Rullmann et al. (2008), some sign languages seem to pattern with English by having modals with varying flavors of epistemic, deontic, or root. In this regard, these languages could be classified in the cell where unselective modal base and specified force intersects in Table 2.3. Yet, as shown in this section, sign languages differ from spoken languages by disambiguating flavors by assigning different syntactic positions like ASL or PSL, and using distinct nonmanual markers like PSL. These two patterns will continue to appear in languages that do not show the dual nature in the following section.

2.3.3 Sign languages that don't have modal base duality

As in spoken language typology, some sign languages do not show epistemic and non-epistemic modal base duality. German Sign Language (DGS) is one of these languages where modal MUST cannot be used in epistemic contexts (Bross, 2018; Bross and Hole, 2017; Herrmann, 2013). As seen in sentence (2.47), MUST is unacceptable in an epistemic context where the signer expresses the possibility of where Peter is. Unlike PSL or TSL, epistemic nonmanual markers are also not enough to derive the epistemic flavor when combined with MUST. Thus, we can conclude that MUST in DGS is lexically specified for its modal base.

(2.47) INDEX$_{3a}$ LIGHT THERE $\overline{\text{*PETER AT-HOME } \overline{\text{MUST}}}^{\text{epistemic}}$ (hn+ec)

'The light is on, Peter must be at home.'

(DGS, Bross, 2018, p.194)

To convey epistemic modality, DGS uses only nonmanual markers as in (2.48 - 2.50). Bross (2018) shows that epistemic adverbs such as SURELY or POSSIBLY can also be used to convey epistemic meaning, yet they can be omitted and nonmanual markers will be enough to convey the epistemic meaning.

(2.48) $\overline{\text{INDEX}_{3a}\ \text{LIGHT}\ \text{THERE}}^{\text{epistemic}}\ \ \text{PETER}\ \overline{\text{AT-HOME}}^{\text{hn+ec}}$

'The light is on, Peter must be at home.'

(DGS, Bross, 2018, p.194)

(2.49) $\overline{(\text{POSSIBLY})\ \text{SWEN}\ \text{WORK}_{3a}\ \text{GO}_{3a}}^{\text{epistemic}}$

'Swen could be off to work.'

(DGS, Bross, 2018, p.193)

(2.50) $\overline{(\text{SURELY})\ \text{SWEN}\ \text{WORK}_{3a}\ \text{GO}_{3a}}^{\text{epistemic}}$

'Swen must be off to work.'

(DGS, Bross, 2018, p.194)

DGS patterns with Paciran Javanese not only by having modal base duality but also by varying ordering source. It uses modal CAN to express either deontic permission (2.51) or ability (2.52). Different than ASL's signer perspective mapping, DGS directly maps the scope of the modal on the syntactic position. Bross and Hole (2017) explains this pattern as mapping an intermediate operator (deontic) as a left-to-right concatenation strategy whereas a lower operator (ability) is mapped as a right-to-left concatenation strategy (p. 14).

(2.51) $\overline{(\text{LISA}\ \text{PARENTS}}^{\text{br}}\ \ \overline{\text{EASY})}^{\text{hb}}\ \text{CAN}\ \text{UNTIL}\ \text{12-O'CLOCK}\ \text{AWAY}_{\text{PERSON-CL}}$

'(Lisa's parents are not strict.) She is allowed to stay out until 12 o'clock.'

(DGS, Bross and Hole, 2017, p.22)

(2.52) $\overline{\text{ADMINISTRATIVE OFFICE VISIT++}}^{\text{br}}$ DEAF SIGN LANGUAGE INTERPRETER ORDER CAN

'When visiting an administrative office, a deaf person has the option to consult with a sign language interpreter.'

(DGS, Bross and Hole, 2017, p.22)

In addition to manual mapping, Bross and Hole (2017) also proposes a distinction between not-at-issue and at-issue content, the first of which is realized as nonmanual markers and the second as manual signs. As epistemic is a not-at-issue category based on its patterns like anchoring to the speaker, scoping over negation, and being unquestionable (Tonhauser, 2012), their hypothesis not only holds for DGS epistemic but also epistemics in TSL and Iranian Sign Language (ZEI). Different than DGS, ZEI has different lexical signs to convey distinct flavors like MISHE (possible - epistemic), HATMAN (certainly - epistemic) (2.53), MAJBOR (obliged - deontic) (2.54), or MITUNE (able - ability) among others (Siyavoshi, 2019). ZEI makes further distinction by lexicalizing the modal flavors in distinct signs. With regard to overspecification of different modal flavors, ZEI would be in the cell where specified modal flavor and modal force intersect in Rullmann et al.'s (2008) modal typology (Table 2.3).

(2.53) HATMAN NIGHT RETURN

'He certainly will come back at night.'

(ZEI, Siyavoshi, 2019, p.665)

(2.54) GAS NOT-EXIST MAJBUR TAXI SIT GO

'If I run out of gas, I have to take a taxi.'

(ZEI, Siyavoshi, 2019, p.662)

Even though ZEI has lexical distinction for modal flavors, it also interestingly reported to be able to convey epistemic via only nonmanual markers like mouth corners down (horseshoe mouth), eye squint, or brow furrow (Figure 2.1).

Initially, there seems to be a correlation between sign languages that do not have duality and expressing epistemic via nonmanual markers, but this pattern becomes questionable

Figure 2.1. Mouth corners down and eye squint in ZEI (Siyavoshi, 2019)

with TSL modals which have both duality and can convey epistemic via only nonmanual markers. Either this observed correlation holds and TSL modals form an exception, or we have this correlation due to undocumented sign languages patterning with TSL. I will discuss what the role of nonmanual markers might be in the following section. If we focus on how manual modal signs show typological patterns compared to spoken languages, we have two cells of Rullmann et al. (2008)'s table filled (Table 2.4). Either other patterns have not been documented yet or sign languages interestingly cluster into these two cells.

Table 2.4. Modal base and force correlations in sign languages

	selective modal base	unselective modal base
specified force	ASL, TSL, LSE, NGT, PSL	DGS, ZEI
unspecified force	?	?

Even though modals in sign languages can be categorized typologically as in Table 2.4, I have shown that sign languages have more fine-grained distinctions in modal flavors by using syntactic mapping and nonmanual markers. Thus, they show at least two way interaction to

derive the modal flavor as the interaction of context and syntactic position, or the interaction of context and nonmanual markers.

2.3.4 Role of nonmanual markers

As mentioned in previous sections, nonmanual markers appear with modal notions to convey (i) epistemic modality as in DGS, ZEI, TSL, or Isareli Sign Language (ISL) and (ii) signer's epistemic commitment to the proposition as in ASL or NGT.

Nonmanual Markers Conveying Epistemic Modal

As presented before, nonmanual markers can be used alone to convey the epistemic. Only DGS has been investigated for nonmanual usage, and in DGS, the same nonmanual markers (2.55) cannot be used in deontic contexts (2.56). We can conclude that these nonmanual markers behave as the epistemic morpheme. Even though the authors did not discuss if nonmanual markers are acceptable with other structures, ZEI and TSL are other languages where nonmanual markers alone can convey epistemic meaning. As shown in Figure 2.1, mouth corners down and squint are enough to convey epistemic meaning in ZEI (Siyavoshi, 2019).

(2.55) $\overline{\text{INDEX}_{3a}\ \text{LIGHT THERE}}^{\text{epistemic}}\ \text{PETER}\ \overline{\text{AT-HOME}}^{\text{hn+ec}}$

'The light is on, Peter must be at home.'

(DGS, Bross, 2018, p.194)

(2.56) $\overline{\text{PAUL PARENTS STRICT}}^{\text{epistemic}}\ *\text{PAUL}\ \overline{\text{AT-HOME}}^{\text{hn+ec}}$

'Paul's parents are strict. Paul has to stay at home.'

(DGS, Bross, 2018, p.195)

Similar pattern also holds for TSL epistemic (Lin & Chang, 2011). The authors provided the figures of sentences where epistemic is only conveyed via nonmanual markers as 'upward and-backward head tilt and strengthened movement' (Figure 2.2). They highlighted that these nonmanual markers convey that the signer is certain about the embedded proposition

'He is unable to drive'. Interestingly, they also reported that nonmanual markers are sideward head tilt and mouth corners down as in ZEI to convey that the signer is uncertain about the embedded proposition (Figure 2.3).

Figure 2.2. Nonmanual markers when the signer is certain about the proposition in TSL (Lin & Chang, 2011)

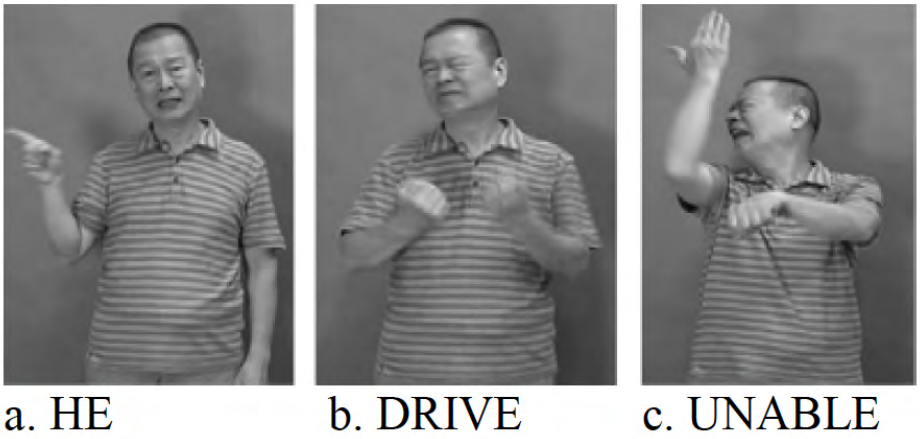

Figure 2.3. Nonmanual markers when the signer is uncertain about the proposition in TSL (Lin & Chang, 2011)

While nonmanual markers in DGS function to mark epistemic, those in TSL seem to convey the signer's epistemic commitment based on the manipulation of nonmanual markers. Epistemic modals are well-known to convey speaker's epistemic commitment and signal the addressee that the speaker does not know the proposition and should not be accountable if

the proposition turns out to be false (Krifka, 2021). In this regard, nonmanual markers in TSL may be used to convey the signer's commitment rather than conveying a possibility of the proposition. In other words, following Bross and Hole (2017)'s proposal on nonmanual markers being not-at-issue content and Krifka (2021)'s discussion on commitment, TSL may have a labor division between manual signs which express at-issue content by conveying the possibility of the proposition, and nonmanual markers which express not-at-issue content by conveying signer's commitment to the proposition. Similar modification of nonmanual markers has also been reported for DGS and ISL. ISL can also convey epistemic with nonmanual markers alone (Herrmann, 2013). These interesting patterns still need to be further tested in terms of nonmanual markers' acceptability with other structures to test if they are lexically tied to the epistemic or could appear with other structures and keep their core feature.

Nonmanual Markers Conveying Epistemic Commitment

In addition to sign languages that permit nonmanual markers to indicate the epistemic alone, other sign languages allow the manipulation of nonmanual markers; these include NGT (Herrmann, 2013), ASL (Shaffer, 2004), Japanese Sign Language (JSL) (Akahori et al., 2013). Different than DGS and TSL, all these languages have manual signs for epistemic modal. Shaffer (2004) presents data where signers manipulate both the intensity of manual signs and nonmanual markers by changing the repetition of internal movement and the nonmanual marker. As seen in (2.57-2.59), manual signs are modified with slow or sharp reduplication and nonmanual markers are modified with increased intensity when the signer's commitment is also increased. ASL seems to have nonmanual markers to signal the signer's commitment to the embedded proposition. Yet, all reported examples have epistemic modals or attitude verbs that are well-known to mark the speaker's commitment. The similar pattern needs to be further investigated to test if these patterns come from the inherent properties of epistemics and attitude verbs or if they can show similar patterns with deontic, root modals, or other type of sentences, too.

(2.57) [LIBRARY HAVE DEAF LIFE]$_{\text{TOP}}$ $\overset{\text{slight bf, hn}}{\overline{\text{SEEM}}}$ slow reduplication

'I think the library may have Deaf Life.'

(ASL, Shaffer, 2004, p. 192)

(2.58) [LIBRARY HAVE DEAF LIFE]$_{\text{TOP}}$ $\overset{\text{bf, hn}}{\overline{\text{SEEM}}}$

'I think the library has Deaf Life.'

(ASL, Shaffer, 2004, p. 192)

(2.59) [LIBRARY HAVE DEAF LIFE]$_{\text{TOP}}$ $\overset{\text{solid bf, sharp hn}}{\overline{\text{SEEM}}}$ sharp reduplication

'Surely, the library has Deaf Life.'

(ASL, Shaffer, 2004, p. 192)

JSL is also reported to manipulate the degree of head tilt but for the degree of probability (Akahori et al., 2013). The authors claimed that head is tilted more when the probability gets lower as seen in Figure 2.4. Based on their claim, JSL seems to convey the epistemic through manual signs and nonmanual markers together whereas other sign languages use nonmanual markers for epistemic commitment. Yet, this pattern should be also tested if head tilt appears with other structures and allows similar modification, then a conclusive result would be proposed.

Figure 2.4. Modification of head tilt along with the probabilty (Akahori et al., 2013)

Along with modal base duality, sign languages bring their own typological picture that is the interaction of manual signs and nonmanual markers. If we summarize the patterns

attested in the literature, Table 2.5 shows that epistemic is the only modality that is able to be carried entirely by nonmanual markers which provides further support from different sign languages to Bross and Hole's (2017) bodily mapping hypothesis. Languages that have both manual signs and nonmanual markers raise interesting questions for both Bross and Hole's (2017) hypothesis and for overall discussion on where nonmanual markers live in the grammar of sign languages.

Table 2.5. Sign language typology of modals in terms of manual signs and nonmanual markers

sign languages	expression of modals	
	manual + nmms	only nmms
ASL (Shaffer, 2004, Shaffer and Janzen, 2016)	all modals	
JSL (Akahori et al., 2013)	all modals	-
LSE (Herrero-Blanco & Salazar-Garcia, 2010)	all modals	-
PSL (Abdel-Fattah & Alawnah, 2020)	all modals	-
NGT (Klomp, 2021)	all modals	-
TSL (Lin & Chang, 2011)	all modals	epistemic
DGS (Bross, 2018, Herrmann, 2013)	deontic, root	epistemic
ZEI (Siyavoshi, 2019)	deontic, root	epistemic

I will attempt to answer these questions based on modals in TİD. In the following section, I will first present the literature on TİD, then show that nonmanual markers are neither lexical nor structural requirement of modal signs in TİD based on our previous studies.

2.4 Modals in TİD

TİD shows the combined manual and nonmanual pattern in the sign language literature by having dedicated manual modal signs and co-occurring nonmanual markers. Only one sign (LAZIM 'necessary') can have both circumstantial and epistemic modal base, yet the epistemic base has further restrictions on the conversational background. Manual modal signs and their flavors will be further discussed in the following sections. Since TİD expresses epistemic modality by having both manual signs and nonmanual markers, possible roles of nonmanual markers will be further discussed based on the findings of two previous studies (Karabüklü et al., 2018; Karabüklü and Wilbur, 2020).

2.4.1 Manual Signs

TİD is reported to have seven manual signs as given in Figure 2.5: OLABILIR 'possible' (2.60), LAZIM 'necessary' (2.61), SERBEST 'free' (2.62), OLUMLU 'positive' (2.63), YAP 'do' (2.63), MECBUR 'obligatory' (2.64), and GEREK 'required' (2.65). These signs have not been tested for modal force which will be tested in the Mutually Exclusive Propositions Task in Chapter 4 by following Rullmann et al. (2008) and Vander Klok (2013)'s discussions.

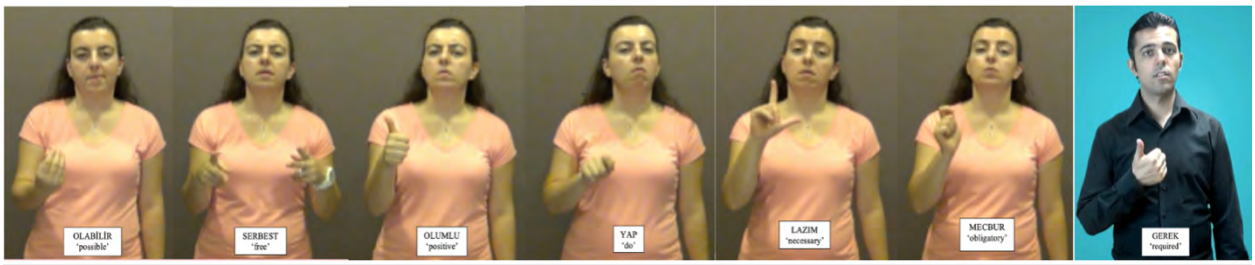

Figure 2.5. Manual modal signs in TİD: OLABILIR 'possible', SERBEST 'free', OLUMLU 'positive', YAP 'do',LAZIM 'necessary', MECBUR 'obligatory', and GEREK 'required' respectively.

(2.60) LIGHT-ON EXISTENTIAL, $\overline{\text{MOM HOME EXISTENTIAL OLABILIR}}^{\text{ht, sq}}$

'The light is on, mom might be at home.'

(epistemic, Karabüklü et al., 2018, p.86)

(2.61) THURSDAY COME $\overline{\text{LAZIM}}^{\text{br}}$

'He must/should come on Thursday.'

(deontic, Karabüklü et al., 2018, p.87)

(2.62) NIGHT $_{\text{a}}$IX$_{\text{b}}$ HANG-OUT SERBEST

'He can hang out till midnight.'

(deontic, Karabüklü et al., 2018, p.88)

(2.63) KADIR MAGIC OLUMLU/YAP

'Kadir can perform magic.'

(ability, Karabüklü et al., 2018, p.88)

(2.64) MEDICINE DRINK MECBUR

'I have to take medicine.'

(deontic, Yildirim, 2015)

(2.65) YES SAFETY^BELT WEAR GEREK

'Yes, everyone has to wear a safety belt.'

(deontic, Gökgöz, 2009)

When modal flavors of these signs are considered, the manual signs OLABILIR, SERBEST, OLUMLU and YAP have a specified modal base and ordering source, LAZIM can have both circumstantial and epistemic bases with restriction on the latter one. MECBUR and GEREK are argued to be deontic in the literature, yet I will present the evidence in Chapter 4 that MECBUR has non-deontic flavor even though it can only have circumstantial base.

Modals with specified modal flavor

Manual signs OLABILIR 'possible', SERBEST 'free', YAP 'do', and OLUMLU 'positive' are accepted only in specific contexts that are epistemic, permission and ability, respectively. As seen in sentence (2.66), it is an epistemic context where the signer expresses the possibility of the proposition 'Mom is home'. While OLABILIR is acceptable in this context, other modal signs are unacceptable and do not have the epistemic flavor. OLABILIR is also not acceptable in other contexts that convey deontic (permission) (2.67), ability (2.68), or deontic (obligation) (2.69). As seen in these examples, OLABILIR is lexically specified for the epistemic modal base.

(2.66) Context: You see that the lights are on in your mother's house and you say:

LIGHT-ON EXISTENTIAL. $\overline{\text{MOM HOME OLABILIR/SERBEST/YAP/OLUMLU}}^{\text{sq, ht/hn}}$

'The light is on; mom might be home.'

(2.67) Context: Bulut's parents are not so strict and they allow him to stay outside at night.

BULUT $_{a}$IX$_{b}$ 12 O'CLOCK $\overline{\text{HANG-OUT}}^{\text{hn}}$ $\overline{\text{SERBEST/OLABILIR/OLUMLU}}^{\text{hbt}}$

'Bulut can hang outside till midnight.'

(2.68) Context: Kadir went to a special course in the States and learnt how to perform magic.

KADIR$_a$ MAGIC $\overline{\text{YAP/OLUMLU/OLABILIR/SERBEST}}^{\text{hn}}$ IX$_{3a}$

'Kadir can perform magic.'

(2.69) Context: Ali was on holiday for a week and he needs to return to work today. If he does not come, he will be fired.

TODAY ALI COME $\overline{\text{LAZIM}}^{\text{eo,br}}$/OLABILIR/SERBEST/YAP/OLUMLU

'Ali must come (to work) today.'

Similar to OLABILIR, the same pattern also holds for the signs SERBEST, OLUMLU, and YAP. As seen in (2.66-2.69), SERBEST is acceptable in the deontic contexts where the subject is allowed to be outside (2.67). It is specified for the circumstantial modal base in Kratzer's (1977) model, and deontic in Hacquard's (2006) model, yet it is further restricted for permission contexts which could be derived with the ordering source over the conversational background. In the same respect, YAP and OLUMLU are also specified for circumstantial modal base and ordering source that restricts the conversational background for the subject's abilities or capacities. As discussed in other spoken languages like Paciran Javanese and sign languages like ZEI or PSL, TİD also makes fine-grained distinctions in its modal system by lexicalizing modal base and even ordering source. It also has signs that have different ordering sources and modal bases which I will present in the following section.

Modals with unspecified flavors

MECBUR 'obligatory' (2.64) was reported as another deontic sign (Özkul, 2019; Yildirim, 2015). It was also shown that it is unacceptable in epistemic contexts (2.70). Even though MECBUR is always referred as a deontic sign, it can appear in non-deontic contexts (2.71) where the signer is not forced or required to drive a motorbike by a boss or a rule. In contrast, the signer expresses his own desires in (2.71); in that sense, MECBUR has also bouletic flavor that scopes over the subject's desires or wishes. Thus, MECBUR seems to have different flavors via various ordering sources that are derived from the conversational background while it is lexically restricted for only circumstantial modal base.

(2.70) *IX$_3$ CAR^DRIVE^CAN MECBUR

'It is epistemically necessary that he can drive a car.'

(epistemic, Özkul, 2019, p.563)

(2.71) MOTORBIKE LEAVE IMPOSSIBLE $\overline{\text{MECBUR}}^{\text{bf,hn}}$ RIDE++

'I can't stop riding the motorbike. I must ride a bike. [I can't help riding a motorbike.]

(bouletic, Makaroglu and Dikyuva, 2017)

Similarly, LAZIM was reported to have deontic flavor (Gökgöz, 2009; Karabüklü et al., 2018; Özkul, 2019; Yildirim, 2015), yet sentences (2.72-2.73) show that it also has other flavors where the signer is not bound to any rule or regulation. Both sentences convey the signer's own desires or goals in the situation such as finding a job (2.72) or thinking about college for his son (2.73). Even though it is difficult to know which conversational background these sentences were signed in without a context, it is clear that LAZIM also can combine with different ordering sources to derive bouletic or teleological flavors from the conversational background.

(2.72) IX$_1$ JOB EMPTY-NO $\overline{\text{JOB ENTER LAZIM}}^{\text{bf, nw}}$

'I don't have a job; I should find a job.'

(teleological, Makaroglu and Dikyuva, 2017)

(2.73) IX$_1$ SON PRIMARY SECONDARY HIGH SCHOOL FINISH $\overline{\text{UNIVERSITY}}^{\text{br}}$ $\overline{\text{WHAT}}^{\text{br,hs}}$ $\overline{\text{THINK LAZIM}}^{\text{br}}$ IX$_1$

'My son will finish high school; we should think about what to do about college.'

(bouletic/teleological, Makaroglu and Dikyuva, 2017)

As for GEREK, it was reported as a deontic sign (Gökgöz, 2009), yet it has not been tested for other modal flavors. Thus, MECBUR, LAZIM and GEREK will be further tested in the Modal Flavors Contexts Test via production and rating tasks for their acceptability in different contexts in Chapter 4. Contexts were prepared to convey teleological, bouletic, and goal-oriented flavors by following the discussions in von Fintel and Iatridou (2008), Rullmann et al. (2008) and Vander Klok (2016).

Epistemic flavor of LAZIM: Further restrictions

LAZIM was also reported to be acceptable in epistemic contexts (Karabüklü et al., 2018; Özkul, 2019), yet not in all epistemic contexts. In our previous study (Karabüklü et al., 2018), participants did not accept LAZIM in the epistemic context where the signer only has information that the light is on (2.74). They commented that there might be other possibilities like mom forgetting that the light was on or someone else being home. Thus, they did not find the context providing a strong background to license LAZIM. Instead, they preferred OLABILIR in this context. Yet, LAZIM has epistemic flavor with the right kind of context. In (2.75), participants found it acceptable where the signer has more evidence on the proposition by knowing the regulations of school for the office hour, and the subject. Rather than guessing as in (2.74), the signer makes an inference based on contextual or previous information in (2.75).

(2.74) Context: When you go home, you see that the light is on and you're guessing:

LIGHT-ON EXISTENTIAL, MOM HOME EXISTENTIAL ?LAZIM/OLABILIR

'The light is on, mom must be at home.'

(epistemic, Karabüklü et al., 2018)

(2.75) Context: You want to see Sumru and you know that it is her office hour. She should be in her office during the office hour. You say:

SUMRU ROOM NON-EXISTENTIAL, IX$_3$ TIME ROOM $\overline{\text{OL LAZIM}_{deontic}}^{\text{eo}}$ PALM-UP, SECRETARY $\overline{\text{WORK ROOM GO OL LAZIM}_{epistemic}}^{\text{sq}}$

'Sumru is not at her office, she should be at her office at this time, she must have gone to the secretary's office.'

(epistemic, Karabüklü et al., 2018)

Even though LAZIM seems to pattern with modals that can combine with epistemic and non-epistemic modal base in other sign languages, it has an evidential restriction in its epistemic flavor like *must* in English (Matthewson, 2015, von Fintel and Gillies, 2010). Context in (2.75) clearly shows that LAZIM is acceptable in epistemic inference contexts,

however we have not tested it for other kinds of evidential types (Karabüklü et al., 2018). By building on the initial findings and following Matthewson's (2020) discussion on encoding evidentiality in languages, LAZIM along with the other epistemic modal OLABILIR will be tested for evidential restriction in the Evidential Restriction Contexts Study via rating task in Chapter 5.

Another difference between deontic and epistemic usage of LAZIM is co-occurring nonmanual markers; the deontic one in sentence (2.75) has eyes open (eo) over the modal while the epistemic one (2.75) has eye squint (sq) over the epistemic sentence. At a glance, different nonmanual markers seem to be tied to modal flavors: eyes open - deontic, eye squint - epistemic. Yet, as seen in all examples, these are not the only nonmanual markers appearing with modals, there are also brow raise (br), brow frown (bf), head nod (hn), or head tilt (ht) appearing with modal signs whose possible functions will be addressed in the following section.

In conclusion, TİD has manual signs that are lexicalized for different modal flavors. Some signs are only used for a specific modal interpretation like OLABILIR 'possible' for epistemic, SERBEST 'free' for permission, YAP 'do' or OLUMLU 'positive' for ability. TİD also has signs whose interpretations will depend on the context that they appear in like LAZIM 'necessary' or MECBUR 'obligatory'. Even though the data presents an overview for the crosslinguistic behavior of TİD modals, the signs that have more than one interpretation need further testing to fully understand their semantics. Also, the evidential restriction on LAZIM 'necessary' needs further investigation to capture its different acceptability patterns from OLABILIR 'possible'.

2.4.2 Nonmanual markers

As in all sign languages, nonmanual markers have been analyzed as functioning in prosody (Göksel & Kelepir, 2013), syntax (Gökgöz, 2011), semantics (Dikyuva, 2011; Karabüklü and Wilbur, 2020), or pragmatics (Göksel & Kelepir, 2013). As understood from references and discussed in Pfau and Quer (2010) that nonmanual markers may not belong to a single grammatical category and function in all subparts, we first properly define their function in

the structures they co-occur with. In order to better depict their role with modal signs, I will first show that they are neither lexically nor structurally required with modals.

Nonmanual markers are not lexically required

Given that sentence (2.76) does not have a nonmanual over the modal LAZIM and is nonetheless an acceptable sentence, it is clear that nonmanuals are not just the lexically required parts of manual signs. Furthermore, LAZIM can appear with various nonmanuals such as brow frown (bf) and nose wrinkle (nw) in (2.77), brow raise (br) in (2.78), or repetitive head nod (rhn) and brow raise (br) (2.79). Examples clearly show that nonmanuals are not lexically attached to LAZIM.

(2.76) $\overline{\text{IX}_2\ \text{HANG-OUT MONEY SPEND}}^{\text{bf}}$ NOT-GOOD, IX_2 SPOUSE HOUSE FAMILY $\overline{\text{THINK}}^{\text{br}}$ LAZIM

'You're hanging out too much and spending too much money. That's not good. You should think about your spouse, family, and house.'

(weak necessity, Makaroglu and Dikyuva, 2017)

(2.77) IX_1 JOB EMPTY-NO $\overline{\text{JOB ENTER LAZIM}}^{\text{bf, nw}}$

'I don't have a job; I should find a job.'

(goal-oriented, teleological, Makaroglu and Dikyuva, 2017)

(2.78) IX_1 SON PRIMARY SECONDARY HIGH SCHOOL FINISH $\overline{\text{UNIVERSITY}}^{\text{br}}$ $\overline{\text{WHAT}}^{\text{br,hs}}$ $\overline{\text{THINK LAZIM}}^{\text{br}}$ IX_1

'My son will finish high school; we should think about what to do about college.'

(goal-oriented, teleological, Makaroglu and Dikyuva, 2017)

(2.79) $\overline{\overline{\text{DRIVE}}^{\text{hn}}\ \overline{\text{KNOW LAZIM}}^{\text{rhn}}}^{\text{br}}$

'You should know how to drive a car.'

(deontic, Karabüklü and Wilbur, 2020)

Not only LAZIM, but also other manual signs have varying nonmanual markers, or they are also acceptable with no nonmanual markers. Their patterns also support the proposal

that nonmanual markers have distinct functions other than marking the lexical sign. Similar to LAZIM, OLABILIR has only head nod (hn) in (2.80), or repetitive head nod (rhn) and squint (sq) in (2.81), or head tilt (ht) and squint (sq) in (2.82).

(2.80) $\overline{\text{SERPIL}_a\ \text{IX}_{31}}^{\text{hn}}$ CHOCOLATE EAT $\overline{\text{OLABILIR}}^{\text{hn}}$

'Serpil may have eaten the chocolate.'

(epistemic, Karabüklü and Wilbur, 2020)

(2.81) $\overline{\text{SERPIL}_a\ \text{IX}_{31}}^{\text{br}}$ $\overline{\text{CHOCOLATE EAT OLABILIR}}^{\text{sq, rhn}}$

'Serpil may have eaten the chocolate.'

(epistemic, Karabüklü and Wilbur, 2020)

(2.82) LIGHT-ON EXISTENTIAL, MOM $\overline{\text{HOME EXISTENTIAL OLABILIR}}^{\text{sq, ht}}$

'The light is on; mom may be home.'

(epistemic, Karabüklü et al., 2018)

I have also calculated the percentages of nonmanual markers in our two previous studies as seen in Table 2.6 (Karabüklü et al., 2018) and Table 2.7 (Karabüklü and Wilbur, 2020). Nonmanuals appearing with same modal signs show variation in both studies when the two tables are compared. If a specific nonmanual marker was a lexical part of a modal sign, it should have appeared constantly with that sign, which is not the case as seen in Tables 2.6 and 2.7.

Table 2.6. Nonmanuals with SERBEST, OLUMLU, OLABILIR and LAZIM in Karabüklü et al.'s (2018) study*

Manual/NMMs	lp	pc	eo	es	br	bf	bs	ht	hn	hb	no nmm
SERBEST	83%					33%	50%				
OLUMLU	82%	45%									
OLABILIR				42%	11%	3%	3%	14%	9%		39%
LAZIM			11%	32%	56%	29%	34%	3%	39%	11%	40%

*Nonmanuals co-occur so the total may be more than 100%. Abbreviations used in Table are: NMMs - nonmanual markers, lp - lips pursed, eo - eyes open, es - eye squint, br - brow raise, bf - brow frown, bs - brow scrunch, ht - head tilt, hn - head nod, hb - head back, no nmm - no nonmanual marker.

Table 2.7. Nonmanuals with SERBEST, OLUMLU, OLABILIR, LAZIM, MECBUR and YAP in Karabüklü and Wilbur's (2020) data*

Manual/NMMs	lp	pc	eo	es	br	bf	ht	hn	hb
SERBEST	14 %					93 %	7 %	86%	36%
OLUMLU	70 %	52 %		7 %	3%	81		81%	48 %
OLABILIR	5 %			70%	85%	25%	35%	90%	35%
LAZIM	20%		22 %	28%	89 %	14%	32%	97%	32%
MECBUR	26 %			20%	100%		33%	60 %	53 %
YAP	15 %	10 %		15 %	25%	70 %	15 %	95 %	50%

∗Nonmanuals co-occur so the total may be more than 100%. Abbreviations used in Table are: NMMs - nonmanual markers, lp - lips pursed, pc - puffed cheeks, eo - eyes open, es - eye squint, br - brow raise, bf - brow frown, ht - head tilt, hn - head nod, hb - head back.

As seen in both qualitative and quantitative data, nonmanual markers are not lexical ones in the case of modal signs. Based on the percentages and the behavior of nonmanual markers, I will focus on head movements (head tilt, repetitive and single head nod) since they have the highest percentage, and squint since it has more predictable occurrence with epistemic signs. The rest of the discussion on nonmanual markers will be on head movements and squint.

Nonmanual markers are not structurally required

Another possible function of nonmanual markers may be due to modal force, base, or ordering source. Even though modal force of signs will be tested, based on the assumptions on modal force in the literature, both squint and head movements accompany OLABILIR which is assumed to be existential (2.83) and LAZIM which is assumed to be universal (2.84). Based on their cooccurrence with both existential and universal, it can be clearly concluded that nonmanual markers are not markers of modal force.

(2.83) $\overline{\text{SERPIL}_{\text{a}} \text{ IX}_{3\text{a}}}^{\text{sq}}$ CHOCOLATE $\overline{\text{EAT OLABILIR}}^{\text{rhn}}$

'Serpil may have eaten the chocolate.'

(existential, Karabüklü and Wilbur, 2020)

(2.84) $\overset{\text{hn}}{\overline{\text{SERPIL}_{\text{a}}}}\ \text{IX}_{3\text{a}}\ \overset{\text{sq}}{\overline{\text{CHOCOLATE}\ \overset{\text{hn}}{\overline{\text{EAT}}}\ \overset{\text{hn}}{\overline{\text{LAZIM}}}}}$

'Serpil must have eaten the chocolate.'

(universal, Karabüklü and Wilbur, 2020)

Another part of modal semantics is the modal base which the interpretation of a modal highly depends on. Based on Table 2.7, head movements especially head nod appear with all modals that have epistemic and non-epistemic modal bases. Even though squint appears with epistemics (2.83)-(2.84), it is also attested with ability modals (2.85-2.86) where the signer is not certain about the subject's skills and the modal base is circumstantial. While epistemic modals have epistemic conversational backgrounds that are based on the speakers knowledge about what is expressed, ability modals have realistic backgrounds that are based on real-life situations, circumstances, or rules. Eye squint and head movements can appear with both epistemic and realistic conversational backgrounds and this observation eliminates the possibility of nonmanual markers being the marker of conversational background.

(2.85) $\overset{\text{hn}}{\overline{\text{IX}_1}}\ \text{SWIM}\ \overset{\text{rhn}}{\overline{\overset{\text{sq}}{\overline{\text{OLUMLU}}}}}$

'I think she can swim.'

(ability, Karabüklü and Wilbur, 2020)

(2.86) $\overset{\text{hn}}{\overline{\text{IX}_1}}\ \text{SWIM}\ \overset{\text{rhn}}{\overline{\overset{\text{sq}}{\overline{\text{YAP}}}}}$

'I think she can swim.'

(ability, Karabüklü and Wilbur, 2020)

Based on modal semantics, the third option is that nonmanual markers might be the marker of the ordering source. If nonmanual markers are the markers of the ordering source, they should differ with the different interpretations. Based on this assumption, head movements do not mark the ordering source because they can appear with different interpretations of modals. The context in (2.87) conveys that the subject needs to know how to drive otherwise s/he will lose his/her job. In this case, LAZIM has its deontic interpretation because the requirement is imposed by the company. In contrast, the context in (2.88) shows that

driving is a requirement for the job, thus if the subject's aim is to get the job, then s/he should know how to drive. In sentence (2.88), LAZIM has its teleological interpretation (aims or goals). In both cases, head nod and repetitive head nod appear with LAZIM.

(2.87) Context: You're working in a delivery company and your company made a decision in the last meeting about driving. They want each employee to know how to drive. They're giving a year to get a driver's license:

DRIVE $\overline{\text{KNOW LAZIM}}^{\text{rhn}}$

'You must know how to drive.'

(deontic, Karabüklü and Wilbur, 2020)

(2.88) Context: One of your friends wants to apply for a job in your company. S/he asks about the job. You know that they're looking for a driver. The person needs to know how to drive otherwise they won't hire that person. You're saying:

DRIVE KNOW $\overline{\text{LAZIM}}^{\text{hbt}}$ $\overline{\text{IX}_3}^{\text{hn}}$

'You must know how to drive.'

(teleological, Karabüklü and Wilbur, 2020)

With regard to the ordering source, squint is also not its marker because sentences with only manual signs and no nonmanual markers are acceptable as discussed in the previous section. The acceptability of only manual signs in sentences is the main challenge to the proposal that nonmanual markers are the markers of modal structure because the core parts of the modal semantics do not change from one sentence to another. If nonmanual markers were the markers of a part of modal semantics, they would have consistently appeared with these parts. Then, the question is what nonmanual markers contribute to the modal sentences that they occur in.

2.4.3 Nonmanual markers have their own function

The appearance of modal signs without nonmanual markers shows that nonmanual markers are separate morphemes and contribute to the semantic computation of the proposition.

To further support this argument, sentences without nonmanual markers will be tested for their acceptabilities in the Nonmanual Markers Rating Task in Chapter 6. As for their function, I propose that squint is the uncertainty marker and head movements (single and repetitive head nods) belong to the information structure domain, yet they are strategies to convey the signer's commitment to the proposition or the act. In the following sections, I will present Karabüklü and Wilbur's (2020) study on how the signer's certainty levels affect the intensification of squint and head movements along with other studies presenting other structures that these nonmanual markers are reported with.

As a brief methodological background on Karabüklü and Wilbur (2020), target sentences with different modal signs were created and the same target sentence was presented in closely similar context which differed on the possibility of the proposition. The signer was asked to first sign the context, then wait a few seconds, and sign the target sentence. For the initial analysis, the nonmanual markers appeared with target sentences were annotated and reported in Karabüklü and Wilbur (2020). Later, nonmanual markers appeared with target sentences were further annotated for their axis of articulation, intensity, and repetition by using the nonmanual marker template developed by Kentner et al. (2022). Then, the apperances of nonmanual markers and intensification were dummy-coded as 0- non-apparent, 1 - apparent barely noticeable, 2- apparent and noticable, 3-maximum articulation. Lastly, the correlation between the nonmanual markers and their intensification were examined. All the correlations of nonmanual markers are reported first time here in addition to Karabüklü and Wilbur's (2020) findings.

Squint: Uncertainty Marker

As seen in previous sections, squint is closely tied to the epistemic by appearing with OLABILIR and epistemic usage of LAZIM. It has been also reported with attitude verbs as THINK/GUESS (Göksel & Kelepir, 2016), and relative clauses (Kubus, 2016).

First, we presented the same epistemic sentence within closely similar contexts where we changed the likelihood of the possibility (Karabüklü & Wilbur, 2020). As seen in the contexts (2.89-2.91), the possibility of the proposition 'Serpil ate chocolate' becomes more

likely to be true. When the likelihood is increased in contexts (2.89-2.91), the intensification of squint is decreased as seen from the left most frame to the right most frame in Figure 2.6, even missing as seen in the last frame.

(2.89) Context: There was chocolate in the lab. The next day, when you want to have some chocolate, you realized that someone ate it all up. You, Serpil, Asli and Süleyman are working in the lab and you don't know who ate it. You're guessing:

Target Sentence: SERPIL CHOCOLATE EAT OLABILIR
'Serpil might have eaten the chocolate.'

(2.90) Context: There was chocolate in the lab. The next day, when you want to have some chocolate, you realized that someone ate all it up. You know that Serpil is so fond of chocolate. You're guessing:

Target Sentence: SERPIL CHOCOLATE EAT OLABILIR
'Serpil might have eaten the chocolate.'

(2.91) Context: There was chocolate in the lab. The next day, when you want to have some chocolate, you realized that someone ate all it up. Only you and Serpil are working in the lab. You're guessing:

Target Sentence: SERPIL CHOCOLATE EAT OLABILIR
'Serpil might have eaten the chocolate.'

In addition to qualitative data presented above, appearances and intensity of nonmanual markers in the data were annotated by using the nonmanual markers annotation template (Kentner et al., 2022). They were annotated for which direction an articulator moved (for head nod, head (articulator) moves down), for the repetition of the movement (single, multiple, trilled), for the symmetry of the movement (eye wink vs. eyes closed), and for the degree of the movement (minimum, medium, or maximum). The change in the degree of movement was used to observe the intensification. There were three levels to code the degree: (1) min: movement is perceptible, possibly just barely, (2) mid: movement is clear, but not extreme,

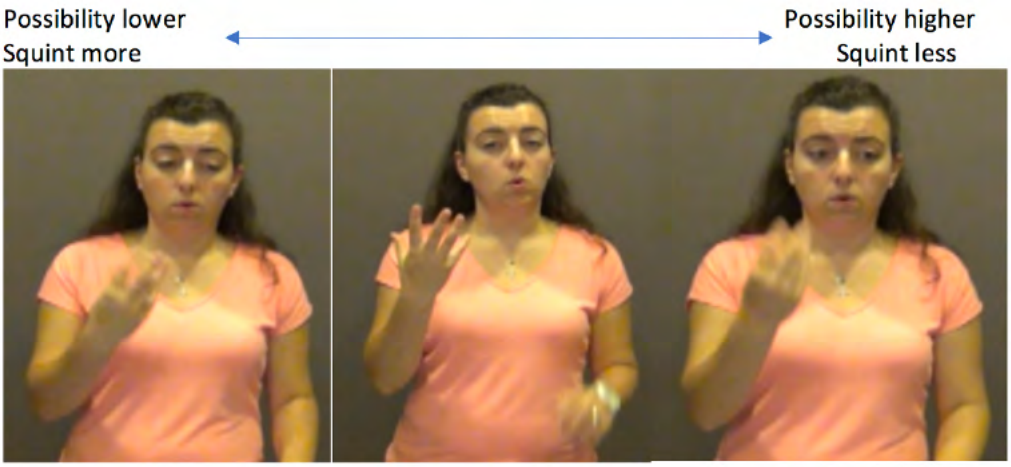

Figure 2.6. Squint is more intensified with more uncertainty (Karabüklü and Wilbur, 2020, p.198)

and (3) max: movement appears extreme, hits end range of movement for articulator. Cases of 3 (max) for squint are excluded from the calculations because it also encodes 'eyes close'.

When the appearance of squint is examined in all available data, its appearance is pretty low as seen in percentages in Figure 2.7 where numbers 1 and 2 on bars (blue-squint is annotated as 1 and orange-squint is annotated as 2) denote the intensification of squint and the numbers 1-4 denote the certainty level from less certain (1) to more certain (4) denoted by the contexts. These percentages also support the claim that squint is a distinct morpheme rather than being part of modal semantics or the lexical nonmanual marker. Yet, when we solely focus on the cases where it appears (Figure 2.7), we can observe the mentioned correlation where the stronger realization of squint (2) is increased in frequency with the increased uncertainty strength in the contexts.

This correlation clearly suggests that when the likelihood of the proposition is increased, the signer (speaker) is more certain that the proposition is true. When the signer's certainty increased, her commitment to the truth of the proposition increased (Faller, 2002). This pattern nicely shows that squint is likely the morpheme that signals the signer's uncertainty. However, one observation blocks this clean conclusion, namely that squint can also appear with non-first person subjects as observed with attitude verbs like THINK(GUESS) (2.92).

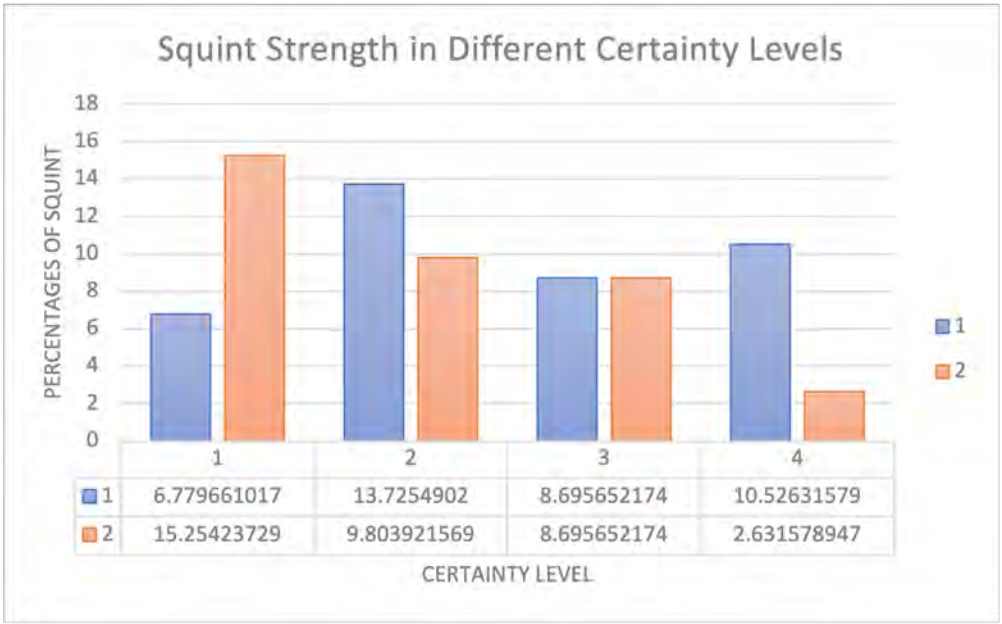

Figure 2.7. Percentages of intensified squint based on certainty levels

Here, the squint obviously does not reflect speaker certainty. I will follow authors' glossing convention of THINK(GUESS) because TİD has two signs TAHMIN 'think(guess)' (first picture in Figure 2.8) and DUSUN 'think(imagine)' (second picture in Figure 2.8).

(2.92) IX$_2$ ELECTION $\overline{\text{WIN THINK(GUESS) WHO}}^{\text{sq}}$

'Who do you think will win the election?'

(Göksel and Kelepir, 2016, p.80)

(2.93) AYŞE $\overline{\text{THINK(GUESS) ÜLKÜ SLEEP}}^{\text{sq}}$

'Aye thinks Ülkü sleeps.'

(Göksel and Kelepir, 2016, p.79)

The semantics of attitude verbs, similar to modals, includes the modal base. The verbs presented in (2.92-2.93) also have a modal base that is compatible with the subject's (rather than the speaker's) knowledge worlds, doxastic worlds (Hintikka, 1969). At a glance, it may be also possible to propose that squint is the morpheme of an epistemic modal base, yet there are two contradictory points for this proposal. The first one is that there are epistemic

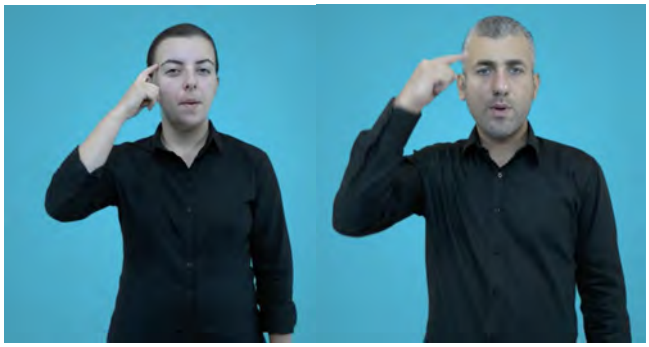

Figure 2.8. THINK(GUESS) and THINK(IMAGINE) in TİD (Makaroglu & Dikyuva, 2017)

sentences without squint. The second is that all attitude verbs that have doxastic modal bases like BIL 'know' do not occur with squint as seen in (2.94). Appendix A presents the attitude verbs attested in the online TİD dictionary (Makaroglu & Dikyuva, 2017).

(2.94) HASAN KNOW ELIF HORSE-RIDE WORK SUCCEED WORK++ SUCCEED
'Hasan knows that Elif is working on and succeeding at horseback riding.'
(Göksel and Kelepir, 2016, p.81)

The puzzle with attitude verbs is that the attitude verb expresses the subject's attitudes to the embedded proposition, not the speaker's, whereas speaker commitment is always related to the speaker. A crucial difference between the attitude verb THINK(GUESS) and KNOW is that the embedded proposition of THINK(GUESS) can be either true or false whereas the embedded proposition in KNOW should be true in all projected possible worlds. The semantics of THINK(GUESS) is similar to epistemics in terms of having both p and not p cases. Considering squints appearance with epistemics and the attitude verb THINK(GUESS), squint may encode just uncertainty rather than specifically the speaker's certainty.

Further support for this claim comes from Kubus (2016)'s re-introduced topic analysis of relative clauses (2.95). Squint is the nonmanual that occurs with most of Kubus (2016) data and approximately 80% of relative clauses are re-introduced in the discourse. In contrast to epistemics or attitude verbs like THINK(GUESS) that have either speaker's or subject's uncertainty, a re-introduced topic suggests uncertainty for the addressee. In other words,

the speaker is certain about the proposition or the reference that is re-introduced but does not know whether the addressee will be able to retrieve it.

(2.95) $\overline{\text{BUOY}_1\ \text{MARRY}}^{\text{hn}}\ \overline{\text{FINISH}}^{\text{hn, br}}\ \overline{\text{IX}_i\ \text{SINGLE}_j}^{\text{sq}}\ \text{CL-MEET}_{i,j}$

'The first (woman), who was already married, met (the woman) who was single.'

(Kubus, 2016, p.262)

In addition to epistemics, attitude verbs, and re-introduced topics, squint has also been observed with ability modals as shown in previous examples and also in (2.96). In these contexts, the signer is not certain about the abilities of the subject and guesses that the subject can sign.

(2.96) $\overline{\text{SIGN}\ \text{YAP}}^{\text{sq}}$
^{hn rhn}

'She can sign.'

Based on all the patterns, squint can be anchored to signer (speaker) as in epistemic and ability modals, to subject as in attitude verbs, or to addressee as in re-introduced topics. It will be further tested in terms of occurrence with other modals and attitude verbs in rating task in Chapter 6

Head Movements: More Uncertainty or Another Function?

Head nod and side to side head tilt are also observed with modal signs. Head nod is realized as either a single nod (2.97) or repetitive nods (2.98). As seen in sentence (2.96) above, repetitive head nod occurs with squint. Side to side head tilt is also observed with modals along with squint in (2.99). Sentences (2.98) and (2.99) are the same sentences with different nonmanuals. These sentences appeared in different contexts. As for (2.98), the signer knows that the subject loves chocolate and she is the most likely one to have eaten the chocolate in the lab. In context for (2.99), the signer knows that the subject likes to eat snacks and she is likely to have eaten the chocolate in the lab. It can be argued that the embedded proposition in (2.98) is more likely to be true.

(2.97) $\overset{\text{hbt}}{\overline{\text{CAR}}}\ \overset{\text{hs}}{\overline{\text{CAR}\hat{}\text{DRIVE}}}\ \overset{\text{hn}}{\overline{\text{BIL OLABILIR}}}$

'She might know how to drive.'

(2.98) $\overset{\text{hn}}{\overline{\text{SERPIL}_{\text{a}}\ \text{IX}_{3\text{a}}}}\ \text{CHOCOLATE}\ \overset{\text{rhn}}{\overline{\text{EAT OLABILIR}}}$

'Serpil might have eaten the chocolate.'

(2.99) $\overset{\text{hn}}{\overline{\text{SERPIL}_{\text{a}}\ \text{IX}_{3\text{a}}}}\ \text{CHOCOLATE}\ \overset{\text{ht, sq}}{\overline{\text{EAT OLABILIR}}}$

'Serpil might have eaten the chocolate.'

Along with epistemic contexts, head nod was also observed with other modals. As seen in Figure 2.9, head nod becomes deeper when the signer is more certain about the subjects abilities. Head movements (head tilt and head nod) seem to be parallel to squint. In other words, head movement is realized as head tilt or repetitive small head nod when the signer is not certain about the proposition. It is realized as single head nod or single deep head nod when the signer is more certain about the proposition. Figure 2.10 also shows this tendency in all data. When the strength of head nod is compared to the strength of contexts, the stronger version of head nod (3) is increased with the increased strength of contexts. On the other hand, the weakest version of head nod (1) is decreased with the increased strength of contexts. Additionally, absence of head nod in different strengths of contexts supports the claim that head nod is a distinct morpheme rather than being part of modal semantics or lexical nonmanual marker.

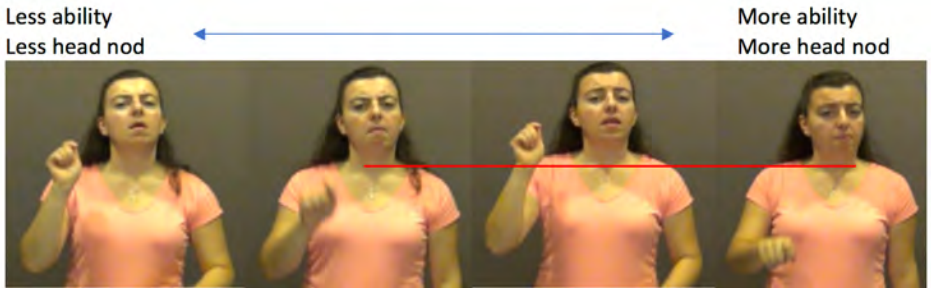

Figure 2.9. Head nod is more intensified with more certainty (Karabüklü and Wilbur, 2020, p. 200)

I have already proposed that squint is the marker of uncertainty, so if this analysis of head movement is correct, then the question is why there is a need of two morphemes

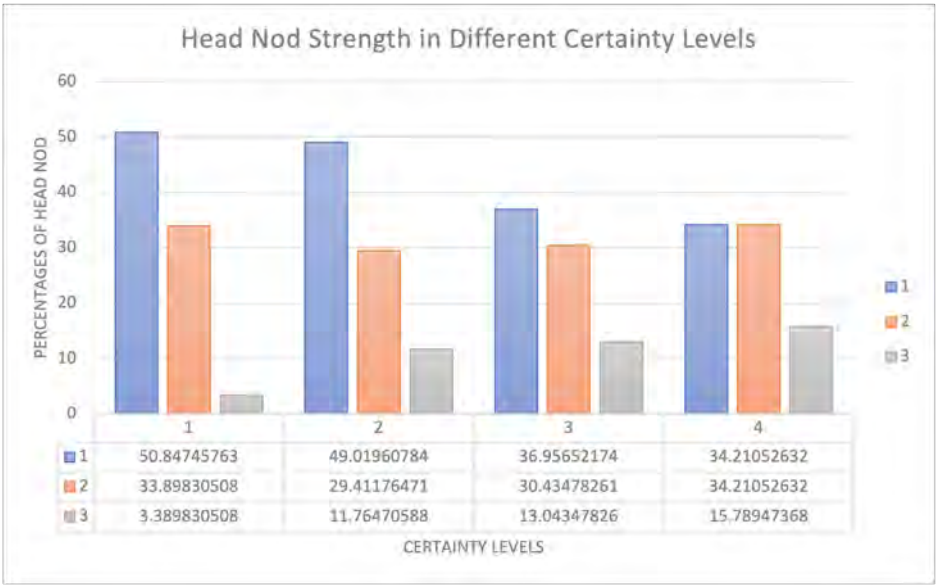

Figure 2.10. Percentages of intensified head nod based on certainty levels

for uncertainty. Could squint and head be the realizations of different notions? Initial answer comes from the negative relation of cooccurrence of head nod and squint in the contexts. Figure 2.11 represents the cooccurrence of head nod and squint in different degrees in percentages. Occurrences of both squint and head nod in Karabüklü and Wilbur's (2020) data were counted for each different intensification level. Then, the correlation between squint and head nod was calculated based on these occurrences. As seen in Figure 2.11, squint is more intensified when head nod does not occur in sentences and squint disappears when head nod is more intensified. Overall, it is clear that squint gets weaker (from 2 to 0) when head nod gets stronger (from 0 to 3). More crucially, squint never appears when there is a strong deep head nod; this situation suggests that they have independent functions.

Another answer to the question could be a structure other than modals. Head movements were also reported with commands in TİD (2.100-2.101) (Özsoy et al., 2018). These authors reported head movement as head tilt, yet they also noted that the direction of head tilt in Figure 2.13 mirrors the movement path of the agreeing verb TAKE. Nonmanual is realized as head nod when the verb is not an agreeing verb (Figure 2.12). Based on modals and commands, head nod may seem to be another marker of certainty or commitment. Yet, I

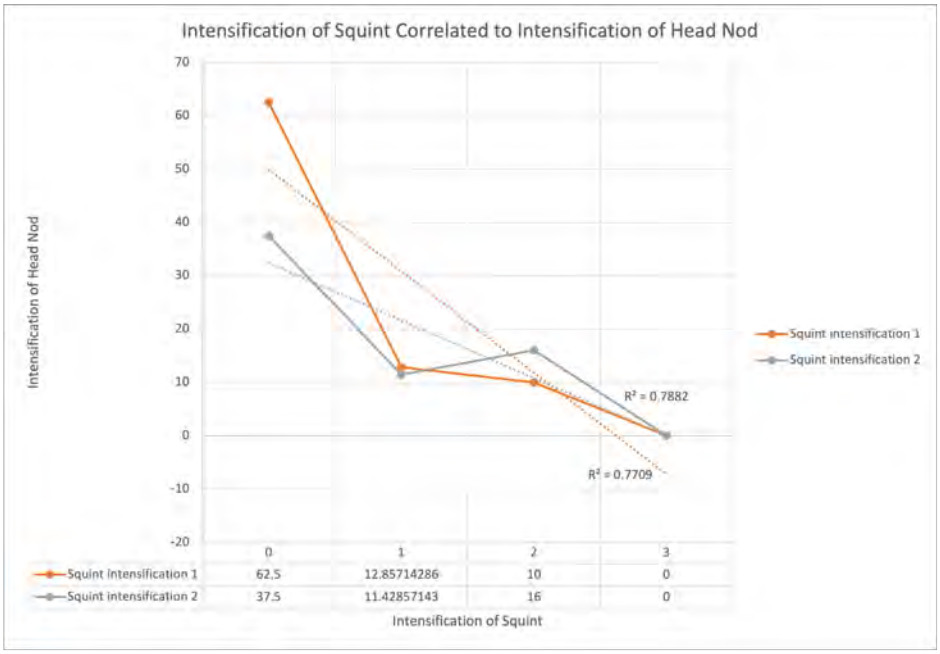

Figure 2.11. Correlation of squint and head nod

will show that head nod belongs to the domain of information structure by appearing with focus (Gürer & Karabüklü, 2022). Furthermore, high commitment is the by-product of deep head nod as in the emphasized do-support in English. To further support this proposal, head movements will be tested in terms of appearance and acceptability with different modals and attitude verbs in Chapter 6.

(2.100) BALL $\overset{\text{hn}}{\overline{\text{PLAY}}}$

'Play ball!'

(Özsoy et al., 2018, p.169)

(2.101) IX_3 LOAN $\overset{\text{ht}}{\overline{\text{TAKE}}}$

'Borrow money from him.'

(Özsoy et al., 2018, p.169)

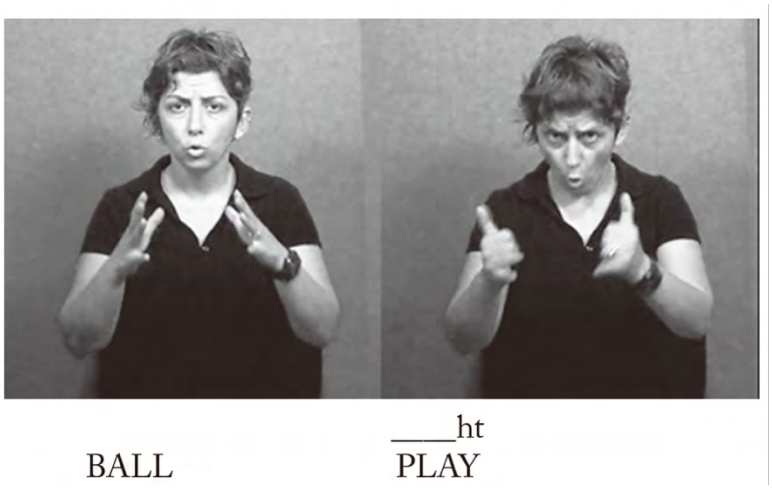

Figure 2.12. Head nod in commands (Özsoy et al., 2018)

Figure 2.13. Head tilt in commands (Özsoy et al., 2018)

2.5 Conclusion

In this chapter, I showed that modal notions in spoken languages show typological variety in terms of lexicalization of different semantic parts. English modal notions are famous for having a specified modal force and deriving modal flavor from the context by combining with different modal bases and ordering sources. St'amt'icets modals behave as the mirror effect of English modals by having a specified modal base but unspecified modal force that is a challenge to Kratzer's (1977) analysis. Even though these two patterns are argued to be the most optimal ones for languages (Deal, 2011; Rullmann et al., 2008), studies showed that

languages can have underspecified modals by having unspecified modal force and base as in Washo (Bochnak, 2015) or overspecified modals by having specified modal force and base as in Paciran Javanese (Vander Klok, 2013).

While aligning with these patterns in spoken languages, sign language typology brings its own features as syntactic mapping and nonmanual markers to distinguish modal flavors. As shown above, some sign languages like DGS use different syntactic positions to disambiguate modal flavors. Some such as PSL use distinct nonmanual markers for epistemic and deontic flavors. In the case of modals in TİD, most modals pattern with Paciran Javanese by having a specified modal flavor. Modals that have varying modal flavor are deontic ones and only LAZIM can appear in epistemic context with the additional requirement of evidential restriction. Similar to PSL, LAZIM has different nonmanual markers with its epistemic and deontic flavors. Yet, two previous studies clearly showed that modals are acceptable without any nonmanual markers and other structures can also share the same nonmanual markers. Thus, it is clear that squint and head movement have their own function separate from these structures. Based on the literature, research questions which are addressed in this dissertation are: (i) Which forces do manual modal signs have? (ii) Other than epistemic and deontic, which other flavors do LAZIM, MECBUR, and GEREK have?, (iii) What kind of evidential restriction do LAZIM and OLABILIR have when they appear in epistemic contexts?, and (iv) What are the functions of squint and head movements? Methodology to address these questions is presented in the next chapter.

3. METHODOLOGY

I present the overall structure of methodology in this chapter, details of each study and their results in the following chapters. Each participant took all tasks in sequential sessions. The chapter also includes the statistical framework that was used in the analysis of all studies. Detailed presentations of each study's procedure, data processing, and analysis will be given in their own respective chapters.

3.1 Studies in Dissertation

Building on the previous findings in the literature, the aim of the dissertation is to describe the semantics of modal signs and the role of nonmanual markers. To fulfill this aim, each research question raised in the previous chapter was addressed by one study, three of which were for manual signs and one of which was for nonmanual markers squint and head movements. Study I used acceptability ratings of manual modal signs to investigate their modal force by testing them with mutually exclusive propositions. Study II had both production and acceptability rating tasks to examine modal flavors of three signs LAZIM, MECBUR and GEREK within contexts that convey different flavors: teleological, bouletic, and goal-oriented. Study III targeted evidential restrictions on LAZIM and OLABILIR via the acceptability rating task. Signs were tested in contexts that convey various kinds of evidence to better understand why LAZIM is used in restricted epistemic contexts. Lastly, Study IV examined how squint and head movements reflect the signer's certainty about the proposition via the rating task.

3.2 Participants

Seventeen participants were recruited for all studies; one did not complete all tasks, so 16 participants who completed all the tasks are reported in the dissertation. Participants were recruited with a Deaf consultant's help; all were active members of Deaf society during the studies. All self-reported between 50 – 75% hearing loss and they used TİD on daily basis to communicate with their family and friends since their childhood.

Table 3.2 gives participants' self reported demographic and language use information. Participants included 9 female and 7 male with age M=35.19, sd=7.55. 7 of participants were Deaf of Hearing (DoH), that is, the first generation Deaf in their family with hearing parents. 9 of them were Deaf of Deaf (DoD) some of whom were second generation and some of whom were fourth generation. First generation participants were usually exposed to sign language at primary or secondary school from other Deaf students at the age of 6-7, and 11-12, respectively. With respect to their language use at home and at work, first generation participants reported using either Turkish or basic TİD. Some participants reported using written Turkish, basic TİD, or TİD alphabet.

Table 3.1. Language Usages in Participants' Schools

Part.	Lang. at Pri. Sch,	Lang. at Sec. Sch.	Lang. at High Sch.	Lang. at University
P01	little TİD	TİD	TİD	NA
P02	students used TİD	TİD	TİD	NA
P03	TİD	TİD	TİD	NA
P04	40% used TİD	40% used TİD	Turkish	NA
P05	TİD	TİD	TİD	Turkish
P06	little TİD	little TİD	little TİD	NA
P07	TİD	TİD	TİD	NA
P08	TİD	TİD	TİD	Turkish
P09	Turkish	TİD	TİD	NA
P10	Turkish	Turkish	Turkish and TİD	Turkish
P11	Turkish	Turkish	Turkish	Turkish
P12	TİD forbidden	TİD	Turkish	Turkish
P13	TİD	Turkish	Turkish	NA
P14	students used TİD	TİD	TİD	Turkish
P15	Turkish	Turkish	Turkish	NA
P16	TİD	NA	NA	NA

Abbreviations used in the table are: Part. - participant, Lang. at Pri, Sch. - language used at primary school, Lang. at Sec. Sch. - language used at secondary school, Lang. at High Sch. - language used at high school, Lang. at University - language used at university, TİD - Turkish Sign Language, NA - not applicable

Table 3.2. Participants' Demographic and Language Information

Part.	Deaf Gen.	SL Exp.	Other Langs.	Lang. w/ family	Lang. w/ friends	Lang. at job
P01	1	7 yrs	IS	TİD	TİD	TİD
P02	2	birth	ASL (basic)	TİD	TİD	a little signing
P03	4	birth	ASL, IS	TİD	TİD	TİD
P04	2	birth	IS	TİD	TİD	TİD
P05	4	birth	IS, Mardin SL	TİD	TİD	written Turkish
P06	2	birth	-	TİD	TİD	written Turkish
P07	4	birth	-	TİD	TİD	TİD
P08	2	birth	IS	TİD	TİD	TİD
P09	1	7 yrs	Turkish, IS	TİD	TİD	TİD
P10	4	birth	IS	TİD	TİD	TİD
P11	1	12 yrs	Turkish	Turkish	TİD	TİD
P12	1	11 yrs	IS	TİD	TİD	written Turkish
P13	2	birth	DGS, LIS (basic)	TİD	TİD	written Turkish, TİD alphabet
P14	1	7 yrs	IS	Turkish, simple TİD	TİD	TİD
P15	1	7 yrs	-	TİD	TİD	-
P16	1	6 yrs	IS (basic)	TİD	TİD	TİD

Abbreviations used in the table are: Part. - participant, Deaf Gen. - generation of deafness, SL Exp - first exposure to sign language, Lang(s).- language(s), IS - International Sign, ASL - American Sign Language, DGS - German Sign Language, TİD - Turkish Sign Language, NA - not applicable

3.2.1 Procedure

The fieldwork procedure includes not only the data collection but also the stimuli preparation, which is of equal weight and significance. Thus, this section will present both the stimuli preparation and the data collection processes.

Stimuli Preparation

Even though elicited translation of a target sentence in a given context is one of the common semantic fieldwork methods (Bohnemeyer, 2015; Bochnak and Matthewson, 2020), it is also known that translation tasks may be misleading especially on tense, aspect and modality (TAM) notions because languages divide these semantic notions so differently in their grammars (Cover, 2015). Furthermore, participants need to be bilingual in both languages that the stimuli is presented in and the participants will translate to. Yet, the reading proficiency of Deaf signers is low due to the oralist education (Göksel et al., 2021; Ilkbasaran, 2013, 2015). This is why elicited translation will not provide valid results (Van Herreweghe & Vermeerbergen, 2012) where the context yields the truth conditions for the target sentences and subtle differences are crucial to capture meaning differences.

To ensure that the stimuli is naturalistic and targeting the research questions, I checked all the contexts and target sentences with a Deaf consultant who is Deaf of Deaf and active member of Deaf community in Istanbul. The stimuli were written in Turkish and the Deaf consultant translated them into TİD. When the contexts and the target sentences were revised for naturalness, all the stimuli were recorded over Zoom meeting or FaceTime based on the most convenient process for the consultant in 8 sessions lasting approximately 8 hours. After the first recording, all videos were formatted and the stimuli that needed revision were re-recorded in 4 sessions lasting approximately three and half hours. All the trial items and the instruction videos were also recorded in TİD.

Two sets were prepared for all tasks in the studies. Each set was prepared as different survey in Qualtrics and randomly assigned to the participants. After the stimuli preparation process was completed, Qualtrics surveys were prepared for each task. Sets 1 and 2 in each

task were also presented in different surveys except the mutually exclusive proposition test due to the time restrictions and participants responded to the different sets.

Data Collection

Data collection for each study will be discussed in detail in Chapters 4, 5, and 6. Since all participants carried out all tasks this section will present the mega procedure of all sessions. During the data collection, each participant went through ten sessions on average to complete all the tasks. The first sessions were carried out with the Deaf consultant to make the participant comfortable during the introduction, filling out the consent form and the background questionnaire (Appendix B), and the trial of the first survey. Consent form and background questionnaire were also presented as Qualtrics surveys. After the participant felt comfortable to continue with the researcher, the consultant left the meeting and the following sessions continued with only the researcher.

Due to the time restriction, all participants could not take two sets of surveys in both production and rating tasks. For the production task, first half of the participants (8) took both sets while the second half (8) took either the first set or the second set, yielding a total of 12 for each set. For the rating tasks, all the participants (16) took either one of the sets, yielding a total of 8 for each set. The rating tasks were given in the random order for the first group of participants as seen in Table 3.3. The first half of the second group took the first set in the production tasks while the second half took the second set. For the second group of participants, participants 9 and 10 did the same set in both production and rating (Set 1) while participants 11 and 12 did the rating set that they did not do in the production task (Set 1 - Set 2) (Table 3.3). The same pattern applied for the second half of the second group. Participants 13 and 14 took the same sets in both the production and rating (Set 2) while participants 15 and 16 took different sets (Set 2 - Set 1) (Table 3.3).

Two strategies could be used in the semantic fieldwork: (i) presenting the stimuli in a non-thematic, non-narrative order, or (ii) presenting the stimuli in a thematic order (Louie, 2015). Both have advantages and disadvantages. The first one will be easier to collect true minimal pairs, but boring and tiring for the participant. The second one will not give true

Table 3.3. Participant and Task Distributions

Participants	Production Tasks	Rating Tasks
P1	S1, S2	S2
P2	S1, S2	S1
P3	S1, S2	S1
P4	S1, S2	S2
P5	S1, S2	S1
P6	S1, S2	S1
P7	S1, S2	S2
P8	S1, S2	S2
P9	S1	S1
P10	S1	S1
P11	S1	S2
P12	S1	S2
P13	S2	S1
P14	S2	S1
P15	S2	S2
P16	S2	S2

minimal pairs. I used the first method in the rating tasks by randomizing the test items whereas I used the second method in the production tasks. Test items were not randomized and the related themes were presented one after another, such as seeing part of an event, the end of an event, and the whole event in the evidential restriction task, or all similar modal flavors like bouletic, teleological, and goal-oriented. Thus, the participants could comment on the nuances among target signs. This is why production sessions were carried out as controlled-elicitation sessions where the researcher and the participant discuss the acceptability of the target sign in a specific given context.

All participants took the surveys in the same order: consent form, background questionnaire, modal flavors production task, evidential restriction production task, mutually exclusive propositions rating task, modal flavors rating task, nonmanual production task, evidential restriction rating task, questions production task, and nonmanual markers rating task. Figure 3.1 shows the order and planned numbers of sessions. It took 10 sessions per participant on average because some tasks were completed in more than one session. The production tasks were always given before the rating tasks to prevent bias in the production

task. All sessions were carried out and recorded in Zoom; stored in the lab storage and backed up in the researcher's external drives.

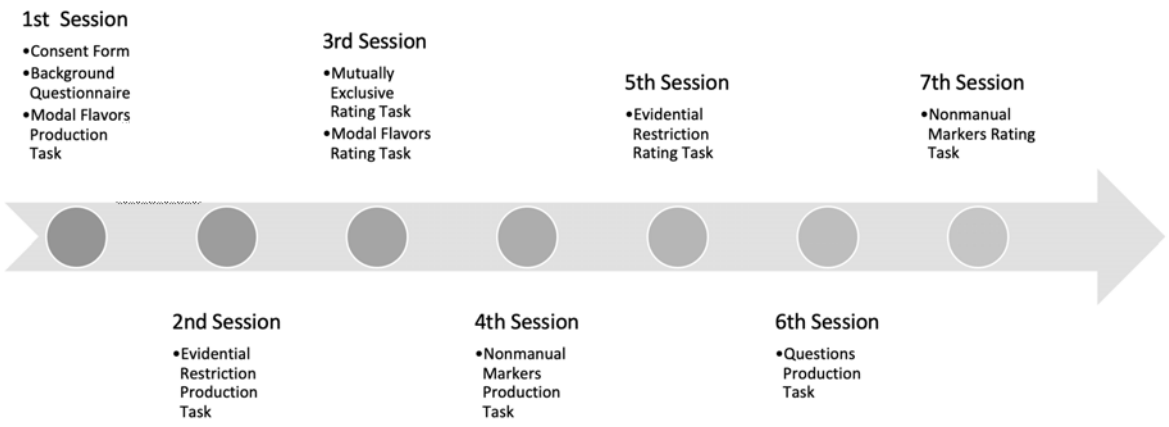

Figure 3.1. Planned Data Collection Process

3.3 Analysis: Statistical Framework

Participants rated or produced each target structure more than once in tasks so data come from within-subject and between-subject. All ratings were on a slider, which formed continuous data sets. All studies have mixed design where rating tasks were analyzed with multilevel mixed effects regression model and production tasks were analyzed with multilevel binominal regression model.

Furthermore, as shown in Participants Section, participants form two groups based on their first sign language exposure. Participants who were born to Deaf parents (DoD) were exposed to signing from birth while participants who were born to hearing parents (DoH) were exposed to signing in primary or secondary school. Effects of first language exposure have been repeatedly proven (Mayberry and Eichen, 1991; Mayberry et al., 2002) and how DoH signers' late exposure affects their not only linguistic (Lillo-Martin et al., 2020) but also academic (Hrastinski and Wilbur, 2016; Wilbur, 2000) or social skills (Pfau et al., 2021). Due to this effect, two groups of participants' linguistic characteristics may differ. This is why

their language background in statistical model was not treated as demographic information, but rather as a source of variation in the data.

Multilevel model (MLM) is the statistical model used to capture the effects of group or cluster difference in the dependent variable (Gries, 2015; Johnson, 2014; Levy, 2009; Sönning, 2018). The fundamental difference of MLM from generalized linear models (GLM) is that the independence assumption (the data points are independent) is violated in hierarchically structured (nested) data (Sönning, 2018). In a hierarchical data structure, clustered data points may be more similar to one another due to the features of the cluster, that is speaker, dialect, or language input or background in linguistic studies. In this case, MLM allows intercepts and slopes to randomly vary across clusters to better capture both how individuals behave within and between clusters, and if there is any significant difference between clusters affecting the dependent variable.

This is why multilevel mixed effects model is the overarching structure of statistical analysis in all studies reported in the dissertation. Data in each study has its own hierarchical structure based on research questions in the study. That said, the first model of each study has two groups of participants DoD and DoH as the top cluster where participants are nested inside. Then, individual data points are nested under participants. Totally unconditional multilevel model is first run for each study to capture any variation resulting from DoD and DoH groups to the dependent variable.

4. MANUAL MODAL SIGNS IN TİD

Semantic parts of manual modal signs are tested through two studies; modal force of all modal signs is targeted with the Mutually Exclusive Propositions Study as a rating task and the modal flavors of LAZIM, MECBUR, and GEREK via both production and rating tasks. The first section presents the Mutually Exclusive Propositions Study and results; the second section presents the Modal Flavors Study and results.

4.1 Modal Force: Mutually Exclusive Propositions

As discussed in Chapter 2, modal force can be lexicalized as in English or vary across the contexts as in St'amt'icets. If a modal is lexicalized for existential force, it will be acceptable with the mutually exclusive propositions. For example, *paleng* in Paciran Javanese is acceptable with both p (taking a nap) and ¬p (not taking a nap) in (4.1). In contrast, *mesthi* in (4.2) yields contradiction when it is used with mutually exclusive propositions like sleeping over or going home.

(4.1) Context: Bu Zum is not at home, I think.

Paleng	*bu*	*Zum*	*lagek*	*turu*	*awan,*	***paleng***	*bu*	*Zum*	*gak*	*lagek*
EPIST	Mrs.	Zum	PROG	sleep	noon,	EPIST	Mrs.	Zum	NEG	PROG
turu	*awan.*									
sleep	noon									

'Maybe Bu Zum is taking a nap; maybe she's not taking a nap.'

(4.2) Context: You know that Titin is at Devi's house. Can you say?

**Mesthi*	*Titin*	*ape*	*nginep*	*utowo*	***mesthi***	*Titin*	*ape*	*muleh.*
EPIST.NEC	Titin	FUT	Av.stay.over	or	EPIST.NEC	Titin	FUT	go.home

'Certainly Titin will sleep over or certainly Titin will go home.'

Building on this linguistic test and the literature on modals in TİD, the expected results are that modals that have existential force will be found acceptable and rated high on a slider while modals that have universal force will be found unacceptable and rated low on a slider.

4.1.1 Stimuli

Following discussions in Rullmann et al. (2008) and Vander Klok (2016), each target item contains the same modal sign in two sentences following each other in the form of p and ¬p as in (4.3) or in the form of two sentences that convey the exclusive propositions as in (4.4). All test items are given in Appendix C.

Test sentence structure:

(4.3) IX-2 HERE STAY MODAL, LEAVE MODAL

'You MODAL stay here, or you MODAL leave.'

(4.4) IX-2 HERE STAY MODAL, STAY^NOT MODAL

'You MODAL stay here, or you MODAL not stay.'

With respect to modals with negation, TİD shows three patterns: First, as expected from the epistemics, they usually yield ungrammaticality when appearing with negation (Hacquard, 2006, 2011). Negation appears only before the epistemic modal OLABILIR to express the possibility of ¬p (Karabüklü and Wilbur, 2020). Second, deontic signs LAZIM, GEREK and MECBUR allow both modal-negation (4.5) and negation-modal (4.6) sequences yielding the meanings of 'mustn't' and 'don't have to', respectively. Lastly, the ability sign OLUMLU has a suppletive form for its negation OLUMSUZ as in Figure 4.1.

(4.5) Context: Today is a holiday.

$$\underline{\qquad\qquad}^{\text{br}}$$
$$\text{TODAY SCHOOL GO LAZIM } \overline{\text{NOT}}^{\text{hbt}}$$

'You **don't have to** go to school today.'

(Özkul, 2019, p.570)

(4.6) Context: According to the school regulations, it is forbidden to run in the corridors. Tell this to your son:

IX_2 SCHOOL CORRIDOR RUN NOT LAZIM

'You **mustn't** run in the school corridor.'

(Özkul, 2019, p.570)

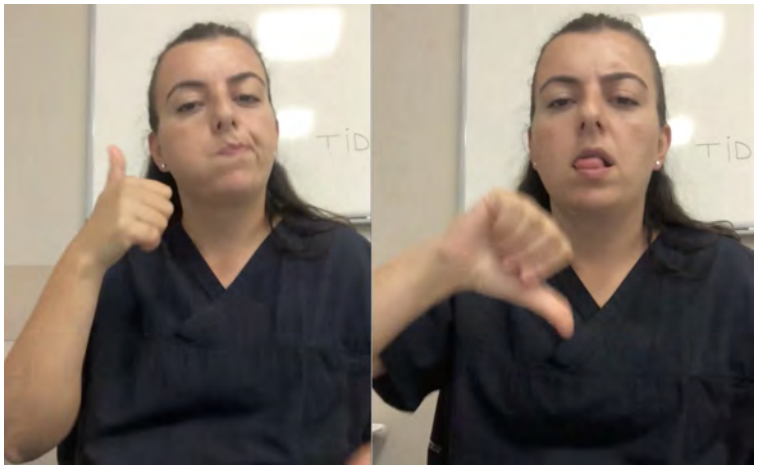

Figure 4.1. The left picture is the ability sign OLUMLU 'positive' and the right picture is its suppletive form OLUMSUZ 'negative'.

During the stimuli preparation, the Deaf consultant also pointed out that ACABA 'perhaps, maybe' (Figure 4.2) can be also used as an epistemic sign and was also added to the target items. She also highlighted that OLABILIR sounds more acceptable with mutually exclusive propositions than with p and ¬p sequences. This is why OLABILIR also has sublevels like LAZIM, MECBUR, and GEREK.

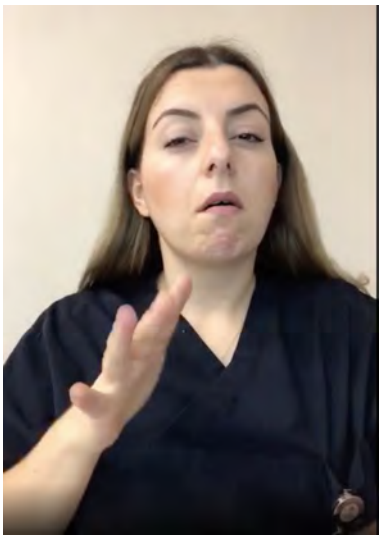

Figure 4.2. Manual sign ACABA 'perhaps, maybe'

4.1.2 Design

The study was conducted using acceptability rating methodology within a 2x8 mixed effects factorial design. Modal sign and the order of negation and modal were experimentally manipulated between-person variables. As shown above, the order of negation and modal was manipulated for only the signs LAZIM, MECBUR, GEREK, and OLABILIR which allow that variation. Each target structure had two test items resulting in twenty four test items in total (Table 4.1).

Table 4.1. Factors of Mutually Exclusive Propositions Test

Modal Signs	Levels of Negation
ACABA (n=2)	Neg-Modal (n=2)
OLABILIR (n=4)	Neg-Modal (n=2)
	ME Propositions (n=2)
LAZIM (n=4)	Neg-Modal (n=2)
	Modal-Neg (n=2)
YAP (n=2)	Modal-Neg (n=2)
OLUMLU (n=2)	Modal-Neg (n=2)
SERBEST (n=2)	Modal-Neg (n=2)
MECBUR (n=4)	Neg-Modal (n=2)
	Modal-Neg (n=2)
GEREK (n=4)	Neg-Modal (n=2)
	Modal-Neg (n=2)
Total=24	

4.1.3 Procedure

During each trial, participants first did a trial session to familiarize them with the scale and the task. Participants were instructed to watch the video recording of sentences that contain both the modal and its negation. They were asked to rate if the sentences were acceptable in the given sequence. They could watch the video again if they wanted. All instructions were given in TİD before the trial session. After the trial session, all participants rated both sets of target items; all stimuli were presented in randomized order in Qualtrics (Figure 4.3).

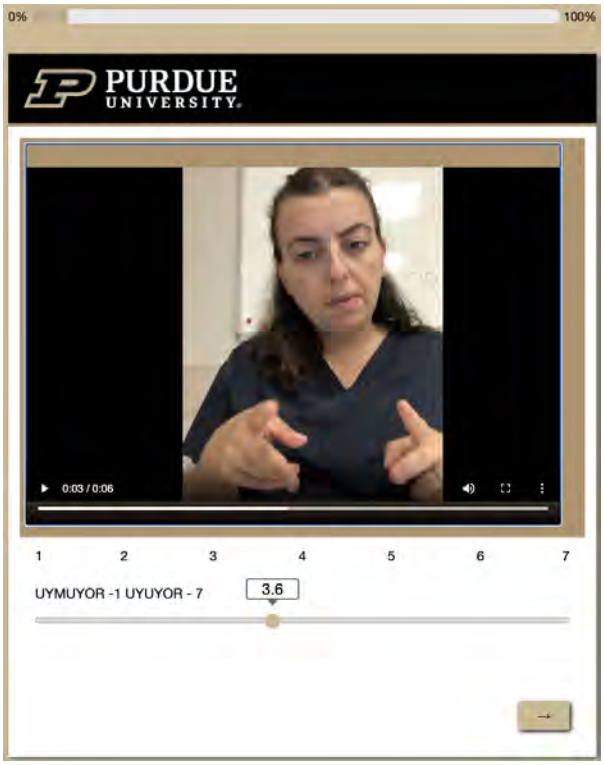

Figure 4.3. Acceptability Judgement Task in Mutually Exclusive Proposition Study

The response variable was the rating from 1 (not at all acceptable) to 7 (totally acceptable). The results indicated which modal signs (those that were found acceptable) have existential force and which ones (those that were found unacceptable) have universal force. If the modal has an existential force, both p and ¬p would hold in the projected possible world, hence sentence (4.3) denoting both propositions would be found acceptable. In contrast, if the modal has a universal force, only p or ¬p would hold in the projected accessible possible worlds, thus having both p and ¬p in the same sentence would yield contradiction. Based on this prediction, sentence (4.3) would be found unacceptable. If the assumptions in the literature hold for the modal force of signs, Table 4.2 presents the expected acceptability results.

Table 4.2. Predictions for the mutually exclusive propositions test

Modal Sign	Expected Result
OLABILIR	acceptable → existential
ACABA	acceptable → existential
LAZIM	unacceptable → universal
YAP	unacceptable → universal
OLUMLU	unacceptable → universal
SERBEST	acceptable → existential
MECBUR	unacceptable → universal
GEREK	unacceptable → universal

4.1.4 Data Analysis

All acceptability ratings of each target item come from both between-participants and within-participants since each target structure was presented two times with different lexical items. Thus, the variation in the data can result from modal sign itself and the signer because signers (speakers) may have their own idiolects and behave differently from each other (Gries, 2015; Johnson, 2014; Levy, 2009; Sönning, 2018). Participants also belong to two different groups based on their language input Deaf of Hearing (DoH) who were born to hearing parents, and Deaf of Deaf (DoD) who were born to Deaf parents. Even though language background can be another demographic information about participants, DoH babies are usually exposed to their native language later than their DoD peers. It has been already shown that language input and the age of acquisition have critical roles in linguistic skills (Krebs et al., 2021; Malaia et al., 2020; Mayberry and Eichen, 1991; Mayberry et al., 2002). This is why language background is modelled as another level in the analysis rather than a random variable.

Due to the nested structure of data, it was analyzed with multilevel model (MLM) mixed effects in SPSS. As seen in Figure 4.4, negation position either before or after modal (NP) is the first level which is partially nested in modal signs (Level 2). Modal signs are fully nested in participants where each participant rated each target (Level 3). Based on their language

background, participants are also nested in DoH (Deaf of Hearing) and DoD (Deaf of Deaf) clusters (Level 4). Participants demographics were presented in detail in Chapter 3.

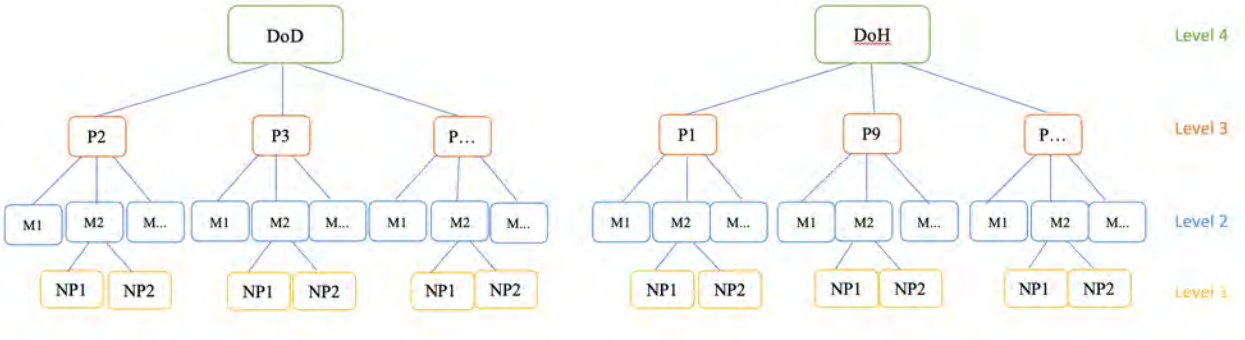

Figure 4.4. Multilevel Structure of Study

Data Coding

All categorical variables were dummy-coded: Gender was coded as female 1, male 0. Generation of deafness was coded as first generation 1, second generation 2, and so on. Language input was coded as DoH 0, DoD 1. Participants were assigned to numbers to anonymize them as 1,2,3 and so on. Modal signs were assigned to numbers as ACABA 1, GEREK 2, LAZIM 3, MECBUR 4, OLABILIR 5, OLUMLU 6, SERBEST 7, and YAP 8. Negation order was coded: modals that have suppletive forms for negation or do not have syntactic variation as 0, modal and negation order as 1, and negation and modal order as 2. After running descriptive statistics on acceptability ratings, means of ratings seem to show three modal groups as in Figure 4.5, these three groups were also dummy coded as modal type into three groups OLABILIR, ACABA, and SERBEST in *existential* 1, GEREK, MECBUR, and LAZIM in *universal* 2, and OLUMLU and YAP in *ability* 3 to test if there is a significant difference among them.

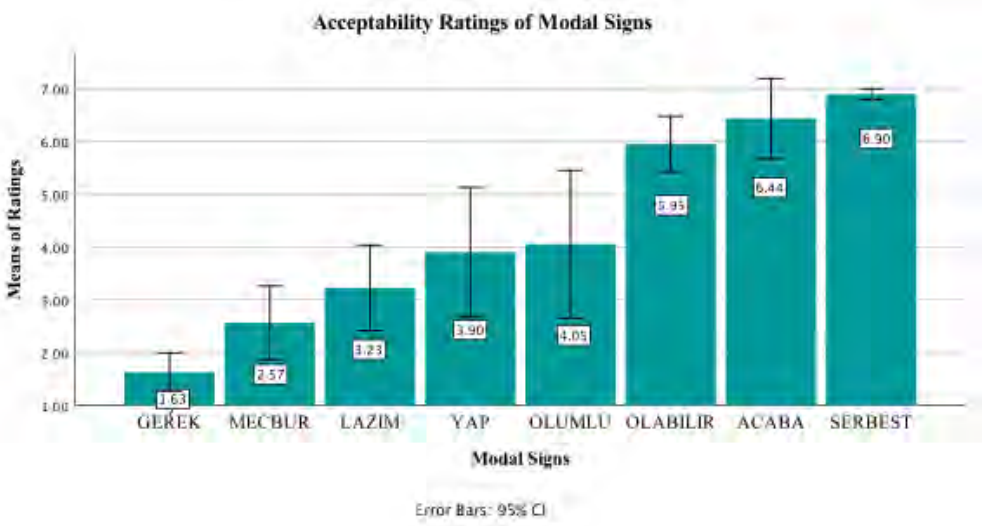

Figure 4.5. Means of Acceptability Ratings of Modal Signs

4.1.5 Results

Descriptive Results

I obtained 400 acceptability ratings for each target structure from all 16 participants. All the analyses were run on all these datapoints. Only modals that do not have two negation modal orders were not included in the analysis of modal and negation effect in order not to interpolate the results. Descriptive results of all acceptability ratings is presented in Table 4.3 and acceptability ratings based on modal and negation order is presented in Table 4.4. Figure 4.5 shows the means of acceptability ratings of each modal.

Multilevel (MLM) Analysis

I first analyzed data by using totally unconditional model to observe which level contributes to the variation in the acceptability ratings. As seen in Table 4.5, variance in the acceptability ratings results from negation modal order (.34) and modal types (3.56), but not from language input or participant. When intra-class correlation (ICC) was calculated for each variance, the biggest proportion of variation is due modal type (58%) while the

Table 4.3. Descriptive Statistics of Acceptability Ratings

Modal	Min	Max	Mean	Standard Deviation
ACABA	1.4	7	6.44	1.42
GEREK	1	7	1.63	1.19
LAZIM	1	7	3.7	2.78
MECBUR	1	7	3.46	2.53
OLABILIR	1	7	6.04	1.81
OLUMLU	1	7	4.05	2.85
SERBEST	6	7	6.9	.28
YAP	1	7	3.90	2.65

Table 4.4. Descriptive Statistics of Acceptability Ratings Based on Modal and Negation Order

Modal	Negation Type	Min	Max	Mean	Standard Deviation
ACABA	Pre-Modal Neg	1.4	7	6.44	1.42
GEREK	Post-Modal Neg	1	7	2.08	1.52
GEREK	Pre-Modal Neg	1	3	1.19	.41
LAZIM	Post-Modal Neg	1	7	3.7	2.78
LAZIM	Pre-Modal Neg	1	7	2.76	2.43
MECBUR	Post-Modal Neg	1	7	3.46	2.53
MECBUR	Pre-Modal Neg	1	7	1.67	1.61
OLABILIR	ME Proposition	1	7	6.04	1.81
OLABILIR	Pre-Modal Neg	1	7	5.87	2.02
SERBEST	ME Proposition	6	7	6.9	.28
YAP	ME Propositions	1	7	3.90	2.65

variation due to negation order is small (6%). Even though negation order contributes to the variation in the ratings as seen in Figure 4.6, it is not significant (p=.36). The only significant independent variable is modal type (p<.001) affecting the acceptability ratings.

Even though language input does not have a significance, there is a slight difference in acceptability ratings as in Figure 4.7. In contrast to literature, non-significance is most likely due to small number of data points 9 DoD and 7 DoH participants. Even though participants were born to different families and exposed to sign language at different ages, another reason for non-significance could be that participants have similar language input in adulthood because some DoD and DoH participants are family members or friends with

Table 4.5. Covariates in Acceptability Ratings Based on Independent Variables

Parameter	Estimate	SE	p
AcceptabilityRating	2.22	.37	<.001
LanguageInput	.00	.00	-
LanguageInput*Participant	.00	.00	-
LanguageInput*Participant*ModalType	3.56	1.14	.002
LanguageInput*Participant*Modalype*Negation	.34	.37	.35

Figure 4.6. Acceptability Ratings Based on Modal Negation Order

each other. Due to the non-significance of language background, the rest of the analysis was carried out in three level model in which participants form the last nest in the data structure as in Figure 4.8.

Within three level multimodel mixed effect analysis, I analyzed each modal type as a fixed effect and participant as a random effect, and age, gender, and generation as variables of level three. Only gender among all three variables in level three has a significant effect (p<.001) on the acceptability ratings. Overall, females rated acceptability judgments significantly lower than males (Table 4.6). Table 4.7 shows sample regression coeffients (β), standard error (SE), significance level (p), and confidence intervals (CI) when each modal force group is compared to each other.

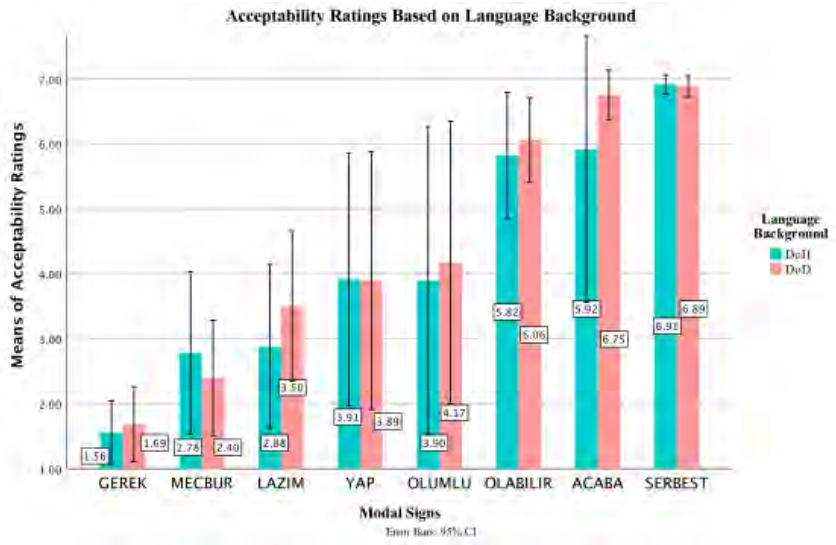

Figure 4.7. Acceptability Ratings Compared for DoH and DoD Groups

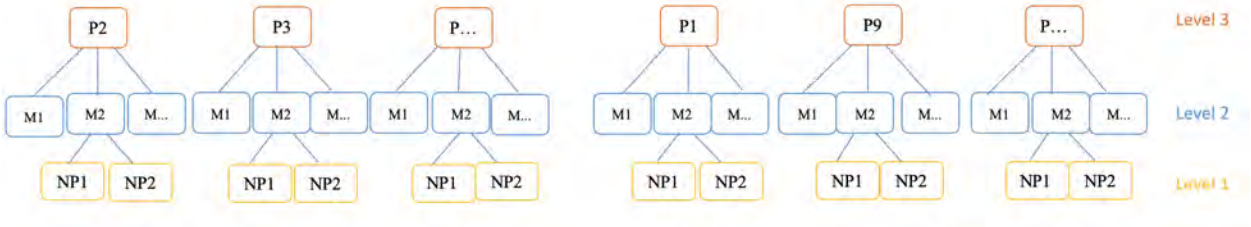

Figure 4.8. Three Level Structure of Data

As seen in both Table 4.7 and Figure 4.9, signers rated modal signs OLABILIR, ACABA, and SERBEST (existential - color coded as blue) together significantly higher than both modal signs YAP and OLUMLU, (ability - color coded as dark magenta) and modal signs GEREK, MECBUR, and LAZIM (universal - color coded as dark green). They also rated modal signs YAP and OLUMLU together significantly higher than modal signs GEREK, MECBUR, and LAZIM.

Furthermore, each modal in each modal type (existential, universal, and ability) was also analyzed by using multilevel mixed effects model where each modal is treated as a fixed effect and participant as a random effect. Table 4.8 represents sample regression coeffients (β),

Table 4.6. Effects of Variables in Level Three on Acceptability Ratings

Level 3 Variables	β	SE	p	CI
Age	-.03	.02	.06	-.07 .0019
Gender	-1.52	.23	**<.001**	-1.97 -1.07
Generation	-.07	.12	.54	-.31 .16

Table 4.7. Main Effect of Modal Force on Acceptability Ratings

Modal Forces	β	SE	p	CI
Existential-Universal	-3.84	.33	<.001	-4.54 -3.14
Existential-Ability	-.0027	.004	<.001	-.0037 -.0018
Universal-Ability	1.5	.31	<.001	.88 2.12

standard error (SE), significance level (p), and confidence intervals (CI) when each modal force group is compared to each other in its own group.

Table 4.8. Results of Modals Compared to Modal Force Group Members

Modal Signs	β	SE	p	CI
OLUMLU -YAP	.0003	.0007	<.59	-.001 .002
LAZIM -MECBUR	-.66	.34	0.59	-1.35 .03
GEREK -MECBUR	.93	.35	**.011**	.22 1.65
GEREK -LAZIM	1.60	.36	**<.001**	.87 2.32
OLABILIR -SERBEST	.95	.37	**.014**	.20 1.96
ACABA -OLABILIR	-.48	.40	.24	-1.30 .33
ACABA -SERBEST	.46	.36	.21	-.27 1.20

As seen in both Table 4.7 and Figure 4.10, participants rated LAZIM significantly higher than GEREK and MECBUR significantly higher than GEREK. They also rated SERBEST significantly higher than OLABILIR.

4.1.6 Discussion: Why are there three groups in modal force?

As predicted from the assumptions in the literature (Table 4.2), deontic modals in mutually exclusive propositions were rated lower and epistemic and permission modals in mutually exclusive propositions were rated higher. Yet, results show that modals cluster in three

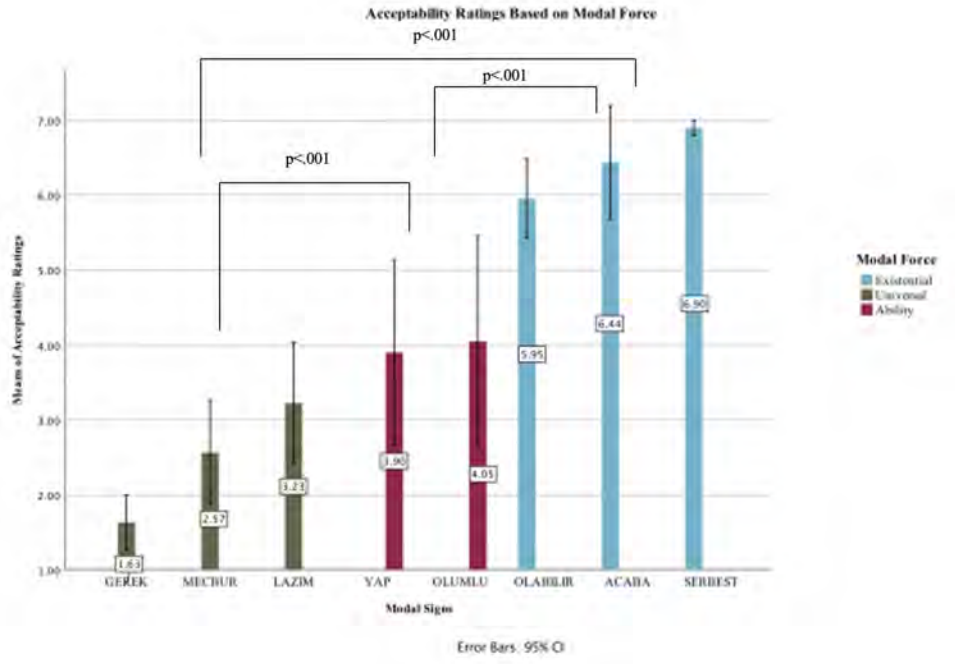

Figure 4.9. Acceptability Ratings Affected By Modal Force

groups with significant differences among them: (i) Epistemic modals OLABILIR, ACABA, and deontic permission modal SERBEST have higher acceptability ratings (5-7). (ii) Ability modals YAP and OLUMLU have middle acceptability ratings (3.5-4). (iii) Deontic modals GEREK, LAZIM and MECBUR have low ratings (1.5-3.5). When we categorize 0-3.5 points on 7-point slider as unacceptable and 3.5-7 points as acceptable, deontic modals in mutually exclusive propositions were found unacceptable because they yield contradiction. Thus, we can conclude that they have universal modal force. In contrast, epistemic and permission modals in mutually exclusive propositions were found acceptable because they do not yield contradiction. Therefore, we can conclude that they have existential force. Based on the predictions in Table 4.2, modal signs were expected to cluster into two groups instead of three and ability modals OLUMLU and YAP were also expected to behave as deontic modals. Based on the results of statistical test, participants clearly rated ability modals differently than deontic and epistemic modals. Acceptability ratings of ability modals are in the range of 3.9-4.05, which is our cutoff point for acceptability.

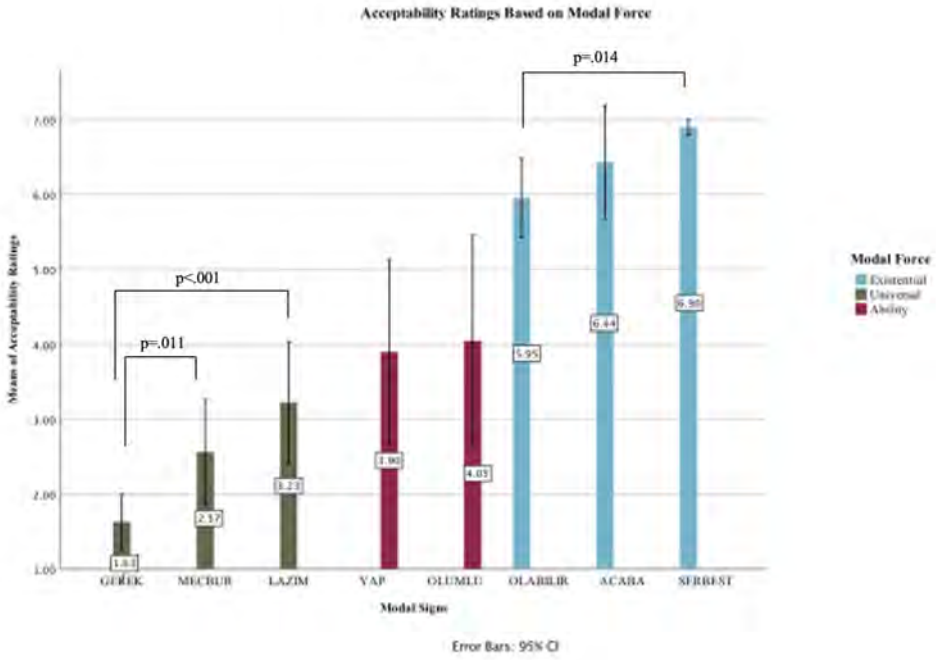

Figure 4.10. Acceptability Ratings Affected By Modal Force

Before presenting other reasons, I want to show that YAP has other functions that are close to its ability usage in the following subsection; its multifuctionality might be affecting its acceptability ratings without any context to distinguish these functions.

Other usages of YAP

While OLUMLU has been previously reported as an ability sign (Dikyuva et al., 2017; Saral, 2020) participants produced and accepted YAP in ability contexts in elicitation sessions (Karabüklü et al., 2018). Yet, YAP is also one of the verbs in 'do-make' pair (4.7) like in English. Figure 4.11 shows both signs the first of which is the one used in ability contexts.

There is no analysis on their distinction or functions and both are translated as 'yap' to Turkish and there is no other way to distinguish them in writing, so I will gloss both as MAKE/DO here. Both seem to appear after nouns as a verb (4.7), yet IRON could be a verb or a noun because it is one of noun-verb pairs in TİD (Özkul, 2013).

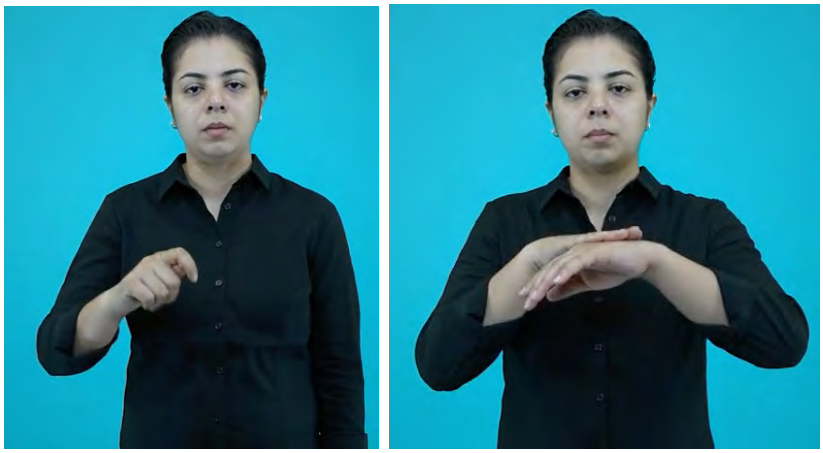

Figure 4.11. Two YAP signs in TİD (Makaroglu & Dikyuva, 2017)

(4.7) MOM IRON DO/MAKE

'Mom does ironing.'

(Makaroglu & Dikyuva, 2017)

When we look at other examples, they can be used while giving advice (4.8), explaining a cause (4.9), or talking about someone's abilities (4.10). Furthermore, the signer in Figure 4.12 uses one DO/MAKE in the first clause 'You shouldn't be so angry' (4.8) and the other DO/MAKE in the second clause 'You should be nice, positive' (4.8). First one with negation in Figure 4.12 is also reported in negative commands (Özsoy et al., 2018), but I did not have either of these signs in deontic contexts (close kin of commands) in my elicitation sessions. YAP is mostly used along with OLUMLU in ability contexts as in (4.10).

(4.8) CL-MEET VERY BAD MAKE^NOT NICE POSITIVE 3-GIVE-3 YAP

'You shouldn't be so angry when meeting with him/her. You should be more positive.'

(Makaroglu & Dikyuva, 2017)

(4.9) THREE LITRE WATER WATER^DRINK++ UPSET-STOMACH YAP

'If you drink three liters of water, it will make you nauseous.'

(Makaroglu & Dikyuva, 2017)

(4.10) DAD CLOTHES CUT, SEW, IRON VARIETY ALL YAP

'My dad can do tailoring, cutting, sewing, ironing, all of them.'

(Makaroglu & Dikyuva, 2017)

Figure 4.12. Both signs used as YAP (make/do)

Since YAP seem to be multifuctional and these functions could be related, the acceptability ratings might be affected by its multifunctionality without a context to distinguish its functions. We need further analysis of its usage as a verb and a compound verb form, so I will leave its analysis for future studies.

Possible reasons for OLUMLU's difference

There might be a few reasons affecting the ratings of OLUMLU. First, it is the one with more variation among others as seen in its confidence intervals. The variance might be due to different idiolects of signers for some of whom these signs can be existential and some of whom they can be universal. Variation cannot be due to dialect because most of signers (15) are Istanbul residents.

Another and more theoretically appealing reason can be that it has a varying force and the ratings reflect its ambiguous nature. As seen in St‘amt‘icets (Rullmann et al., 2008), Washo (Bochnak, 2015), or Nez Perce (Deal, 2011), OLUMLU may be interpreted as both existential and universal. Signs are presented without any context, so if it has a varying modal force it is natural that it was rated in the middle. Modals with varying force are usually shown to have one force as a default and other one is derived with either strengthening or weakening; that is, if they have a universal force as a default, it is weakened to have existential interpretation (St'amt'icets, Rullmann et al., 2008; Washo, Bochnak, 2015). These modals are interpreted as existential in downward entailing environments like conditionals where the proposition needs to hold in all possible worlds. As presented in Chapter 2, modals with varying force can be also analyzed as having existential as their default force which is strengthened to have universal interpretation (Nez Perce, Deal, 2011).

Even though we do not have supporting data for either case, OLUMLU seems to have universal force as its default since it was rated closer (M range=3.9 - 4.05) to deontic modals that have universal force (M range= 1.63-3.23) than epistemic modals that have existential force (M range = 5.95-6.90). Based on linguistics tests in the literature, downward entailing environments should cause the acceptability ratings lower by making them behave as deontic modals. In order to present a full analysis for all modal signs, I will consider it as having universal force as a default, yet it needs to be further tested in downward entailing environments in future studies.

4.2 Modal Flavor

Another semnatic component of modals is modal flavor that is modelled via both modal base and ordering source (Hacquard, 2006; Kratzer, 1977). As stated in Chapter 2, modals in some languages like English have different flavors based on the coversational backgrounds that they occur in. In contrast, modals in some languages like St'amt'cets have lexicalized flavors. This difference can be also seen in a single language as *might* in English (4.11) always has epistemic flavor while *can* has deontic (4.12) or ability (4.13) flavor based on the context.

(4.11) Context: Mary is not home and she goes swimming every morning.

Mary might be at the pool. *epistemic*

(4.12) Context: Josh's family lets him play with his toys after he finishes his homework.

He did all his homework.

Josh can play with his toys. *deontic*

(4.13) Context: Josh learned how to swim that summer and now, he knows how to swim.

Josh can swim. *ability*

Similarly, some TİD modals have been shown to be lexicalized for their modal flavors like OLABILIR, SERBEST, OLUMLU and YAP (Karabüklü et al., 2018). Only LAZIM is reported to have both epistemic and circumstantial modal base (Karabüklü et al., 2018, Özkul, 2019), which will be further tested in Chapter 5. Yet, as discussed in Chapter 2, deontic signs LAZIM (4.15) and MECBUR (4.14) can appear in bouletic and teleological contexts.

(4.14) MOTORBIKE LEAVE IMPOSSIBLE $\overline{\text{MECBUR}}^{\text{bf,hn}}$ RIDE++

'I can't stop riding the motorbike. I must ride a bike. [I can't help riding a motorbike.]

(bouletic, Makaroglu and Dikyuva, 2017)

(4.15) IX_1 SON PRIMARY SECONDARY HIGH SCHOOL FINISH $\overline{\text{UNIVERSITY}}^{\text{br}}$ $\overline{\text{WHAT}}^{\text{br,hs}}$ $\overline{\text{THINK LAZIM}}^{\text{br}}$ IX_1

'My son will finish high school; we should think about what to do about college.'

(bouletic/teleological, Makaroglu and Dikyuva, 2017)

To fully capture their flavors, three modal signs LAZIM, MECBUR and GEREK are further tested in the current study. Since their deontic and epistemic flavors are known, this study was dedicated to addressing other untested flavors teleological, bouletic, and goal-oriented in both production and acceptability rating tasks.

4.2.1 Production Task

Stimuli

The production task was carried out to capture other possible signs or nonmanual markers that participants would prefer to use in these contexts. Following Vander Klok's (2016) questionnaire and Rullmann et al. (2008) and von Fintel and Iatridou's (2008) discussions, contexts were prepared to convey teleological, bouletic, and goal-oriented flavors. None of the target signs were presented in the contexts in order not to prime their productions.

All contexts were recorded with the Deaf consultant and checked for their naturalness in TİD. Stimuli that were found unnatural were rerecorded. Also, one context from each type were prepared for trial session. All contexts in trial and main sessions were presented as video recordings in TİD.

Design

The production task was conducted using semi-guided semantic elicitation methodology (Cover, 2015) within 3x1 mixed effects factorial design. Since the same contexts were used in both the production and rating tasks, the same number of contexts were presented in the production task. Two sets of target items were prepared for a total of 18 target items as shown in Table 4.9. All the contexts are presented in Appendix D.

Table 4.9. Factors of Modal Flavors Contexts Test

Manual Signs	Context Types
LAZIM (n=6)	Teleological (n=2)
	Bouletic (n=2)
	Goal-oriented (n=2)
MECBUR (n=6)	Teleological (n=2)
	Bouletic (n=2)
	Goal-oriented (n=2)
GEREK (n=6)	Teleological (n=2)
	Bouletic (n=2)
	Goal-oriented (n=2)
Total=18	

Procedure

During each trial, participants first did a trial session to familiarize them with the task. Participants were asked to watch the instruction video then do the trial session. After the trial session, they started the main session. They watched the context signed in TİD, then were asked what they would sign in the given context (Figure 4.13). After their initial response, they were asked if other modal signs are acceptable in the same context. All stimuli were presented in Qualtrics. Contexts were not randomized and similar contexts were presented together to keep thematic order and participants' focus on one type of context (Louie, 2015).

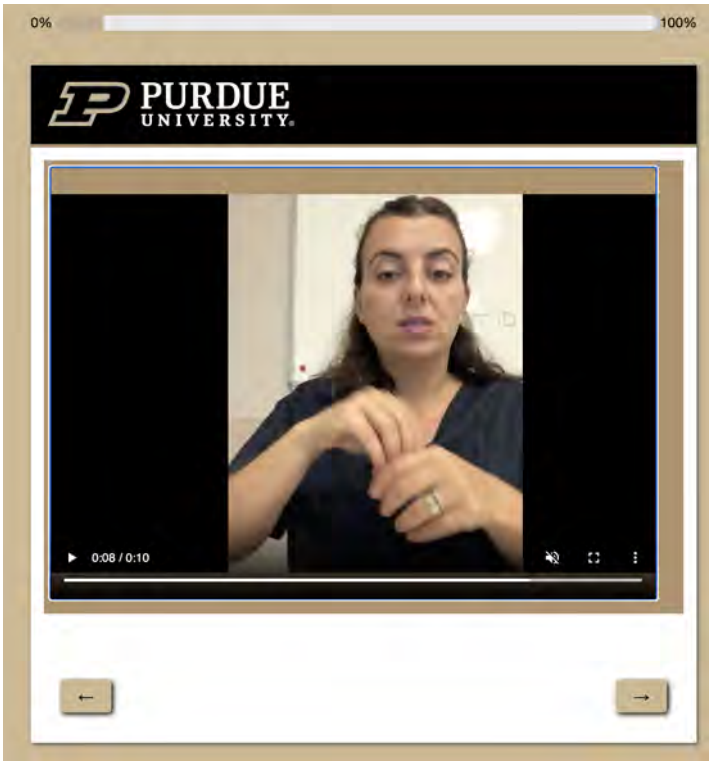

Figure 4.13. Production Task in Modal Flavors Context Study

8 of 16 participants responded to all target contexts in both sets. Due to time restrictions, the other half of participants were randomly assigned one set and responded to the contexts in that set. Thus, each target context has been responded by 12 participants.

Data Analysis

Similar to the Mutually Exclusive Propositions Study, data in this study came from both between-participants and within-participants since each target context was responded by each participant more than once. As data in previous study, this data also has nested structure: Participants in two groups DoD and DoH form the top cluster (Level 4 in Figure 4.14); participants (Level 3) were nested into these two groups; context types (C1, C2, C3 - Level 2) were nested in participants since all participants had responded to each target context. Lastly, each modal (M1, M2, M3 - Level 1) was fully nested in each context type so that the effect of context on the production of signs can be tested in full paradigm. Yet, the dependent variable in this task is binary while it was continuous in the previous task. This is why each target sign LAZIM, MECBUR, and GEREK was analyzed with multilevel binary logistic regression in SPSS.

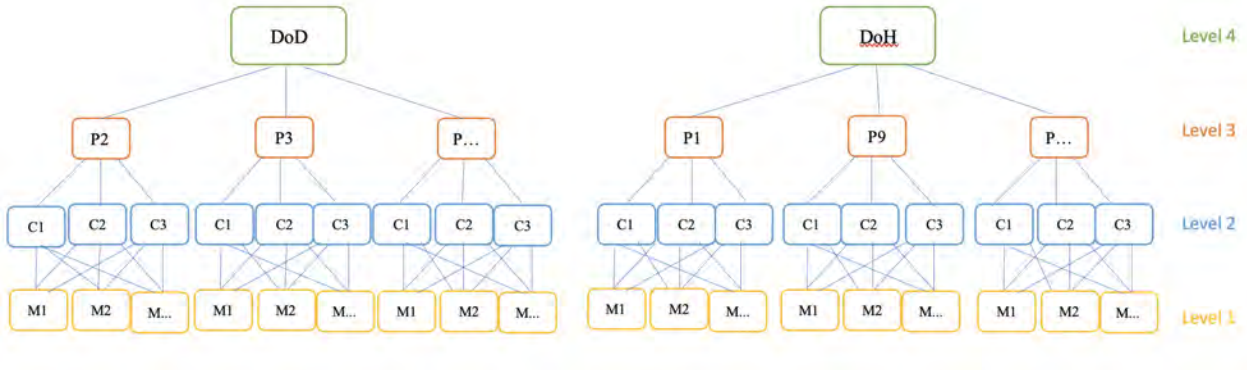

Figure 4.14. 4 Level Hierarchical Structure of Modal Flavor Data

Data Annotation and Coding

Recordings of each session were annotated for stimuli, target context, gloss, signs, preference, singer's comments, and comments in EUDICO Linguistic Annotator (ELAN) (Crasborn & Sloetjes, 2008) as in Figure 4.15. Stimuli was the context that was shown to the participant. Target context was the context types: teleological, bouletic, or goal-oriented. Each context was labelled with one of these types.

Gloss was the annotated response of the participant to the context. Gloss was labelled for the target signs LAZIM, MECBUR, and GEREK in Signs tier. If the participant preferred

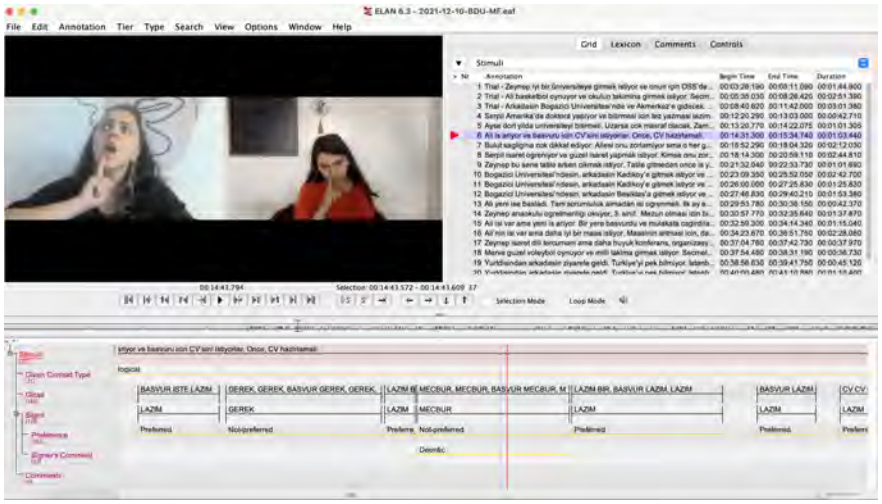

Figure 4.15. Template Used to Annotate Modal Flavors Production Task

the sign in the given context, it is annotated as preferred in Preference tier, otherwise as not-preferred. This annotation was done for each target sign in each context. Sometimes participants commented if modal flavor will be different with the target sign. For example, the participant was asked for MECBUR in the given context in Figure 4.15. She commented that it sounds like a command if she uses MECBUR, that is sentence sounds deontic rather than teleological. In these cases, that sign was annotated as not-preferred and interpreted modal flavor was annotated in Signer's Comments tier. After annotations for all participants were completed, data was exported to an excel file. Signers' preferences for target signs were coded as 1 if it was annotated as preferred, otherwise as 0. All independent variables were dummy-coded.

Results

I obtained 216 responses for each target sign from all 16 participants. All data was included in the analysis. Data was first analyzed by using totally unconditional model for each target sign. No significant variation was found due to context type and language input (DoD or DoH) for all modals (Tables 4.10, 4.11, 4.12).

Table 4.10. Covariates in Production of LAZIM

Parameter	β	SE	Z	p
LanguageInput	.00	-	-	-
LanguageInput*Participant	.00	-	-	-
LanguageInput*Participant*ContextType	.00	-	-	-

Table 4.11. Covariates in Production of MECBUR

Parameter	β	SE	Z	p
LanguageInput	.00	-	-	-
LanguageInput*Participant	.00	-	-	-
LanguageInput*Participant*ContextType	.00	-	-	-

Table 4.12. Covariates in Production of GEREK

Parameter	β	SE	Z	p
LanguageInput	.00	-	-	-
LanguageInput*Participant	.00	-	-	-
LanguageInput*Participant*ContextType	7.348E-11	-	-	-

Even though there was no significant effect of context type on the production of modals, their percentages of preferences are drastically different as seen in Figure 4.16. Percentages add up to more than 100 because if a signer preferred two or three target signs in a given context, all preferences were coded as 1. Similar proportion also holds when participants' first responses in terms of modal signs are analyzed as in Figure 4.17. To test if there is a significant difference among participants' preferences of signs, they were also analyzed with multilevel mixed effects.

There was again no significant variation due to the context types but overall preferences of signs are significantly different from each other as seen in Table 4.13 and Figure 4.18. Thus, participants preferred LAZIM significantly more than both GEREK and MECBUR. They also preferred MECBUR significantly more than GEREK.

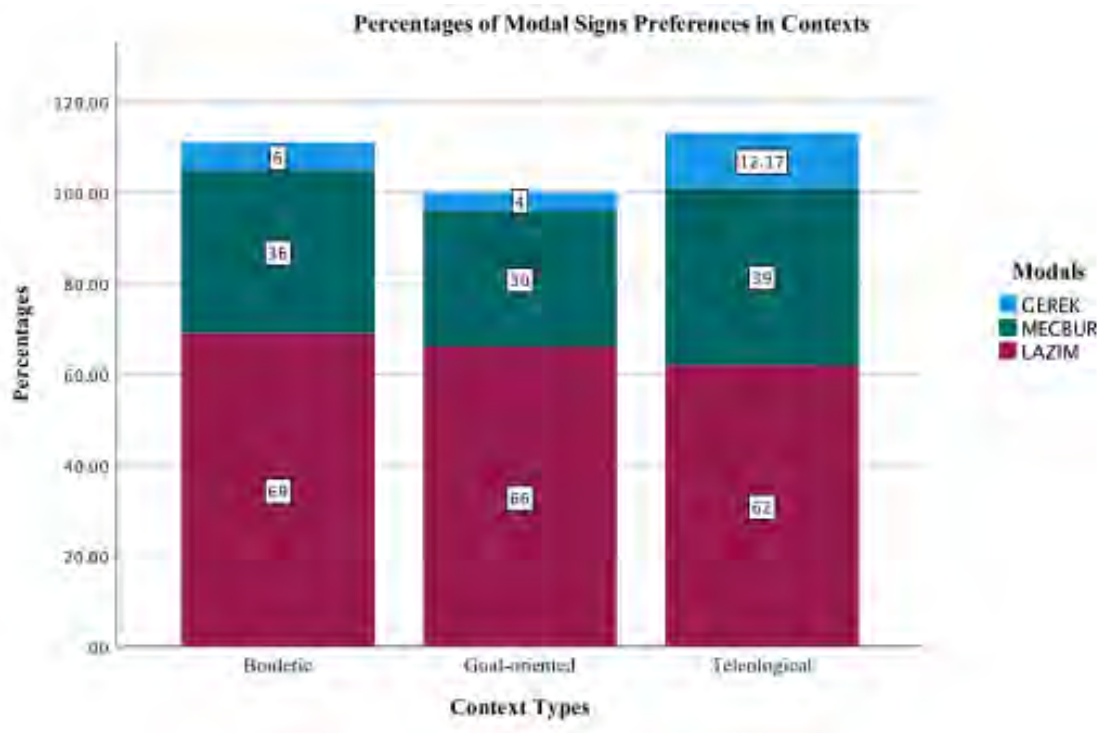

Figure 4.16. Percentages of Modal Signs across Context Types

Table 4.13. Fixed Effects on Modal Signs in Production Data

Parameter	β	SE	p	CI
GEREK-LAZIM	57.67	3.67	<.001	47.48-67.84
GEREK-MECBUR	27	1.53	.003	20.43-33.57
MECBUR-LAZIM	30.67	3.34	<.001	21.41-39.92

4.2.2 Acceptability Rating Task

Stimuli

The acceptability rating task had the same contexts as the production task and target sentences contained only one of LAZIM, MECBUR, and GEREK. Target sentences were recorded with the Deaf consultant and checked for their naturalness in TİD. Stimuli that were found unnatural were rerecorded. All contexts and target sentences in trial and main sessions were presented as video recordings in TİD.

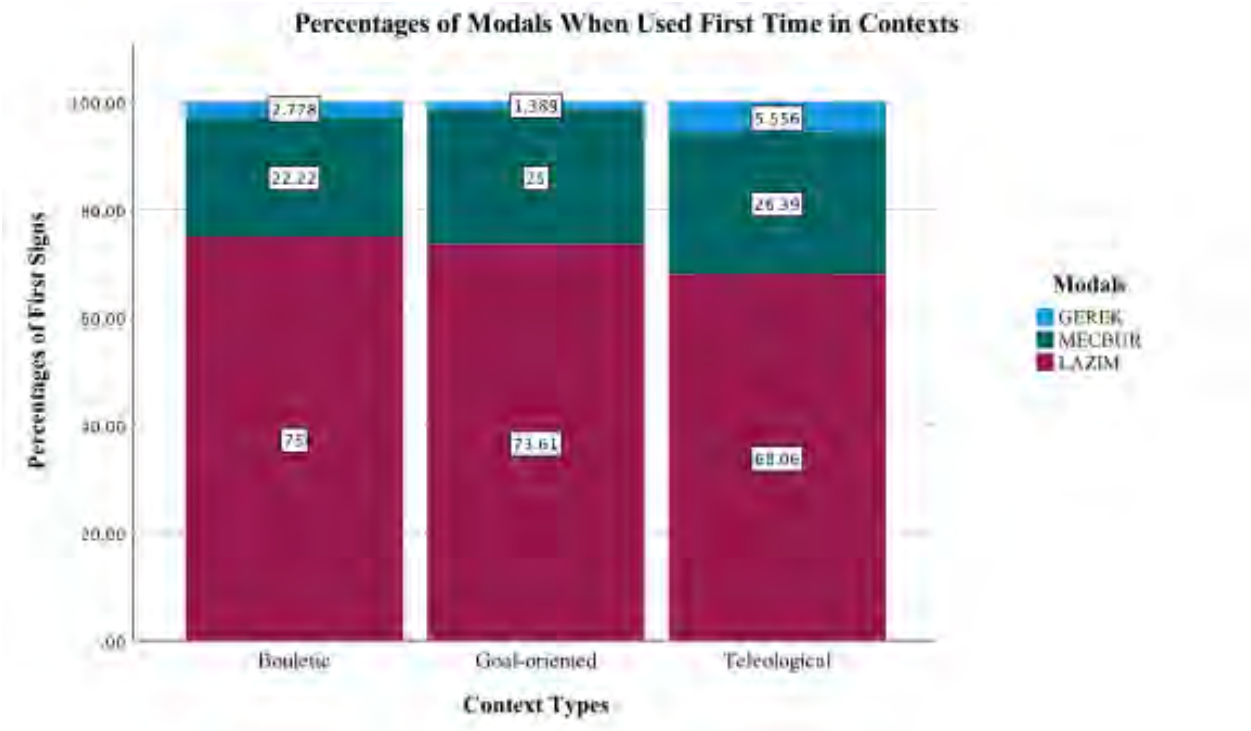

Figure 4.17. Percentages of Modal Signs When Signed First

Design

The task was conducted by within 3x3 mixed effects factorial design. Modal signs LAZIM, MECBUR, and GEREK and context types teleological, bouletic, and goal-oriented are fully crossed. Two sets of target items were prepared for a total of 18 target items as shown in Table 4.14. All the contexts are presented in Appendix D.

Procedure

During each trial, participants first did a trial session to familiarize them with the task. Participants were randomly assigned to one of the sets of target items and rated all test items in that set in randomized order. Participants were asked to watch the instruction video then do the trial session. After trial session, they started the main session. They watched the context, then target sentence signed in TİD (Figure 4.19); they were asked to

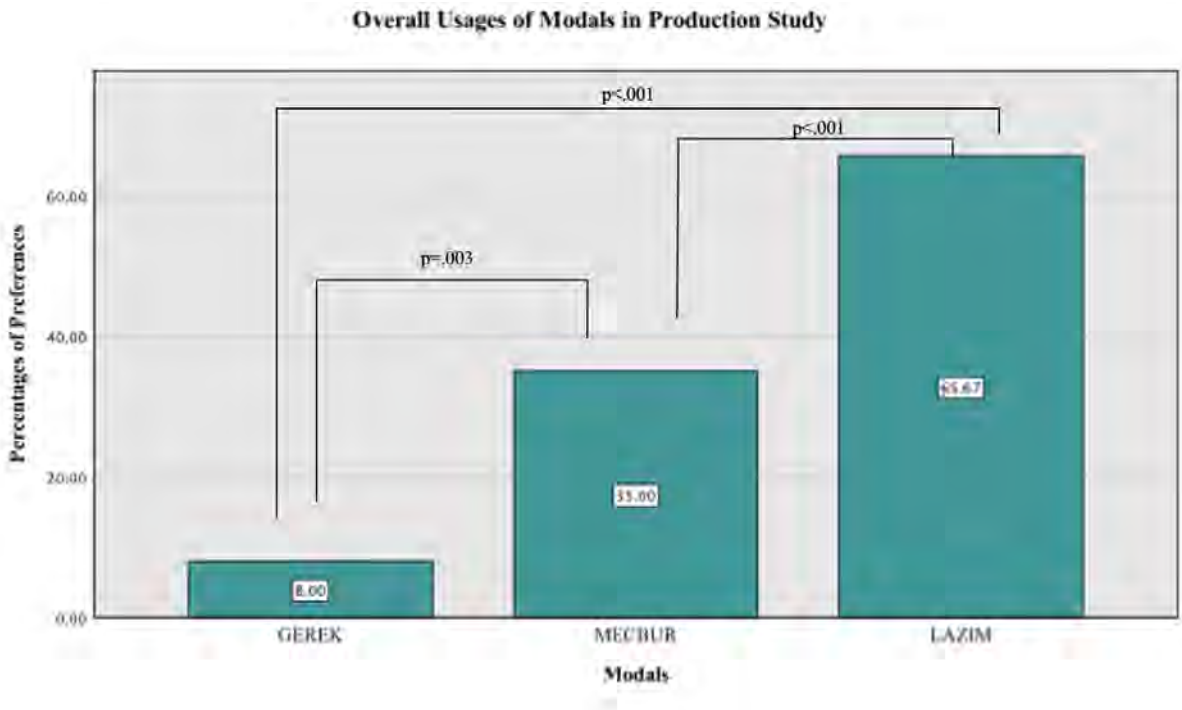

Figure 4.18. Significant Difference of Modal Signs in Production Task

rate the acceptability ('uygun' in the first scale) of the sentence in the given context on a 7-point slider. Participants also rated the naturalness ('doğal' in the second scale) of the target sentences on a 7-point slider. The term natural was used instead of grammaticality because Deaf community used this term for acceptable deaf-like signing. They were instructed to rate naturalness based on if they thought the sentence was TİD like and signed by a Deaf person rather than borrowing from Turkish and signed by a non-proficient signer. The aim was to avoid unacceptability ratings of modal signs due to unnatural or ungrammatical signing like GEREK being a loan from Turkish. In other words, participants would rate GEREK unacceptable not only because it was unacceptable in the context, but also because participants thought it was an unnatural or ungrammatical TİD sign. Thus, naturalness ratings show this possible effect.

Table 4.14. Factors of Modal Flavors Contexts Test

Manual Signs	Context Types
LAZIM (n=6)	Teleological (n=2)
	Bouletic (n=2)
	Goal-oriented (n=2)
MECBUR (n=6)	Teleological (n=2)
	Bouletic (n=2)
	Goal-oriented (n=2)
GEREK (n=6)	Teleological (n=2)
	Bouletic (n=2)
	Goal-oriented (n=2)
Total=18	

Data Analysis

The rating task data was also analyzed with multilevel model mixed effects since modal signs were rated in each target context. As in Figure 4.14, modal signs (M1, M2, M3) are first level fully nested in the contexts (C1, C2, C3) (Level 2). Contexts are fully nested in participants where each participant rated each target combination (Level 3). Lastly, participants are also nested in top clusters DoH (Deaf of Hearing) and DoD (Deaf of Deaf) based on their language background (Level 4).

Data Coding and Cleaning

Acceptability ratings were compared with naturalness ratings in terms of their correlations. The expected correlation was either positive or negative in terms of natural but not acceptable. If a participant's ratings had a negative correlation in terms of acceptable but not natural, this participant's data was excluded. 3 participants' data were excluded due to the negative correlation in their acceptability and naturalness ratings.

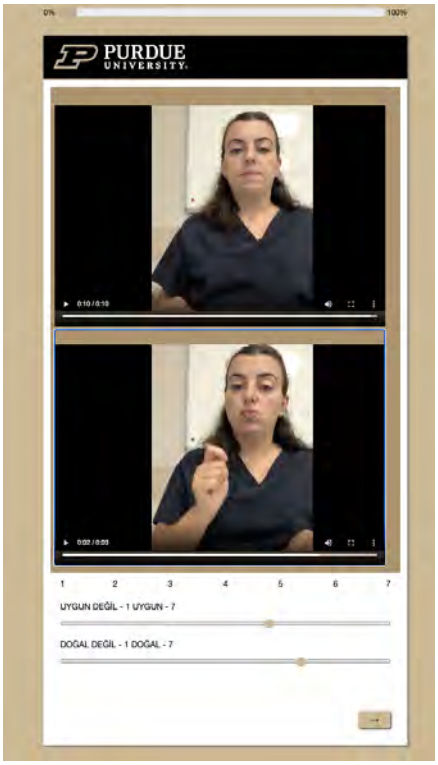

Figure 4.19. Acceptability Rating Task in Modal Flavors Study

Results

After exclusion, data contained 357 data points on which all analyses were carried out. Table 4.15 presents descriptive results only for modal signs; Table 4.16 presents descriptive results of modals in each context.

Table 4.15. Descriptive Statistics of Modal Flavors Acceptability Ratings

Modal	Min	Max	Mean	Standard Deviation
GEREK	1	7	4.18	2.30
LAZIM	1.9	7	6.72	.94
MECBUR	1.1	7	6.27	1.46

I first analyzed data by using totally unconditional model to observe which level brings the variation in the acceptability ratings. As seen in Table 4.17, variance in the acceptability ratings results from modal signs (1.95) and participant (.25), but not from language input

Table 4.16. Descriptive Statistics of Acceptability Ratings Based on Modal in Contexts

Context Type	Modal	Min	Max	Mean	Standard Deviation
Bouletic	GEREK	1	7	3.96	2.34
	LAZIM	4	7	6.90	.50
	MECBUR	1.3	7	6.27	1.40
Goal-oriented	GEREK	1	7	4.08	2.4
	LAZIM	4.6	7	6.88	.50
	MECBUR	1.1	7	6.26	1.53
Teleological	GEREK	1	7	4.46	2.2
	LAZIM	1.9	7	6.38	1.43
	MECBUR	1	7	5.69	2.01

or context types. When intra-class correlation (ICC) was calculated for each variance, the biggest proportion of variation is due to modal signs (48%) while the variation due to participant is small (6%). The only significant independent variable is modal signs ($p<.001$) affecting the acceptability ratings.

Table 4.17. Covariates in Modal Flavor Acceptability Ratings

Parameter	β	SE	p
AcceptabilityRating	1.84	.17	<.001
LanguageInput	.00	.00	-
LanguageInput*Participant	.25	.23	.28
LanguageInput*Participant*ContextType	.00	.00	-
LanguageInput*Participant*Contextlype*Modal	1.95	.36	<.001

Since language input does not have an effect on ratings, the rest of the analysis was carried out in three level model where participants form the top cluster in data structure. In this three level model, modals, context types were analyzed as fixed effects; participants and language background as random effects with age, gender, and generation as variables of level three. Table 4.18 shows sample regression coefficient (β), standard error (SE), significance level (p), and confidence intervals (CI) for each variable.

As seen in Table 4.18, context types (bouletic, goal-oriented, and teleological) has no significant effect on acceptability rating. As for modal signs itself, only GEREK has a significant effect on acceptability ratings. Thus, participants rated target sentences lower when

Table 4.18. Effects of All Independent Variables on Acceptability Ratings in Modal Flavors

Variables	β	SE	p	CI
Age	.01	.02	.72	-.06 .09
Gender	-36	.48	.47	-.74 1.47
Generation	-.007	.24	.98	-.57 .56
Bouletic	.03	.26	.91	-.49 .55
Goal-oriented	.06	.26	.81	-.46 .58
Teleological	.00	.00	-	-
GEREK	-2.02	.26	**<.001**	-2.54 -1.50
LAZIM	.46	.26	.085	-.07 .98
MECBUR	.00	.00	-	-

sentences have GEREK. Figure 4.20 shows acceptability ratings of modal signs in each context.

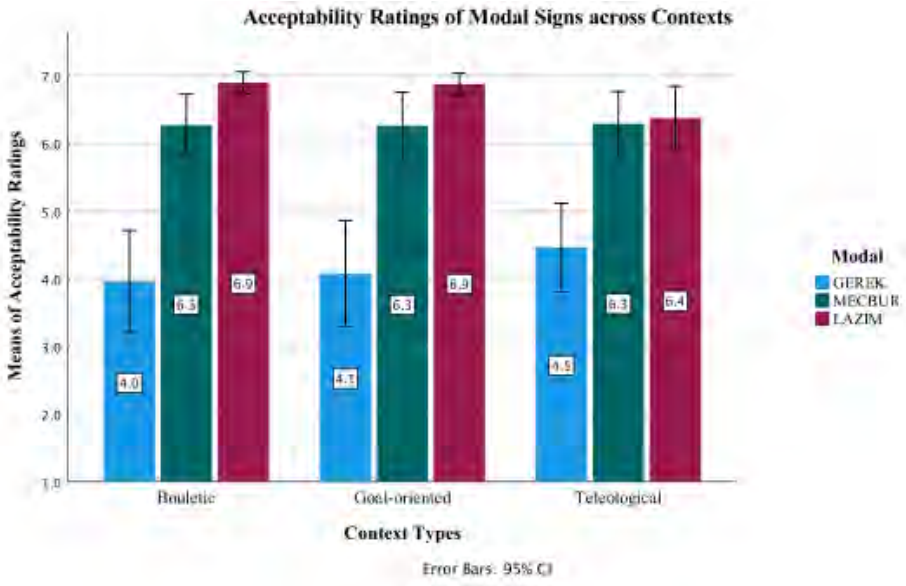

Figure 4.20. Acceptability Ratings of Modal Signs Across Contexts

Since modals contribute more variation (ICC=48%, p<.001) to acceptability ratings, each modal was further analyzed with each other where modal and context types were treated as fixed effects, participant as random effect within multilevel analysis. Table 4.19 and Figure 4.21 show the difference in acceptability of modal signs. As in the production task,

participants found LAZIM more acceptable than GEREK (p<.001) and MECBUR (p=.007) in all contexts. They also found MECBUR more acceptable than GEREK (p<.001) in all contexts.

Table 4.19. Difference Between Modal Signs

Modals	β	SE	p	CI
GEREK-LAZIM	2.47	.28	**<.001**	1.90 3.04
GEREK-MECBUR	2.04	.28	**<.001**	1.49 2.58
LAZIM-MECBUR	-.45	.16	**.007**	-.76 -.13

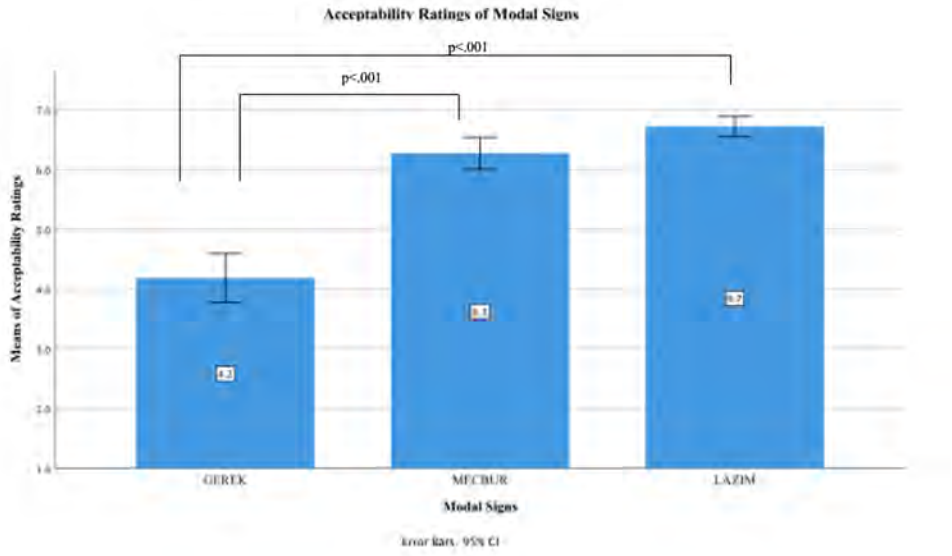

Figure 4.21. Significant Difference of Modal Signs in Rating Task

4.2.3 Discussion: Where does the difference come from?

Results of both production and acceptability rating tasks showed that context does not affect the production and the acceptability of modals GEREK, LAZIM, and MECBUR. Findings clearly show that these modals can have various flavors as bouletic, teleological, goal-oriented based on the context they appear in. If they had specific modal flavors, their acceptability ratings were expected to change with different context types. In other words, these modal signs are not lexicalized for an ordering source, and instead combine with ordering sources based on subject's desires or wishes (bouletic), aims (teleological), goals (goal-oriented).

Yet, there are significant differences among these modal signs' production and acceptability. GEREK has the lowest percentage (4-12%) in production and mean (M=4.18) in acceptability ratings. MECBUR has higher percentage (23-26%) in production and mean (M=6.27) in acceptability ratings. LAZIM has the highest percentage (68-76%) in production and also higher mean (M=6.72) in acceptability ratings. Based on the results, it is clear that none of the independent variables affects these differences. The possible explanation for GEREK comes from the participants' comments in production tasks. When they were asked for GEREK in elicitation sessions, nearly all participants commented that it is used rarely and not a native TİD sign as seen in Figure 4.22. Participants' observations are reflected in the production task data. Relatively higher acceptability rating of GEREK than its percentage in production task may show that signers would accept it when their interlocutors use it but not prefer to sign it themselves.

Figure 4.22. Participant commented that GEREK is not native TİD sign.

Similar to GEREK, difference between LAZIM and MECBUR might be the reflection of their frequencies and participants' idiolects. As for lexical frequencies, LAZIM was found

to have a higher frequency (N=417, 0.40%, rank=36th) than MECBUR (N=225, 0.22%, rank=74th) among the top-ranked 100 glosses (Makaroglu, 2021). As for idiolects, even though participant level variation is not significant, there is variation in the acceptability ratings coming from participants. Table 4.20 shows covariate estimate for participant level in the comparision of signs. Based on their intra-class correlation (ICC), variation in ratings due to participants is 17% in the difference between GEREK and LAZIM, 25% in the difference between GEREK and MECBUR, and 9% in the difference between LAZIM and MECBUR. Non-significance could be due to the low number of participants. The significant difference between LAZIM and MECBUR still needs to be further examined in future studies.

Table 4.20. Covariates Between Modal Signs

Modals	β	SE	p	ICC
GEREK-LAZIM	.55	.34	.107	17%
GEREK-MECBUR	.96	.51	.059	25%
LAZIM-MECBUR	.14	.09	.129	9%

4.3 Semantics of modals with circumstantial base

I have examined modal force and flavor of manual signs by testing them with mutually exclusive propositions and in various contexts yielding bouletic, teleological, or goal-oriented flavors. I have shown that modal signs GEREK, LAZIM and MECBUR have universal modal force while ACABA, OLABILIR and SERBEST have existential modal force. I will consider YAP and OLUMLU as having universal force as a default by leaving their varying modal force for future studies.

As for modal flavors, ability modals YAP and OLUMLU, deontic permission modal SERBEST, epistemic modals ACABA and OLABILIR have already reported to have specified modal flavors (Karabüklü et al., 2018). The current study on modal flavors of GEREK, LAZIM and MECBUR showed that they are not specified with a specific flavor and can have different flavors based on contexts they appear in. I will present semantics of SERBEST, YAP, OLUMLU, GEREK and MECBUR in this section and ACABA, LAZIM and OLABILIR after presenting results of the evidential restriction study in next chapter.

4.3.1 SERBEST: Specified force and flavor

By leaving epistemic modals to be further tested in the next chapter, SERBEST 'free' is the only one with a specified force and flavor. Sentence (4.16) is one of the target sentences in Mutually Exclusive Propositions Study where SERBEST appears with mutually exclusive propositions FOOD FINISH SERBEST '(He) can finish his meal' or LEAVE SERBEST '(He) can leave (his meal).' Based on the results, participants found sentences with SERBEST acceptable. It has the highest mean and smallest variation (M=6.9, SD=.28) in terms of acceptability ratings (Table 4.3). Thus, its modal force is clearly existential.

(4.16) BULUT$_{a}$ FOOD EAT, FINISH^NOT, MOM SAY$_{3a}$,FOOD FINISH SERBEST, LEAVE SERBEST

'Bulut had his meal but didn't finish it. Mom says: You can finish it, or leave it.'

In terms of its modal flavor, as shown in examples through (4.17)-(4.20) in Chapter 2, it is only acceptable in deontic permission context (4.18). Following Kratzer's theoretic model of modals, modal flavor is explained via modal base and ordering source. These two components form two conversational backgrounds. Modal base, the first conversational background, assigns to each world a set of propositions which are true in that world based on rules, circumstances, or subject's desires or aims. Ordering source, the second conversational background, assigns to each world a set of propositions representing norms, laws, desires, goals, so on with respect to the ideal world. The accessibility relation, a function from worlds to sets of propositions, picks out true propositions in the modal base. Then, the ordering source ranks the set of worlds according to how many of ordering source propositions are true in each world. The modal quantifies over only the most ideal worlds based on the ordering source (Matthewson, 2016). Kratzer introduces two modal bases: Epistemic modal base expresses sets of propositions that express a piece of established knowledge or available evidence in a world for a group of people, a community, so on. Circumstantial modal base expresses sets of propositions that express relevant facts about the circumstances.

(4.17) Context: You see that the lights are on in your mothers house and you say:

LIGHT-ON EXISTENTIAL. MOM HOME OLABILIR/?SERBEST/?YAP/?OLUMLU
sq, ht/hn

'The light is on; mom might be home.'

epistemic

(4.18) Context: Bulut's parents are not so strict and they allow him to stay outside at night. BULUT $_{a}$IX$_{b}$ 12 O'CLOCK $\overline{\text{HANG-OUT}}^{\text{hn}}$ $\overline{\text{SERBEST/?OLABILIR/?OLUMLU}}^{\text{hbt}}$

'Bulut can hang outside till midnight.'

deontic-permission

(4.19) Context: Kadir went to a special course in the States and learnt how to perform magic. KADIR$_{a}$ MAGIC $\overline{\text{YAP/OLUMLU/?OLABILIR/?SERBEST}}^{\text{hn}}$ IX$_{3a}$

'Kadir can perform magic.'

ability

(4.20) Context: Ali was on holiday for a week and he needs to return to work today. If he does not come, he will be fired.

TODAY ALI COME $\overline{\text{LAZIM}}^{\text{eo,br}}$?OLABILIR/?SERBEST/?YAP/?OLUMLU

'Ali must come (to the work) today.'

deontic-requirements

As SERBEST is unacceptable in epistemic context (4.17), it is lexicalized for its modal base *c(f)* in 4.21 that is circumstantial. Circumstantial base can combine with different ordering sources like rules or laws yielding deontic, or subject's aims yielding teleological. Furthermore, SERBEST is also not acceptable in just any circumstantial modal context (4.19-4.20), but only in deontic permission context (4.18). Thus, SERBEST is also lexicalized for its ordering source *c(h)* in 4.21 which ranks permission contexts as the best ones for its truth conditions.

(4.21) $[\![\text{SERBEST}(f)(h)(p)]\!]$ is only defined if *c(f)* is a circumstantial modal base and *c(h)* is a permission ordering source.

If defined, $[\![\text{SERBEST}]\!]$: $\lambda f_{<s,<st,t>>}.\lambda h_{<s,<st,t>>}.\lambda p_{<st,t>}.\exists w' \in \text{BEST}_{h(w)}(\cap f(w)):p(w)=1$

Having presented the semantics of SERBEST which has a lexicalized modal force and flavor, I will focus on the modals with specified force but unspecified flavor in the following section.

4.3.2 MECBUR: Specified force and unspecified flavor

I will give semantics of MECBUR here and leave GEREK since GEREK has the lowest percentage of usage (8%) acceptability rating (M=4.18, SD=2.30). Nearly all participants also commented that they would not sign it and it is a loan from Turkish (Figure 4.22). This is why I will not discuss it in detail but its potential semantics would be similar to MECBUR.

Similar to SERBEST, MECBUR also has specified modal force. When they were presented in mutually exclusive propositions such as FOOD CAREFUL MECBUR and CAREFUL^NOT MECBUR, participants found these sentences (4.22) unacceptable (M= 3.46, SD=2.53). Its acceptability rating shows that a contradiction appears in mutually exclusive propositions where we present both p and ¬p at the same time. Thus, MECBUR has a universal force which requires either p or ¬p to be true in all possible worlds.

(4.22) ASLI DIABETES SICK, FOOD CAREFUL MECBUR, CAREFUL MECBUR^NOT

'Asli has diabetes, she must be careful with her diet, doesn't have to be careful with it.'

As for its modal flavor, MECBUR has been already reported being acceptable in deontic (4.23) (Yildirim, 2015) and unacceptable in epistemic context (4.24) (Özkul, 2019). Hence, MECBUR is specified for its modal base which is circumstantial.

(4.23) MEDICINE DRINK MECBUR

'I have to take medicine.'

(deontic, Yildirim, 2015)

(4.24) *IX$_3$ CAR^DRIVE^CAN MECBUR

'It is epistemically necessary that he can drive a car.'

(epistemic, Özkul, 2019, p.563)

Its ordering source is further investigated in the Modal Flavors Study. Results of both production and rating tasks show that it is acceptable in bouletic (4.25) where brushing teeth is subject's desire, not parents' rules, teleological (4.26) where having a PhD is subject's aim but not a law enforced requirement, or goal-oriented context (4.27) where going to Besiktas is

subject's goal. Thus, MECBUR, unlike SERBEST, is not specified for its ordering source and it can be combined with different ordering sources as long as the modal base is circumstantial.

(4.25) *Bouletic Context:* Bulut is so careful on his health. His parents don't force him but he regularly brushes his teeth. He doesn't want to have cavities.
BULUT SLEEP^NOT BEFORE TEETH BRUSH MECBUR
'Bulut should/must brush his teeth before sleeping.'

(4.26) *Teleological Context:* Serpil is in a PhD program in the States and she needs to write a dissertation to earn her degree.
SERPIL THESIS WRITE MECBUR
'Serpil should/must write a thesis.'

(4.27) *Goal-oriented Context:* You're in Bogazici University, your friend asks you how to go to Besiktas. S/he can only go by bus.
BESIKTAS GO FOR BUS GET-ON MECBUR
'To go to Besiktas, you should take the bus.'

Based on its patterns in different contexts, I propose that MECBUR is lexicalized for its modal force (∀) and its modal base (*c(f)*) (4.28). Yet, it can have different flavors with different ordering sources (*c(h)*) derived from the conversational background.

(4.28) $[\![\text{MECBUR}(f)(h)(p)]\!]$ is only defined if *c(f)* is a circumstantial modal base.
If defined, $[\![\text{MECBUR}]\!]$: $\lambda f_{<s,<st,t>>}.\lambda h_{<s,<st,t>>}.\lambda p_{<st,t>}.\forall w' \in \text{BEST}_{h(w)}(\cap f(w)):p(w)=1$

Up to this point, we have seen modals with one ordering source like 'getting a PhD', 'keeping teeth healthy', or 'going to Besiktas'. It is also possible to have a second ordering source as in (4.29) where the first order source is going to Kadikoy and the second one is seeing Bosphorus. MECBUR is also acceptable in these contexts behaving as 'should' or 'ought to' in English.

(4.29) *Goal-oriented Context:* You're in Bogazici University, your friend wants to go to Kadikoy, and asks you how to go. There are couple routes to take, but your friend also wants to see Bosphorus.

KADIKOY GO FOR FERRY GET-ON MECBUR

'To go to Kadikoy, you should take the ferry.'

These modals are called 'weak' necessity and analyzed as having a smaller quantificational domain (von Fintel & Iatridou, 2008). In other words, if a modal is true in more possible worlds, it has a stronger reading like paying a fine when parked illegally. If a modal is true in fewer possible worlds it has a weaker reading. For example, in (4.29), there are a couple ways to go to Kadikoy from Bogazici; someone can take a bus, ferry, or metro. Any choice will be true to fulfill the first goal 'going to Kadikoy'. So, the first ordering source ranks the possible worlds that are already restricted by the modal base. Then, ferry is one of few options to both go to Kadikoy and see Bosphorus. After first ordering source, the second ordering source ranks the possible worlds that are picked by the first one and the quantificational domain gets smaller. Thus, MECBUR can also have two ordering sources and have a weaker reading.

In terms of modal typology, modals in TİD up to this point showed two patterns: SERBEST is similar to English *might* with specified force and flavor. MECBUR is similar to English *can, must* with specified force and unspecified flavor. The following section will present modals that possibly have varying force and behave like those in St'amt'icets.

4.3.3 Attempt to explain OLUMLU

As seen in the results of Mutually Exclusive Propositions Study, OLUMLU is rated in the middle (M=4.05) and multilevel analysis also showed that it is significantly different than both universals (deontic signs) and existentials (epistemic signs). Signs are presented without any context, so if it has a varying modal force it is natural that it was rated in the middle. Modals with varying force are usually shown to have one force as a default and other one is derived with either strengthening or weakening. More clearly, if they have a universal force as a default, it is weakened to have existential interpretation. These modals lose their existential interpretation in downward entailing environments like conditionals or generics where the proposition needs to hold in all possible worlds. As for existential, modals

with varying force can have existential as their default force, which is strengthened to have universal interpretation.

OLUMLU seems to have universal force as its default since it was rated closer (M range=3.9 - 4.05) to deontic modals which have universal force (M range= 1.63-3.23) than epistemic modals which have existential force (M range = 5.95-6.90). Further support comes from its usage with conditionals. In (4.30), two participants were talking about the soccer team that one was playing on during a free conversation task in the SignHub Project database. In the conversation, one participant asked about averages of teams at the end of tournament. Another participant commented that the goalkeeper was not that good and they did not have a high average. He followed by saying if they had another goalkeeper from a different team, they would have had a higher average. As seen in sentence (4.30), he signed OLUMLU in the matrix clause of a conditional. Since conditionals restrict the truth conditions of matrix clauses, the proposition denoted by the matrix clause has to be true in all these restricted possible worlds. Thus, OLUMLU loses its existential interpretation with conditionals and only has its universal interpretation.

(4.30) Context: Two participants were talking about the soccer team that one was playing on during a free conversation. One asked about averages of teams at the end of tournament. Another participant replied that the goalkeeper was not good, and:

hn
br,sq
#R-E-M-Z-I IZMIR IX-3 CL-TAKE-PUT OLUMLU INCREASE

'If they had Remzi from Izmir (team), then the score could be higher.'

corpus data from COST-IS-1006 project

As for its modal flavor, it is only acceptable in ability contexts (4.33) among all flavors (4.31-4.34). Thus, it has a lexicalized circumstantial modal base and a lexicalized ordering source ranking possible worlds based on the subject's abilities or capacities.

(4.31) Context: You see that the lights are on in your mother's house and you say:

sq, ht/hn
LIGHT-ON EXISTENTIAL. MOM HOME OLABILIR/?OLUMLU

'The light is on; mom might be home.'

epistemic

(4.32) Context: Bulut's parents are not so strict and they allow him to stay outside at night. BULUT $_{a}$IX$_{b}$ 12 O'CLOCK $\overline{\text{HANG-OUT}}^{\text{hn}}$ $\overline{\text{SERBEST/?OLUMLU}}^{\text{hbt}}$

'Bulut can hang outside till midnight.'

deontic-permission

(4.33) Context: Kadir went to a special course in the States and learnt how to perform magic. KADIR$_{a}$ MAGIC $\overline{\text{OLUMLU}}^{\text{hn}}$ IX$_{3a}$

'Kadir can perform magic.'

ability

(4.34) Context: Ali was on holiday for a week and he needs to return to work today. If he does not come, he will be fired.

TODAY ALI COME $\overline{\text{LAZIM/?OLUMLU}}^{\text{eo,br}}$

'Ali must come (to the work) today.'

deontic-requirements

Testing OLUMLU for its existential interpretation and in different environments will give a stronger basis for the analysis. Since the SignHub database does not include other possible test items like generic statements or indefinites, I will propose the first attempt on its analysis based on conditional statement and following Rullmann et al. (2008)'s analysis. They analyzed modals with varying force as plural indefinites where a variable W quantifies over pluralities of worlds. Indefinite determiners are represented by a choice function that picks out an individual from the set. They represent modal base as B in their article, but I will keep it as f to have a consistent representation across all modals. Similarly, they argued that the modal choice function f will pick out a subset of the possible worlds that are accessible from modal base. Then, the universal quantifier quantifies over the individual worlds that are picked out by f (4.35).

(4.35) $[\![\text{OLUMLU}(f)(f)(h)(p)]\!]$ is only defined if *c(f)* is a circumstantial modal base and (c(h)) is an ability ordering source, and f is a choice function of type $< st, st >$ such that f(f(w)) $\subset$ f(w).

If defined,

$[\![\text{OLUMLU}]\!]$:$\lambda f_{<s,<st,t>>}.\lambda f_{<st,st>}.\lambda h_{<s,<st,t>>}.\lambda p_{<st,t>}.\forall w' \in \text{BEST}_{h(w)}(\cap f(w)):p(w)=1$

Following Rullmann et al.'s (2008) analysis, I proposed that OLUMLU may have universal force as its default and is weakened to existential. Its modal flavor is specified for ability by requiring circumstantial modal base and ability ordering source in the projected possible worlds. In other words, its circumstantial modal base will pick out only the compatible possible worlds, then ability ordering source will rank the possible worlds where the subject's abilities or capabilities hold as best worlds.

4.4 Conclusion

Mutually Exclusive Propositions Study aimed to investigate modal force of manual signs. Results showed that modals cluster into three groups based on their acceptability ratings in mutually exclusive propositions. LAZIM and MECBUR have universal force while ACABA, SERBEST and OLABILIR have existential force. OLUMLU seems to have a varying force by significantly differing from the two previous groups.

Modal Flavors Study targeted to test if GEREK, LAZIM and MECBUR have lexicalized for a specific flavor or not. Production and acceptability rating tasks showed that GEREK is not produced that much by the participants and further found as a non-native TİD sign. This would explain its low percentages but a better acceptability rating mean (M=4.18, SD=2.30). Signers will understand it when their interlocutor uses it, but they will not prefer to use it themselves.

As for LAZIM and MECBUR, there is a significant difference in their percentages of usages but there is no effect of context type. Two signs have different frequencies, so their frequencies most likely affected their productions. In contrast, they have closer ratings in acceptability ratings without any significant effect of context type. This shows that they are not specified for their modal flavor and they can have different flavors based on the contexts that they appear in.

If we categorize TİD modals in terms of Rullmann et al. (2008)'s typological features, Table 4.21 shows the intersections of their features. Similar to Paciran Javanese, TİD modals

Table 4.21. TİD modals typological features

	selective modal base	unselective modal base
specified force	SERBEST, MECBUR	
unspecified force	OLUMLU	

seem to include more than one typological behaviour in a single language. TİD modals encapsulate three typological patterns with modals that have specified force and flavor SERBEST, modals that have specified force and selective base, but unspecified ordering source MECBUR, and modals that seem to have unspecified force but specified flavor OLUMLU. These three patterns are predicted to be realized rarely in languages due to both overspecification (specified force and flavor) and underspecification (unspecified force and flavor) (Deal, 2011; Rullmann et al., 2008). Languages have been predicted to vary in one dimension as either force or flavor, but modals in Washo already showed that some languages allow variation in both dimensions (Bochnak, 2015). Data in TİD also show that it has modals varying in flavor or force. The full pattern will become obvious after the results of Evidential Restriction Study in the next chapter.

5. EVIDENTIAL RESTRICTION ON EPISTEMIC SIGNS

All modal signs that were analyzed in the previous chapter have circumstantial base. The epistemic sign OLABILIR was also shown to have only epistemic modal base (5.1) and not circumstantial (5.2-5.4) (Karabüklü et al., 2018).

(5.1) Context: You see that the lights are on in your mother's house and you say:
LIGHT-ON EXISTENTIAL. $\overline{\text{MOM HOME OLABILIR}}^{\text{sq, ht/hn}}$
'The light is on; mom might be home.'

epistemic

(5.2) Context: Bulut's parents are not so strict and they allow him to stay outside at night. BULUT $_{a}$IX$_{b}$ 12 O'CLOCK $\overline{\text{HANG-OUT}}^{\text{hn}}$ $\overline{\text{SERBEST/?OLABILIR}}^{\text{hbt}}$
'Bulut can hang outside till midnight.'

permission

(5.3) Context: Kadir went to a special course in the States and learnt how to perform magic. KADIR$_{a}$ MAGIC $\overline{\text{YAP/OLUMLU/?OLABILIR}}^{\text{hn}}$ IX$_{3a}$
'Kadir can perform magic.'

ability

(5.4) Context: Ali was on holiday for a week and he needs to return to work today. If he does not come, he will be fired.
TODAY ALI COME $\overline{\text{LAZIM}}^{\text{eo,br}}$?OLABILIR/
'Ali must come (to work) today.'

deontic

The only sign that can have both modal bases is LAZIM, yet it has further requirements in epistemic contexts. As seen in the context in (5.5), the signer makes an inference based on the available evidence and her information about the subject and situation; the inference in the sentence is a strong one where other possibilities are eliminated by the background information. OLABILIR is also acceptable in this context, yet does not give the strong inference

reading. Furthermore, LAZIM was not found acceptable in each epistemic context as in (5.6) where the signer only knows that the light is on. The signers found LAZIM unacceptable in this context and preferred OLABILIR.

(5.5) Context: You went to Sumru's office and know that it's her office hour. She's not in her office and you're saying:

SECRETARY WORK ROOM GO LAZIM^{sq}

'She must have gone to the secretary's office.'

(5.6) Context: You see that the light is on at home and you're saying.

MOM HOME EXISTENTIAL OLABILIR/?LAZIM.

'Mom might be home.'

Similar restrictions are also discussed for epistemic modals that require an evidential source in other other languages and they differ in which evidential dimension they require. For example, *must* in English requires inference and trustworthiness (Matthewson, 2015, 2020; von Fintel and Gillies, 2010); *lákw7a* in St'amt'icets requires sensory evidence (Matthewson, 2020), *'nakw* requires non-visual sensory evidence (Matthewson, 2020; Peterson, 2010) among others (see Matthewson (2020) for detailed typological and theoretical discussion on evidential restrictions in epistemic modals). Before presenting the study testing evidential restriction on epistemic signs ACABA, OLABILIR and LAZIM, I will briefly present definitions of and theoretical perspectives on epistemic and evidentiality and then, evidential requirement on *must*, which has the closest pattern with LAZIM.

5.1 Epistemic and Evidentiality

In terms of quantificational accounts of modals, an epistemic modal is a quantifier that quantifies over the possible worlds that are picked out by epistemic modal base. Evidentials encode the information source of the speaker for the proposition that the speaker puts forward. Even though these definitions do not hint any relation between two categories, scholars have analyzed them as either separate categories (Aikhenvald, 2004; De Haan, 1999), or same identity where evidential is a subtype of epistemic modal (Matthewson, 2015, 2020). The

relation becomes obvious when we look at the definition of epistemic modal base which is defined as 'speaker's degree of certainty or the necessity/possibility of the truth of the proposition expressed by p' (Faller, 2011, p.660). Conveying the source of information (evidential) directly affects the 'degree of certainty' (epistemic).

Faller's (2002) definition reflects Krifka's (2021) subjective (speaker's degree of certainty) and objective (the necessity/possibility of the truth of the proposition) epistemic distinction. I will address this distinction when discussing the relationship between manual signs and nonmanual markers.

Typological patterns of languages in terms of encoding evidentiality is another reason for these two perspectives as a separate category or the same one. Not all languages encode epistemic and evidentiality as separate morphemes. These categories can be realized as two different morphemes like *-AbIl* (epistemic) (5.7) and *-mIş* (evidential) (5.8) in Turkish and they can be used together (5.9). In languages that do not have a separate morpheme, evidentiality is encoded through modals like *must*, adverbs like *apparently* or *evidently*, or attitude verbs like *seem, think*, so on. Since two categories are encapsulated in one form as *must* in the second category, they will inevitably interact.

(5.7) *Ali yarn gel-ebil-ir.*
Ali tomorrow come-epis-aor
'Ali might come tomorrow.'

epistemic

(5.8) *Ali yarn gel-ecek-miş.*
Ali today come-fut-evid
'(I heard/inferred that) Ali will come tomorrow.'

evidential

(5.9) *Ali yarn gel-ebil-ir-miş.*
Ali today come-epis-aor-evid
'(I heard/inferred that) there is a possibility that Ali will come tomorrow.'

epistemic-evidential together

To better understand how these two notions interact, I will present Faller's (2002) discussion on epistemic and evidential in Cuzco Quechua where the two notions are separately encoded, then Matthewson (2015) and von Fintel and Gillies's (2010) discussions on which evidential dimension is required by *must* in epistemic contexts in the following sections.

5.1.1 Cuzco Quechua: Epistemic and evidentiality are encoded separately

Languages may convey pure possibility where a speaker states a possibility without indicating how she obtained that possibility. For example, when a speaker uses *may* as in 'John may be home' she expresses that there is a possibility of John being home without indicating her grounds for this possibility. Similarly, *-AbIl* in Turkish in (5.7) conveys the possibility of Ali's being home without conveying the source of information. If the speaker wants to express the source of information for the possibility in Turkish, she can use both morphemes epistemic and evidential together as in (5.9).

Cuzco Quechua also has separate morphemes to encode possibility and evidentiality. As seen in (5.10a), possibility of Pilar being at school is expressed by the irrealis mood marker *-man*. The speaker only conveys the possibility in (5.10a) and she uses one of the evidential morphemes to convey the source of information for this possibility (5.10b). As seen in (5.10b), Cuzco Quechua has separate morphemes for different types of evidentials.

(5.10) *a.* *Pilar yachay wasi-pi ka-sha-n-**man.***
Pilar know house-loc be-prog-3-**man**
'p=Pilar might be at school.'

(*epistemic, Faller, 2002, p. 85*)

b. *Pilar yachay wasi-pi-**n/-s/-chá** ka-sha-n-**man.***
Pilar know house-loc-**n/-s/-chá** be-prog-3-**man.**
'p=Pilar might be at school.
EV= **-mi:** speaker has best possible grounds for saying that Pilar might be at school (=inference)
-si: speaker was told that Pilar might be at school.
chá: speaker conjectures that Pilar may be at school.'

epistemic-evidential together (Faller, 2002, p. 85)

Similar to Cuzco Quechua, Faller (2002) presents examples from other languages that distinguish epistemic and evidential. To present a couple of examples, Western Tarahumara has a reportative suffix *-ra* to express source of information without conveying the possibility. Reportative suffix *-na* in Iquito is also used to express that the statement is reported without casting any doubt to its truth. Thus, even though epistemic and evidential have close kinship, they are distinct notions and languages can have pure possibility and pure evidentiality. Following Faller's (2002, 2011) discussion, I will also treat epistemic and evidential as two separate notions that can be realized as separate morphemes or a single morpheme based on a language's typological pattern.

5.1.2 English *must*: Evidentiality is a requirement

Faller (2002) also discusses examples from languages that have ambiguous markers between epistemic and evidential. She gives German verb *sollen* as an example that has deontic, epistemic, and evidential uses. The speaker in (5.11a) expresses a likelihood of movie being good without expressing how she arrived at this judgment. In contrast, she reports others judgment about the movie in (5.11b) without herself necessarily sharing this judgment.

(5.11) *a.* *Der* *Film* ***sollte*** *gut* *sein.*
the movie **sollen**-3sg.-subj good be
'The movie should be good.
MV: possibility'

(*epistemic, Faller, 2002, p. 87*)

b. *Der* *Film* ***soll*** *gut* *sein.*
the movie **sollen**-3sg good be
'The movie is said to be good.
EV: reportative'

(*evidential, Faller, 2002, p. 87*)

German *soll* can be used as either epistemic or evidential; in contrast, English does not have this ambiguity, but requires evidentiality in epistemic *must*. More clearly, *must* is not

acceptable in a context where the speaker has direct evidence (5.12). It is acceptable in contexts where the speaker either sees the endresult 'getting wet from rain' and making an inference (5.13), or makes a logical deduction and infers the proposition (5.14).

(5.12) *Seeing the pouring rain.*

??It must be raining.

(von Fintel and Gillies, 2010, p. 353)

(5.13) *Seeing wet raingear and knowing rain is the only cause.*

It must be raining.

(von Fintel and Gillies, 2010, p. 353)

(5.14) *Chris has lost her ball, but she knows with full certainty that it is in either Box A or B or C. She says:*

The ball is in A or B or C. It is not in A... It is not in B. So, it must be in C.

(von Fintel and Gillies, 2010, p. 362)

Based on the behavior of *must* with different evidential kinds and sources, von Fintel and Gillies (2010) argue that p (It is raining) or its negation is not known based on direct evidence or trustworthy source (5.12). In formal analysis of modals, modal base represents the information compatible with what is known in the context. Since the speaker cannot use *must* in a direct evidence context, the authors propose a special set of propositions which has 'direct information' and called it as the kernel (K). K has its own special modal base where all propositions are true. In the lexical entry of *must*, it presupposes that K settles if proposition is entailed or contradicted by any propositions in K. If it is the case, *must* is infelicitous to use. Otherwise, if K fails to directly settle if p is entailed or contradicted, then *must* is felicitous and true to use.

By further investigating the types of evidentiality that *must* requires in von Fintel and Gillies's (2010) analysis, Matthewson (2015) argues that evidentiality is not a requirement in these modals, but it is part of epistemic modals whose modal base relies on evidence. As I stated before, I will follow Faller's (2002) treatment of epistemic and evidential as distinct notions to set up the patterns that TİD modals show. Yet, Matthewson's (2015) analysis is

valuable in terms of observing how evidentiality is encoded. As she shows through (5.15-5.19), *must* is not acceptable in the contexts where the speaker has direct evidence about the proposition through all sensory channels. Kernel has the direct evidence and propositions embedded under *must* are already entailed in the kernel so *must* becomes infelicitous in these contexts.

(5.15) *The speaker sees the rain.*

K: {it is raining, ...}

?It must be raining.

visual witness (Matthewson, 2015, p.145)

(5.16) *The speaker hears people playing Tchaikovsky.*

K:{they are playing Tchaikovsky,...}

?They must be playing Tchaikovsky.

auditory witness (Matthewson, 2015, p.145)

(5.17) *The speaker smells something good.*

K: {something smells good, ...}

?Something must smell good.

olfactory witness (Matthewson, 2015, p.145)

(5.18) *The speaker tastes something good.*

K: {something tastes good, ...}

?Something must taste good.

gustatory witness (Matthewson, 2015, p.145)

(5.19) *The speaker feels that his/her coat is wet.*

K: {my coat is wet, ...}

?My coat must be wet.

tactile witness (Matthewson, 2015, p.145)

Yet, it is not about if the evidence is sensory or not. In other words, when the speaker has indirect sensory evidence, then *must* becomes felicitous in these contexts. As through

(5.20)-(5.22), she provides contexts where the speaker has indirect information about the proposition rather than direct information (5.15-5.19). *must* is acceptable in these contexts since propositions are not entailed or contradicted by the kernel. Similarly, trustworthiness also needs to be indirect evidence (5.23) and does not make *must* felicitous when it is with direct evidence (5.24).

(5.20) *The speaker sees people behind a window wincing and holding their ears while listening to music.*

K:{they're wincing and holding their ears, they're listening to music, people wince and hold their ears when things are too loud,...}

The music must be too loud.

indirect visual (Matthewson, 2015, p.146)

(5.21) *The speaker hears someone crying inside the next room.*

K:{someone is crying in the next room, I just saw Susie go into that room, I know the room was empty before,...}

Susie must be crying.

indirect auditory (Matthewson, 2015, p.146)

(5.22) *The speaker smells a smell like burning meat.*

K:{I smell something like burning meat, I was cooking meat earlier, I haven't turned the oven off, ...}

I must have burnt the meat.

indirect smelling (Matthewson, 2015, p.146)

(5.23) *Belinda tells the speaker that Bob's light is on.*

K:{Belinda said Bob's lights are on, Belinda is a reliable source about Bob's lights, Bob's lights are on, Bob's lights are only on when he's home,...}

Bob must be home.

direct trustworthy report (Matthewson, 2015, p.147)

(5.24) *Belinda tells the speaker that Bob is home.*

K:{Belinda said Bob is home, Belinda is a reliable source about Bob's whereabouts, Bob is home,...}

?Bob must be home.

direct trustworthy report (Matthewson, 2015, p.146)

Based on the patterns of *must* and modals in evidential contexts in other languages (Matthewson, 2020), she proposes that evidential meaning is encoded based on dimension rather than direct-indirect distinctions proposed before (Aikhenvald, 2004, Willett, 1988). As given in (5.25), she proposes three dimensions: (i) evidence type is which sensory channel the evidence is gained, (ii) evidence location is if the speaker witnessed all of the event, or only end results, and (iii) evidence strength is if the source of evidence is trustworthy or reliable (Matthewson, 2015, p. 148).

(5.25) Dimensions of meaning encoded in evidential restrictions:

1. Evidence **type**: whether evidence is visual, sensory, reported, etc.
2. Evidence **location**: whether the speaker witnessed the event itself or merely some of its results
3. Evidence **strength**: the trustworthiness/reliability of the evidence

Following the proposal on three dimensions, LAZIM and OLABILIR are tested across various evidential contexts to investigate which dimension they require in their epistemic interpretations.

5.2 Evidential Restriction Study

5.2.1 Stimuli

Following discussions in Faller (2002) and Matthewson (2015), epistemic signs were tested in the contexts that convey an evidential type, location, or source. Pure possibility was also added to the target contexts since it is unknown if TİD marks evidentiality morphologically. As seen in the previous section, some languages have morphemes that encode possibility without requiring any evidentiality and evidentiality without conveying the possibility (Faller,

2002). OLABILIR might behave like these morphemes or TİD may have a different morpheme to encode pure possibility and OLABILIR still has evidentiality requirement like sensory evidence 'The light is on' in (5.68), yet not as strong as LAZIM. Pure possibility contexts were presented as possible without evidence where the signer is talking about a possible event. One stimuli was more realistic like 'You don't know who broke the glass and you're guessing' while another was possibility outside the world like 'Aliens may exist' to decrease the world knowledge effect.

For evidence types, building on Matthewson's categorization, evidence location and evidence strength were presented as the subtypes of evidence types seeing and hearsay (Table 5.1). Since the target audience was Deaf participants, evidence type hearing was presented as hearsay where subtypes were rumors, trusting the source, and not trusting the source. Similarly, the evidence location was presented as the subtypes of the evidence type seeing: seeing the whole event, seeing the part of the event, and seeing the end-result of the event. Table 5.1 summarizes all the factors in the test.

Table 5.1. Factors of Evidential Restrictions Test

Evidence Dimension	Evidence Types	Subtypes
Pure Possibility Evidence Types	Seeing	Seeing the whole event
		Seeing the part of event
		Seeing the end-result
	Smelling	
	Hearsay	Rumors
		Trusting the source
		Not trusting the source

During the stimuli preparation, the consultant presented another epistemic sign ACABA (Figure 5.1) which can co-occur with OLABILIR. She also pointed out that LAZIM needs to be preceded by OL to be interpreted as epistemic. Otherwise, it is interpreted as deontic. After the discussions with her, each target sentence for the rating tasks were recorded with five manual signs as in (5.26).

(5.26) Context (Pure Possibility): 'You're chatting with your friend and talking if there's life in other planets:'

OTHER PLANET IX LIFE OLABILIR

OTHER PLANET IX LIFE ACABA

OTHER PLANET IX LIFE OLABILIR ACABA

OTHER PLANET IX LIFE LAZIM

OTHER PLANET IX LIFE OL LAZIM

'There may be life in other planets.'

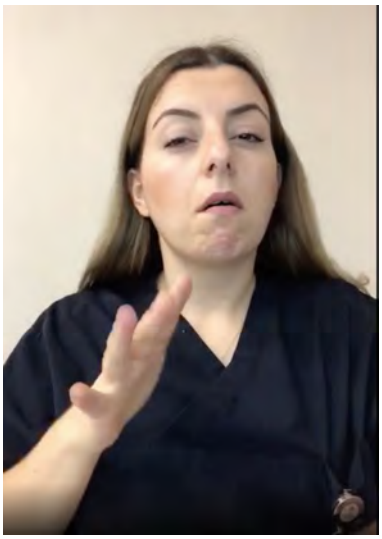

Figure 5.1. Manual sign ACABA 'perhaps'

5.2.2 Design

Task was conducted by within 5x8 mixed effects factorial design. Modal signs OLABILIR, ACABA, OLABILIR ACABA, LAZIM, and OL LAZIM were fully crossed with all context types, pure possibility, smelling, seeing the part of an event, seeing the end or the endresult of an event, seeing the whole event, rumors, hearsay and trusting source, and hearsay and not trusting source. Two sets of target items were prepared and all stimuli is given in Appendix E.

5.2.3 Procedure

During each trial, participants first did a trial session to familiarize them with the scale and the task. Participants were instructed to watch the video recording of contexts and target sentences. They were asked to rate if the sentences were acceptable in the given context. They could watch the video again if they wanted. They rated the acceptability of the target sentence in the given context on a 7-point slider. They also rated the naturalness of the target sentences on a 7-point slider, so the unnatural and infelicitous sentences could be separated. After the consultant commented that LAZIM is interpreted as deontic, but OL LAZIM as epistemic, participants were also asked to rate the target sentences as command (deontic) or guess (epistemic) on a 7-point slider (Figure 5.2). All instructions were given in TİD before the trial session. After the trial session, all participants rated both sets of target items; all stimuli was presented in randomized order in Qualtrics.

The response variable was the rating from 1 (not at all acceptable) to 7 (totally acceptable). The results indicated which modal signs that were found acceptable in the given context. If a modal sign is found acceptable across all context types, then it does not require a specific evidentiality in the context. If a modal sign is found acceptable in one type or subtype of contexts, then it lexically requires that evidential type in epistemic contexts.

5.2.4 Data Analysis

Rating task data analyzed with multilevel model mixed effects since modal signs were rated in each target context. As in Figure 5.3, modal signs (M1, M2, so on) are first level fully nested in the contexts (C1, C2, so on) (Level 2). Contexts are fully nested in participants where each participant rated each target combination (Level 3). Lastly, participants are also nested in top clusters DoH (Deaf of Hearing) and DoD (Deaf of Deaf) based on their language background (Level 4).

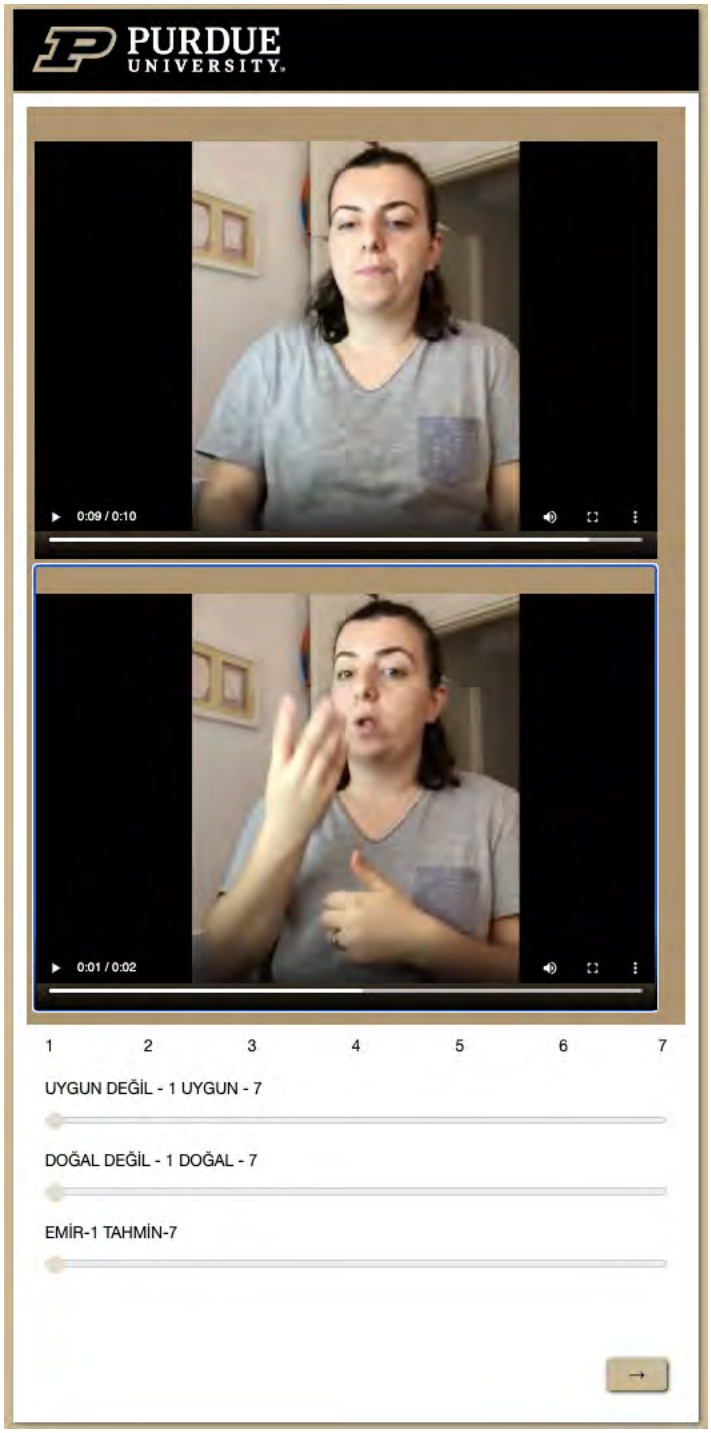

Figure 5.2. Rating Task in Evidential Restriction Study

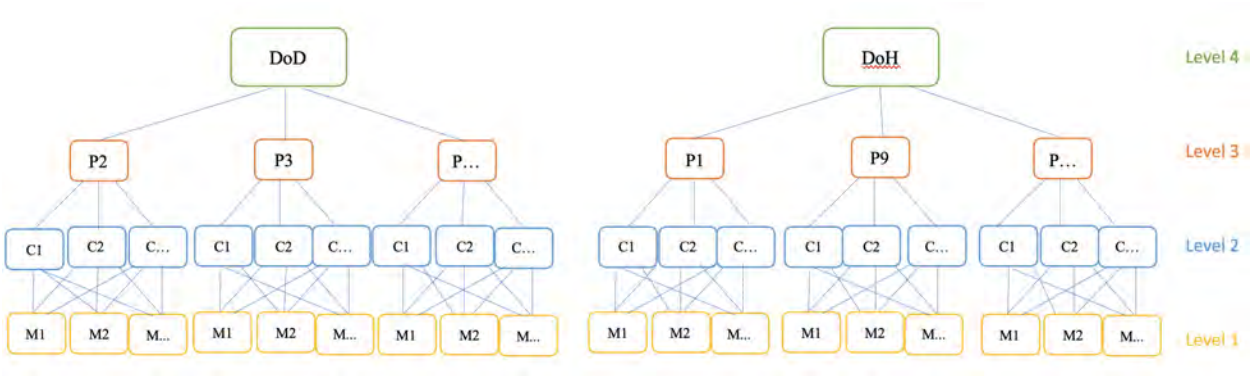

Figure 5.3. 4 Level Hierarchical Structure of Evidential Restriction Data

Data Coding and Cleaning

All categorical variables were dummy-coded: Gender was coded as female 1, male 0. Generation of deafness was coded as first generation 1, second generation 2, and so on. Language input was coded as DoH 0, DoD 1. Participants were assigned to numbers to anonymize them as 1,2,3 and so on. Modal signs were assigned to numbers as ACABA 1, OLABILIR 2, OLABILIR ACABA 3, LAZIM 4, OL LAZIM 5. Context types were also assigned to numbers as pure possibility 1, smelling 2, and seeing part of event 3, and so on.

Acceptability ratings were compared with naturalness ratings in terms of their correlations. The expected correlation was either positive or negative in terms of natural and acceptable, or natural but not acceptable. If a participant's ratings had a negative correlation in terms of acceptable but not natural, their data was excluded. 2 participants' data was excluded due to the negative correlation in their acceptability and naturalness ratings.

5.2.5 Results of Acceptability Ratings

Descriptive Results

After exclusion, data contained 1200 data points on which all the analyses were carried out. Table 5.2 presents the descriptive results only for modal signs; Table 5.3 presents the

descriptive results of modals in each context. Overall, LAZIM and OL LAZIM have lower means than other signs.

Table 5.2. Descriptive Statistics of Evidential Restriction Acceptability Ratings

Modal	Min	Max	Mean	Standard Deviation
ACABA	1	7	5.56	2.14
LAZIM	1	7	2.34	1.96
OL LAZIM	1	7	3.57	2.30
OLABILIR	1	7	5.65	2.07
OLABILIR ACABA	1	7	6.09	1.81

Multilevel (MLM) Analysis

I first analyzed data by using totally unconditional model to observe which level brings the variation in the acceptability ratings. As seen in Table 5.4, variance in the acceptability ratings results from modal signs (3.19) and participant (.31), but not from language input or context types. When intra-class correlation (ICC) was calculated for each variance, the biggest proportion of variation is due to modal signs (50%) while the variation due to participant is small (5%) and not significant (p=.063).

Since language input does not have an effect on ratings, the rest of the analysis was carried out in three level model where participants form the top cluster in data structure. In this three level model, modals, context types were analyzed as fixed effects; participants and language background as random effects with age, gender, and generation as variables of level three. Table 5.5 shows F and p values for each variable.

Since the interaction between context types and modals is significant (p<.001), the difference among contexts and the significance of each sign in that context were analyzed by taking each context and the modal ACABA as references for comparison. As seen in Table 5.6, modals were found significantly less acceptable in SP (seeing the part of an event) (p=.018) and SW (seeing the whole event) contexts (p=.038) than T (trusting the source) context. They were found significantly more acceptable in R (rumors) context (p=.032) than NT (not trusting the source) context. They were found significantly more acceptable in PP (pure possibility) (p=.002), R (p<.001), and S (smelling) contexts (p=.003) than SW context. They

Table 5.3. Descriptive Statistics of Evidential Restriction Acceptability Ratings Based on Modal in Contexts

Context Type	Modal	Min	Max	Mean	SD
Pure Possibility	ACABA	1.7	7	6.30	1.45
	LAZIM	1	7	2.24	2.22
	OL LAZIM	1	7	3.94	2.65
	OLABILIR	1.2	7	6.66	1.13
	OLABILIR ACABA	2	7	6.61	1.08
Smelling	ACABA	1.1	7	6.21	1.66
	LAZIM	1	7	2.14	2.01
	OL LAZIM	1	7	3.88	2.34
	OLABILIR	1.2	7	6.47	1.28
	OLABILIR ACABA	6	7	6.90	.26
Rumors	ACABA	3.5	7	6.45	1.17
	LAZIM	1	7	2.21	1.74
	OL LAZIM	1	7	2.71	1.91
	OLABILIR	1.1	7	6.15	1.61
	OLABILIR ACABA	4	7	6.55	.94
Trusting Source	ACABA	1.1	7	5.65	1.93
	LAZIM	1	7	2.68	1.78
	OL LAZIM	1	7	4.25	2.32
	OLABILIR	3.4	7	6.22	1.17
	OLABILIR ACABA	4	7	6.60	.92
Not Trusting Source	ACABA	1.1	7	5.20	2.45
	LAZIM	1	7	1.66	1.55
	OL LAZIM	1	7	2.17	1.45
	OLABILIR	1	7	4.49	2.60
	OLABILIR ACABA	1	7	5.31	2.43
Part of Event	ACABA	1	7	4.43	2.52
	LAZIM	1	7	2.92	2.10
	OL LAZIM	1	7	3.85	2.52
	OLABILIR	1.2	7	5.10	2.28
	OLABILIR ACABA	1.1	7	5.36	2.31
End of Event	ACABA	1	7	5.63	2.25
	LAZIM	1	7	2.14	1.84
	OL LAZIM	1	7	4.79	2.21
	OLABILIR	1.4	7	5.83	1.70
	OLABILIR ACABA	1.1	7	6.30	1.50
Whole Event	ACABA	1.1	7	4.59	2.48
	LAZIM	1	7	2.69	2.24
	OL LAZIM	1	7	2.97	1.87
	OLABILIR	1.4	7	4.28	2.76
	OLABILIR ACABA	1.1	7	5.12	2.60

Table 5.4. Covariates in Evidential Restriction Acceptability Ratings

Parameter	β	SE	p
AcceptabilityRating	2.86	.16	**<.001**
LanguageInput	.00	.00	-
LanguageInput*Participant	.31	.17	.063
LanguageInput*Participant*ContextType	.00	.00	-
LanguageInput*Participant*ContextType*Modal	3.19	.29	**<.001**

Table 5.5. Effects of All Independent Variables on Acceptability Ratings in Evidential Restriction

Variables	F	p
Age	.37	.56
Gender	.88	.37
Generation	.07	.80
Context Type	6.77	**<.001**
Modal	162.53	**<.001**
Context Type*Modal	2.52	**<.001**

were found significantly more acceptable in PP (p<.001), R (p<.001), S (p=.001), and SE (seeing the end/endresult of an event) contexts (p=.028) than SP context.

When modals were compared in a specific context, LAZIM and OL LAZIM are significantly rated lower than other modals in all contexts. LAZIM is also rated significantly lower than OL LAZIM in all contexts. Even though context types affect their acceptability ratings, the significant difference not only between other modals and LAZIM-OL LAZIM, but also between LAZIM and OL LAZIM are still observed in all contexts. Significance levels among OLABILIR, ACABA, and OLABILIR ACABA change based on the context types. OLABILIR was found less acceptable than ACABA (p=.005) and OLABILIR ACABA (p<.001) in NT context. There is no significant difference among ACABA and OLABILIR ACABA in NT context. ACABA is rated significantly lower than OLABILIR ACABA (p=.026) in T context. There is no significant difference among OLABILIR, ACABA and OLABILIR ACABA in the rest of the contexts. Table 5.7 presents all comparisons of modals in all contexts.

Table 5.6. Effect of Evidential Contexts on Acceptability Ratings of Modals

Context	β	SE	t	p	Context	β	SE	t	p
T-NT	-.40	.54	-.742	.46	NT-PP	1.01	.54	1.85	.06
T- PP	.60	.54	1.11	.27	NT-R	1.17	.54	2.15	**.032**
T- R	.77	.54	1.41	.16	NT-S	.91	.54	1.68	.09
T- S	.51	.54	.93	.35	NT-SE	.31	.54	.577	.56
T-SE	-.09	.54	-.17	.87	NT-SP	-.89	.54	-1.63	.10
T-SP	-1.29	.54	-2.38	**.018**	NT-SW	-.73	.54	-1.34	.18
T-SW	-1.13	.54	-2.08	**.038**	NT-T	.40	.54	.74	.46
SW-NT	.73	.54	1.34	.18	SP-NT	.89	.54	1.63	.10
SW-PP	1.74	.54	3.19	**.002**	SP-PP	1.89	.54	3.49	**<.001**
SW-R	1.90	.54	3.49	**<.001**	SP-R	2.06	.54	3.79	**<.001**
SW-S	1.64	.54	3.01	**.003**	SP-S	1.80	.54	3.31	**.001**
SW-SE	1.04	.54	1.92	.06	SP-SE	1.20	.54	2.21	**.028**
SW-SP	-.16	.54	-.29	.77	SP-SW	.16	.54	.29	.77
SW-T	1.13	.54	2.08	**.038**	SP-T	1.29	.54	2.38	**.018**
SE-NT	-.31	.54	-.58	.56	S-NT	-.91	.54	-1.68	.10
SE-PP	.69	.54	1.28	.20	S-PP	.10	.54	.18	.86
SE-R	.86	.54	1.58	.12	S-R	.26	.54	.48	.63
SE-S	.60	.54	1.10	.27	S-SE	-.60	.54	-1.10	.27
SE-SP	-1.20	.54	-2.21	**.028**	S-SP	-1.80	.54	-3.31	**.001**
SE-SW	-1.04	.54	-1.92	.06	S-SW	-1.64	.54	-3.02	**.003**
SE-T	.09	.54	.165	.87	S-T	-.51	.54	-.93	.35
PP-NT	-1.01	.54	-1.85	.06	R-NT	-1.17	.54	-2.15	**.032**
PP-R	.16	.54	.30	.76	R-PP	-.16	.54	-.30	.76
PP-S	-.10	.54	-.18	.86	R-S	-.26	.54	-.48	.63
PP-SE	-.70	.54	-1.28	.20	R-SE	-.86	.54	-1.58	.12
PP-SP	-1.89	.54	-3.49	**<.001**	R-SP	-2.06	.54	-3.76	**<.001**
PP-SW	-1.74	.54	-3.19	**.002**	R-SW	-1.90	.54	-3.50	**<.001**
PP-T	-.60	.54	-1.11	.27	R-T	-.77	.54	-1.41	.16

Abbreviations in the table are: NT - not trusting the source, PP - pure possibility, R - rumors, S - smelling, SE - seeing the end/endresult of an event, SP - seeing the part of an event, SW - seeing the whole event, T - trusting the source

Table 5.7. Acceptability Ratings of Modals in Each Context

NT

	L	OL	O	A	OA
L					
OL	**<.001**				
O	**<.001**	**<.001**			
A	**<.001**	**.004**	**.005**		
OA	**.002**	**<.001**	**<.001**	n.s.	

PP

	L	OL	O	A	OA
L					
OL	**.005**				
O	**<.001**	**<.001**			
A	**<.001**	**<.001**	n.s.		
OA	**.012**	**<.001**	n.s.	n.s.	

R

	L	OL	O	A	OA
L					
OL	**.017**				
O	**.007**	**.009**			
A	**<.001**	**<.001**	n.s.		
OA	**.016**	**.032**	n.s.	n.s.	

S

	L	OL	O	A	OA
L					
OL	**.008**				
O	**<.001**	**<.001**			
A	**<.001**	**<.001**	n.s.		
OA	**.005**	**<.001**	n.s.	n.s.	

SE

	L	OL	O	A	OA
L					
OL	**<.001**				
O	**<.001**	**<.001**			
A	**<.001**	n.s.	n.s.		
OA	**<.001**	**<.001**	n.s.	n.s.	

SP

	L	OL	O	A	OA
L					
OL	**<.001**				
O	**<.001**	**.009**			
A	**.003**	**.039**	n.s.		
OA	**<.001**	**.045**	n.s.	n.s.	

SW

	L	OL	O	A	OA
L					
OL	**.028**				
O	**.013**	**.004**			
A	**<.001**	**<.001**	n.s.		
OA	**.040**	**<.001**	n.s.	n.s.	

T

	L	OL	O	A	OA
L					
OL	**<.001**				
O	**<.001**	**<.001**			
A	**<.001**	**.004**	**.005**		
OA	**.002**	**<.001**	n.s.	**.026**	

Abbreviations in the table are: L: LAZIM, OL: OL LAZIM, O: OLABILIR, A: ACABA, OA: OLABILIR ACABA *for modals, and NT - not trusting the source, PP - pure possibility, R - rumors, S - smelling, SE - seeing the end/endresult of an event, SP - seeing the part of an event, SW - seeing the whole event, T - trusting the source for contexts*

5.2.6 Results of Command-Guess Ratings

Results of acceptability ratings clearly showed that context types do not affect the ratings of LAZIM and OL LAZIM. Remember that the Deaf consultant also commented that LAZIM was interpreted as 'command' meaning deontic while OL LAZIM was interpreted as 'guess' meaning epistemic. This is why participants were also asked to rate the target sentences for command-guess continuum on a 7-point slider. Higher ratings close to 7 denote 'guess' (epistemic) and lower ratings close to 1 denote 'command' (deontic). I will present the results of command-guess ratings in this section to better understand the behaviors and the acceptability ratings of LAZIM and OL LAZIM compared to other epistemic signs OLABLIR, ACABA, and OLABILIR ACABA.

Descriptive Results

Table 5.8 shows the means of ratings of modals as either command (deontic) or guess (epistemic). Command was given at the lowest end (1) of the scale while guess was given at the highest end (7) of the scale. LAZIM has the lowest mean (M=1.87) followed by OL LAZIM (M=3.28). The rest of signs have higher ratings with closer means as also seen in Figure 5.4.

Table 5.8. Descriptive Statistics of Target Sentences Command-Guess Ratings

Modal	Min	Max	Mean	Standard Deviation
ACABA	1	7	6.10	1.67
LAZIM	1	7	1.87	1.48
OL LAZIM	1	7	3.28	2.28
OLABILIR	1	7	6.16	1.66
OLABILIR ACABA	1	7	6.38	1.55

Multilevel Model (MLM) Results

Similarly to the analysis of acceptability ratings, I first analyzed data by using totally unconditional model. As seen in Table 5.9, variance in command-guess ratings result from language input (.11), participant (.04), and modals themselves (4.28), but not from the context. Intra-class correlation (ICC) shows that the biggest proportion of variation is due

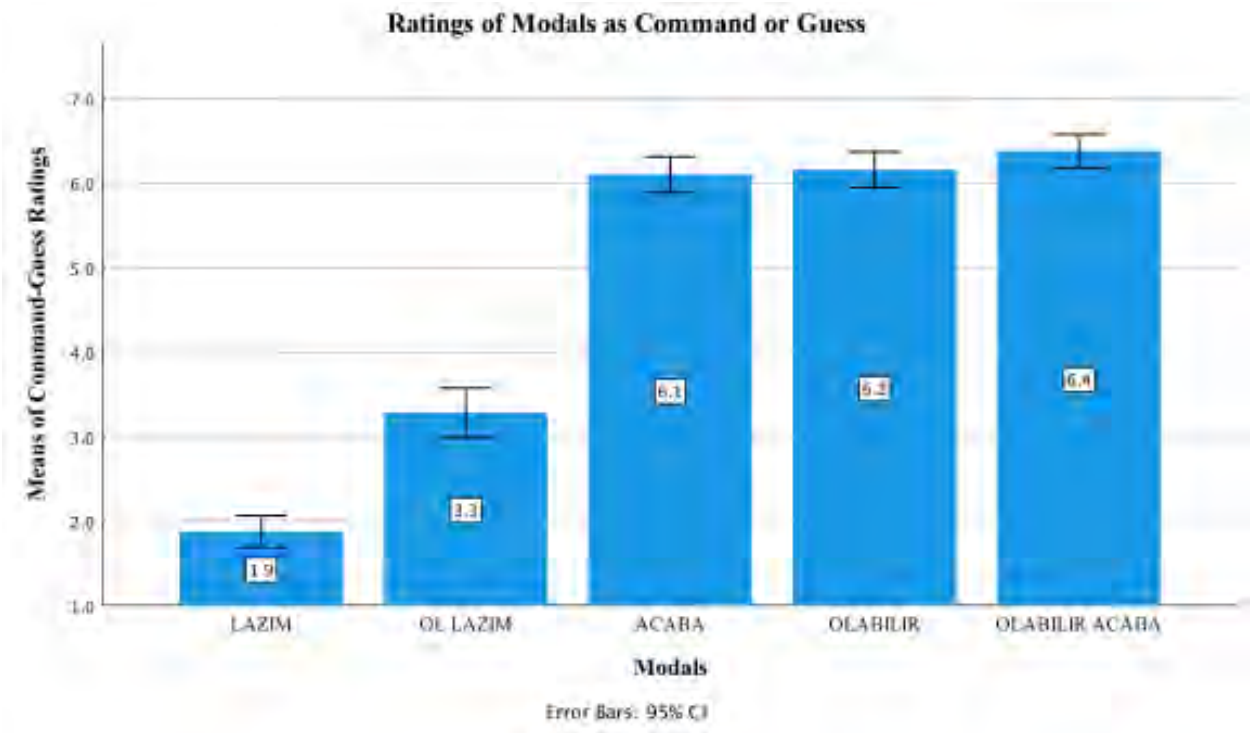

Figure 5.4. Ratings of Modals as Command or Guess

to modal signs (65%). Variation due to language input (2%) and participant (1%) forms the smallest proportion.

Table 5.9. Covariates in Command-Guess Ratings

Parameter	β	SE	p
Command-GuessRating	2.12	.12	<.001
LanguageInput	.11	.19	.57
LanguageInput*Participant	.04	.07	.55
LanguageInput*Participant*ContextType	.00	.00	-
LanguageInput*Participant*ContextType*Modal	4.28	.33	<.001

Four-level model was kept in the rest of analysis because the most top nest (language input) contributes to the variation. In the model, modals were analyzed as fixed effects; language input, participant, and context types as random effects with age, gender, and generation as random variable of level three. Table 5.10 shows sample regression coefficient (β), standard error (SE), t-test result (t), and significance level (p). As expected, results

show that the effect of context types is not significant in the ratings of command-guess. Overall, LAZIM and OL LAZIM were rated significantly lower than other modals (p<.001). Deaf of Hearing (DoH) participants rated modals significantly higher (p=.046) than Deaf of Deaf (DoD) participants.

Table 5.10. Results of Independent Variables in Command-Guess Ratings

Parameter	Estimate	SE	t	p
parent = H	.52	.24	2.18	**.046**
parent = D	.00	.00		
age	-.002	.02	-.11	.92
gender	-.07	.27	-.25	.81
generation	.09	.17	.581	.58
participant	.05	.03	1.86	.10
ACABA	-.20	.18	-1.12	.26
LAZIM	-4.50	.18	-25.12	**<.001**
OL LAZIM	-3.11	.18	-17.38	**<.001**
OLABILIR	-.18	.18	-1.02	.31
OLABILIR ACABA	.00	.00		

Parameters having .00 values were treated as the reference point in the model.

Since both LAZIM and OL LAZIM were rated significantly lower (command was given as 1) than other modals, their ratings were compared in post-hoc test. Variation in ratings of LAZIM and OL LAZIM as command-guess comes from modals (F=59.38, p<.001) and participants (F=6.59, p<.001) not from language input (Table 5.11). Overall, OL LAZIM is rated significantly higher than LAZIM (p<.001). Participants also show variation in their ratings; four participants rated OL LAZIM significantly lower than LAZIM while one participant rated it significantly higher.

As an interim summary, results of both acceptability ratings and command-guess ratings show that LAZIM and OL LAZIM behave differently than epistemic signs. Command (1)-guess (7) results show that LAZIM is treated as a deontic sign and this is the most likely reason for its lowest acceptability ratings (M=2.34, sd=1.96). Similar pattern holds for OL LAZIM, yet it has higher ratings in both command-guess (M=3.28, sd=2.28) acceptability ratings (M=3.57, sd=2.30). OL LAZIM is treated as closer to epistemic staying at the middle range in command-guess ratings. This result may show that OL LAZIM is ambiguous between deontic

Table 5.11. Results of Independent Variables in Command-Guess Ratings

Parameter	Estimate	SE	t	p
LAZIM-OL LAZIM	1.39	.18	7.71	**<.001**
parent = H	-.73	.49	-1.48	.14
parent = D	.00	.00		
P1	-.17	.49	-.34	.74
P2	-.20	.45	-.46	.65
P3	.47	.49	-.46	.33
P6	.22	.49	.44	.66
P7	-1.55	.49	-3.15	**.002**
P8	-1.75	.49	-3.56	**<.001**
P9	-.37	.49	-.74	.46
P10	-1.49	.49	-3.03	**.002**
P11	-1.01	.49	-2.05	**.043**
P12	.86	.49	1.75	.08
P13	.00	.00		
P14	1.53	.49	3.10	**.002**
P15	.10	.49	.20	.84
P16	.00	.00		

and epistemic but I have not observed it in the modal flavors production task. This potential ambiguity and its difference from LAZIM need to be further investigated in future studies.

5.3 What do results show in terms of epistemics and evidentiality?

Based on the results of acceptability ratings, NT context yields the lowest ratings (M=3.77, sd=2.63), and is followed by SW (M=3.93, sd=2.56) and SP (M=4.33, sd=2.48) as seen in Figure 5.5. TİD signers do not prefer so much to use epistemic signs in NT since the source of information is not trustworthy. Thus, we can speculate that epistemic modals signal the signer commitment to some extent and do not only report the hearsay. If epistemic signs were used to report the proposition, NT should have behaved similarly to other hearsay contexts, namely R (M=4.81, sd=2.45) and T (M=5.08, sd=2.22). SW and SP show the expected patterns by yielding lower ratings because the signer sees either the whole event or its part. Thus, in contrast to NT, the signer commitment should be higher while reporting

an event that she witnessed. As a cooperative signer, she is expected to signal the commitment to the proposition to her interlocutor when she has better evidence (Grice, 1975, Krifka, 2021). PP yields the highest ratings (M=5.15, sd=2.52) for epistemic signs and R, SE (M=4.94, sd=2.41), S (M=5.12, sd=2.46), and T behave similarly. In these contexts, the signer has only indirect evidence like hearsay, smelling, or seeing the end or end-result of an event. Then, the signer is neither close to full commitment as in SP or SW, nor close to total lack of commitment as in NT. She uses epistemic signs to convey that she gained the information through indirect evidence and does not fully commit to it.

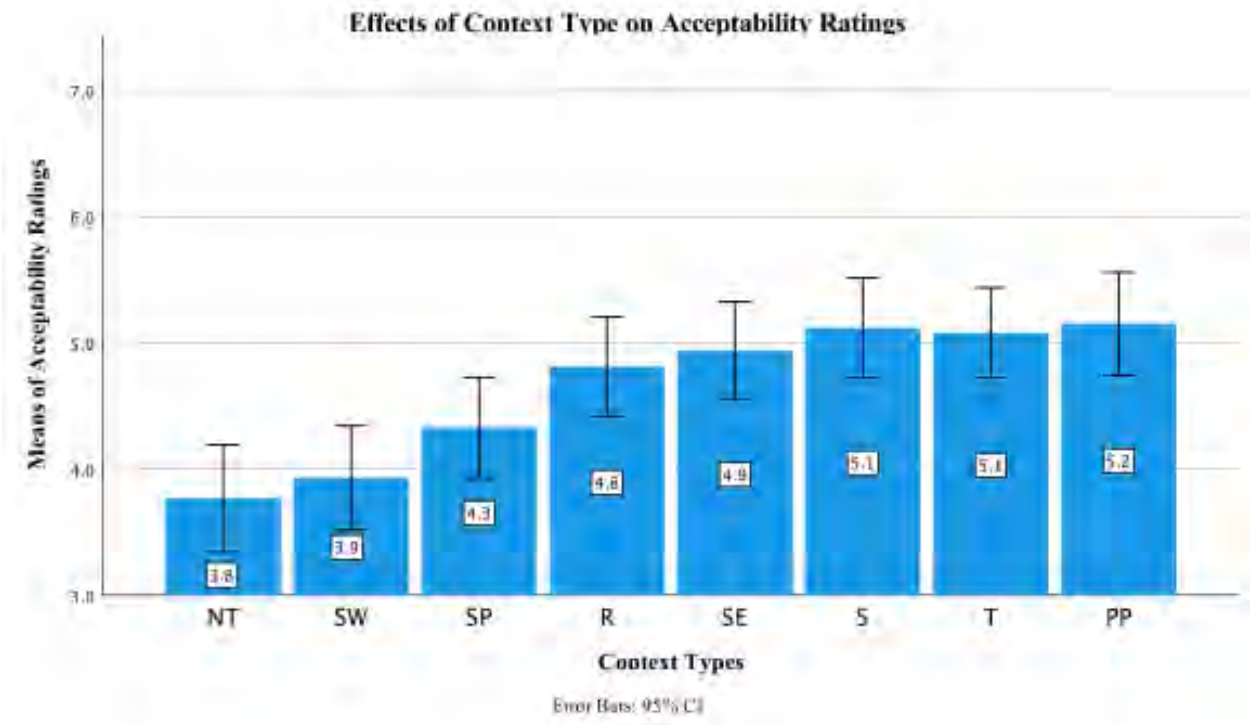

Figure 5.5. Effects of Contexts on Modals' Acceptability Ratings

As for modal signs, I first want to present that ACABA is an epistemic adverbial and can co-occur with the epistemic sign OLABILIR. As seen in sentences in 5.27, ACABA (5.27a-b) and OLABILIR (5.27e) can appear alone in a sentence to convey the epistemic meaning. Furthermore, ACABA can appear in sentence-initial (5.27a,c) and in sentence-final positions (5.27b,d). In contrast, OLABILIR can only appear in sentence-final position (5.27e,f). Results of acceptability ratings show that they were increased when both signs co-occurred except

in PP contexts (Figure 5.6). The difference among these three signs became significant in T (contexts where OLABILIR ACABA has the highest rating (M=6.60, sd=.92), is followed by OLABILIR (M=6.22, sd=1.17), then ACABA (M=5.65, sd=1.93). OLABILIR was found significantly more acceptable (p=.005) than ACABA, and OLABILIR ACABA (p=.026) than ACABA. Another context where these signs have significantly different results is NT in which ACABA (M=5.20, sd=2.45) was found significantly more acceptable (p=.005) than OLABILIR (M=4.49, sd=2.60), and OLABILIR ACABA (M=5.31, sd=2.43) than OLABILIR (p<.001).

(5.27) a. ACABA ALI LOTTERY WIN

b. ALI LOTTERY WIN ACABA

c. ACABA ALI LOTTERY WIN OLABILIR

d. ALI LOTTERY WIN OLABILIR ACABA

e. ALI LOTTERY WIN OLABILIR

f. *OLABILIR ALI LOTTERY WIN

'Maybe, Ali may have won the lottery.'

Patterns of OLABILIR, ACABA and OLABILIR ACABA show a mirror image effect in two totally contrasting contexts as in T contexts (5.28) and NT contexts (5.29). As suggested for evidential contexts, epistemic modals may also signal the signer's commitment along with the possibility of the proposition. Another explanation for this difference from Lassiter (2017)'s degree analysis of modals could be that ACABA and OLABILIR convey the different degrees of possibilities of the proposition. ACABA may signal the lower possibility of the embedded proposition while OLABILIR may signal the higher possibility of the embedded proposition. Then, even though their modal force is existential as shown in the mutually exclusive proposition study, they do not denote p and ¬p equally (50%) in their domain. Patterns of epistemic signs and these predictions will contribute to future testing grounds for theoretical models and empirical studies.

(5.28) *Trusting the Source Context:* One of your friends told you that Ali won the lottery. You didn't talk with Ali; you don't know. Your friend tells the truth; you trust him.
ALI LOTTERY WIN OLABILIR

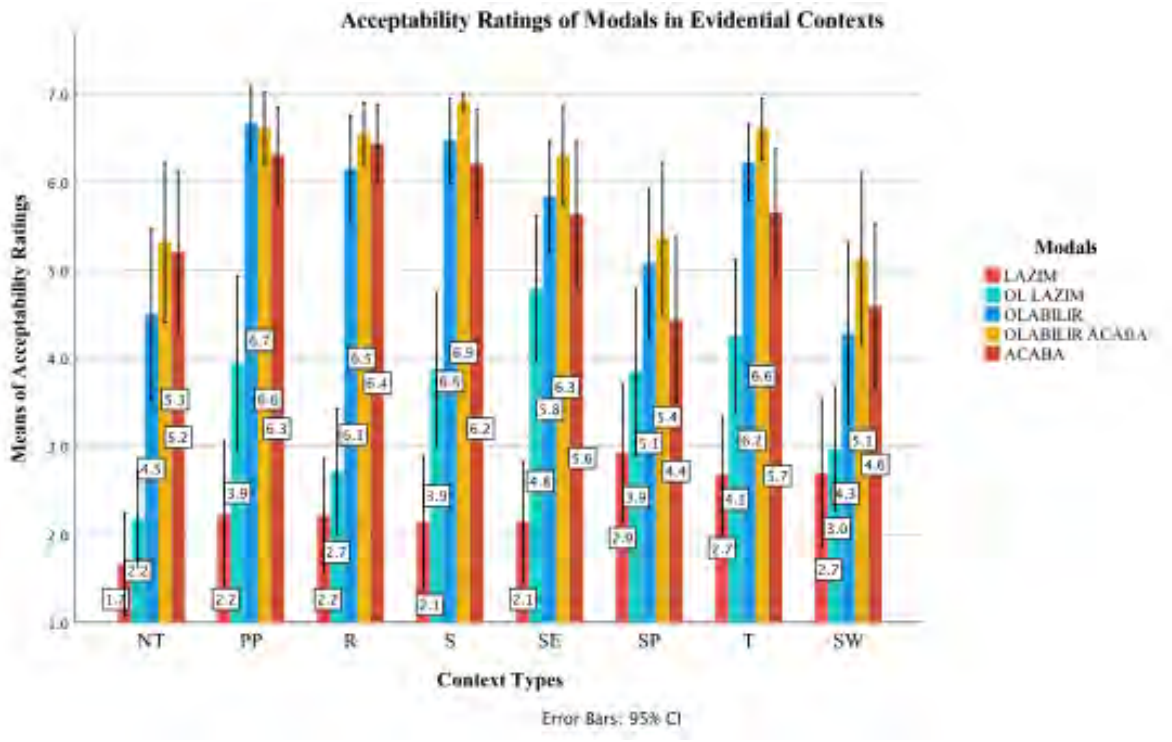

Figure 5.6. Acceptability Ratings of Modals in Each Context

ALI LOTTERY WIN ACABA

ALI LOTTERY WIN OLABILIR ACABA

'Ali may have won the lottery.'

(5.29) *Not-trusting the Source Context:* One of your friends told you that Ali won the lottery. You didn't talk with Ali; you don't trust what your friend says.

ALI LOTTERY WIN OLABILIR

ALI LOTTERY WIN ACABA

ALI LOTTERY WIN OLABILIR ACABA

'Ali may have won the lottery.'

5.3.1 Puzzle of LAZIM and OL LAZIM

When we turn to LAZIM and OL LAZIM, they were rated significantly lower than other signs in all contexts, except for OL LAZIM in SE contexts. Furthermore, LAZIM was also

rated significantly lower than OL LAZIM. This difference can be explained based on their interpretations as deontic signs. In similar fashion, LAZIM was also rated lower than OL LAZIM in command-guess ratings, thus LAZIM was treated as a deontic modal. In contrast, OL LAZIM was found significantly higher than LAZIM, staying in the middle range (M=3.28, sd=2.28). TİD signers clearly treated LAZIM and OL LAZIM differently, and the first one as a deontic sign. These patterns show that the picture is different than *must* in English. More clearly, *must* can be used both in deontic and epistemic contexts without requiring another morpheme as long as the evidential requirement is met in the context. The situation is distinct in TİD. Required evidential information in the context is not enough to make only LAZIM acceptable as an epistemic sign even in the right kind of context. If it was the case, LAZIM should have had the similar ratings to OL LAZIM in both acceptability and command-guess ratings. Hence, LAZIM requires an additional morpheme along with the right kind of context in order to be interpreted as epistemic. I will discuss the possible role of OL in the following section.

Why do we need OL?

To my knowledge, English or other languages that Matthewson (2015) reported for evidential meaning do not require an additional morpheme to derive the epistemic meaning of a modal. In other words, *must* in English can appear in both deontic and epistemic contexts without any additional morpheme. In TİD, results show that LAZIM alone is not enough to be felicitously interpreted as epistemic even in right kind of context. It should be accompanied by OL. I will first present OL and discuss its potential function, then its role in epistemic contexts.

Possible function of OL

OL means 'to be, become, or happen' in TİD and is signed with the dominant hand in the coronal plane. It starts with all fingers selected open hand and ends in flat o handshape with close fingers in the ipsilateral side of the signer as seen in Figure 5.7. It is less frequent (.002%) than LAZIM and MECBUR (Makaroglu, 2021). Another crucial point is that TİD

does not have a copula as far as studies show; nominal sentences in (5.30) do not have a specific sign for copula. Instead, the existential sign is used as agreeing locative sign to show mom's location (5.30a), and no existential nor another sign is used in (5.30b).

Figure 5.7. Sign OL taken from Makaroglu and Dikyuva (2017)

(5.30) a. MOM HOME LOC^EXISTENTIAL

'Mom is home.'

b. BABY 8 MONTHS 2^WEEK

'The baby is 8 months 2 weeks old.'

When OL is used in sentences (5.31-5.36), it can appear both after noun like SIBLING, HOUR, adjective like IN-LOVE, or verb like APPOINT. Different than sentences in (5.30) where a state is expressed, OL conveys transition from one state to another. For example, the transition is from not being a sibling to being a sibling in (5.31), or from meals tasting good to tasting bad in (5.32), from not being appointed to being appointed in (5.33a). Also note that the verb APPOINT can be used without OL in (5.33b). It needs to be further investigated if there is any difference between these two sentences.

(5.31) $\overset{\text{br}}{\overline{\text{NEW BABY COME}}}$ SIBLING OL $\overset{\text{br}}{\overline{\text{VERY}}}$ HAPPY

'A new baby is coming. I will have a sibling. I am so happy.'

(Makaroglu & Dikyuva, 2017)

(5.32) $\overline{\text{IX-POSS-1 MOM BEFORE MEAL TASTE^GOOD++, NOW MEAL TASTE^BAD OL}}^{\text{bf}}$
$\overline{\text{SHOCK}}^{\text{bf}}$

'Mom's meals tasted good before, now it happens to taste bad, I'm shocked.'

(Makaroglu & Dikyuva, 2017)

(5.33) a. $\overline{\text{IX-1 GIRL SIBLING}}^{\text{br}}$ $\overline{\text{IX-3}}^{\text{br,hn}}$ ESKISEHIR APPOINT WORK XXX OL

'My sister is appointed to Eskisehir.'

(Makaroglu & Dikyuva, 2017)

b. HEARING SCHOOL BORED/NOT-HAPPY, APPOINT DEAF SCHOOL ENTER

'I wasn't happy in the hearing school; I was appointed to the deaf school.'

(Makaroglu & Dikyuva, 2017)

(5.34) $\overline{\text{IX-1 FRIEND MEET, IX-1 WAIT TWO^HOUR THREE^HOUR OL, WAIT^NOT}}^{\text{bf}}$
$\overline{\text{LOSS(HARM) IX-1 GO}}^{\text{bf}}$

'I was going to meet with my friends, I waited for two-three hours, then I left.'

(Makaroglu & Dikyuva, 2017)

(5.35) $\overline{\text{NEW MARRY}}^{\text{br}}$ 3_{a}-IX-3_{b} FIVE^YEAR FAST OL, SHOCK IX-1

'It has been five years since I married, so fast, I'm shocked.'

(Makaroglu & Dikyuva, 2017)

(5.36) MAN SEE, FACE HANDSOME, SEE, IN-LOVE OL, TOMORROW IX-1 FOLLOW

'The man was so handsome that I fell in love. I followed him next day.'

(Makaroglu & Dikyuva, 2017)

In all these examples, OL marks the change of state from one to another and the proposition having OL is a situation at the truth value level. In order to capture the difference between LAZIM and OL LAZIM, I propose that the distinction comes from OL itself. Crosslinguistically, it is well observed that modals with statives are interpreted as circumstantial or epistemic (5.37a) while modals with eventives are mostly interpreted as circumstantial (5.37b). Ramchand (2014) explains this difference by merging modals in different heights:

Epistemics merge above T and the interpretation is gained where the temporal parameters of the situation are bound. Circumstantials merge below T and they bound the temporal parameters of the situation. To keep things simple, I will keep event argument by following Hacquard (2006) and it is bounded by either circumstantial modal or OL in our case.

(5.37) a. Eeyore must be sad/in the field. (epistemic or obligational)

b. Eeyore must go to Christopher Robin's party. (only obligational)

(taken from Ramchand (2014), p.103)

Different than Kratzer, Hacquard (2006) proposes three accessibility relations, circumstantial, deontic, and epistemic in different heights, and modals based on their heights bound the event and time argument of the proposition. The core proposal in both Hacquard (2006) and Ramchand (2014) is the same, trying to capture the different interpretations in (5.37a) and (5.37b). Sentences with LAZIM and OL LAZIM in TİD show similar patterns in their discussions. Further support for different hierarchical argumentation comes from the occurrences of LAZIM and OL LAZIM with other modals and perfective morpheme 'bn'. As seen in (5.38), when LAZIM is used as an epistemic it can take scope over another modal SERBEST. It also appears after the verb with perfective nonmanual marker 'bn' (Karabüklü & Wilbur, 2021) in (5.39) where epistemic takes scope over perfective. When LAZIM and OLABILIR cooccur OLABILIR takes scope over LAZIM and the latter is interpreted as deontic.

(5.38) IX_3 CAR PARK SERBEST OL LAZIM

'It must be allowed to park here.'

(5.39) $\overset{\text{bn}}{\overline{\text{MARRY}}}$ OL LAZIM

'They must have been married.'

(5.40) $\overset{\text{sq}}{\overline{\text{ALI SWIM GO LAZIM OLABILIR}}}$

'Ali may need to go to swimming.'

By following their analysis, if OL is not in the sentence, the event argument is bound by LAZIM and it is interpreted as deontic similar to (5.37b). If OL is in the sentence, the

event argument is bound by OL giving a situation based on its patterns as a verb. Then, this situation together with OL LAZIM is interpreted as either epistemic or circumstantial as seen in the command-guess ratings. Even though OL needs to be further investigated, I propose that semantics of OL is a function taking an event (e) and an individual (x) as its arguments and giving a situation (s) (5.41). OL might be the overt morphological realization of this crosslinguistic distinction in TİD.

(5.41) $[\![\text{OL}]\!]$: $\lambda f_{<e,s>}\ \lambda e_v.\lambda x_e$

5.3.2 Semantics of LAZIM

Compared to all other modals, LAZIM is the only one which can be combined with both circumstantial (5.43-5.45) and epistemic modal base (5.42) in TİD. The Modal Flavors Context Study also showed that it can have bouletic (5.43), teleological (5.44), and goal-oriented (5.45) interpretations. Similar to MECBUR, it can also have a second ordering source as going to Kadikoy the first ordering source, seeing Bosphorus the second ordering source in (5.46). Thus, it is not lexically specified for either modal base or ordering source.

(5.42) Context: You went to Sumru's office and know that it's her office hour. She's not in her office and you're saying:

SECRETARY WORK ROOM GO LAZIM^{sq}

'She must have gone to the secretary's office.'

(5.43) *Bouletic Context:* Bulut is so careful on his health. His parents don't force him but he regularly brushes his teeth. He doesn't want to have cavities.

BULUT SLEEP^NOT BEFORE TEETH BRUSH LAZIM

'Bulut should/must brush his teeth before sleeping.'

(5.44) *Teleological Context:* Serpil is in a PhD program in the States and she needs to write a dissertation to earn her degree.

SERPIL THESIS WRITE LAZIM

'Serpil should/must write a thesis.'

(5.45) *Goal-oriented Context:* You're in Bogazici University, your friend asks you how to go to Besiktas. S/he can only go by bus.

BESIKTAS GO FOR BUS GET-ON LAZIM

'To go to Besiktas, you should take the bus.'

(5.46) *Goal-oriented Context:* You're in Bogazici University, your friend wants to go to Kadikoy, and asks you how to go. There are a couple of routes to take, but your friend also wants to see Bosphorus.

KADIKOY GO FOR FERRY GET-ON LAZIM

'To go to Kadikoy, you should take the ferry.'

Even though LAZIM is acceptable in epistemic contexts, it is lexically restricted for strong inference contexts as shown in the evidential restriction study. It was not rated similar to epistemic signs that have higher ratings, so it is infelicitous in all contexts as pure possibility (PP), rumors (R), not trusting the source (NT), smelling (S), seeing part of an event (SP), and seeing whole event (SW). It had higher ratings in seeing end or endresult of an event (SE) and trusting the source (T) contexts. In the sessions, participants highlighted that it would be acceptable in these contexts except NT if they have previous information about the situation (5.47) or the subject (5.48), or a strong deduction (5.49). All contexts given here are updated with participants' comments for the acceptability of LAZIM. No matter which kind of contexts is presented, participants always added the strong inference based on previous information or deduction to make LAZIM acceptable. This is why I will analyze LAZIM requiring only inference in its epistemic contexts. As discussed in previous section, OL bounds the event argument and gives a situation as an argument to LAZIM in epistemic contexts, so we can explain its behaviour in both modal bases with a single lexical entry.

(5.47) *Rumors Context:* There are rumors about someone that you know. They say that she is promoted. You know that she wanted that promotion and worked hard for it for a long time. She is a hardworking person.

#Z PROMOTE OL LAZIM

'Zeynep must have been promoted.'

(5.48) *Smelling Context:* You went to your friend's house and it smells so nice and clean. You know that your friend is so tidy and clean; he pays attention to hygiene.

ALI HOUSE CLEAN OL LAZIM

'Ali may have cleaned the house.'

(5.49) *Seeing and Deduction:* You go to work in the morning and see your friend's bag at the office. Everyone else has a bag, but only Serpil does not.

BAG SERPIL$_{a}$ IX-POSS$_{3a}$ OL LAZIM

'The bag must be Serpil's.'

The last semantic component for LAZIM is its modal force and it is universal based on the results of the Mutually Exclusive Propositions Study. Modal force is lexicalized for LAZIM, so I will take it as its lexical part in (5.50). Its modal base (f) and ordering source (g) are not lexically specified, and are derived through the contexts in which it appears. The modal base (f) projects possible worlds based on the conversational backgrounds, either circumstantial or epistemic ones. Then, the ordering source (h) ranks these possible worlds based on the source: deontic, teleological, bouletic, or goal-oriented. For the case in (5.46), the second ordering source is projected by the conversational background similar to MECBUR, then this ordering source further ranks the possible worlds.

(5.50) $[\![\text{LAZIM}]\!]$: $\lambda f_{<s,<st,t>>}.\lambda h_{<s,<st,t>>}.\lambda p_{<st,t>}.\ \forall w' \in \text{BEST}_{h(w)}(\cap f(w)):p(w)=1$

As for its epistemic meaning (5.51), I will follow von Fintel and Gillies's (2010) analysis on *must* and propose that the kernel (K) settles if the embedded proposition under LAZIM is entailed or contradicted in the kernel. Remember that direct information is sent to the kernel which is a specific modal base intersecting with the one projected by the conversational background. If p is not settled by the kernel, then LAZIM is acceptable in epistemic context. Then, the ordering source ranks the projected possible worlds. If we follow Matthewson's (2015) analysis, evidentiality would be treated as the ordering source in this case.

(5.51) Epistemic interpretation of LAZIM:

$[\![\text{LAZIM}(f)(h)(p)]\!]$ is only defined if K does not directly settle $[\![p]\!]_c$ If defined, $[\![\text{LAZIM}]\!]$: $\lambda f_{<s,<st,t>>}.\lambda h_{<s,<st,t>>}.\lambda p_{<st,t>}.\ \forall w' \in \text{BEST}_{h(w)}(\cap f(w)):p(w)=1$

As an interim summary, LAZIM shows similar patterns to modals in other languages by having specified modal force, and unspecified modal base and ordering source. Yet it has a unique feature by requiring another morpheme and further evidential restriction in epistemic contexts. OL appearing with LAZIM in epistemic contexts may be the overt morphological realization of the well-known distinction of interpretations of modals as circumstantial with eventives, circumstantial or epistemic with statives.

5.4 Semantics of Epistemic Signs

After showing that ACABA behaves as an adverbial and cooccurs with OLABILIR, I will only discuss the semantics of ACABA and OLABILIR in this section. Based on high acceptability ratings of both signs in pure possibility (PP) contexts where the signer does not have any evidential information, I argue that both signs are epistemic signs without being specified for a specific evidential type, source, or strength. Evidentiality may be conveyed through contextual information, or via epistemic interpretation of LAZIM, yet it should be further investigated if TİD has a specific evidential morpheme.

5.4.1 Semantics of ACABA

In the previous chapter, ACABA has shown to have existential force (M=6.44, sd=1.42) in the Mutually Exclusive Propositions Study. Thus, it has a specified modal force. As for its modal flavor, it is only acceptable in epistemic contexts (5.52-5.55). Hence, it is only specified for epistemic modal base.

(5.52) Context: You see that the lights are on in your mothers house and you say:
LIGHT-ON EXISTENTIAL. $\overset{\text{sq, ht/hn}}{\overline{\text{MOM HOME ACABA}}}$
'The light is on; mom might be home.'

(5.53) Context: Bulut's parents are not so strict and they allow him to stay outside at night.
BULUT $_{a}$IX$_{b}$ 12 O'CLOCK $\overset{\text{hn}}{\overline{\text{HANG-OUT}}}$ $\overset{\text{hbt}}{\overline{\text{SERBEST/?ACABA}}}$
'Bulut can hang outside till midnight.'

(5.54) Context: Kadir went to a special course in the States and learnt how to perform magic.

KADIR$_a$ MAGIC $\overline{\text{YAP/OLUMLU/?}}^{\text{hn}}$ ACABA IX$_{3a}$

'Kadir can perform magic.'

(5.55) Context: Ali was on holiday for a week and he needs to return to work today. If he does not come, he will be fired.

TODAY ALI COME $\overline{\text{LAZIM}}^{\text{eo,br}}$?ACABA

'Ali must come (to work) today.'

Based on its patterns, its epistemic modal base (c(f)) projects the compatible possible worlds, then ordering source (c(h)) ranks the best possible worlds based on the conversational background (5.56). Modal ACABA existentially quantifies over these possible worlds.

(5.56) $[\![\text{ACABA}(f)(h)(p)]\!]$ is only defined if c(f) is epistemic modal base.

If defined, $[\![\text{ACABA}]\!]$: $\lambda f_{<s,<st,t>>}.\lambda h_{<s,<st,t>>}.\lambda p_{<st,t>}.\ \exists w' \in \text{BEST}_{h(w)}(\cap f(w)):p(w)=1$

5.4.2 Semantics of OLABILIR

Kinship between OL and OLABILIR

Before presenting the semantic analysis of OLABILIR, I will first show the resemblance between the sign OL and OLABILIR. As seen in Figure 5.8, both signs have the same handshape, orientation, and movement. They only differ in their mouthings $\overline{\text{OL}}^{/ol/}$ and $\overline{\text{OL.}}^{/olabilir/}$ As explained in the previous section, TİD does not have copula and both signs were probably borrowed from Turkish. *Olabilir* is a fully inflected word in Turkish as *ol-abil-ir* (be-modal-aorist) where *-AbIl* is the modal suffix. Yet, its patterns in both languages are different. More clearly, *olabilir* is used with nominal predicates in Turkish as seen in (5.57). *Ol* is ungrammatical if it is attached to a verbal root (5.58); only modal and person suffixes attach to verbal root (5.59). In contrast, OLABILIR can be used right after a verb as a modal auxiliary (5.60).

(5.57) *Ali ev-de ol-abil-ir*
Ali home-loc. cop-modal-aor
'Ali may be home.'

(5.58) **Ali gel-ol-abil-ir*
Ali come-cop-modal-aor
'Ali may be coming.'

(5.59) *Ali gel-ebil-ir*
Ali come-modal-aor
'Ali may be coming.'

(5.60) $\overline{\text{ALI COME OLABILIR}}^{\text{sq}}$
'Ali may be coming.'

Even though OLABILIR is borrowed from Turkish, it became the part of TİD grammar since participants found it natural (M=6.32, sd=1.44). Remember that another target sign GEREK was not considered as a natural sign (4-13% in production task), yet this is not the case for OLABILIR based on its naturalness rating mean.

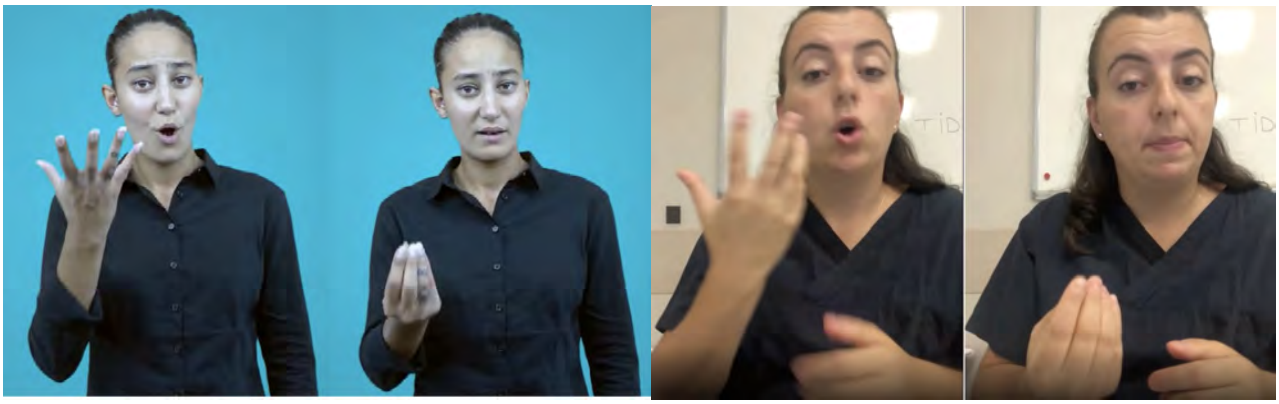

Figure 5.8. OL in the left two frames (Makaroglu & Dikyuva, 2017) and OLABILIR in the right two frames

OL also behaves differently than *ol* in Turkish. As shown above, OL does not appear with nominal predicates and it conveys the state of change when it appears with verbs. In contrast, *ol* in Turkish appears instead of *-I* (5.62) when copula is followed after modal suffix *-AbIl* both in nominal predicate (5.63) and verbal predicate (5.66). It also appears in embedded nominal sentences (5.67).

(5.61) *Aye* *hasta* ∅
A. ill
'Aye is ill.'

(Kelepir, 2006, p83-84)

(5.62) *Aye* *hasta* *i-di.*
A. ill cop-past
'Aye was ill.'

(Kelepir, 2006, p83-84)

(5.63) *Aye* *hasta* *ol-abil-ir.*
A. ill cop-modal-aor
'Aye can be sick.'

(Kelepir, 2006, p83-84)

(5.64) *Aye* *gel-iyor* ∅
A. come-prog
'Aye is coming.'

(Kelepir, 2006, p83-84)

(5.65) *Aye* *gel-iyor* *i-di*
A. come-prog cop-past
'Aye was coming.'

(Kelepir, 2006, p83-84)

(5.66) *Aye* *gel-iyor* *ol-abil-ir*
A. come-prog cop-modal-aor
'Aye may be coming.'

(Kelepir, 2006, p83-84)

(5.67) *Aye'nin* *hasta* *ol-du-un-u* *bil-iyor-um*
A.-gen. ill cop-DIk-3poss-acc know-prog-1p
'I know that Aye is ill.'

(Kelepir, 2006, p90)

Overall, both OL and OLABILIR could be borrowed from Turkish but they have become part of TİD grammar and have distinct patterns than their Turkish counterparts. Based on this kinship and their patterns, the question is what the semantics of OLABILIR is and how its semantics relate to OL.

5.4.3 Puzzle in the analysis of OLABILIR

There are two possible paths to explain the relation of OL and OLABILIR: First one is treating them as different lexical items and giving different semantics to them. Second one is treating them as a single lexical item and giving them the same semantics. For the second path, I could propose that OL encodes the change of state and turns an eventive into a situation to explain the patterns of OL LAZIM in the previous section. If this analysis is on the right track, it should have the same semantics with OLABILIR where both signs are the same manual signs whose mouthings are different. The crucial point is that epistemic meaning comes from the syntactic height of LAZIM in the case of epistemic usages of OL LAZIM. If OL and OLABILIR are the same sign, the puzzle is where the epistemic meaning comes from. It definitely does not come from nonmanual markers since OLABILIR is acceptable without any nonmanual markers. As shown in Chapter 2, OLABILIR appeared with no nonmanuals in 39% of data in our previous study (Karabüklü et al., 2018). Then, the epistemic morpheme could be a null morpheme. Yet, all these hypotheses need to be further investigated theoretically.

In order to have a complete explanation for modals in TİD, I will choose the first path with the data and evidence that I have so far. Bearing in mind that OL and OLABILIR can be the same sign, yet this kinship is left for future studies, I will treat them as separate signs in this dissertation.

In this case, as a modal, OLABILIR existentially quantifies over the epistemic possible worlds. In other words, the results of the Mutually Exclusive Propositions Study showed that OLABILIR has an existential modal force (M=6.04, sd=1.81). As for its modal flavor, it is only acceptable in epistemic contexts (5.68-5.71). Hence, OLABILIR is lexically specified for both its modal force and modal base.

(5.68) Context: You see that the lights are on in your mothers house and you say:
LIGHT-ON EXISTENTIAL. $\overline{\text{MOM HOME OLABILIR/?SERBEST/?YAP/?OLUMLU}}^{\text{sq, ht/hn}}$
'The light is on; mom might be home.'

(5.69) Context: Bulut's parents are not so strict and they allow him to stay outside at night.
BULUT $_{a}$IX$_{b}$ 12 O'CLOCK $\overline{\text{HANG-OUT}}^{\text{hn}}$ $\overline{\text{SERBEST/?OLABILIR/?OLUMLU}}^{\text{hbt}}$
'Bulut can hang outside till midnight.'

(5.70) Context: Kadir went to a special course in the States and learnt how to perform magic.
KADIR$_{a}$ MAGIC $\overline{\text{YAP/OLUMLU/?OLABILIR/?SERBEST}}^{\text{hn}}$ IX$_{3a}$
'Kadir can perform magic.'

(5.71) Context: Ali was on holiday for a week and he needs to return to work today. If he does not come, he will be fired.
TODAY ALI COME $\overline{\text{LAZIM}}^{\text{eo,br}}$?OLABILIR/?SERBEST/?YAP/?OLUMLU
'Ali must come (to work) today.'

Based on its patterns, its epistemic modal base (c(f)) projects the compatible possible worlds from the conversational background. Then, ordering source (c(h)) ranks the best possible worlds based on the conversational background (5.72). Modal OLABILIR existentially quantifies over these possible worlds.

(5.72) $[\![\text{OLABILIR}(f)(h)(p)]\!]$ is only defined if c(f) is epistemic modal base.
If defined, $[\![\text{OLABILIR}]\!]$:
$\lambda f_{<s,<st,t>>}.\lambda h_{<s,<st,t>>}.\lambda p_{<st,t>}.\exists w' \in \text{BEST}_{h(w)}(\cap f(w)):p(w)=1$

5.5 Conclusion

The results of the evidential restriction study not only yielded the full typological patterns of modals in TİD, but also brought new patterns and puzzles into the picture in terms of the

patterns of LAZIM, OL LAZIM, and OLABILIR. To my knowledge, LAZIM, distinct from modal morphemes in other languages, requires not only the right kind of epistemic context but also the morphological make-up for its epistemic interpretation. I have shown that LAZIM alone is interpreted as deontic, and it requires OL along with a strong inference or deduction context. Thus, neither epistemic context with the right evidential strength alone nor morphological order OL LAZIM is enough to make LAZIM felicitous in epistemic contexts. The analysis of OL brings new questions for the analysis of OLABILIR since both signs are probably the same sign. With possible paths in the analysis of OLABILIR, this puzzle is left for future studies.

With having semantics of all modal signs, TİD shows three typological features of modals: (i) modals with specified force and selective base, (ii) modals with specified force and unselective modal base, and (iii) modals with unspecified force and selective modal base (Table 5.12).

Table 5.12. TİD modals typological features

	selective modal base	unselective modal base
specified force	SERBEST, ACABA, OLABILIR, MECBUR	LAZIM
unspecified force	OLUMLU	-

Up to this point, I only explained the patterns of manual signs and how they behave in modal contexts. All of the analyses of modals are based on the fact that they can appear without any nonmanual marker, and nonmanual markers are not their lexical or structural part as shown in Chapter 2. After this point, the focus will be shifted to the role of nonmanual markers in the next chapter. I will present the nonmanual markers rating study and its results. Based on these results, I will explain the function of nonmanual markers in modal sentences.

6. ROLE OF NONMANUAL MARKERS

As discussed in Chapter 2, modal signs were attested with nonmanual markers such as squint, single or repetitive head nod, or head tilt. Yet, the same modal can appear with different nonmanuals as OLABILIR with head nod (hn) in (6.1), repetitive head nod (rhn) in (6.2), or head tilt (ht) and squint (sq) in (6.3). Also, modal sentences can appear without any nonmanual markers (Karabüklü et al., 2018). These show that they are neither lexical nor structural parts of manual signs. Furthermore, we have also shown that the realizations of these nonmanual markers were affected by contextual information (Karabüklü & Wilbur, 2020).

(6.1) $\overset{\text{hbt}}{\overline{\text{CAR}}}\ \overset{\text{hs}}{\overline{\text{CAR\^{}DRIVE}}}\ \overset{\text{hn}}{\overline{\text{BIL OLABILIR}}}$

'She might know how to drive.'

(6.2) $\overset{\text{hn}}{\overline{\text{SERPIL}_{\text{a}}\ \text{IX}_{\text{3a}}}}\ \text{CHOCOLATE}\ \overset{\text{rhn}}{\overline{\text{EAT OLABILIR}}}$

'Serpil might have eaten the chocolate.'

(6.3) $\overset{\text{hn}}{\overline{\text{SERPIL}_{\text{a}}\ \text{IX}_{\text{3a}}}}\ \text{CHOCOLATE}\ \overset{\text{ht, sq}}{\overline{\text{EAT OLABILIR}}}$

'Serpil might have eaten the chocolate.'

Along with these patterns, these nonmanual markers have been also observed with other structures, for example, squint with attitude verbs like THINK/GUESS (6.4) (Göksel & Kelepir, 2016), re-introduced relative clauses (6.5) (Kubus, 2016), head tilt (nod) with yes/no questions (Göksel & Kelepir, 2013) and commands (6.6) (Özsoy et al., 2018).

(6.4) AYŞE $\overset{\text{sq}}{\overline{\text{THINK(GUESS) ÜLKÜ SLEEP}}}$

'Aye thinks Ülkü sleeps.'

(Göksel and Kelepir, 2016, p.79)

(6.5) $\overset{\text{sq}}{\overline{\overset{\text{hn}}{\overline{\text{BUOY}_1\ \text{MARY}}}\ \overset{\text{hn, br}}{\overline{\text{FINISH}}}\ \overset{\text{sq}}{\overline{\text{IX}_{\text{i}}\ \text{SINGLE}_{\text{j}}}}}}\ \text{CL-MEET}_{\text{i,j}}$

'The first (woman), who was already married, met (the woman) who was single.'

(Kubus, 2016, p.262)

(6.6) BALL $\overset{\text{hn}}{\overline{\text{PLAY}}}$

'Play ball!'

(Özsoy et al., 2018, p.169)

Building on these observed patterns, I propose that nonmanual markers have their own functions which yield the effects observed across structures. In other words, I analyze squint as the uncertainty marker based on the close kinship of epistemics and attitude verbs that squint has been observed with. As for head nod (single or repetitive), it belongs to the information structure domain (Gürer and Karabüklü, 2022, Karabüklü and Gürer, in prep.). This is why there is an effect of increased certainty because the verb or modal is focused, and thus, has verum focus similar to spoken languages (Tonhauser, 2016). To test these hypotheses, I carried out a rating study on the effects of nonmanual markers on certainty levels.

6.1 Nonmanual Markers Rating Study

6.1.1 Stimuli

Based on the previous occurrences of nonmanual markers, sentences in the study included declarative, modal, and matrix verbs TELL, KNOW and GUESS. Matrix verbs will allow us to observe if nonmanual markers are embedded with these verbs which have different modal bases. In other words, semantic analysis of matrix verbs like KNOW and GUESS have doxastic modal base that is similar with epistemic modal base (Hintikka, 1969). As for the choice of these specific verbs, TAHMIN (think, guess) has been previously reported to appear with eye squint while BIL (know) occurs without squint in TİD (Göksel & Kelepir, 2016). If eye squint was the marker of the doxastic modal base, it would have appeared with both TAHMIN and BIL even though these verbs could be lexicalized differently crosslinguistically. Yet, for the epistemic commitment marker, it is expected to appear in certainty levels less than 100% despite the matrix verb. SOYLE (tell) is added because it does not have a specific nonmanual marker and it is used in reportative structures (Kelepir & Göksel, 2013).

As for nonmanual markers, the target sentences only include eye squint (sq), side to side head tilt (ht), repetitive head nod (rhn), single head nod (hn), and the combinations of squint with repetitive head nod, head tilt, and no nonmanual markers (no nmm) as seen in Table 6.1. All conditions were recorded and revised with the Deaf consultant. All sentences with nonmanual markers are presented in Appendix F.

Nonmanual markers usually appear together in the natural data, and manipulating them separately could create unnatural results, yielding lower ratings. To check this effect, the natural sentences occurring with the target nonmanual markers from Karabüklü and Wilbur (2020) data were also added to the survey as a benchmark. The challenge is that the natural sentences rarely have the single nonmanual marker, but combinations of them as in sentence (6.7). Yet, their ratings can be compared to the target sentences and the interactions of nonmanual markers can be measured.

(6.7) HOUSE $\overline{\text{GO}}^{\text{sq}}$ $\overline{\text{OLABILIR}}^{\text{ht}}$

'She might have gone to home.'

6.1.2 Design

The study had 12x7 mixed effects factorial design. Nonmanual markers (squint, head nod, repetitive head nod, head tilt, repetitive head nod and squint, and head tilt and squint) were fully crossed with all sentence types declarative, modals (OLABILIR, LAZIM, OL LAZIM, MECBUR, GEREK, SERBEST, OLUMLU, and YAP), and attitude verbs (TAHMIN, BIL, and SOYLE). Two checkpoints were also presented as 'Please choose the number 4.' Two sets of target items were prepared for all conditions (Appendix F).

6.1.3 Procedure

During each trial, participants first did a trial session to familiarize them with the scale and task. Participants were instructed to imagine that they were at a party and saw two people signing. They were told that they saw one person's signing the sentence that they watched. They were asked to rate how much the signer was certain on a 7-point slider where

Table 6.1. Factors of Nonmanual Markers Rating Test

Modal Signs	Nonmanual Markers	Modal Signs	Nonmanual Markers
Declarative (n=14)	no nmm (n=2)	SERBEST (n=14)	no nmm (n=2)
	sq (n=2)		sq (n=2)
	ht (n=2)		ht (n=2)
	hn (n=2)		hn (n=2)
	rhn (n=2)		rhn (n=2)
	ht & sq (n=2)		ht & sq (n=2)
	rhn & sq (n=2)		rhn & sq (n=2)
OLABILIR (n=14)	no nmm (n=2)	BIL (n=14)	no nmm (n=2)
	sq (n=2)		sq (n=2)
	ht (n=2)		ht (n=2)
	hn (n=2)		hn (n=2)
	rhn (n=2)		rhn (n=2)
	ht & sq (n=2)		ht & sq (n=2)
	rhn & sq (n=2)		rhn & sq (n=2)
LAZIM (n=14)	no nmm (n=2)	OLUMLU (n=14)	no nmm (n=2)
	sq (n=2)		sq (n=2)
	ht (n=2)		ht (n=2)
	hn (n=2)		hn (n=2)
	rhn (n=2)		rhn (n=2)
	ht & sq (n=2)		ht & sq (n=2)
	rhn & sq (n=2)		rhn & sq (n=2)
OL LAZIM (n=14)	no nmm (n=2)	YAP (n=14)	no nmm (n=2)
	sq (n=2)		sq (n=2)
	ht (n=2)		ht (n=2)
	hn (n=2)		hn (n=2)
	rhn (n=2)		rhn (n=2)
	ht & sq (n=2)		ht & sq (n=2)
	rhn & sq (n=2)		rhn & sq (n=2)
MECBUR (n=14)	no nmm (n=14)	SOYLE (n=14)	no nmm (n=2)
	sq (n=2)		sq (n=2)
	ht (n=2)		ht (n=2)
	hn (n=2)		hn (n=2)
	rhn (n=2)		rhn (n=2)
	ht & sq (n=2)		ht & sq (n=2)
	rhn & sq (n=2)		rhn & sq (n=2)
GEREK (n=14)	no nmm (n=2)	TAHMIN (n=14)	no nmm (n=2)
	sq (n=2)		sq (n=2)
	ht (n=2)		ht (n=2)
	hn (n=2)		hn (n=2)
	rhn (n=2)		rhn (n=2)
	ht & sq (n=2)		ht & sq (n=2)
	rhn & sq (n=2)		rhn & sq (n=2)
Total =168			

7 meant fully certain and 1 not at all certain. Participants were randomly assigned one of the sets, but all did the items from the natural data from previous study. All items were shown in randomized order in Qualtrics.

As noted above, forcing the production of nonmanual markers alone in isolation may create unnatural signing and affect the ratings. Thus, the participants also rated the naturalness of the target sentences on a 7-point slider, so the correlation between certainty and naturalness ratings could be checked. The third and last question in this task was the choice of who is certain: the signer, the subject, the embedded subject if the sentence has attitude verb, or other, where they can enter more than one option like both signer and subject (6.1).

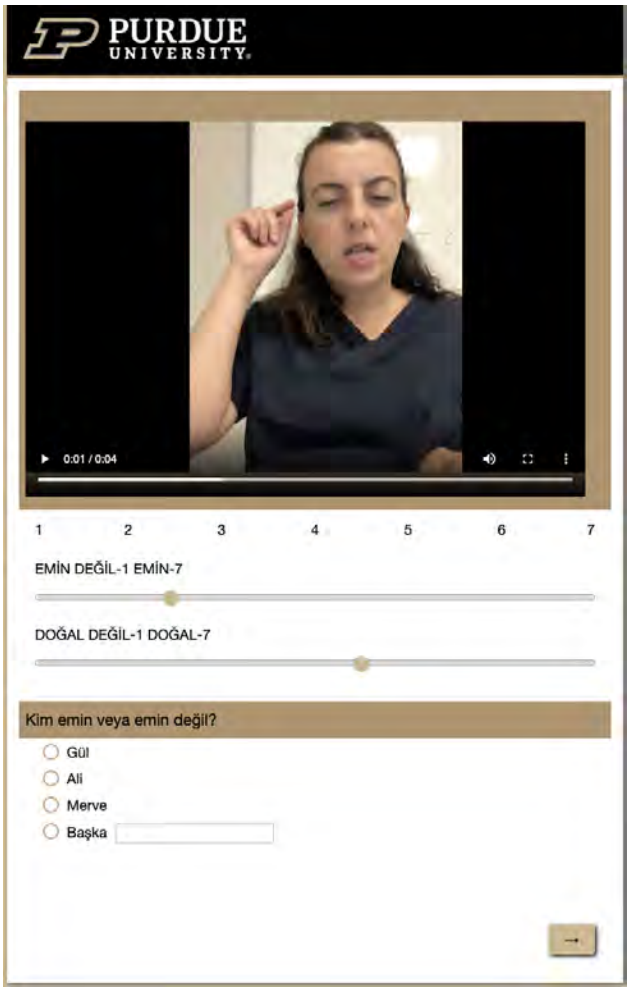

Figure 6.1. Nonmanual Markers Rating Study

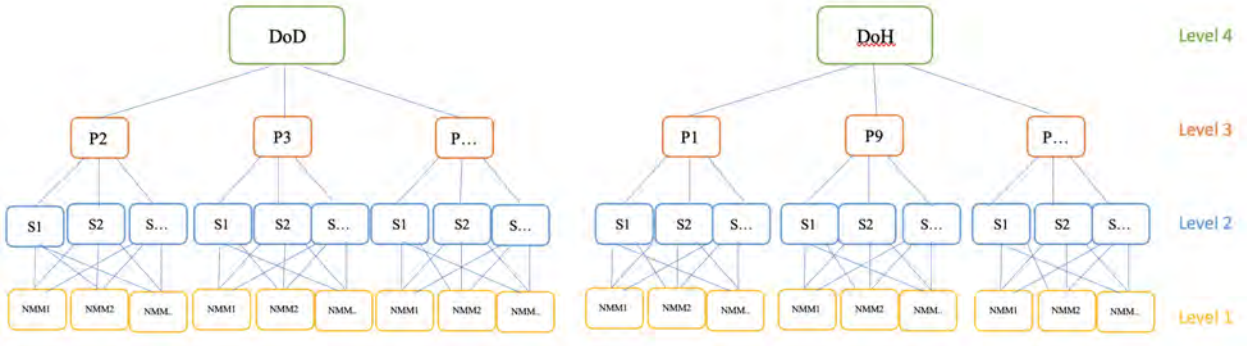

Figure 6.2. 4 Level Hierarchical Structure of Nonmanual Markers Rating Data

The response variable was the rating from 1 (not at all certain) to 7 (totally certain). The results indicated how sentence types and nonmanual markers affect the rating of signer's certainty.

6.1.4 Data Analysis

Data was analyzed with multilevel model mixed effects in SPSS. As in Figure 6.2, nonmanual markers (NMM1, NMM2, so on) are first level fully nested in the sentence types (S1, S2, so on) (Level 2). Sentences are fully nested in participants where each participant rated each target combination (Level 3). Lastly, participants are also nested in top clusters DoH (Deaf of Hearing) and DoD (Deaf of Deaf) based on their language background (Level 4).

Data Coding and Cleaning

All categorical variables were dummy-coded: Gender was coded as female 1, male 0. Generation of deafness was coded as first generation 1, second generation 2, and so on. Language input was coded as DoH 0, DoD 1. Participants were assigned to numbers to make them anonymous as 1,2,3 and so on. Due to the internet connection, some participants missed one random item and their results were also coded as missing points.

Answers to checkpoints were controlled to see if participants paid attention to the task. One participant answered one of the checkpoints wrong and that participant's data was excluded.

6.1.5 Results

Descriptive Results

After exclusion, data contained 1372 data points on which all the analyses were carried out. Table 6.2 presents the descriptive results only for sentences; Table 6.3 presents the descriptive results only for nonmanual markers. Table 6.4 presents the descriptive results for each nonmanual marker with each sentence type. Overall, sentence types have closer (Table 6.2) means while for nonmanual markers, head tilt has the lowest mean and head nod has the highest mean (Table 6.3).

Table 6.2. Descriptive Statistics of Certainty Ratings Based on Sentence Types

Sentence	Min	Max	Mean	Standard Deviation
Declarative	1	7	4.67	2.38
BIL (know)	1	7	4.60	2.17
GEREK	1	7	3.74	2.34
LAZIM	1	7	4.49	2.28
MECBUR	1	7	4.41	2.33
OLABILIR	1	7	4.33	2.01
OL LAZIM	1	7	4.37	2.00
OLUMLU	1	7	5.81	1.85
SERBEST	1	7	4.90	2.04
SOYLE (tell)	1	7	4.78	2.28
TAHMIN (guess)	1	7	3.68	1.88
YAP	1	7	5.48	2.02

Table 6.3. Descriptive Statistics of Certainty Ratings Based on Nonmanual Markers

Nonmanuals	Min	Max	Mean	Standard Deviation
head nod (hn)	1	7	5.74	1.77
head tilt (ht)	1	7	3.29	1.98
repetitive head nod (rhn)	1	7	5.61	1.93
squint (sq)	1	7	4.18	2.12
head tilt and squint (htsq)	1	7	3.65	2.04
repetitive head nod and squint (rhnsq)	1	7	5.13	1.98
no nonmanuals (non)	1	7	4.57	2.34

Table 6.4. Descriptive Statistics of Certainty Ratings Based on Nonmanual Markers and Sentence Types

NMM	Min	Max	Mean	SD	NMM	Min	Max	Mean	SD	NMM	Min	Max	Mean	SD
Declarative					BIL					GEREK				
hn	1	7	6.25	1.73	hn	1	7	5.55	1.77	hn	1	7	5.01	2.10
ht	1	7	2.74	1.77	ht	1	7	3.61	2.16	ht	1	7	2.75	1.65
rhn	1	7	6.67	.69	rhn	1	7	5.91	1.81	rhn	1	7	3.43	2.60
sq	1	7	4.73	2.10	sq	1	7	3.93	1.69	sq	1	7	3.51	2.51
htsq	1	7	3.45	2.36	htsq	1	7	3.14	2.29	htsq	1	7	3.08	2.04
rhnsq	1	7	4.00	2.43	rhnsq	1	7	4.69	1.98	rhnsq	1	7	4.17	2.44
non	1	7	4.86	2.50	non	1	7	5.59	1.79	non	1	7	4.26	2.54
MECBUR					OLABILIR					LAZIM				
hn	1	7	5.96	1.61	hn	1	7	5.35	1.31	hn	1	7	5.29	2.18
ht	1	7	2.81	1.69	ht	1	7	2.47	1.61	ht	1	7	2.79	1.95
rhn	1	7	5.72	1.98	rhn	1	7	5.54	1.23	rhn	1	7	5.61	2.29
sq	1	7	3.58	2.37	sq	1	7	3.62	2.03	sq	1	7	4.62	2.36
htsq	1	7	2.87	1.81	htsq	1	7	3.73	1.45	htsq	1	7	3.50	1.68
rhnsq	1	7	5.35	2.07	rhnsq	1	7	5.15	1.83	rhnsq	1	7	5.10	2.01
non	1	7	4.56	2.60	non	1	7	3.45	1.80	non	1	7	4.53	2.42
OL LAZIM					OLUMLU					SERBEST				
hn	1	7	5.79	1.78	hn	6.1	7	6.87	.33	hn	2.2	7	6.08	1.47
ht	1	7	3.12	1.84	ht	1	7	4.28	2.42	ht	1.1	7	3.51	1.72
rhn	1	7	5.80	2.15	rhn	5	7	6.84	.52	rhn	1.1	7	6.06	1.65
sq	1	7	4.22	1.82	sq	4	7	5.99	1.24	sq	1	7	4.41	1.98
htsq	1	7	3.73	1.45	htsq	2	7	5.05	1.72	htsq	1.2	7	4.01	1.75
rhnsq	1	7	4.71	2.08	rhnsq	1.2	7	6.15	1.77	rhnsq	2	7	5.45	1.69
non	1	7	5.06	1.90	non	1.1	7	5.58	2.41	non	1	7	4.80	2.61
TAHMIN					YAP					SOYLE				
hn	2.2	7	3.91	1.98	hn	3.8	7	6.58	.81	hn	1.1	7	5.43	2.19
ht	1	7	3.05	1.82	ht	1.1	7	3.99	1.93	ht	1.1	7	4.56	2.54
rhn	1	7	4.44	2.00	rhn	1.1	7	6.22	1.58	rhn	2.9	7	6.31	1.28
sq	1	7	3.31	1.73	sq	1.1	7	4.63	2.38	sq	4	7	4.55	2.20
htsq	1.1	5.5	2.85	1.81	htsq	1	7	3.23	1.98	htsq	1	7	2.10	2.14
rhnsq	1	5.1	4.03	1.43	rhnsq	4	7	6.24	.96	rhnsq	1.1	7	5.28	1.87
non	1	7	3.73	1.94	non	1.1	7	4.18	2.58	non	1.1	7	4.20	2.50

Multilevel Model (MLM) Results

I first analyzed data by using totally unconditional model to observe which level contributes to the variation in the certainty ratings. As seen in Table 6.5, variance in the certainty ratings results from participant (.74), sentence types (.68), and nonmanual markers (1.79) were at significant levels, but not from language input. When intra-class correlation (ICC) was calculated for each variance, the biggest proportion of variation is due to nonmanual markers (36%) while the variation due to participant is smaller (15%) and the one due to sentence types is the smallest (13%).

Table 6.5. Covariates in Certainty Level Ratings

Parameter	β	SE	p
CertaintyRating	1.72	.20	<.001
LanguageInput	.00	.00	-
LanguageInput*Participant	.74	.32	.020
LanguageInput*Participant*SentenceType	.68	.13	<.001
LanguageInput*Participant*SentenceType*NMMs	1.79	.24	<.001

Since language input does not have an effect on ratings, the rest of analysis was carried out in three level model where participants form the top cluster in data structure. In this three level model, sentence types and nonmanual markers were analyzed as fixed effects; participant as random effects with age, gender, and generation as variables of level three. Table 6.6 shows F and p values for each variable. Gender, generation, sentence types, nonmanual markers, and the interaction between sentence types and nonmanual markers have a significant effect on the certainty ratings (Table 6.7). Thus, males rated the target sentences significantly higher than females (p<.001), and the second generation of Deaf of Deaf (DoD) participants rated the target sentences significantly lower than the first generation (Deaf of Hearing) and the fourth generation DoD participants.

In order to analyze the interaction of nonmanual markers and sentence types, the same model was used by keeping one nonmanual marker and one sentence type as reference points where the intercept was referred to that sentence type and that nonmanual marker in each analysis. I will summarize overall findings here, but appendix G presents more detail on the

Table 6.6. Effects of All Independent Variables on Acceptability Ratings in Evidential Restriction

Variables	F	p
Age	11.56	**<.001**
Gender	5.55	.51
Generation	14.80	**<.001**
Sentence	5.37	**<.001**
NMMs	61.09	**<.001**
Sentence*NMMs	1.96	**<.001**

Table 6.7. Effects in Certainty Level Ratings

Parameter	β	SE	t	p
CertaintyRating	3.69	.54	6.89	**<.001**
Age	-.10	.02	-52	.60
Gender = M	1.29	.55	2.36	**.02**
Gender = F	.00	.00		
Generation = 1	.00	.00		
Generation = 2	-1.49	.39	-3.85	**<.001**
Generation = 4	.00	.00		

Parameters having .00 values were treated as the reference point in the model.

results of multilevel mixed effects analysis on each nonmanual marker with each sentence type.

Overall, head nod (hn) and repetitive head nod (rhn) yielded higher ratings in the certainty levels whereas head tilt (ht) and squint (sq) yielded lower ratings in the certainty levels. If we assume that declarative sentences which are unmarked with modals or attitude verbs form the baseline in terms of certainty, head nod and repetitive head nod are significantly found more certain (p=.018 and p.002, respectively) than no nonmanual condition (Table 6.8). Head tilt yielded significantly lower certainty levels compared to no nonmanual (p<.001), head nod (p<.001), and repetitive head nod (p<.001). Squint also showed similar results by yielding significantly lower ratings than head nod (p=.004) and repetitive head nod (p<.001).

Yet, the effects of nonmanual markers are within the range of the perceived certainty level of the sentence type. In other words, a sentence with attitude verb BIL (know) yields a higher level certainty than the one with TAHMIN (guess). As seen in Table 6.9, only repetitive head nod is rated significantly higher than head tilt (p=.007), squint (p=.019), and head tilt and squint (p=.028). In contrast, nonmanual markers caused more significant changes in the ratings of nonmanual markers with the attitude verb BIL (Table 6.8). Head nod and repetitive head nod yielded higher ratings compared to other nonmanual marker and no nonmanual conditions. Squint and head tilt yielded lower ratings compared to other nonmanual marker and no nonmanual marker conditions. Similar patterns are also observed for modal signs. MECBUR (required) is rated higher with head nod and repetitive head nod while it is rated lower with squint and head tilt. In contrast, modal OLUMLU (positive) had fewer effect in ratings (Tables 6.8 and 6.9).

Table 6.8. Effects of Nonmanual Markers and Sentence Types on Certainty Ratings - Part 1

Declarative

	non	hn	rhn	ht	sq	htsq	rhnsq
non							
hn	**.018**						
rhn	**.002**	n.s.					
ht	**<.001**	**<.001**	**<.001**				
sq	n.s.	**.004**	**<.001**	**.002**			
htsq	**.017**	**<.001**	**<.001**	n.s.	n.s.		
rhnsq	n.s.	**<.001**	**<.001**	**.029**	n.s.	n.s.	

BIL

	non	hn	rhn	ht	sq	htsq	rhnsq
non							
hn	n.s.						
rhn	n.s.	n.s.					
ht	**.002**	**.002**	**<.001**				
sq	**.004**	**.005**	**<.001**	n.s.			
htsq	**<.001**	**<.001**	**<.001**	n.s.	n.s.		
rhnsq	n.s.	n.s.	**.036**	**.051**	n.s.	**.005**	

GEREK

	non	hn	rhn	ht	sq	htsq	rhnsq
non							
hn	n.s.						
rhn	n.s.	**.007**					
ht	**.013**	**<.001**	n.s.				
sq	n.s.	**.010**	n.s.	n.s.			
htsq	n.s.	**<.001**	n.s.	n.s.	n.s.		
rhnsq	n.s.	n.s.	n.s.	**.014**	n.s.	n.s.	

LAZIM

	non	hn	rhn	ht	sq	htsq	rhnsq
non							
hn	n.s.						
rhn	n.s.	n.s.					
ht	**.003**	**<.001**	**<.001**				
sq	n.s.	n.s.	n.s.	**.002**			
htsq	n.s.	**.002**	**<.001**	n.s.	n.s.		
rhnsq	n.s.	n.s.	n.s.	**<.001**	n.s.	**.006**	

MECBUR

	non	hn	rhn	ht	sq	htsq	rhnsq
non							
hn	**.015**						
rhn	n.s.	n.s.					
ht	**.002**	**<.001**	**<.001**				
sq	n.s.	**<.001**	**<.001**	n.s.			
htsq	**.006**	**<.001**	**<.001**	n.s.	n.s.		
rhnsq	n.s.	n.s.	n.s.	**<.001**	**.002**	**<.001**	

OLABILIR

	non	hn	rhn	ht	sq	htsq	rhnsq
non							
hn	**.002**						
rhn	**<.001**	n.s.					
ht	n.s.	**<.001**	**<.001**				
sq	n.s.	**<.001**	**<.001**	**.028**			
htsq	n.s.	**.034**	**.005**	**<.001**	n.s		
rhnsq	**.007**	n.s.	n.s.	**<.001**	**.004**	n.s.	

Abbreviations in the table are: non - non nonmanual marker, hn - head nod, rhn - repetitive head nod, ht - head tilt, sq - squint, htsq - head tilt and squint, rhnsq - repetitive head nod and squint

Table 6.9. Effects of Nonmanual Markers and Sentence Types on Certainty Ratings - Part 2

OL LAZIM

	non	hn	rhn	ht	sq	htsq	rhnsq
non							
hn	n.s.						
rhn	**.029**	**<.001**					
ht	**<.001**	**<.001**	n.s.				
sq	n.s.	**.012**	n.s.	**.036**			
htsq	**.022**	**<.001**	n.s.	n.s.	n.s.		
rhnsq	n.s.	n.s.	n.s.	**.006**	n.s.	n.s.	

OLUMLU

	non	hn	rhn	ht	sq	htsq	rhnsq
non							
hn	**.036**						
rhn	**.029**	n.s.					
ht	**.025**	n.s.	**<.001**				
sq	n.s.	n.s.	n.s.	**.003**			
htsq	n.s.	**.003**	**.002**	n.s.	n.s.		
rhnsq	n.s.	n.s.	n.s.	**.001**	n.s.	n.s.	

SERBEST

	non	hn	rhn	ht	sq	htsq	rhnsq
non							
hn	**.027**						
rhn	**.029**	n.s.					
ht	**.025**	**<.001**	**<.001**				
sq	n.s.	**.004**	**.004**	n.s.			
htsq	n.s.	**<.001**	**<.001**	n.s.	n.s.		
rhnsq	n.s.	n.s.	n.s.	**<.001**	n.s.	**.013**	

SOYLE

	non	hn	rhn	ht	sq	htsq	rhnsq
non							
hn	**.033**						
rhn	**<.001**	n.s.					
ht	n.s.	n.s.	**.002**				
sq	n.s.	n.s.	**.002**	n.s.			
htsq	n.s.	**<.001**	**<.001**	**.012**	**.012**		
rhnsq	n.s.	n.s.	n.s.	n.s.	n.s.	**<.001**	

TAHMIN

	non	hn	rhn	ht	sq	htsq	rhnsq
non							
hn	n.s.						
rhn	n.s.	n.s.					
ht	n.s.	n.s.	**.007**				
sq	n.s.	n.s.	**.019**	n.s.			
htsq	n.s.	n.s.	**.028**	n.s.	n.s.		
rhnsq	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	

YAP

	non	hn	rhn	ht	sq	htsq	rhnsq
non							
hn	**<.001**						
rhn	**<.001**	n.s.					
ht	n.s.	**<.001**	**<.001**				
sq	n.s.	**<.001**	**.002**	n.s.			
htsq	n.s.	**<.001**	**<.001**	n.s.	**.015**		
rhnsq	**<.001**	n.s.	n.s.	**<.001**	**.002**	**<.001**	

Abbreviations in the table are: non - non nonmanual marker, hn - head nod, rhn - repetitive head nod, ht - head tilt, sq - squint, htsq - head tilt and squint, rhnsq - repetitive head nod and squint

6.2 Interaction of Manual Signs and Nonmanual Markers

Results showed that both sentence types and nonmanual markers have significant effects on the ratings of certainty levels. As expected from a cooperative interlocutor, the speaker needs to convey how much she commits to the proposition (Grice, 1975) in order not to be blamed as deceiving (Krifka, 2017). Certainty ratings of different sentence types have borne out that well-known principle as seen in Figure 6.3. As predicted by this principle, TAHMIN (guess) (M=3.7, sd=1.88) and OLABILIR (possible) (M=4.33, sd=2.01) are rated lower than declarative sentences (M=4.67, sd=2.38) if we consider declarative sentences as the reference point since a speaker is expected to use the declarative when they are committed to the proposition. Modal signs MECBUR (obligatory) (M=4.41, sd=2.33), LAZIM (required) (M=4.49, sd=2.28), and OL LAZIM (be required) (M=4.37, sd=2), and attitude verb BIL (know) (M=4.60, sd=2.17) were rated closer to declarative sentences. As for the patterns of TAHMIN, OLABILIR, and OL LAZIM, they have lower ratings than declarative since a cooperative signer would use these modals and the attitude verb to convey the lack of commitment to the proposition. The matrix verb SOYLE (tell) (M=4.78, sd=2.28) and modal signs SERBEST (free) (M=4.90, sd=2.04), OLUMLU (positive) (M=5.81, sd=1.85), and YAP (do/make) (M=5.48, sd=2.02) were rated higher than the declarative. SOYLE was expected to pattern with declarative and lower than BIL as a reportative verb. SERBEST, and OLUMLU were also expected to pattern with other modals. Yet, these ratings reflect all the nonmanual marker conditions, so the realization of some nonmanual markers were found less natural in isolation and this situation affects the ratings. Based on the patterns of YAP appearing in commands, abilities (Chapter 4), it is expected that it might be interpreted as a command without a context in the study. Different than other modal signs, GEREK (required) has the lowest rating (M=3.74, sd=2.34) which is most likely the reflection of its being regarded as a non-native sign by the signers (Chapter 4).

When we focus on only the effects of nonmanual markers on certainty ratings, the signer was found less certain with head tilt (M=3.29, sd=1.98), head tilt and squint (M=3.65, sd=1.98), and squint (4.18, sd=2.12) if we take no nonmanual markers (M=4.57, sd=2.34) as a reference point (Figure 6.4). These results supported the predictions for the effects of

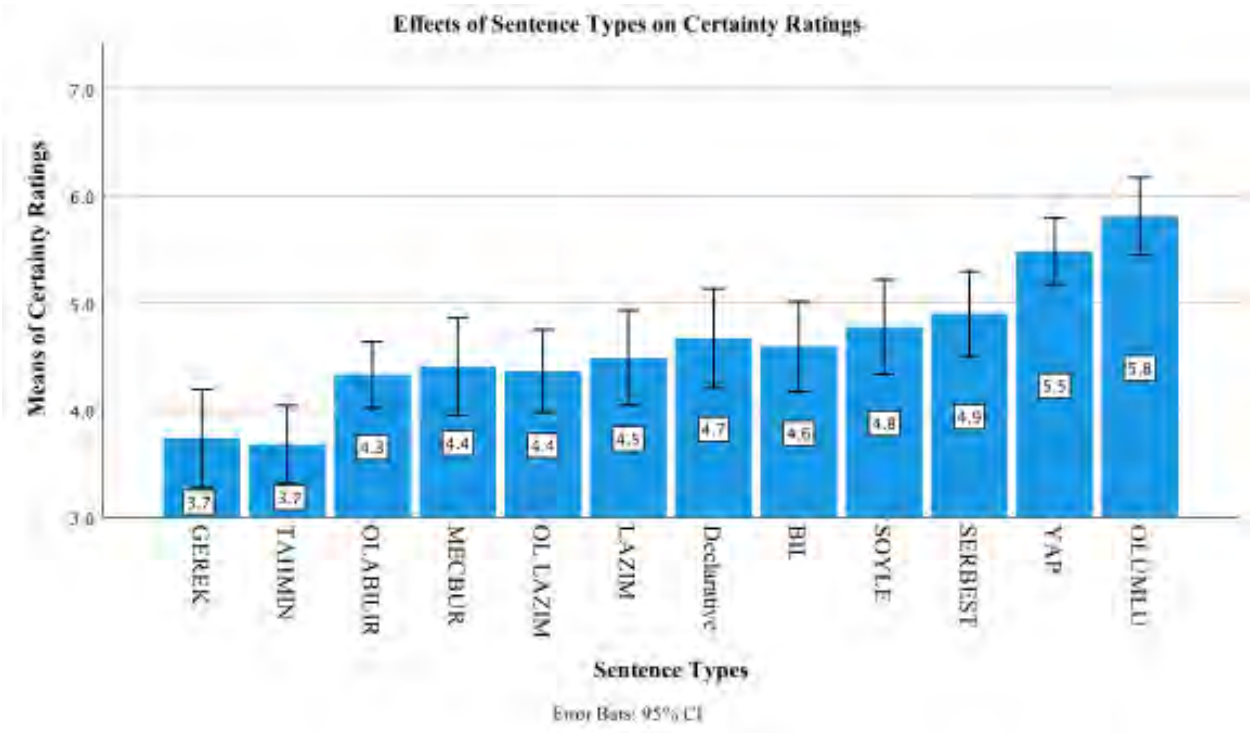

Figure 6.3. Effects of Sentence Types on Certainty Ratings

squint and head movements, and further confirmed the results of Karabüklü and Wilbur (2020). As expected, squint decreases the certainty level while head nod and repetitive head nod increase it. As for head tilt, it is rated lower than squint. The reason for its ratings could be that participants found the target items with head tilt unnatural as also reflected in its naturalness rating (M=3.14, sd=2.37) (Table 6.10). Its isolated production may yield infelicitous spreading domain and/or onset and offset times. To my knowledge, head tilt has not been reported with another construction in the literature, thus it might be only specific to epistemic modal OLABILIR in some signers' idolect. It needs to be further examined.

As expected, the interactions of sentence types and nonmanual markers is significant and nonmanual markers affected the certainty ratings within the range of sentence type. As seen in Figure 6.5, head nod increased the certainty rating of TAHMIN, but not as much as of BIL. Similarly, squint decreased the certainty rating of OL LAZIM, but not as much as of TAHMIN

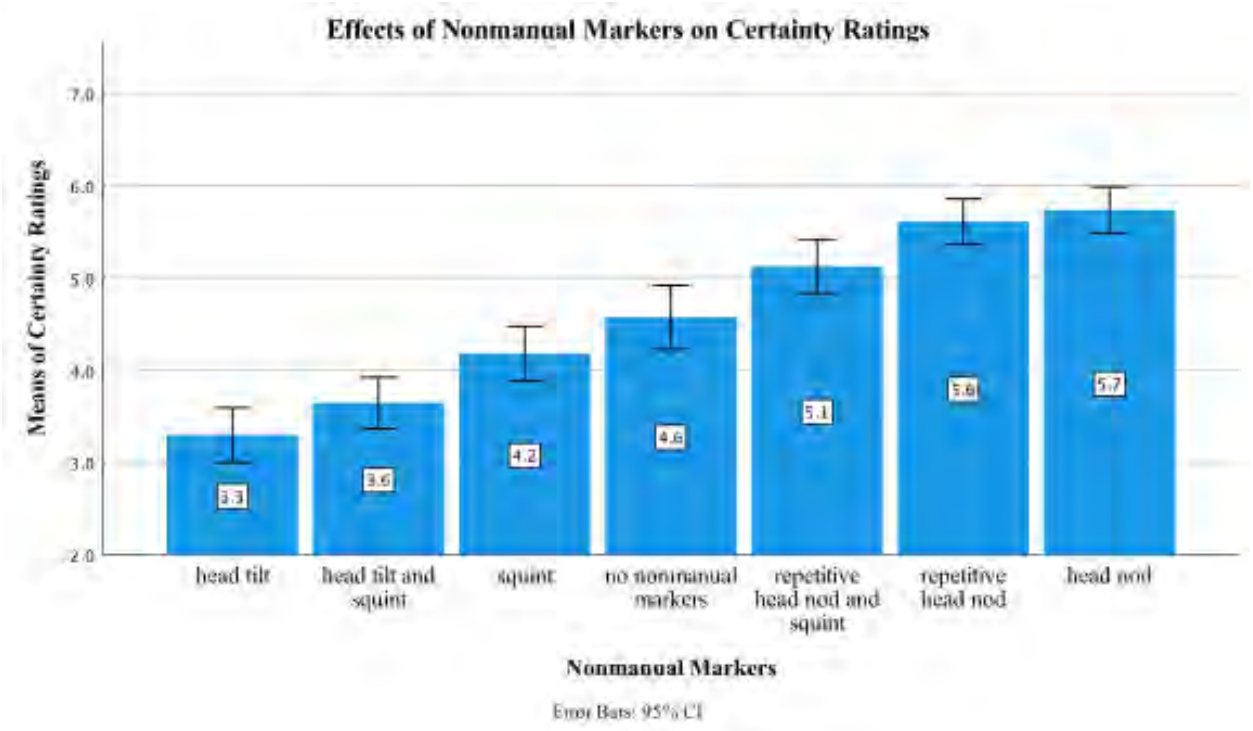

Figure 6.4. Effects of Nonmanual Markers on Certainty Ratings

Table 6.10. Descriptive Statistics of Naturalness Ratings Based on Nonmanual Markers

Nonmanuals	Min	Max	Mean	Standard Deviation
head nod (hn)	1	7	5.73	1.93
head tilt (ht)	1	7	3.14	2.37
repetitive head nod (rhn)	1	7	5.66	2.01
squint (sq)	1	7	4.26	2.44
head tilt and squint (htsq)	1	7	4.20	2.53
repetitive head nod and squint (rhnsq)	1	7	5.37	2.14
no nonmanuals (non)	1	7	4.33	2.34

(Figure 6.6). Effects of all tested nonmanuals markers can be seen for all sentence types in Figure 6.7.

Overall, squint results in less certainty (Figure 6.6) and head nod and repetitive head nod in more certainty (Figure 6.5). Then, the question is why we might need two distinct articulators eyes and head for different parts of the same scale, less certain and more certain. Furthermore, why is neutral eye position not enough to mark higher certainty and neutral

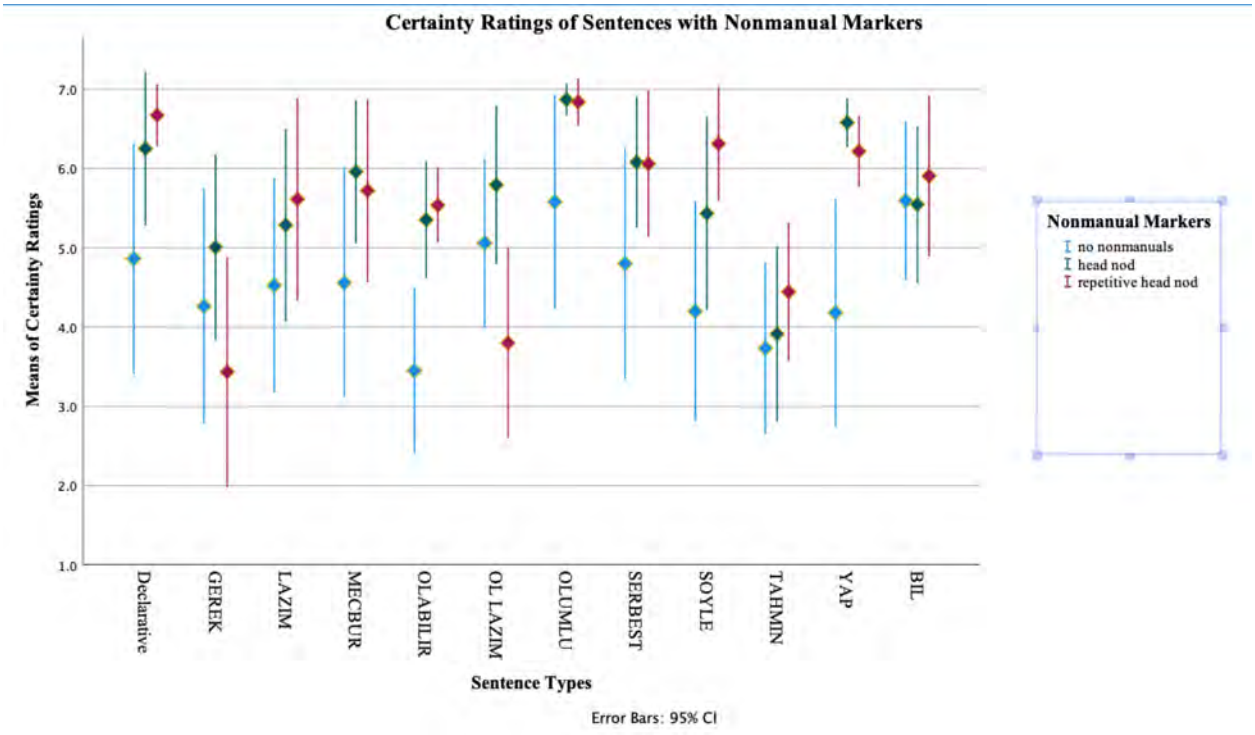

Figure 6.5. Effects of Head Nod and Repetitive Head Nod on Different Sentence Types

head position to mark lower certainty? In the following section, I will answer these questions building on patterns of squint and head nod in different structures. I will show that head nod belongs to the information structure domain and certainty effects are a byproduct of its appearance with sentences. I will analyze squint as the uncertainty marker above tense phrase, which can be anchored to the signer in epistemics, subject in attitude verbs, and addressee in re-introduced topics.

6.3 Head Nod: Information Structure

As previously mentioned, head nod does not only appear with modals or attitude verbs. Another structure which it is attested with is the information structure domain (Gürer and Karabüklü, 2022, Karabüklü and Gürer, in prep.). As shown for spoken languages (Hübscher et al., 2017, del Mar Vanrell et al., 2013), realization of focus as falling intonation in sentences yields higher certainty ratings. Then, having higher certainty ratings with sharp

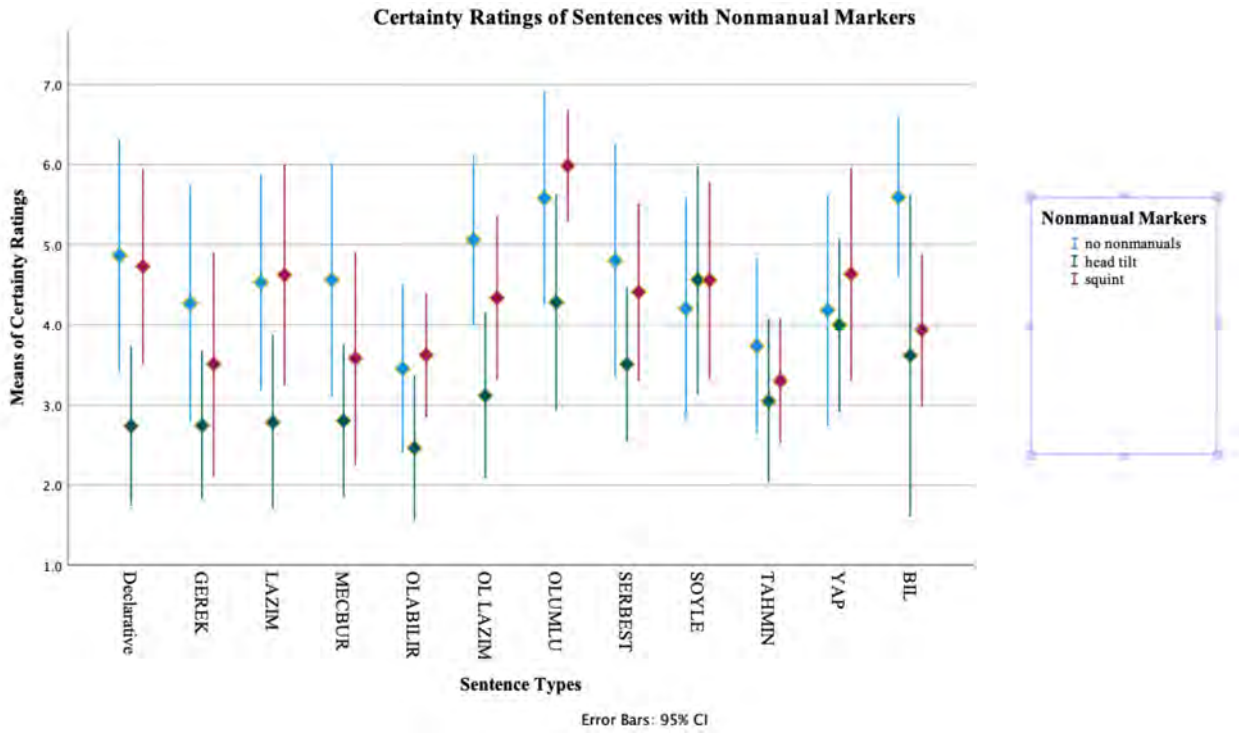

Figure 6.6. Effects of Head Tilt and Squint on Different Sentence Types

head nod and repetitive head nod is not surprising because it makes the item it co-occurs more prominent in the structure. Focus bearing items are the most prominent ones, so they are expected to be marked in languages (Truckenbrodt, 1995). In parallel with findings on spoken languages, it is expected that a focused verb yields higher certainty.

6.3.1 Brief Background on Focus in TİD

Focus is simultaneously marked via longer durations in focused manual signs (Karabüklü and Gürer, in prep.) and head nod at the edge of the intonational phrase (Gürer & Karabüklü, 2022). As for head nod, it is attested both with focused items (6.8) and non-focused items (6.9), thus it is not the marker of focus. ASLI in (6.8) is focused as an answer to a wh- question (Rooth, 1992), yet VELI which had head nod over is already present in the question and not the focus bearing item in the answer.

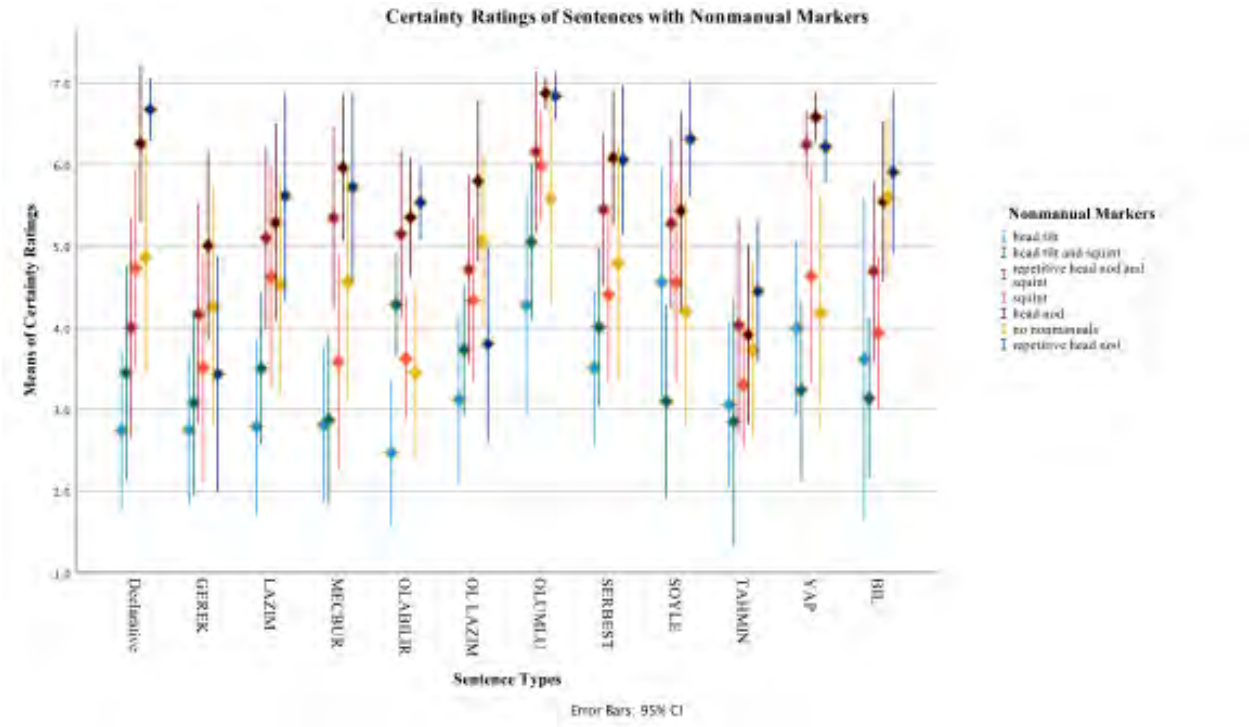

Figure 6.7. Effects of Sentence Types and Nonmanual Markers Together on Certainty Ratings

To further support the proposal that head nod is not the sole marker of the certainty, I want to give a brief background on data elicitation for the following examples (6.8-6.9). The participants had pictures of subjects with different items in front of them, and the Deaf consultant who was asking questions did not see those pictures. Thus, the participants have the direct evidence (seeing) on the answers 'Asli has the rabbit' or 'Veli has two clementines.' By accessing the direct evidence, the participant is fully certain about the answer, then we would have expected for the head nod to appear over the existential in these sentences, too. In other words, even though the participant was fully certain about these answers, head nod shows a different pattern 'appearing on the subject' than the one in the Nonmanual Markers Rating Study where it appears on the modal or the verb.

(6.8) Q: IX$_3$ RABBIT IX$_3$ WHO

'Who has the rabbit?'

$\overline{[\text{ASLI}]_{\text{F}}}^{\text{hn}}$ RABBIT EXISTENTIAL PALM-UP

'Asli has the rabbit.'

(taken from Gürer and Karabüklü, 2022)

(6.9) Q: VELI IX$_3$ WHAT IX$_3$

'What does Veli have?'

$\overline{\text{VELI}}^{\text{br, hn}}$ [CLEMENTINE TWO]$_{\text{F}}$ EXISTENTIAL

'Veli has two clementines.'

(taken from Gürer and Karabüklü, 2022)

When we examine head nod in terms of a possible phonological phrase boundary marker, it appears with the focus phrase that appears in the left-most phonological phrase in (6.10) and with the topic phrase in (6.11). In the first example (6.10), the unaccented phrases are wrapped in a single phrase [RABBIT EXISTENTIAL PALM-UP]. In (6.11), the unaccented verb is within the phonological phrase [CHOCOLATE TWO EXISTENTIAL] including the focus phrase [CHOCOLATE TWO]. The hypothesis that head nod is an edge marker is supported in (6.12) with focus on the verb. Different than focus on the object phrase (6.11), the verb is signed with head nod when it has focus in (6.12). The verb is wrapped in a distinct phonological phrase in (6.12) and separated from the object. The object has the default position for focus in TİD with the smallest duration change among subject and verb between focus-nonfocus pairs (Karabüklü and Gürer, in prep.), so the verb is marked with both duration and head nod to have its own phonological phrase when it has focus. We have also found that head nod on the subject becomes prominent when the subject has focus.

(6.10) $\overline{[[\text{ASLI}_{\text{F}}]_{\text{PhP}}}^{\text{hn}}$ [RABBIT EXISTENTIAL PALM-UP]$_{\text{PhP}}]_{\text{IP}}$

'Asli has a rabbit.'

(taken from Gürer and Karabüklü, 2022)

(6.11) $\overline{[[\text{IX}_3\ \text{BILGE}\ \text{IX}_3]_{\text{PhP}}}^{\text{hn, br}}\ [\text{CHOCOLATE}_{\text{F}}\ \text{TWO}\ \text{EXISTENTIAL}]_{\text{PhP}}]_{\text{IP}}$

'Bilge has two chocolate (bars).'

(taken from Gürer and Karabüklü, 2022)

(6.12) Q: ASLI_{a} $\text{IX-POSS}_{3\text{a}}$ RED PEPPER EXISTENTIAL

'Does Asli have a red pepper?'

$\overline{[[\text{ASLI}_{\text{a}}\ \text{IX-POSS}_{3\text{a}}]_{\text{PhP}}}^{\text{hn}}\ [\text{RED BELL-PEPPER}]_{\text{PhP}}\ \overline{[\text{EXISTENTIAL}]_{\text{PhP}}]_{\text{IP}}}^{\text{hn}}$

'Asli has a red pepper.'

(taken from Gürer and Karabüklü, 2022)

6.3.2 Certainty Effect Due to Focus

Patterning with the focus on verb, all stimuli had head nod on the modal or verb, and not on other constituents as in (6.13). Similarly, repetitive head nod appeared over the verb phrase and not in other constituents in the stimuli (6.14). Thus, based on the realization of focus on verb (6.12), these sentences can be interpreted as the modal having the focus with head nod or repetitive head nod. When the verb has the focus, two alternatives denoted by the focus are p and ¬p (Rooth, 1992). Since all stimuli had positive sentences, focused verb or modal yields the emphasis on p, that is VERUM focus (Romero & Han, 2004).

(6.13) ALI SWIM $\overline{\text{LAZIM}}^{\text{hn}}$

'Ali must/should swim.'

(6.14) ALI $\overline{\text{SWIM LAZIM}}^{\text{rhn}}$

'Ali must/should swim.'

VERUM (aka truth) was proposed as an epistemic operator where the speaker knows the truth of the proposition. Focus on the verb is one of the common ways of its realization. Then, head nod, the edge marker of phonological phrase, yields the highest certainty ratings when it appeared on the modal or verb. The signer conveys that she is committed to the propositions in verbs and to the act in modals. Hence, head nod is not the certainty marker, but the certainty effect comes from its appearance as an information structure marker on the verb or modal, yielding VERUM focus.

6.4 Eye squint: Uncertainty Marker

I analyzed head nod as the marker in the information structure and certainty effect is due to its appearance on the verb or modal, thus yielding VERUM focus. In contrast, I will analyze squint as the morpheme of uncertainty. When all usages of squint are considered, its main contribution to the structure is the uncertainty. As seen in (6.15), the signer is uncertain about the proposition which can be true or false. Similarly, uncertainty holds for the embedded sentence in (6.16) where the proposition can hold in the real world or not. Yet, the uncertainty is attributed to the subject in attitude verbs rather than the speaker in epistemics. Lastly, relative clauses were reported to mostly have squint and were analyzed as re-introduced topics (Kubus, 2016). In this case, the signer is certain about the reference of the re-introduced topic but not certain if the addressee will retrieve the reference in the discourse.

(6.15) $\overset{\text{hn}}{\overline{\text{SERPIL}_{\text{a}}\ \text{IX}_{3\text{a}}}}$ CHOCOLATE $\overset{\text{ht, sq}}{\overline{\text{EAT OLABILIR}}}$

'Serpil might have eaten the chocolate.'

(6.16) AYŞE $\overset{\text{sq}}{\overline{\text{THINK(GUESS) ÜLKÜ}}}$ SLEEP

'Ayşe thinks Ülkü sleeps.'

(Göksel and Kelepir, 2016, p.79)

(6.17) $\overset{\text{sq}}{\overline{\overset{\text{hn}}{\overline{\text{BUOY}_1\ \text{MARY}}}\ \overset{\text{hn, br}}{\overline{\text{FINISH}}}\ \overset{\text{sq}}{\overline{\text{IX}_{\text{i}}\ \text{SINGLE}_{\text{j}}}}}}$ CL-MEET$_{\text{i,j}}$

'The first (woman), who was already married, met (the woman) who was single.'

(Kubus, 2016, p.262)

Based on its occurrence on various structures and the results of the Nonmanual Markers Rating Study, squint is the uncertainty marker which can be anchored to the signer, the subject, or the addressee. If squint is a single morpheme, then it fills a head position in terms of syntactic relations. It also appears with the epistemic modal OLABILIR that already fills in the head position, and it is clearly shown that they can appear separately. Then, the puzzle is where the squint lives.

One possible explanation is Bross and Hole's (2017) bodily mapping hypothesis. They proposed that nonmanual markers contribute to the not-at-issue content while manual signs contribute to the at-issue context. In our case, squint should contribute to the not-at-issue content while OLABILIR and attitude verbs like TAHMIN should contribute to the at-issue content. This will explain if they function at the proposition level or above the proposition level. Yet, we still do not know if we have two epistemic phrases one of which functions at not-at-issue level, and another of which functions at at-issue level. I will attempt to show this is the case by following Krifka's (2021) analysis on the layers of assertion. I will briefly introduce his argumentation where he introduces new phrases above assertion, then present the supporting data for squint.

6.4.1 Krifka's Layers of Assertion

Krifka (2021) analyzes illocutionary force assertion in three layers: commitment phrase, judge phrase, and act phrase. Commitment Phrase (ComP) has the public assertions, and its syntactic head turns a proposition p into the propositional function that the speaker x is publicly committed in world i to p. Judge Phrase (JP) has the private judgments and its head turns a proposition p into the propositional function that a judger x judges the proposition p to be true. Act Phrase (ActP) distinguishes assertions from questions. A speaker makes a public commitment to a proposition in an assertion. In contrast, in a question, the speaker restricts the possible continuations of a conversation so that the addressee makes a public commitment to a proposition (p. 6).

The role of the judge phrase is to make the judge parameter j available for linguistic operators. By turning the context parameter j into a lambda-bound variable, j becomes accessible to binding and shifting, like the addressee in questions. The role of the commitment phrase is to change the propositional function into a public commitment that involves the judge parameter j. The judger is responsible for the truth of the proposition, and the meaning expressed by tense phrase. Assertive act phrase adds this propositional function to the common ground when the judger is the speaker.

Considering evidential as relating to the source of evidence for a proposition, and epistemic as relating to the level of certainty, he treats them as the modifiers of judge phrase. Furthermore, he distinguished epistemics as subjective epistemic modifiers (adverbs *certainly, possibly*, so on) and objective epistemic modifiers (adjectives *certain, possible*, so on). Environments in which their distinction can be observed are conditionals, negation, and questions. Subjective epistemics are usually unacceptable in conditional clauses (6.18), with negation (6.19), and in questions (6.20) while objective epistemics are acceptable in all. He proposes that subjective epistemics are in JP (6.21) while objective epistemics are in TP (6.22). In other words, subjective epistemics contribute to not-at-issue content whereas objective epistemics contribute to at-issue content.

(6.18) a. Wenn Max ??sicherlich/??vielleicht/?möglicherweise/?wahrscheinlich/?sicher scharcht, sollten wir Ohrtstöpsel mitnehmen.
'If Max is certainly/ perhaps/ possibly/ probably/ for sure snoring, we should bring earplugs.'
b.Wenn es sicher/wahrscheinlich/möglich ist, dass Max schnarcht, sollten wir Ohrtstöpsel mitnehmen.
'If Max is certainly/ perhaps/ possibly/ probably/ for sure snoring, we should bring earplugs.'

(Krifka, 2021, p.11)

(6.19) a. Max schnarcht *nicht sicherlich/*unsicherlich laut.
'Max is not certaintly/uncertainly snoring.'
b.Es ist nicht sicher / unsicher, ob Max laut schnarcht.
'It is not certain/uncertain that Max snores loudly.'

(Krifka, 2021, p.12)

(6.20) a. *Schnarcht Max sicherlich laut?
'Does Max certainly snore?'
b. Ist es sicher, dass Max laut schnarcht?
'Is it certain that Max snores?'

(Krifka, 2021, p.12)

(6.21) [$_{\text{ActP}}$ Max$_1$ [$_{\text{Act'}}$ [$_{\text{Act}}$ schnarcht] [$_{\text{ComP}}$ t$_1$ [$_{\text{Com'}}$ [$_{\text{JP}}$ t$_1$ [$_{\text{J'}}$ sicherlich [$_{\text{TP}}$ t$_1$ laut t$_0$] [$_{\text{J}}$ t$_0$ J-]] [$_{\text{Com}}$ t$_0$ ⊢]]]]]]

(Krifka, 2021, p.12)

(6.22) [$_{\text{ActP}}$ Es$_1$ [$_{\text{Act'}}$ [$_{\text{Act}}$ ist] [$_{\text{ComP}}$ t$_1$ [$_{\text{Com'}}$ [$_{\text{JP}}$ t$_1$ [$_{\text{J'}}$ [$_{\text{TP}}$ t$_1$ sicher t$_2$ t$_0$] [$_{\text{J}}$ t$_0$ J -]] [$_{\text{Com}}$ t$_0$ ⊢]]][$_{\text{CP}}$ dass Max laut schnarcht]$_2$]]]

(Krifka, 2021, p.12)

He analyzes epistemics and evidentials as the speaker's justification for her commitment to the proposition. In other words, the speaker makes evidential and epistemic modifications to change the type of commitment to the proposition by expressing the source of information or the likelihood of a proposition. Thus, it is safer to commit to the likelihood or the inference of a proposition than to commit to the proposition directly. Following Krifka's (2021) analysis, I will propose that epistemic modals are like objective epistemics and in TP while squint is like subjective epistemic and in JP.

6.4.2 Where may squint live?

We need (not)-at-issue tests to conclusively analyze squint at the JP which is not-at-issue level. Unfortunately, we do not have field specific tests to investigate the at-issueness of nonmanual markers and the current tests are difficult to apply to nonmanual markers. Even though field specific tests need to be developed for sign languages and future studies are needed, I will provide the available evidence on squint in terms of its behavior with negation, questions, and challengeability.

As seen in (6.23), squint spreads over the epistemic sentence where the signer talks about the possibility of the subject not coming. Similarly, squint also appears with yes/no question where the signer asks if the subject (Oya) might not interpret at the conference. As seen in Figure 6.8, it co-occurs with the nonmanual markers of negation, head back tilt, and the nonmanual marker of yes/no question, head forward tilt. Based on Krifka's subjective and objective epistemic analysis, appearance of OLABILIR in questions show that it behaves as an objective epistemic. Spreading of squint over negation and question nonmanual markers show that squint scopes over negation and it is at least in CP domain.

(6.23) Context: Your friend is pregnant and she is due soon. You'll gather with your friends and they asked if she would come. You say.

$\overline{\text{HOUSE COME}\hat{}\text{NOT ACABA}}^{\text{sq}}$

'She may not leave the house.

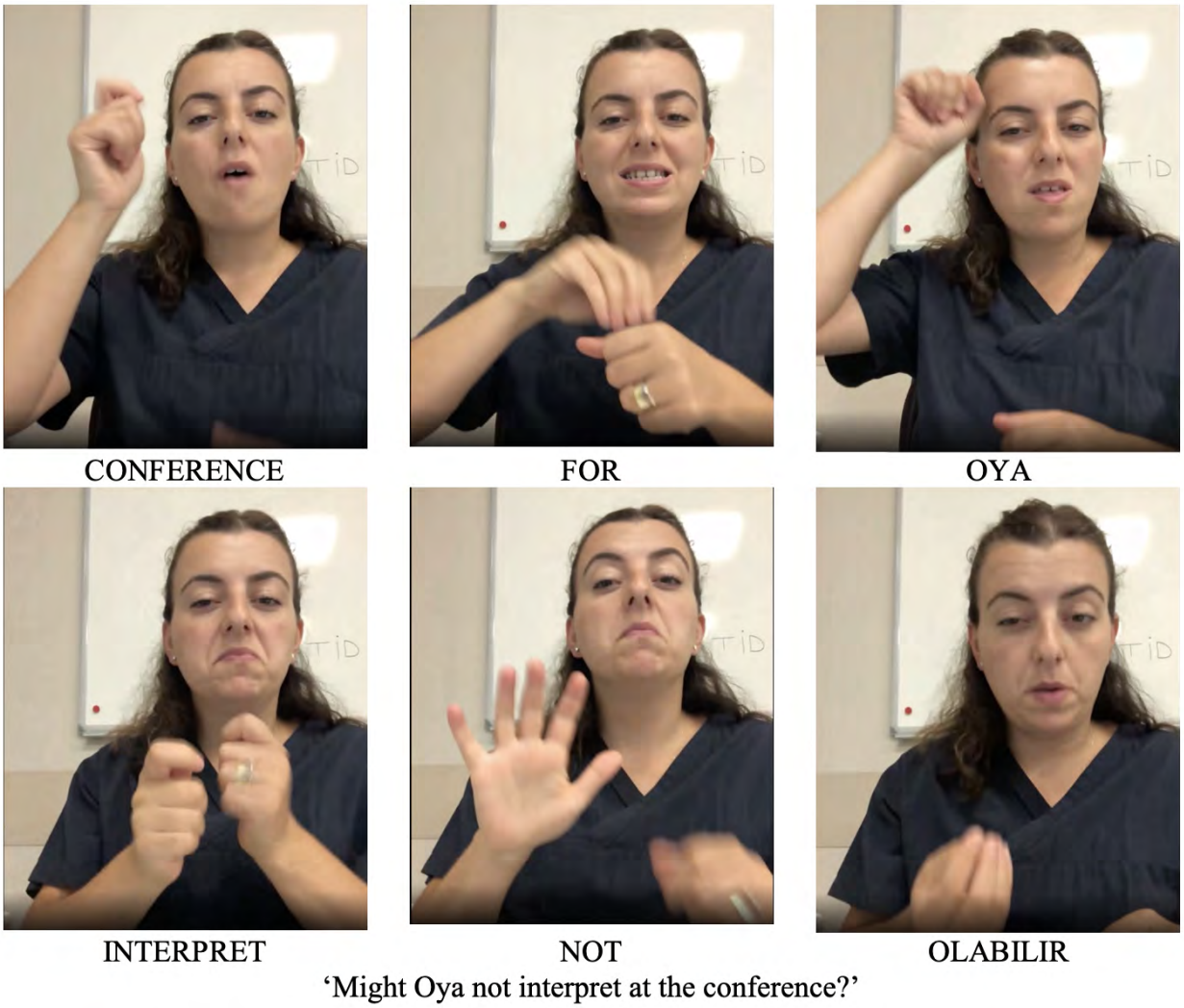

Figure 6.8. Squint appears with negative yes/no questions

In contrast to the epistemic of negative propositions, the signer mentions the impossibility of the proposition in Figure 6.9. In that context, the signer was asked if Elena would come to the school or not. She knew that Elena broke her leg. Then, she says Elena can't come

because she has a broken leg. OLABILIR and squint do not appear in this sentence because she knows that it is impossible for Elena to come, and she fully commits to the proposition.

Figure 6.9. Negation of possibility

Challenging OLABILIR in epistemic context contributes another piece of evidence for the proposal that OLABILIR is at TP level and at-issue level. In the context which was given as an example by the participant, he challenges his interlocutor's proposition which conveys a possibility of a lie with OLABILIR. He challenges the weakness of possibility by bringing stronger evidence, so challenging epistemics is possible in terms of asking to update the modal base as discussed by Faller (2002). The participant asks for an update in the modal base with the stronger evidence 'rules' that will eliminate possible worlds denoting weaker possibility where OLABILIR is felicitous. Hence, challengeability of OLABILIR also shows that it behaves as an objective epistemic and at TP. Non-appearance of squint in B's response is most likely due to B's higher commitment to his proposition, rather than being challenged by his proposition. If we adapt Krifka's (2021) analysis to squint and OLABILIR, squint

would be in JudgeP signalling the signer's justification for his lack of commitment to the proposition. OLABILIR would be in TP behaving as an objective epistemic (6.25).

(6.24) Context: You heard that one of your friends won the lottery and are talking about it with another friend. One of your friends questions if Ali could win that much money and you say that it is regulated by rules and he must have.

A:LIE OLABILIR^{sq}

'It might be a lie (that Ali won that much).'

B:NO^{hs}, IX$_{3a}$ WIN OL LAZIM^{rhn}, RULE EXISTENTIAL^{hn}

'No, he must have won, there are rules.'

(6.25) [$_{ActP}$ [$_{ComP}$] [$_{JP}$ squint] [$_{J'}$ [$_{TP}$ LIE OLABILIR]]]

As stated by Krifka (2021), the judger is the speaker (signer) in most cases, but it can be the addressee as in the case of questions. Epistemics are always speaker anchored so the judge is the signer in the case of epistemics in TİD. Squint can be attributed to the subject in attitude verbs since attitude verbs are the reports of attitudes of the subject, or the signer if signer conveys her commitment via squint to the propositions containing an attitude verb. It needs to be further tested if squint is attributed to the signer or the subject with attitude verbs. As for the occurrence of squint with re-introduced topics, the judge should be the addressee, then it should be somehow anchored to the addressee rather than the signer.

Re-introduced topics in free conversations in the COST-IS 1006 TİD corpus had not only squint but also head forward tilt. Figure 6.10 is taken from a free conversation of two signers about Mother's Day. The signer on the left asked her interlocutor what her plans were for Mother's Day. The other signer replied to her by saying what she bought as a gift. She signed the gift electric coffee maker by using a classifier that can be interpreted as either electric or old-fashioned. She signed the pot with eye squint and head forward tilt, and she paused to check if her interlocutor got her reference as seen in the figure. Then, the interlocutor confirmed her by saying PLUG, which means electric. Then, the signer continued by agreeing with her interlocutor and saying ELECTRIC. She signed ELECTRIC with a deep head nod for her confirmation.

A: POT

B: PLUG

A: ELECTRIC

A: '(For Mother's Day) I bought a coffee maker…'
B: Plug one?
A: Electric one, yes.

Figure 6.10. Head forward tilt and squint in re-introduced topics (COST IS 1006 TİD corpus)

Head forward tilt has been also observed in both yes/no questions (Figure 6.11) and wh- questions (Figure 6.12) (Göksel & Kelepir, 2013). The crucial point here is that the realization of head forward tilts are different. The one with yes/no questions is like head nod without a return to the neutral position. The one with wh questions is head forward movement on the z axis and can appear with a slight head back tilt. Not returning to the neutral and holding head in that position might be the signal of shifting judge from signer to the addressee. Since questions and re-introduced topics are anchored to the addressee, it is not surprising that they share similar nonmanual markers. The shift of the judge would be due to head forward tilt in re-introduced topics rather than squint itself, which should be further examined.

Figure 6.11. Forward head tilt in yes/no questions (Göksel & Kelepir, 2013)

6.5 Conclusion

Results of certainty ratings combined all the puzzle pieces in terms of the role of the nonmanual markers in modal sentences. They showed that nonmanual markers independently affect the certainty levels of sentences within the range of sentences themselves. In other words, nonmanual markers showed similar effects as increase or decrease in certainty for all target items. Yet, the change did not change the ranks of sentences in terms of their own certainty level without any nonmanual markers. Furthermore, I showed that head nod belongs to the information structure domain (Gürer & Karabüklü, 2022) and increased

Figure 6.12. Backward head tilt and head shake in wh-questions (Göksel & Kelepir, 2013)

certainty level is due to the interaction of focus. In other words, the increased certainty level is due to the VERUM focus marked by head nod or repetitive head nod on the verb or the modal. As for squint, it is the uncertainty marker which can convey the signer's, the subject's, or the addressee's uncertainty. Initial data on squint with negation, yes/no questions, and challengeability also suggest that squint is in JudgeP following the analysis in Krifka (2021). If the analysis is on the right track, squint functions at not-at-issue level and reflects Bross and Hole's (2017) at-issue and not-at-issue distinction between manual signs and nonmanual markers.

7. CONCLUSION

The results of the studies provided the basis to test how modal signs in TİD behave in terms of both spoken and sign language typologies. The results of the last study on nonmanual markers shed light on the role of nonmanual markers by testing their functions separately. The last study also shows that they need to be systematically tested and analyzed for their main functions in the structures that they occur with.

7.1 TİD Modal Signs in Modal Typology

In terms of quantificational analysis of modal notions, they have three main semantic parts: modal force, modal base, and ordering source. Crosslinguistic patterns in spoken languages have shown that the lexicalization of these semantic parts yields distinct behaviors. Well-studied English modals have specified modal force while modal flavor based on modal base and ordering source is derived from the contexts that they appear in. In contrast to English, St'amt'icets modals have selective modal base while their modal force is interpreted based on the context that they appear in. It is also possible to find these two patterns occurring in a single language like Paciran Javanese where some modals behave like English ones and some like St'amt'icets.

In terms of modal force and modal base dichotomy, the Mutually Exclusive Propositions Study and the Modal Flavors Study revealed the behaviours of modals in TİD. Some modals like ACABA, SERBEST, OLABILIR show the patterns of specified modal flavor and selective modal base while some like MECBUR have specified modal force and unselective modal flavor. Based on the lexicalization of either modal force or base, languages are argued to factor in one of two dimensions rather than both (Deal, 2011; Rullmann et al., 2008). Yet, it has been shown that languages like Washo can have modals with unspecified modal force and base (Bochnak, 2015). OLUMLU showed the patterns of unspecified modal force based on its acceptability ratings in the mutually exclusive propositions study. Then, TİD may have modals that show variation in both dimensions. The patterns of OLUMLU needs to be further investigated in other environments to test if it shows the same results.

As shown in the evidential restriction study, only LAZIM can have both epistemic and circumstantial modal base, yet it requires a strong inference in the conversational background. Interestingly, the study also showed that LAZIM needs to be preceded by another manual sign OL in addition to the right kind of context. Analysis of OL as a function turning an eventuality into a situation would solve the puzzle in LAZIM and OL LAZIM, but it brings new puzzles for the epistemic sign OLABILIR. OL and OLABILIR appear to be the same manual sign only differing in their mouthings. The same analysis can hold for both OL and OLABILIR, but then the question is where the epistemic comes from. In that case, epistemic can be a null morpheme, but this puzzle is left for future studies due to time constraints.

In terms of sign language typology, epistemics can be realized as only nonmanual markers as in DGS (Bross, 2018), or manual signs and nonmanual markers as in ASL (Shaffer, 2004) while other modals are realized via manual signs and nonmanual markers. TİD belongs to the second category with epistemic signs, ACABA, OLABILIR, and nonmanual marker squint. This dissertation is the first study analyzing cooccurring nonmanual markers within the semantic structure of modals for the second category. Studies in the dissertation showed that reported nonmanual markers are not due to the semantics of modals and they have their own function. Extension of these analyses to other sign languages would give a better perspective on the role of nonmanual markers in the structure.

7.2 Role of Nonmanual Markers

Intensification in nonmanual markers have been reported with modal signs to convey the signer's certainty in other sign languages (Akahori et al., 2013; Herrmann, 2013; Shaffer, 2004). The same pattern in TİD is tested in the nonmanual markers rating study and nonmanual markers are analyzed as separate morphemes with their own functions rather than the prosody of the modal sentences. Results showed that different sentence types like declarative, modals, attitude verbs are perceived to have different certainty levels. Squint and head movements (single, repetitive nod, head tilt) affect the certainty within the range of the sentence's certainty level. In other words, squint decreases the signer's certainty while head nod and repetitive head nod increase it. Head nod is known to function in the

information structure domain (Gürer and Karabüklü, 2022; Karabüklü and Gürer, in prep.) and increased certainty is analyzed as the interaction of focus with sentence type. Based on the patterns of squint in various structures, it is analyzed as the uncertainty marker conveying the lack of the commitment of the judger in terms of Krifka's (2021) analysis. The judge is the signer in epistemics, the subject in the attitude verbs, or the addressee in the re-introduced topic.

Nonmanual markers have been analyzed as functioning in prosody (Dachkovsky and Sandler, 2009; Göksel and Kelepir, 2013; Pfau, 2016; Pfau and Quer, 2010; Wilbur, 1994), syntax (Aarons, 1994; Brunelli, 2011; Gökgöz, 2011; Liddell, 1978; Pfau and Quer, 2007; Wilbur and Patschke, 1999), semantics (Dikyuva, 2011; Karabüklü and Wilbur, 2021; Watson, 2010; Wilbur, 2011), and pragmatics (Coulter, 1978). Based on the literature cited here among others, nonmanual markers seem to function in all domains as also stated by Pfau and Quer (2010). The biggest challenge in the analysis of nonmanual markers is their appearance with various structures as squint in epistemics, attitude verbs, or re-introduced topics. Even though some nonmanual markers can be multifunctional morphemes, they need to be thoroughly analyzed before arriving at a conclusion.

Nonmanual markers yield a challenge as functioning in all domains like prosody, syntax, or semantics (Pfau & Quer, 2010). This challenge is also due to their appearance with various structures as squint in epistemics, attitude verbs, or re-introduced topics in our case. Even though these are different structures, the analysis based on the semantics of these structures in the dissertation showed that squint has the same function across all of them. As a foreign researcher coming from the hearing and spoken language world to Deaf and sign language world, the urge to map nonmanual markers to a category or domain known in spoken languages is an inevitable foil. Due to the simultanous nature of sign languages, they are usually compared to prosody and suprasegmental units. As all morphemes, nonmanuals also have their own phonetic and prosodic features and the confusion lies in if these features are analyzed or the function of nonmanual markers is analyzed as prosodic. Wilbur (2021) discusses why prosodic perspectives do not always capture the patterns of nonmanual markers by citing new research examining them in other domains. On this issue, this dissertation

contributes to the role of nonmanual markers in sign language grammars by analyzing the target nonmanual markers as morphemes in semantic and information structure domains.

7.3 Future Studies

This dissertation used quantificational framework to underpin the behavior of modal signs and to form the basis of modals in TD. Quantificational framework in terms of Kratzerian perspective is not the only option to analyze the modal semantics. As suggested for the goal-oriented interpretations of LAZIM and MECBUR, we need a second ordering source in Kratzerian framework (von Fintel & Iatridou, 2008), which makes the theory more tangled. An alternative analysis is without the ordering source where Finlay (2016) treats *ought* as *most* with an end-relational analysis. He analyzes 'goal' as an end which the subject wants to actualize, and he adds temporality for this end. Finlay's (2016) analysis is also in the framework of possible worlds where modal base is also updated by the 'end' (goal) rather than being realized as an ordering source. Intead of ordering source, end-relational semantics has possibility spaces that induces an ordering of the options. Gradability is captured by the 'most' analysis that identifies the best option.

While Finlay (2016) captures 'ought' and gradability in the domain of possible worlds, another recent framework on modal semantics is degrees and scalarity mostly by Lassiter (2017). As pointed out in the discussion of some analyses, rating studies showed that participants treated presented modals on a continuum rather than separating them in a dichotomy like existential or universal, or not evident or evident. The dissertation did not have the appropriate tests to investigate modals in terms of degrees, but results suggest that it will be worth it to further test the modal signs in terms of degrees and reconsider the nuances appearing in the results.

Degree analysis can be applied to not only the manual modal signs, but also to the nonmanual markers. As found in Karabüklü and Wilbur (2020), squint and head nod can be intensified. These manipulations may correspond to the following examples (7.1-7.3) that are given and their similarity to the modification of nonmanual markers suggested by Daniel

Hole (p.c.). Appositions in these examples convey that the scalar value is higher than the cases where the adpositions are not added.

(7.1) He may, in all likelihood, be in town. *epistemic scalarity*
'It is very likely that he is in town.'

(7.2) He has, on all accounts, left the town. *evidential scalarity*
'Everybody reports that he left town.'

(7.3) He has, for all intents and purposes, complied with their wishes. *cooperation scalarity*
'He did everything they wanted him to do.'

Future tests designed in terms of degrees and scalarity will definitely complete the analysis of both modal signs and nonmanual markers. In terms of nonmanual markers, they still need to be tested for which level they function, at-issue or not-at-issue. The current tests in the literature are designed for spoken languages and impossible to directly apply to nonmanual markers. They should be adopted for sign languages. Leaving developing field-specific at-issueness tests for nonmanual markers for future, this dissertation is among the first ones that experimentally analyzes nonmanual markers in terms of semantics. It has provided a more consistent explanation to the appearance of nonmanual markers across different structures. More crucially, it highlights that nonmanual markers should be tested for what they are doing in the structure rather than how they are realized in the structure.

REFERENCES

Aarons, D. (1994). *Aspects of syntax in ASL* (Boston University, Ph.D. Dissertation).

Abdel-Fattah, M. A. M., & Alawnah, K. M. I. (2020). Modality in Palestinian Sign Language. *International Journal of Innovation, Creativity and Change*, *14*, 1–28.

Aikhenvald, A. (2004). *Evidentiality*. Oxford University Press.

Akahori, H., Yano, U., Matsuoka, K., & Oka, N. (2013). Expressing modality: A descriptive study of japanese sign language. *147th meeting of linguistic society of japan*. Kobe University of Foreign Studies.

Anand, P., & Brasoveanu, A. (2010). Modal concord as modal modification. *Proceedings of Sinn und Bedeutung*, *14*, 19–36.

Bochnak, M. R. (2015). Variable force modality in washo. *Proceedings of NELS 45*, 105–114.

Bochnak, M. R., & Matthewson, L. (2020). Techniques in complex semantic fieldwork. *Annual Review of Linguistics*, *6*, 261–283.

Bohnemeyer, J. (2015). A practical epistemology for semantic elicitation in the field and elsewhere. In M. R. Bochnak & L. Matthewson (Eds.), *Methodologies in semantic fieldwork* (pp. 13–46). Oxford University Press.

Bross, F. (2018). *The clausal syntax of German Sign Language. a cartographic approach* (Stuttgart University, Stuttgart Dissertation).

Bross, F. (2020). *The clausal syntax of german sign language: A cartographic approach*. Language Science Press.

Bross, F., & Hole, D. (2017). Scope taking strategies and the order of clausal categories in German Sign Language. *Glossa: A Journal of General Linguistics*, *2*, 1–30.

Brunelli, M. (2011). *Antisymmetry and sign languages. a comparison between NGT and LIS* (University of Amsterdam Dissertation).

Coulter, G. (1978). Raised eyebrows and wrinkled noses: The grammatical function of facial expression in relative clauses and related constructions. In F. Caccamise & D. Hicks (Eds.), *American sign language in bilingual, bicultural context. proceedings of the second national symposium on sign language research and teaching* (pp. 65–74). Coronada: CA: NAD.

Cover, R. T. (2015). Semantic fieldwork on TAM. In M. R. Bochnak & L. Matthewson (Eds.), *Methodologies in semantic fieldwork* (pp. 233–268). Oxford University Press.

Crasborn, O., & Sloetjes, H. (2008). Enhanced elan functionality for sign language corpora. *Proceedings of LREC 2008, Sixth International Conference on Language Resources and Evaluation*, 1–5.

Dachkovsky, S., & Sandler, W. (2009). Visual intonation in the prosody of sign language. *Language and Speech*, *52*, 287–314.

De Haan, F. (1999). *Visual evidentiality and its origins* (Ms., University of New Mexico).

Deal, A. R. (2011). Modals without scales. *Language*, *87*, 559–585.

del Mar Vanrell, M., Mascaró, I., Torres-Tamarit, F., & Prieto, P. (2013). Intonation as an encoder of speaker certainty: Information and confirmation yes-no questions in catalan. *Language and Speech*, *56*, 163–190.

Dikyuva, H. (2011). *Grammatical nonmanual expressions in turkish sign language (tid)* (The University of Central Lancashire (UCLan), MA Thesis).

Dikyuva, H., Makaroglu, B., & Ark, E. (2017). *Turkish sign language grammar*. Fersa Ofset.

Faller, M. (2002). *Semantics and pragmatics of evidentials in Cuzco Quechua* (Standford University Dissertation).

Faller, M. (2011). A possible world semantics for Cuzco Quechua evidentials. *Proceedings of SALT XX*, *20*, 660–683.

Ferreira Brito, L. (1990). Modalities in Brazilian Sign Language. In S. D. Fischer & P. Siple (Eds.), *Theoretical issues in sign language research* (pp. 229–260). The University of Chicago Press.

Finlay, S. (2016). 'ought': Out of order. In N. Charlow & M. Chrisman (Eds.), *Deontic modality* (pp. 169–199). Oxford University Press.

Gökgöz, K. (2009). *Topics in Turkish Sign Language (Türk Isaret Dili)* (Bogaziçi University MA Thesis).

Gökgöz, K. (2011). Negation in Turkish Sign Language: The syntax of nonmanual markers. *Sign Language and Linguistics*, *14*, 49–75.

Göksel, A., & Kelepir, M. (2013). The phonological and semantic bifurcation of an articulator: Head in questions in Turkish Sign Language. *Sign Language and Linguistics*, *16*, 1–30.

Göksel, A., & Kelepir, M. (2016). Observations on clausal complementation in Turkish Sign Language. In R. Pfau, M. Steinbach, & A. Herrmann (Eds.), *A matter of complexity: Subordination in sign languages* (pp. 65–94). De Gruyter Mouton.

Göksel, A., Tasci, S. S., Demirel, B. E., Özparlak, E. T., Saral, B., & Dikyuva, H. (2021). Deafness in Turkey 1930-2020: Administrative, social, and cultural aspects. In R. Pfau, A. Göksel, & J. Hosemann (Eds.), *Our lives - our stories: Life experiences of elderly deaf people* (pp. 91–127). De Gruyter Mouton.

Grice, P. (1975). Logic and conversation. In P. Cole & J. L. Morgan (Eds.), *Syntax and semantics 3: Speech acts* (pp. 41–58). Academic Press.

Gries, S. T. (2015). The most under-used statistical method in corpus linguistics: Multi-level (and mixed effects) models. *Corpora*, *10*, 95–125.

Gürer, A., & Karabüklü, S. (2022). Non-manual focus marking in Turkish Sign Language. *Seventh Workshop on Turkic and Languages in Contact with Turkic*, Presented at Tu+7, The University of Connecticut, Connecticut, Feb 18–19.

Hacquard, V. (2006). *Aspects of modality* (Massachusetts Institute of Technology Dissertation).

Hacquard, V. (2011). Modality. In C. Maienborn, K. von Heusinger, & P. Portner (Eds.), *Semantics: An international handbook of natural language meaning* (pp. 1484–1515). Mounton de Gruyter.

Herrero-Blanco, A., & Salazar-Garcia, V. (2010). The expression of modality in Spanish Sign Language. *Web Papers in Functional Discourse Grammar (WP-FDG)*, *83*, 19–42.

Herrmann, A. (2013). *Modal and focus particles in sign languages: A cross-linguistic study*. De Gruyter Mouton.

Hintikka, J. (1969). Semantics for propositional attitudes. In J. W. Davis, D. Hockney, & W. K. Wilson (Eds.), *Philosophical logic* (pp. 21–45). D. Reidel Publishing Company.

Hrastinski, I., & Wilbur, R. B. (2016). Academic achievement of deaf and hard of hearing children in an ASL/English bilingual program. *Journal of Deaf Studies and Deaf Education*, *21*, 156–170.

Hübscher, I., Esteve-Gibert, N., & Prieto, P. (2017). Intonation and gesture as bootstrapping devices in speaker uncertainty. *First Language*, *37*, 24–41.

Ilkbasaran, D. (2013). Communicative practices of deaf people in Turkey and sociolinguistics of Turkish Sign Language. In E. Arik (Ed.), *Current directions in Turkish Sign Language* (pp. 19–53). Cambridge Scholars Publishers.

Ilkbasaran, D. (2015). *Literacies, mobilities and agencies of deaf youth in Turkey: Constraints and opportunities in the 21st century* (University of California, San Diego Dissertation).

Johnson, D. E. (2014). Progress in regression: Why natural language data calls for mixed-effects models, Unpublished Ms.

Karabüklü, S., Bross, F., Wilbur, R. B., & Hole, D. (2018). Modal signs and scope relations in TID. *Proceedings of Formal and Experimental Advances in Sign Language Theory*, *2*, 82–92.

Karabüklü, S., & Gürer, A. (n.d.). The prosody of focus in Turkish Sign Language (TID).

Karabüklü, S., & Wilbur, R. B. (2020). Seeing possible worlds. *Proceedings of 55th Chicago Linguistics Society Meeting*, 189–204.

Karabüklü, S., & Wilbur, R. B. (2021). Marking various aspects in TID: BIT (finish) and 'bn'. *Sign Language and Linguistics*, *54*, 182–225.

Kelepir, M. (2006). Copular forms in Turkish, Noghay and Turkmen. *Proceedings of the workshop on Altaic formal linguistics II* (pp. 83–100). MIT Working Papers in Linguistics.

Kelepir, M., & Göksel, A. (2013). Aspects of reported utterances in Turkish Sign Language. In E. Arik (Ed.), *Current directions in Turkish Sign Language research* (pp. 186–213). Cambridge Scholars Publishing.

Kentner, A., Karabüklü, S., & Wilbur, R. B. (2022). Articulatory model for annotating non-manual markers in sign languages. *The 96th Annual Meeting of Linguistic Society of America*, Poster presentation at LSA, Washington, DC, Jan 7–9.

Klomp, U. (2021). *A descriptive grammar of Sign Language of Netherlands* (University of Amsterdam, LOT Dissertation).

Kratzer, A. (1977). What *must* and *can* must and can mean. *Linguistics and Philosophy*, *1*, 337–355.

Krebs, J., Malaia, E., & Wilbur, R. B. (2021). Age of sign language acquisition has lifelong effect on syntactic preferences in sign language users. *International Journal of Behavioral Development*, *45*, 397–408.

Krifka, M. (2017). Epistemic, evidential and discourse modalities in commitment space semantics. *Workshop on Not-At-Issue Meaning and Information Structure*, *University of Oslo*.

Krifka, M. (2021). Layers of assertive clauses: Propositions, judgements, commitments, acts. *Propositionale argumente im sprachvergleich: Theorie und empirie [Propositional arguments in cross-linguistic research: Theoretical and empirical issues]*. Tubingen: Narr.

Kubus, O. (2016). *Relative clause constructions in Turkish Sign Language* (Hamburg University, Ph.D. Dissertation).

Lassiter, D. (2017). *Graded modality: Qualitative and quantative perspectives*. Oxford University Press.

Levy, R. (2009). A brief and friendly introduction to mixed-effects models in linguistics. *Workshop on Ordinary and Multilevel Modelling (WOMM) at CUNY*, Presented at CUNY, UC Davis, March 26–28.

Liddell, S. (1978). Nonmanual signals and relative clauses in American Sign Language. In P. Siple (Ed.), *Understanding language through sign language research* (pp. 59–90). Academic Press.

Lillo-Martin, D., Smith, N., & Tsimpli, I. (2020). Age of acquisition effects in language development. In G. Morgan (Ed.), *Understanding deafness, language and cognitive development: Essays in honour of Bencie Woll* (pp. 93–113). John Benjamins.

Lin, C.-H., & Chang, J.-H. (2011). Modality in Taiwan Sign Language. In W. Nakamura (Ed.), *New perspectives in role and reference grammar* (pp. 246–263). Cambridge Scholars Publishing.

Louie, M. (2015). The problem with non-nonsense elicitation plans (for semantic fieldwork). In M. R. Bochnak & L. Matthewson (Eds.), *Methodologies in semantic fieldwork* (pp. 47–71). Oxford University Press.

Makaroglu, B. (2021). What the frequency list can teach us about Turkish Sign Language? *Poznan Studies in Contemporary Linguistics*, *57*, 619–654.

Makaroglu, B., & Dikyuva, H. (2017). The contemporary Turkish Sign Language dictionary. Ankara: The Turkish Ministry of Family and Social Policy. http://tidsozluk.net

Malaia, E., Krebs, J., Roehm, D., & Wilbur, R. B. (2020). Age of acquisition effects differ across linguistic domains in sign language: Eeg evidence. *Brain and Language*, *200*, 1–10.

Matthewson, L. (2013). Gitksan modals. *International Journal of American Linguistics*, *79*, 349–394.

Matthewson, L. (2015). Evidential restriction on epistemic modals. In L. Alonso-Ovalle & P. Menendez-Benito (Eds.), *Epistemic indefinites* (pp. 141–160). Oxford University Press.

Matthewson, L. (2016). Modality. In M. Aloni & P. Dekker (Eds.), *Cambridge handbook of formal semantics* (pp. 726–775). Cambridge University Press.

Matthewson, L. (2020). Evidence type, evidence location, evidence strength. In C. Lee & J. Park (Eds.), *Evidential and modals* (pp. 82–120). Brill.

Mayberry, R. I., & Eichen, E. (1991). The long-lasting advantage of learning sign language in childhood: Another look at the critical period for language acquisition. *Journal of Memory and Language*, *30*, 486–512.

Mayberry, R. I., Lock, E., & Kazmi, H. (2002). Linguistic ability and early language exposure. *Nature*, *417*, 38.

Özkul, A. (2013). *A phonological and morphological analysis of instrumental noun-verb pairs in Turkish Sign Language (TID)* (Bogaziçi University, MA Thesis).

Özkul, A. (2019). Deontic and epistemic necessity in Turkish Sign Language. *Poznan Studies in Contemporary Linguistics*, *55*, 543–577.

Özsoy, A. S., Kelepir, M., Nuhbalaolu, D., & Hakgüder, E. (2018). Properties of command constructions in TID. *Dilbilim Aratrmalar Dergisi (Journal of Linguistic Research)*, *29*, 161–178.

Peterson, T. (2010). *Epistemic modality and evidentiality in Gitksan at the semantics-pragmatics interface* (University of British Columbia, Vancouver Dissertation).

Pfau, R. (2016). Non-manuals and tones: A comparative perspective on suprasegmental and spreading. *Revista de Estudos Linguisticos da Univerdade do Porto*, *11*, 19–58.

Pfau, R., Göksel, A., & Hosemann, J. (2021). *Our lives - our stories: Life experiences of elderly deaf people*. De Gruyter Mouton.

Pfau, R., & Quer, J. (2002). V-to-neg raising and negative concord in three sign languages. *Rivista di Grammatica Generativa*, *27*, 73–86.

Pfau, R., & Quer, J. (2007). On the syntax of negation and modals in Catalan Sign Language and German Sign Language. In P. Perniss, R. Pfau, & M. Steinbach (Eds.), *Visible variation: Comparative studies in sign language structure* (pp. 129–161). Mouton de Gruyter.

Pfau, R., & Quer, J. (2010). Nonmanuals: Their grammatical and prosodic roles. In D. Brentari (Ed.), *Sign languages* (pp. 381–402). Cambridge University Press.

Ramchand, G. (2014). Stativity and present tense epistemics. *Proceedings of SALT 24* (pp. 102–121). LSA.

Romero, M., & Han, C.-H. (2004). On negative yes/no questions. *Linguistics and Philosophy*, *27*, 609–658.

Rooth, M. (1992). A theory of focus interpretation. *Natural Language Semantics*, *1*, 75–116.

Rullmann, H., Matthewson, L., & Davis, H. (2008). Modals as distributive indefinites. *Natural Language Semantics*, *16*, 317–357.

Saral, B. (2020). Parts of speech. In M. Kelepir (Ed.), *A grammar of Turkish Sign Language (TID)*. SIGN-HUB Sign Language Grammar Series.

Shaffer, B. (2004). Information ordering and speaker subjectivity: Modality in ASL. *Cognitive Linguistics*, *15*, 175–195.

Shaffer, B., & Janzen, T. (2016). Modality and mood in American Sign Language. In J. Nuyts & J. V. D. Auwera (Eds.), *The Oxford handbook of modality and mood* (pp. 1–23). Oxford University Press.

Siyavoshi, S. (2019). Hands and faces: The expression of modality in ZEI, Iranian Sign Language. *Cognitive Linguistics*, *30*, 655–686.

Sönning, L. (2018). Multilevel models for corpus linguistic research: A conceptual introduction, Unpublished Ms.

Tonhauser, J. (2012). Diagnosing (not-)at-issue content. *Proceedings of Semantics of Under-represented Languages of the Americas (SULA)*, *6*, 239–254.

Tonhauser, J. (2016). Prosodic cues to presupposition projection. *Proceedings of SALT*, *26*, 934–960.

Truckenbrodt, H. (1995). *Phonological phrases: Their relation to syntax, focus, and prominence* (Massachusetts Institute of Technology Dissertation).

Van Herreweghe, M., & Vermeerbergen, M. (2012). Handling sign language data. In R. Pfau, M. Steinbach, & B. Woll (Eds.), *Sign language: An international handbook* (pp. 1023–1045). De Gruyter Mouton.

Vander Klok, J. (2013). Pure possibility and pure necessity modals in Paciran Javanese. *Oceanic Linguistics*, *52*, 341–374.

Vander Klok, J. (2016). *Tense, aspect,and modal markers in Paciran Javanese* (McGill University, Ph.D. Dissertation).

von Fintel, K., & Gillies, A. (2010). *Must*...stay...strong! *Natural Language Semantics*, *18*, 511–383.

von Fintel, K., & Iatridou, S. (2008). How to say *ought* in foreign: The composition of weak necessity modals. In J. Guéron & J. Lecarme (Eds.), *Time and modality* (pp. 115–141). Springer.

Watson, K. (2010). *Wh- questions in American Sign Language: Contributions of non-manual marking to structure and meaning* (Purdue University, MA Thesis).

Wilbur, R. B. (1994). Eyeblinks & ASL phrase structure. *Sign Language Studies*, *84*, 221–240.

Wilbur, R. B. (2000). The use of ASL to support the development of English and literacy. *Journal of Deaf Studies and Deaf Education*, *5*, 81–104.

Wilbur, R. B. (2011). Nonmanuals, semantic operators, domain marking, and the solution to two outstanding puzzles in ASL. *Sign Language and Linguistics*, *14*, 148–178.

Wilbur, R. B. (2021). Non-manual markers. Theoretical and experimental perspectives. In J. Quer, R. Pfau, & A. Herrmann (Eds.), *The routledge handbook of theoretical and experimental sign language research* (pp. 230–265). Routledge.

Wilbur, R. B., & Patschke, C. (1999). Syntactic correlates of brow raise in ASL. *Sign Language and Linguistics*, *2*, 3–41.

Willett, T. (1988). A cross-linguistic survey of the grammaticalization of evidentiality. *Studies in Language*, *12*, 51–97.

Yanovich, I. (2013). *Four pieces of modality, context, and usage* (Massachusetts Institute of Technology, Cambridge Dissertation).

Yildirim, O. M. (2015). The expression of necessity in TID. Ms. Bogaziçi University.

A. ATTITUDE VERBS IN TİD

The attitude verbs were searched in an online TİD dictionary that has example sentences for a lexical entry (Makaroglu & Dikyuva, 2017). The following images (Figure A.1) are taken from the example sentences of these lexical items. The examples have these verbs used as attitude verbs.

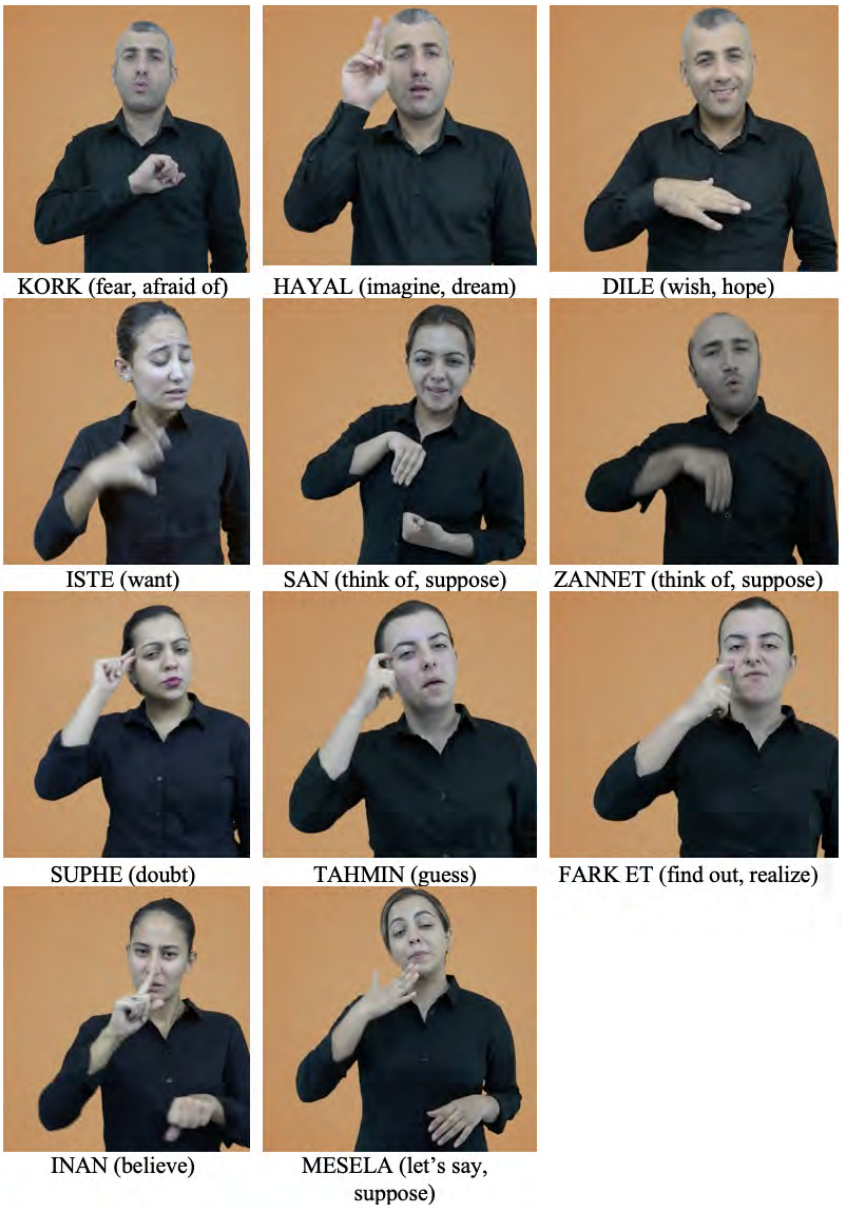

Figure A.1. Attitude verbs that have and do not have squint

B. BACKGROUND QUESTIONNAIRE

The questionnaire was presented in Turkish but explained and translated in TİD by the Deaf consultant during the session.

Name surname:

Date of birth:

Gender: Female Male Other

Occupation:

How much is your hearing loss?:

When did you acquire/learn TİD?:

Who did you acquire/learn TİD?:

Is there any Deafs in the family? If so, who are they?:

Which city do you live?:

Have you lived in other cities? If so, how long?:

In which city did you use or learn TİD mostly?:

Education level:

Which primary school did you graduate? Was TİD used?:

Which secondary school did you graduate? Was TİD used?:

Which high school did you graduate? Was TİD used?:

Which university did you graduate? What was your department?:

Other languages that you use:

Organizations or clubs that you join:

Which language do you use with your family?:

Which language do you use at school or work?:

Which language do you use with your friends?:

I watch videos, lessons, news, or series in TİD:

○always ○sometimes ○rarely ○never

I watch videos, lessons, news, or series in Turkish:

○always ○sometimes ○rarely ○never

I watch videos, attend to workshops or classes, or read about Deaf culture:

○always ○sometimes ○rarely ○never

I attend Deaf activities, organizations, or clubs:

○always ○sometimes ○rarely ○never

I attend hearing activities, organizations, or clubs:

○always ○sometimes ○rarely ○never

TİD is:

○good as much as Turkish ○less good than Turkish ○ not as good as Turkish

---

How much are you comfortable in your languages?

	Low	Fair	Adequate	Good	Excellent
TİD usage/signing	○	○	○	○	○
Understanding TİD	○	○	○	○	○
Reading Turkish	○	○	○	○	○
Writing Turkish	○	○	○	○	○

How much do you agree with the statement below?

	Disagree	Slightly disagree	Neither agree nor disagree	Slightly agree	Agree
I feel like myself when I sign in TİD.	○	○	○	○	○
I feel like myself when I use Turkish.	○	○	○	○	○
I feel belong to Deaf culture.	○	○	○	○	○
I feel belong to hearing culture.	○	○	○	○	○
TİD is my native language.	○	○	○	○	○
Turkish is my native language.	○	○	○	○	○
It is important for me to use TİD fluently.	○	○	○	○	○
It is important for me to use Turkish fluently.	○	○	○	○	○

How much do you agree with the statement below?

	Disagree	Slightly disagree	Neither agree nor disagree	Slightly agree	Agree
Deafs in different cities use different signs.	○	○	○	○	○
I have hard time to understand the signing of people from other cities.	○	○	○	○	○
Youngs and elders sign differently.	○	○	○	○	○
Women and men sign differently.	○	○	○	○	○
Hearing people also learn signing.					
Hearings and Deafs sign differently.	○	○	○	○	○
Turkish is my native language.	○	○	○	○	○
TİD is changing over time.	○	○	○	○	○
It is good that TİD is changing.	○	○	○	○	○
All Deafs in Turkey should sign same way.	○	○	○	○	○

C. TEST ITEMS IN THE MUTUALLY EXCLUSIVE PROPOSITIONS TEST

C.1 Trial Items

(C.1) VACATION GO OLABILIR, VACATION GO^NOT OLABILIR
'She may go to the vacation, may not go to the vacation.'

(C.2) PILL DRINK LAZIM, PILL DRINK LAZIM^NOT
'He must take pills, doesn't have to take pills..'

(C.3) DESSERT EAT SERBEST, DESSERT EAT^NOT SERBEST
'He may eat dessert, may not eat dessert (may leave dessert).'

C.2 Set 1

(C.4) ASLI LAB COME OLABILIR, COME^NOT OLABILIR, IX_1 KNOW^NOT
'Asli might come to the lab, might not come, I don't know.'

(C.5) ALI RED TRAFFIC-LIGHT PASS, FINE PAY LAZIM, FINE PAY^NOT LAZIM
'Ali passed at the red light, he must pay a fine, mustn't pay a fine.'

(C.6) ALI RED TRAFFIC-LIGHT PASS, FINE PAY LAZIM, FINE PAY LAZIM^NOT
'Ali passed at the red light, he must pay a fine, doesn't have to pay a fine.'

(C.7) ALI RED TRAFFIC-LIGHT PASS, FINE PAY MECBUR, FINE PAY^NOT MECBUR
'Ali passed at the red light, he must pay a fine, mustn't pay a fine.'

(C.8) ALI RED TRAFFIC-LIGHT PASS, FINE PAY MECBUR, FINE PAY MECBUR^NOT
'Ali passed at the red light, he must pay a fine, doesn't have to pay a fine.'

(C.9) ALI RED TRAFFIC-LIGHT PASS, FINE PAY GEREK, FINE PAY^NOT GEREK
'Ali passed at the red light, he must pay a fine, mustn't pay a fine.'

(C.10) ALI RED TRAFFIC-LIGHT PASS, FINE PAY GEREK, FINE PAY GEREK^NOT
'Ali passed at the red light, he must pay a fine, doesn't have to pay a fine.'

(C.11) ZEYNEP$_{a}$ ASLI$_{b}$ $_{a}$VISIT$_{b}$, NIGHT DARK, ASLI SAY$_{3a}$, ZEYNEP STAY SERBEST, HOME GO SERBEST

'Zeynep visited Asli and it got dark outside. Asli told: Zeynep, you can stay or can go to home.'

(C.12) SERPIL SWIM OLUMLU, SWIM OLUMSUZ

'Serpil can swim, cannot swim.'

(C.13) SERPIL SWIM YAP, SWIM YAP PALM-UP

'Serpil can swim, cannot swim.'

C.3 Set 2

(C.14) VELI BIRTHDAY PARTY PREPARE OLABILIR, PREPARE^NOT OLABILIR, IX$_{1}$ KNOW^NOT

'Veli might prepare a birthday party, might not prepare (one), I don't know.'

(C.15) ASLI DIABETES SICK, FOOD CAREFUL LAZIM, CAREFUL^NOT LAZIM

'Asli has diabetes, she must be careful with her diet, mustn't be careful with it.'

(C.16) ASLI DIABETES SICK, FOOD CAREFUL LAZIM, CAREFUL LAZIM^NOT

'Asli has diabetes, she must be careful with her diet, doesn't have to be careful with it.'

(C.17) ASLI DIABETES SICK, FOOD CAREFUL MECBUR, CAREFUL^NOT MECBUR

'Asli has diabetes, she must be careful with her diet, mustn't be careful with it.'

(C.18) ASLI DIABETES SICK, FOOD CAREFUL MECBUR, CAREFUL MECBUR^NOT

'Asli has diabetes, she must be careful with her diet, doesn't have to be careful with it.'

(C.19) ASLI DIABETES SICK, FOOD CAREFUL GEREK, CAREFUL^NOT GEREK

'Asli has diabetes, she must be careful with her diet, mustn't be careful with it.'

(C.20) ASLI DIABETES SICK, FOOD CAREFUL GEREK, CAREFUL GEREKˆNOT

'Asli has diabetes, she must be careful with her diet, doesn't have to be careful with it.'

(C.21) BULUT_{a} FOOD EAT, FINISHˆNOT, MOM SAY_{3a},FOOD FINISH SERBEST, LEFT SERBEST

'Bulut had his meal but didn't finish it. Mom says: You can finish it, or leave it.'

(C.22) ALI BIKEˆRIDE OLUMLU, BIKEˆRIDE OLUMSUZ

'Ali can ride a bike, cannot ride a bike.'

(C.23) ALI BIKEˆRIDE YAP, BIKEˆRIDE YAP PALM-UP

'Ali can ride a bike, cannot ride a bike.'

D. TEST ITEMS IN THE MODAL FLAVORS CONTEXT TEST

D.1 Trial Items

(D.1) *Teleological Context:* Zeynep wants to go to a good university and she studies to get a high score in the placement test.

ZEYNEP HIGH SCORE TAKE LAZIM

ZEYNEP HIGH SCORE TAKE MECBUR

ZEYNEP HIGH SCORE TAKE GEREK

'Zeynep should/must get a high score.'

(D.2) *Bouletic Context:* Ali plays basketball and wants to enter into the school team. He will go to the practice for the team elections.

ALI PRACTICE DO LAZIM

ALI PRACTICE DO MECBUR

ALI PRACTICE DO GEREK

'Ali must/should practice.'

(D.3) *Goal-oriented Context:* You and your friend are at Bogaziçi University and your friend will go to Akmerkez. She asks how to go and there are couple ways. You're telling one of them:

AKMERKEZ GO FOR METRO GET-ON LAZIM

AKMERKEZ GO FOR METRO GET-ON MECBUR

AKMERKEZ GO FOR METRO GET-ON GEREK

'You should/must get on the metro to go to Akmerkez.'

D.2 Set 1

(D.4) *Teleological Context:* Serpil is in a PhD program in the States and she needs to write a dissertation to earn her degree.

SERPIL THESIS WRITE LAZIM

SERPIL THESIS WRITE MECBUR

SERPIL THESIS WRITE GEREK

'Serpil should/must write a thesis.'

(D.5) *Teleological Context:* Ayse should finish her degree in four years. Otherwise, the expenses increase and she needs to pass her classes in order to finish on time.

AYSE CLASS PASS LAZIM

AYSE CLASS PASS MECBUR

AYSE CLASS PASS GEREK

'Ayse should/must pass her classes.'

(D.6) *Teleological Context:* Ali is looking for a job and they asked for his CV. First, he needs to prepare a CV.

ALI CV PREPARE LAZIM

ALI CV PREPARE MECBUR

ALI CV PREPARE GEREK

'Ali should/must prepare a CV.'

(D.7) *Bouletic Context:* Bulut is so careful on his health. His parents don't force him but he regularly brushes his teeth. He doesn't want to have cavities.

BULUT SLEEP^NOT BEFORE TEETH BRUSH LAZIM

BULUT SLEEP^NOT BEFORE TEETH BRUSH MECBUR

BULUT SLEEP^NOT BEFORE TEETH BRUSH GEREK

'Bulut should/must brush his teeth before sleeping.'

(D.8) *Bouletic Context:* Serpil is learning how to sign. Nobody forces her but she wants to sign fluently.

SERPIL SIGN PRACTICE LAZIM

SERPIL SIGN PRACTICE MECBUR

SERPIL SIGN PRACTICE GEREK

'Serpil should/must practice signing.'

(D.9) *Bouletic Context:* Zeynep wants to go on a vacation early this year. She needs to complete her tasks at the job. It's okay if she couldn't but then she couldn't go on a vacation early.

ZEYNEP WORK FINISH LAZIM

ZEYNEP WORK FINISH MECBUR

ZEYNEP WORK FINISH GEREK

'Zeynep should/must finish her task.'

(D.10) *Goal-oriented Context:* You're in Bogaziçi University, your friend wants to go to Kadikoy, and asks you how to go. There are couple routes to take.

KADIKOY GO FOR METROBUS GET-ON LAZIM

KADIKOY GO FOR METROBUS GET-ON MECBUR

KADIKOY GO FOR METROBUS GET-ON GEREK

'To go to Kadikoy, you should take the metrobus.'

(D.11) *Goal-oriented Context:* You're in Bogaziçi University, your friend wants to go to Kadikoy, and asks you how to go. There are couple routes to take, but your friend also wants to see Bosphorus.

KADIKOY GO FOR FERRY GET-ON LAZIM

KADIKOY GO FOR FERRY GET-ON MECBUR

KADIKOY GO FOR FERRY GET-ON GEREK

'To go to Kadikoy, you should take the ferry.'

(D.12) *Goal-oriented Context:* You're in Bogaziçi University, your friend asks you how to go to Besiktas. S/he can only go by bus.

BESIKTAS GO FOR BUS GET-ON LAZIM

BESIKTAS GO FOR BUS GET-ON MECBUR

BESIKTAS GO FOR BUS GET-ON GEREK

'To go to Besiktas, you should take the bus.'

D.3 Set 2

(D.13) *Teleological Context:* Ali started a new job. He's on a training for a month before taking all the responsibility.

ALI TRAINING GO LAZIM

ALI TRAINING GO MECBUR

ALI TRAINING GO GEREK

'Ali should/must go to the training.'

(D.14) *Teleological Context:* Zeynep is a third year student in Pre-School Education program. In order to graduate, she needs to do practicum and she can do it this year or next year. To finish early, she should do her practicum this year. Otherwise, she'll finish late.

ZEYNEP PRACTICUM DO LAZIM

ZEYNEP PRACTICUM DO MECBUR

ZEYNEP PRACTICUM DO GEREK

'Zeynep should/must do the practicum.'

(D.15) *Teleological Context:* Ali has a job but looking for a new one. He applied to a new position and they asked for an interview. He needs to pass the interview to have the job.

ALI INTERVIEW PASS LAZIM

ALI INTERVIEW PASS MECBUR

ALI INTERVIEW PASS GEREK

'Ali should/must pass the interview.'

(D.16) *Bouletic Context:* Ali has a job but he wants a raise in his salary. He needs to know English better to have the raise.

ALI ENGLISH PRACTICE LAZIM

ALI ENGLISH PRACTICE MECBUR

ALI ENGLISH PRACTICE GEREK

'Ali should/must practice English.'

(D.17) *Bouletic Context:* Zeynep is a sign language interpreter but she wants to interpret in bigger conferences or organizations. In order to do that, she needs to know international sign well.

ZEYNEP INTERNATIONAL SIGN PRACTICE LAZIM

ZEYNEP INTERNATIONAL SIGN PRACTICE MECBUR

ZEYNEP INTERNATIONAL SIGN PRACTICE GEREK

'Zeynep should/must practice International Sign.'

(D.18) *Bouletic Context:* Merve is a good volleyball player and she wants to be in the national team. She needs to practice a lot to pass the selections.

MERVE TRAINING DO LAZIM

MERVE TRAINING DO MECBUR

MERVE TRAINING DO GEREK

'Merve should/must train.'

(D.19) *Goal-oriented Context:* Your foreign friend came to visit you and doesn't know Turkey well. You're in Istanbul and s/he wants to go to Izmir. S/he is asking you how to go and there are couple ways to go.

IZMIR GO FOR PLANE GET-ON LAZIM

IZMIR GO FOR PLANE GET-ON MECBUR

IZMIR GO FOR PLANE GET-ON GEREK

'You should/must take the plane to go to Izmir.'

(D.20) *Goal-oriented Context:* Your foreign friend came to visit you and doesn't know Turkey well. You're in Istanbul and s/he wants to go to Izmir to sightsee. S/he is asking you how to go.

IZMIR NEIGHBOURHOOD SEE FOR CAR^RIDE LAZIM

IZMIR NEIGHBOURHOOD SEE FOR CAR^RIDE MECBUR

IZMIR NEIGHBOURHOOD SEE FOR CAR^RIDE GEREK

'You should/must ride a car to sightsee in Izmir.'

(D.21) *Goal-oriented Context:* Your foreign friend came to visit you and doesn't know Turkey well. You're in Istanbul and s/he wants to go to Bolu. S/he doesn't have a car and the only way to go is the bus. S/he is asking you how to go.

BOLU GO FOR BUS GET-ON LAZIM

BOLU GO FOR BUS GET-ON MECBUR

BOLU GO FOR BUS GET-ON GEREK

'You should/must take the bus to go to Bolu.'

E. TEST ITEMS IN THE EVIDENTIAL RESTRICTION TEST

E.1 Trial Items

(E.1) *Pure Possibility Context:* You're chatting with your friend about other planets and if there's water on Mars.

#M-A-R-S WATER OLABILIR

#M-A-R-S WATER OL LAZIM

'There may be water on Mars.'

(E.2) *Hearsay Context:* There are rumors about a friend, they said that he was divorced.

#V DIVORCE OLABILIR

#V DIVORCE OL LAZIM

'Veli may have divorced.'

(E.3) *Smelling Context:* You went to your friend's house for breakfast and something smells so good.

MERVE SIMIT BUY OLABILIR

MERVE SIMIT BUY OL LAZIM

'Merve may have bought simit (Turkish bagel).'

E.2 Set 1

(E.4) *Pure Possibility Context:* You're chatting with your friend and talking about if there are aliens. Your friend wonders what you think.

#U CL-ALIEN EXISTENTIAL OLABILIR

#U CL-ALIEN EXISTENTIAL GALIBA

#U CL-ALIEN EXISTENTIAL OLABILIR GALIBA

#U CL-ALIEN EXISTENTIAL LAZIM

#U CL-ALIEN EXISTENTIAL OL LAZIM

'Aliens may exist.'

(E.5) *Pure Possibility Context:* Serpil studies in United States and her friend asks where she will live after gradaution. Serpil tells that she doesn't know and she can go anywhere.

SERPIL TURKEY RETURN OLABILIR, AMERICA STAY OLABILIR, OTHER COUNTRY MOVE OLABILIR

SERPIL TURKEY RETURN GALIBA, AMERICA STAY GALIBA, OTHER COUNTRY MOVE GALIBA

SERPIL TURKEY RETURN OLABILIR GALIBA, AMERICA STAY OLABILIR GALIBA, OTHER COUNTRY MOVE OLABILIR GALIBA

SERPIL TURKEY RETURN LAZIM, AMERICA STAY LAZIM, OTHER COUNTRY MOVE LAZIM

SERPIL TURKEY RETURN OL LAZIM, AMERICA STAY OL LAZIM, OTHER COUNTRY MOVE OL LAZIM

'Serpil may return to Turkey, stay in the States, or move to another country.'

(E.6) *Seeing the Whole Event Context:* You're going to work in the morning and your friend enters the building before you.

ELVAN #L LAB-$_a$ EXISTENTIAL-a OLABILIR

ELVAN #L LAB-$_a$ EXISTENTIAL-$_a$ GALIBA

ELVAN #L LAB-$_a$ EXISTENTIAL-$_a$ OLABILIR GALIBA

ELVAN #L LAB-$_a$ EXISTENTIAL-$_a$ LAZIM

ELVAN #L LAB-$_a$ EXISTENTIAL-$_a$ OL LAZIM

'Elvan may be at the lab.'

(E.7) *Seeing the Part of an Event Context:* You go to work in the morning and see your friend's car at the parking lot.

ELVAN #L LAB-$_a$ EXISTENTIAL-a OLABILIR

ELVAN #L LAB-$_a$ EXISTENTIAL-$_a$ GALIBA

ELVAN #L LAB-$_a$ EXISTENTIAL-$_a$ OLABILIR GALIBA

ELVAN #L LAB-$_a$ EXISTENTIAL-$_a$ LAZIM

ELVAN #L LAB-$_a$ EXISTENTIAL-$_a$ OL LAZIM

'Elvan may be at the lab.'

(E.8) *Seeing the End of an Event Context:* You go to work in the morning and see your friend's bag at the office.

ELVAN #L LAB-$_a$ EXISTENTIAL-a OLABILIR

ELVAN #L LAB-$_a$ EXISTENTIAL-$_a$ GALIBA

ELVAN #L LAB-$_a$ EXISTENTIAL-$_a$ OLABILIR GALIBA

ELVAN #L LAB-$_a$ EXISTENTIAL-$_a$ LAZIM

ELVAN #L LAB-$_a$ EXISTENTIAL-$_a$ OL LAZIM

'Elvan may be at the lab.'

(E.9) *Seeing the Whole Event Context:* Your mom is in the kitchen, takes out the ingredients for a cake, mixes them, and puts the cake in the oven.

MOM CAKE MAKE OLABILIR

MOM CAKE MAKE GALIBA

MOM CAKE MAKE OLABILIR GALIBA

MOM CAKE MAKE LAZIM

MOM CAKE MAKE OL LAZIM

'Mom may make a cake.'

(E.10) *Seeing the Part of an Event Context:* Your mom is in the kitchen, takes out the ingredients for a cake, mixes them.

MOM CAKE MAKE OLABILIR

MOM CAKE MAKE GALIBA

MOM CAKE MAKE OLABILIR GALIBA

MOM CAKE MAKE LAZIM

MOM CAKE MAKE OL LAZIM

'Mom may make a cake.'

(E.11) *Seeing the End of an Event Context:* There is a cake on the kitchen table and it looks so good.

MOM CAKE MAKE OLABILIR

MOM CAKE MAKE GALIBA

MOM CAKE MAKE OLABILIR GALIBA

MOM CAKE MAKE LAZIM

MOM CAKE MAKE OL LAZIM

'Mom may make a cake.'

(E.12) *Smelling Context:* You're cooking something and get tired. You wanted to rest a little bit. You're sitting in the living room and there's a smell of burnt food.

FOOD BURN OLABILIR

FOOD BURN GALIBA

FOOD BURN OLABILIR GALIBA

FOOD BURN LAZIM

FOOD BURN OL LAZIM

'Food may have burnt.'

(E.13) *Smelling Context:* You came home from work and something smells so good in the kitchen.

MOM PASTRY COOK OLABILIR

MOM PASTRY COOK GALIBA

MOM PASTRY COOK OLABILIR GALIBA

MOM PASTRY COOK LAZIM

MOM PASTRY COOK OL LAZIM

'Mom may have made pastry.'

(E.14) *Rumors Context:* There are rumors about someone that you know. They say that he won the lottery.

ALI LOTTERY WIN OLABILIR

ALI LOTTERY WIN GALIBA

ALI LOTTERY WIN OLABILIR GALIBA

ALI LOTTERY WIN LAZIM

ALI LOTTERY WIN OL LAZIM

'Ali may have won the lottery.'

(E.15) *Trusting the Source Context:* One of your friends told you that Ali won the lottery. You didn't talk with Ali; you don't know. Your friend tells the truth; you trust him.

ALI LOTTERY WIN OLABILIR

ALI LOTTERY WIN GALIBA

ALI LOTTERY WIN OLABILIR GALIBA

ALI LOTTERY WIN LAZIM

ALI LOTTERY WIN OL LAZIM

'Ali may have won the lottery.'

(E.16) *Not-trusting the Source Context:* One of your friends told you that Ali won the lottery. You didn't talk with Ali; you don't trust what your friend says.

ALI LOTTERY WIN OLABILIR

ALI LOTTERY WIN GALIBA

ALI LOTTERY WIN OLABILIR GALIBA

ALI LOTTERY WIN LAZIM

ALI LOTTERY WIN OL LAZIM

'Ali may have won the lottery.'

(E.17) *Rumors Context:* There are rumors about someone that you know. They say that he married without telling anybody.

ALI MARRY OLABILIR

ALI MARRY GALIBA

ALI MARRY OLABILIR GALIBA

ALI MARRY LAZIM

ALI MARRY OL LAZIM

'Ali may have married.'

(E.18) *Trusting the Source Context:* One of your friends told you that Ali married. You didn't talk with Ali; you don't know. Your friend tells the truth; you trust him.

ALI MARRY OLABILIR

ALI MARRY GALIBA

ALI MARRY OLABILIR GALIBA

ALI MARRY LAZIM

ALI MARRY OL LAZIM

'Ali may have married.'

(E.19) *Not-trusting the Source Context:* One of your friends told you that Ali married. You didn't talk with Ali; you don't trust what your friend says.

ALI MARRY OLABILIR

ALI MARRY GALIBA

ALI MARRY OLABILIR GALIBA

ALI MARRY LAZIM

ALI MARRY OL LAZIM

'Ali may have married.'

E.3 Set 2

(E.20) *Pure Possibility Context:* You are chatting with your friend and talking about if there's life in other planets. She wonders what you think.

OTHER PLANET CL-PLANET-$_a$ IX-$_a$ LIFE OLABILIR

OTHER PLANET CL-PLANET-$_a$ IX-$_a$ LIFE GALIBA

OTHER PLANET CL-PLANET-$_a$ IX-$_a$ LIFE OLABILIR GALIBA

OTHER PLANET CL-PLANET-$_a$ IX-$_a$ LIFE LAZIM

OTHER PLANET CL-PLANET-$_a$ IX-$_a$ LIFE OL LAZIM

'There may be life in other planets.'

(E.21) *Pure Possibility Context:* You came home and one of the windows was broken. You don't know why.

WIND OLABILIR, SOMEONE STONE THROW OLABILIR, GLASS OWN BREAK OLABILIR

WIND GALIBA, SOMEONE STONE THROW GALIBA, GLASS OWN BREAK GALIBA

WIND OLABILIR GALIBA, SOMEONE STONE THROW OLABILIR GALIBA, GLASS OWN BREAK OLABILIR GALIBA

WIND LAZIM, SOMEONE STONE THROW LAZIM, GLASS OWN BREAK LAZIM

WIND OL LAZIM, SOMEONE STONE THROW OL LAZIM, GLASS OWN BREAK OL LAZIM

'It might be wind, someone may have thrown a stone, glass may have broken itself.'

(E.22) *Seeing the Whole Event Context:* Zeynep loves drawing, she takes out the material and draws a picture.

ZEYNEP PICTURE DO OLABILIR.

ZEYNEP PICTURE DO GALIBA.

ZEYNEP PICTURE DO OLABILIR GALIBA.

ZEYNEP PICTURE DO LAZIM.

ZEYNEP PICTURE DO OL LAZIM.

'Zeynep may have made a picture.'

(E.23) *Seeing the Part of an Event Context:* Zeynep loves drawing, she takes out the material but you don't know if she finished it.

ZEYNEP PICTURE DO OLABILIR.

ZEYNEP PICTURE DO GALIBA.

ZEYNEP PICTURE DO OLABILIR GALIBA.

ZEYNEP PICTURE DO LAZIM.

ZEYNEP PICTURE DO OL LAZIM.

'Zeynep may have made a picture.'

(E.24) *Seeing the End of an Event Context:* Zeynep loves drawing, and there is a picture in her room.

ZEYNEP PICTURE DO OLABILIR.

ZEYNEP PICTURE DO GALIBA.

ZEYNEP PICTURE DO OLABILIR GALIBA.

ZEYNEP PICTURE DO LAZIM.

ZEYNEP PICTURE DO OL LAZIM.

'Zeynep may have made a picture.'

(E.25) *Seeing the Whole Event Context:* You're walking at a park everyday. One day, workers close a part and bring new toys like swing, slide, etc. After a couple of days, kids are playing there.

MUNICIPALITY KID PARK MAKE OLABILIR

MUNICIPALITY KID PARK MAKE GALIBA

MUNICIPALITY KID PARK MAKE GALIBA

MUNICIPALITY KID PARK MAKE LAZIM

MUNICIPALITY KID PARK MAKE OL LAZIM

'Municipality may have made (funded) the playground.'

(E.26) *Seeing the Part of an Event Context:* You're walking at a park everyday. One day, workers close a part and bring new toys like swing, slide, etc.

MUNICIPALITY KID PARK MAKE OLABILIR

MUNICIPALITY KID PARK MAKE GALIBA

MUNICIPALITY KID PARK MAKE GALIBA

MUNICIPALITY KID PARK MAKE LAZIM

MUNICIPALITY KID PARK MAKE OL LAZIM

'Municipality may have made (funded) the playground.'

(E.27) *Seeing the End of an Event Context:* You're walking at a park everyday. One day, you have seen a new kid's playground.

MUNICIPALITY KID PARK MAKE OLABILIR

MUNICIPALITY KID PARK MAKE GALIBA

MUNICIPALITY KID PARK MAKE GALIBA

MUNICIPALITY KID PARK MAKE LAZIM

MUNICIPALITY KID PARK MAKE OL LAZIM

'Municipality may have made (funded) the playground.'

(E.28) *Smelling Context:* You went to your friend's house and it smells so nice and clean.

ALI HOUSE CLEAN OLABILIR

ALI HOUSE CLEAN GALIBA

ALI HOUSE CLEAN OLABILIR GALIBA

ALI HOUSE CLEAN LAZIM

ALI HOUSE CLEAN OL LAZIM

'Ali may have cleaned the house.'

(E.29) *Smelling Context:* Your friends invite you a picnic. When you arrive there, you smell meatballs.

#Z BARBEQUE DO OLABILIR

#Z BARBEQUE DO GALIBA

#Z BARBEQUE DO OLABILIR GALIBA

#Z BARBEQUE DO LAZIM

#Z BARBEQUE DO OL LAZIM

'Zeynep may have made the barbeque.'

(E.30) *Rumors Context:* There are rumors about someone that you know. They say that she bought a new house.

MERVE NEW HOUSE BUY OLABILIR

MERVE NEW HOUSE BUY GALIBA

MERVE NEW HOUSE BUY OLABILIR GALIBA

MERVE NEW HOUSE BUY LAZIM

MERVE NEW HOUSE BUY OL LAZIM

'Merve may have bought a new house.'

(E.31) *Trusting the Source Context:* One of your friends told you that Merve bought a new house. You didn't talk with Merve; you don't know. Your friend tells the truth; you trust him.

MERVE NEW HOUSE BUY OLABILIR

MERVE NEW HOUSE BUY GALIBA

MERVE NEW HOUSE BUY OLABILIR GALIBA

MERVE NEW HOUSE BUY LAZIM

MERVE NEW HOUSE BUY OL LAZIM

'Merve may have bought a new house.'

(E.32) *Not-trusting the Source Context:* One of your friends told you that Merve bought a new house. You didn't talk with Merve; you don't trust what your friend says.

MERVE NEW HOUSE BUY OLABILIR

MERVE NEW HOUSE BUY GALIBA

MERVE NEW HOUSE BUY OLABILIR GALIBA

MERVE NEW HOUSE BUY LAZIM

MERVE NEW HOUSE BUY OL LAZIM

'Merve may have bought a new house.'

(E.33) *Rumors Context:* There are rumors about someone that you know. They say that she is promoted.

#Z PROMOTE OLABILIR

#Z PROMOTE GALIBA

#Z PROMOTE OLABILIR GALIBA

#Z PROMOTE LAZIM

#Z PROMOTE OL LAZIM

'Zeynep may have been promoted.'

(E.34) *Trusting the Source Context:* One of your friends told you that Zeynep is promoted. You didn't talk with Zeynep; you don't know. Your friend tells the truth; you trust him.

#Z PROMOTE OLABILIR

#Z PROMOTE GALIBA

#Z PROMOTE OLABILIR GALIBA

#Z PROMOTE LAZIM

#Z PROMOTE OL LAZIM

'Zeynep may have been promoted.'

(E.35) *Not-trusting the Source Context:* One of your friends told you that Zeynep is promoted. You didn't talk with Zeynep; you don't trust what your friend says.

#Z PROMOTE OLABILIR

#z promote galiba

#z promote olabilir galiba

#z promote lazim

#z promote ol lazim

‘Zeynep may have been promoted.’

F. TEST ITEMS IN THE NONMANUALS RATING TEST

F.1 Trial Items

(F.1) MERVE BASKETBALL $\overline{\text{PLAY}}^{\text{hn}}$

'Merve plays basketball.'

(F.2) $\overline{\text{MERVE BASKETBALL PLAY OLUMLU}}^{\text{rhn}}$

'Merve can play basketball.'

(F.3) $\overline{\text{ALI KNOW MERVE BASKETBALL PLAY}}^{\text{sq, ht}}$

'Ali knows that Merve plays basketball.'

F.2 Set 1

(F.4) ZEYNEP DRIVE

'Zeynep drives.'

(F.5) $\overline{\text{ZEYNEP DRIVE}}^{\text{sq}}$

'Zeynep drives.'

(F.6) $\overline{\text{ZEYNEP DRIVE}}^{\text{ht}}$

'Zeynep drives.'

(F.7) $\overline{\text{ZEYNEP DRIVE}}^{\text{rhn}}$

'Zeynep drives.'

(F.8) ZEYNEP $\overline{\text{DRIVE}}^{\text{hn}}$

'Zeynep drives.'

(F.9) $\overline{\text{ZEYNEP DRIVE}}^{\text{rhn, sq}}$

'Zeynep drives.'

(F.10) $\overline{\text{ZEYNEP DRIVE}}^{\text{ht, sq}}$

'Zeynep drives.'

(F.11) ZEYNEP DRIVE OLABILIR

'Zeynep might drive.'

(F.12) $\overline{\text{ZEYNEP DRIVE OLABILIR}}^{\text{sq}}$

'Zeynep might drive.'

(F.13) $\overline{\text{ZEYNEP DRIVE OLABILIR}}^{\text{ht}}$

'Zeynep might drive.'

(F.14) $\overline{\text{ZEYNEP DRIVE OLABILIR}}^{\text{rhn}}$

'Zeynep might drive.'

(F.15) ZEYNEP DRIVE $\overline{\text{OLABILIR}}^{\text{hn}}$

'Zeynep might drive.'

(F.16) $\overline{\text{ZEYNEP DRIVE OLABILIR}}^{\text{rhn, sq}}$

'Zeynep might drive.'

(F.17) $\overline{\text{ZEYNEP DRIVE OLABILIR}}^{\text{ht, sq}}$

'Zeynep might drive.'

(F.18) ZEYNEP DRIVE LAZIM

'Zeynep must/should drive.'

(F.19) $\overline{\text{ZEYNEP DRIVE LAZIM}}^{\text{sq}}$

'Zeynep must/should drive.'

(F.20) $\overline{\text{ZEYNEP DRIVE LAZIM}}^{\text{ht}}$

'Zeynep must/should drive.'

(F.21) $\overline{\text{ZEYNEP DRIVE LAZIM}}^{\text{rhn}}$

'Zeynep must/should drive.'

(F.22) ZEYNEP DRIVE $\overline{\text{LAZIM}}^{\text{hn}}$

'Zeynep must/should drive.'

(F.23) $\overline{\text{ZEYNEP DRIVE LAZIM}}^{\text{rhn, sq}}$

'Zeynep must/should drive.'

(F.24) $\overline{\text{ZEYNEP DRIVE LAZIM}}^{\text{ht, sq}}$

'Zeynep must/should drive.'

(F.25) ZEYNEP DRIVE OL LAZIM

'Zeynep must/should drive.'

(F.26) $\overline{\text{ZEYNEP DRIVE OL LAZIM}}^{\text{sq}}$

'Zeynep must/should drive.'

(F.27) $\overline{\text{ZEYNEP DRIVE OL LAZIM}}^{\text{ht}}$

'Zeynep must/should drive.'

(F.28) $\overline{\text{ZEYNEP DRIVE OL LAZIM}}^{\text{rhn}}$

'Zeynep must/should drive.'

(F.29) ZEYNEP DRIVE $\overline{\text{OL LAZIM}}^{\text{hn}}$

'Zeynep must/should drive.'

(F.30) $\overline{\text{ZEYNEP DRIVE OL LAZIM}}^{\text{rhn, sq}}$

'Zeynep must/should drive.'

(F.31) $\overline{\text{ZEYNEP DRIVE OL LAZIM}}^{\text{ht, sq}}$

'Zeynep must/should drive.'

(F.32) ZEYNEP DRIVE MECBUR

'Zeynep must/should drive.'

(F.33) $\overline{\text{ZEYNEP DRIVE MECBUR}}^{\text{sq}}$

'Zeynep must/should drive.'

(F.34) $\overline{\text{ZEYNEP DRIVE MECBUR}}^{\text{ht}}$

'Zeynep must/should drive.'

(F.35) $\overline{\text{ZEYNEP DRIVE MECBUR}}^{\text{rhn}}$

'Zeynep must/should drive.'

(F.36) ZEYNEP DRIVE $\overline{\text{MECBUR}}^{\text{hn}}$

'Zeynep must/should drive.'

(F.37) $\overline{\text{ZEYNEP DRIVE MECBUR}}^{\text{rhn, sq}}$

'Zeynep must/should drive.'

(F.38) $\overline{\text{ZEYNEP DRIVE MECBUR}}^{\text{ht, sq}}$

'Zeynep must/should drive.'

(F.39) ZEYNEP DRIVE GEREK

'Zeynep must/should drive.'

(F.40) $\overline{\text{ZEYNEP DRIVE GEREK}}^{\text{sq}}$

'Zeynep must/should drive.'

(F.41) $\overline{\text{ZEYNEP DRIVE GEREK}}^{\text{ht}}$

'Zeynep must/should drive.'

(F.42) $\overline{\text{ZEYNEP DRIVE GEREK}}^{\text{rhn}}$

'Zeynep must/should drive.'

(F.43) ZEYNEP DRIVE $\overline{\text{GEREK}}^{\text{hn}}$

'Zeynep must/should drive.'

(F.44) $\overline{\text{ZEYNEP DRIVE GEREK}}^{\text{rhn, sq}}$

'Zeynep must/should drive.'

(F.45) $\overline{\text{ZEYNEP DRIVE GEREK}}^{\text{ht, sq}}$

'Zeynep must/should drive.'

(F.46) ZEYNEP DRIVE YAP

'Zeynep can drive.'

(F.47) $\overline{\text{ZEYNEP DRIVE YAP}}^{\text{sq}}$

'Zeynep can drive.'

(F.48) $\overline{\text{ZEYNEP DRIVE YAP}}^{\text{ht}}$

'Zeynep can drive.'

(F.49) $\overline{\text{ZEYNEP DRIVE YAP}}^{\text{rhn}}$

'Zeynep can drive.'

(F.50) ZEYNEP DRIVE $\overline{\text{YAP}}^{\text{hn}}$

'Zeynep can drive.'

(F.51) $\overline{\text{ZEYNEP DRIVE YAP}}^{\text{rhn, sq}}$

'Zeynep can drive.'

(F.52) $\overline{\text{ZEYNEP DRIVE YAP}}^{\text{ht, sq}}$

'Zeynep can drive.'

(F.53) ZEYNEP DRIVE OLUMLU

'Zeynep can drive.'

(F.54) $\overline{\text{ZEYNEP DRIVE OLUMLU}}^{\text{sq}}$

'Zeynep can drive.'

(F.55) $\overline{\text{ZEYNEP DRIVE OLUMLU}}^{\text{ht}}$

'Zeynep can drive.'

(F.56) $\overline{\text{ZEYNEP DRIVE OLUMLU}}^{\text{rhn}}$

'Zeynep can drive.'

(F.57) ZEYNEP DRIVE $\overline{\text{OLUMLU}}^{\text{hn}}$

'Zeynep can drive.'

(F.58) $\overline{\text{ZEYNEP DRIVE OLUMLU}}^{\text{rhn, sq}}$

'Zeynep can drive.'

(F.59) $\overline{\text{ZEYNEP DRIVE OLUMLU}}^{\text{ht, sq}}$

'Zeynep can drive.'

(F.60) ZEYNEP DRIVE SERBEST

'Zeynep may drive.'

(F.61) $\overline{\text{ZEYNEP DRIVE SERBEST}}^{\text{sq}}$

'Zeynep may drive.'

(F.62) $\overline{\text{ZEYNEP DRIVE SERBEST}}^{\text{ht}}$

'Zeynep may drive.'

(F.63) $\overline{\text{ZEYNEP DRIVE SERBEST}}^{\text{rhn}}$

'Zeynep may drive.'

(F.64) ZEYNEP DRIVE $\overline{\text{SERBEST}}^{\text{hn}}$

'Zeynep may drive.'

(F.65) $\overline{\text{ZEYNEP DRIVE SERBEST}}^{\text{rhn, sq}}$

'Zeynep may drive.'

(F.66) $\overline{\text{ZEYNEP DRIVE SERBEST}}^{\text{ht, sq}}$

'Zeynep may drive.'

(F.67) AYSE KNOW ZEYNEP DRIVE

'Ayse knows that Zeynep drives.'

(F.68) $\overline{\text{AYSE KNOW ZEYNEP DRIVE}}^{\text{sq}}$

'Ayse knows that Zeynep drives.'

(F.69) $\overline{\text{AYSE KNOW ZEYNEP DRIVE}}^{\text{ht}}$

'Ayse knows that Zeynep drives.'

(F.70) $\overline{\text{AYSE KNOW ZEYNEP DRIVE}}^{\text{rhn}}$

'Ayse knows that Zeynep drives.'

(F.71) AYSE KNOW ZEYNEP $\overline{\text{DRIVE}}^{\text{hn}}$

'Ayse knows that Zeynep drives.'

(F.72) $\overline{\text{AYSE KNOW ZEYNEP DRIVE}}^{\text{rhn, sq}}$

'Ayse knows that Zeynep drives.'

(F.73) $\overline{\text{AYSE KNOW ZEYNEP DRIVE}}^{\text{ht, sq}}$

'Ayse knows that Zeynep drives.'

(F.74) AYSE GUESS ZEYNEP DRIVE

'Ayse guesses that Zeynep drives.'

(F.75) $\overline{\text{AYSE GUESS ZEYNEP DRIVE}}^{\text{sq}}$

'Ayse guesses that Zeynep drives.'

(F.76) $\overline{\text{AYSE GUESS ZEYNEP DRIVE}}^{\text{ht}}$

'Ayse guesses that Zeynep drives.'

(F.77) $\overline{\text{AYSE GUESS ZEYNEP DRIVE}}^{\text{rhn}}$

'Ayse guesses that Zeynep drives.'

(F.78) AYSE GUESS ZEYNEP $\overline{\text{DRIVE}}^{\text{hn}}$

'Ayse guesses that Zeynep drives.'

(F.79) $\overline{\text{AYSE GUESS ZEYNEP DRIVE}}^{\text{rhn, sq}}$

'Ayse guesses that Zeynep drives.'

(F.80) $\overline{\text{AYSE GUESS ZEYNEP DRIVE}}^{\text{ht, sq}}$

'Ayse guesses that Zeynep drives.'

(F.81) AYSE TELL ZEYNEP DRIVE

'Ayse tells that Zeynep drives.'

(F.82) $\overline{\text{AYSE TELL ZEYNEP DRIVE}}^{\text{sq}}$

'Ayse tells that Zeynep drives.'

(F.83) $\overline{\text{AYSE TELL ZEYNEP DRIVE}}^{\text{ht}}$

'Ayse tells that Zeynep drives.'

(F.84) $\overline{\text{AYSE TELL ZEYNEP DRIVE}}^{\text{rhn}}$

'Ayse tells that Zeynep drives.'

(F.85) AYSE TELL ZEYNEP $\overline{\text{DRIVE}}^{\text{hn}}$

'Ayse tells that Zeynep drives.'

(F.86) $\overline{\text{AYSE TELL ZEYNEP DRIVE}}^{\text{rhn, sq}}$

'Ayse tells that Zeynep drives.'

(F.87) $\overline{\text{AYSE TELL ZEYNEP DRIVE}}^{\text{ht, sq}}$

'Ayse tells that Zeynep drives.'

(F.88) $\overline{\text{SWIM YAP}}^{\text{rhn}}$

'He can swim.'

(F.89) $\overline{\text{IX-1 SWIM YAP}}^{\text{rhn, sq}}$

'(I think) he can swim.'

(F.90) SWIM $\overline{\text{YAP}}^{\text{hn}}$

'He can swim.'

(F.91) $\overline{\text{SWIM YAP IX-3}}^{\text{rhn}}$

'He can swim.'

(F.92) $\overline{\text{HOUSE } \overline{\text{GO OLABILIR}}^{\text{ht}}}^{\text{sq}}$

'She might have gone home.'

(F.93) $\overline{\text{HOUSE GO OLABILIR}}^{\text{rhn}}$

'She might have gone home.'

(F.94) HOUSE GO $\overline{\text{OLABILIR}}^{\overline{\text{ht}}}$

'She might have gone home.'

(F.95) $\overline{\text{HOUSE GO OLABILIR}}^{\text{sq}}$

'She might have gone home.'

F.3 Set 2

(F.96) ALI SWIM

'Ali swims.'

(F.97) $\overline{\text{ALI SWIM}}^{\text{sq}}$

'Ali swims.'

(F.98) $\overline{\text{ALI SWIM}}^{\text{ht}}$

'Ali swims.'

(F.99) $\overline{\text{ALI SWIM}}^{\text{rhn}}$

'Ali swims.'

(F.100) ALI $\overline{\text{SWIM}}^{\text{hn}}$

'Ali swims.'

(F.101) $\overline{\text{ALI SWIM}}^{\text{rhn, sq}}$

'Ali swims.'

(F.102) $\overline{\text{ALI SWIM}}^{\text{ht, sq}}$

'Ali swims.'

(F.103) ALI SWIM OLABILIR

'Ali might swim.'

(F.104) $\overline{\text{ALI SWIM OLABILIR}}^{\text{sq}}$

'Ali might swim.'

(F.105) $\overline{\text{ALI SWIM OLABILIR}}^{\text{ht}}$

'Ali might swim.'

(F.106) $\overline{\text{ALI SWIM OLABILIR}}^{\text{rhn}}$

'Ali might swim.'

(F.107) ALI SWIM $\overline{\text{OLABILIR}}^{\text{hn}}$

'Ali might swim.'

(F.108) $\overline{\text{ALI SWIM OLABILIR}}^{\text{rhn, sq}}$

'Ali might swim.'

(F.109) $\overline{\text{ALI SWIM OLABILIR}}^{\text{ht, sq}}$

'Ali might swim.'

(F.110) ALI SWIM LAZIM

'Ali must/should swim.'

(F.111) $\overline{\text{ALI SWIM LAZIM}}^{\text{sq}}$

'Ali must/should swim.'

(F.112) $\overline{\text{ALI SWIM LAZIM}}^{\text{ht}}$

'Ali must/should swim.'

(F.113) $\overline{\text{ALI SWIM LAZIM}}^{\text{rhn}}$

'Ali must/should swim.'

(F.114) ALI SWIM $\overline{\text{LAZIM}}^{\text{hn}}$

'Ali must/should swim.'

(F.115) $\overline{\text{ALI SWIM LAZIM}}^{\text{rhn,sq}}$

'Ali must/should swim.'

(F.116) $\overline{\text{ALI SWIM LAZIM}}^{\text{ht,sq}}$

'Ali must/should swim.'

(F.117) ALI SWIM OL LAZIM

'Ali must swim.'

(F.118) $\overline{\text{ALI SWIM OL LAZIM}}^{\text{sq}}$

'Ali must swim.'

(F.119) $\overline{\text{ALI SWIM OL LAZIM}}^{\text{ht}}$

'Ali must swim.'

(F.120) $\overline{\text{ALI SWIM OL LAZIM}}^{\text{rhn}}$

'Ali must swim.'

(F.121) ALI SWIM $\overline{\text{OL LAZIM}}^{\text{hn}}$

'Ali must swim.'

(F.122) $\overline{\text{ALI SWIM OL LAZIM}}^{\text{rhn,sq}}$

'Ali must swim.'

(F.123) $\overline{\text{ALI SWIM OL LAZIM}}^{\text{ht,sq}}$

'Ali must swim.'

(F.124) ALI SWIM MECBUR

'Ali must/should swim.'

(F.125) $\overline{\text{ALI SWIM MECBUR}}^{\text{sq}}$

'Ali must/should swim.'

(F.126) $\overline{\text{ALI SWIM MECBUR}}^{\text{ht}}$

'Ali must/should swim.'

(F.127) $\overline{\text{ALI SWIM MECBUR}}^{\text{rhn}}$

'Ali must/should swim.'

(F.128) ALI SWIM $\overline{\text{MECBUR}}^{\text{hn}}$

'Ali must/should swim.'

(F.129) $\overline{\text{ALI SWIM MECBUR}}^{\text{rhn,sq}}$

'Ali must/should swim.'

(F.130) $\overline{\text{ALI SWIM MECBUR}}^{\text{ht,sq}}$

'Ali must/should swim.'

(F.131) ALI SWIM GEREK

'Ali must/should swim.'

(F.132) $\overline{\text{ALI SWIM GEREK}}^{\text{sq}}$

'Ali must/should swim.'

(F.133) $\overline{\text{ALI SWIM GEREK}}^{\text{ht}}$

'Ali must/should swim.'

(F.134) $\overline{\text{ALI SWIM GEREK}}^{\text{rhn}}$

'Ali must/should swim.'

(F.135) ALI SWIM $\overline{\text{GEREK}}^{\text{hn}}$

'Ali must/should swim.'

(F.136) $\overline{\text{ALI SWIM GEREK}}^{\text{rhn, sq}}$

'Ali must/should swim.'

(F.137) $\overline{\text{ALI SWIM GEREK}}^{\text{ht, sq}}$

'Ali must/should swim.'

(F.138) ALI SWIM SERBEST

'Ali may swim.'

(F.139) $\overline{\text{ALI SWIM SERBEST}}^{\text{sq}}$

'Ali may swim.'

(F.140) $\overline{\text{ALI SWIM SERBEST}}^{\text{ht}}$

'Ali may swim.'

(F.141) $\overline{\text{ALI SWIM SERBEST}}^{\text{rhn}}$

'Ali may swim.'

(F.142) ALI SWIM $\overline{\text{SERBEST}}^{\text{hn}}$

'Ali may swim.'

(F.143) $\overline{\text{ALI SWIM SERBEST}}^{\text{rhn, sq}}$

'Ali may swim.'

(F.144) $\overline{\text{ALI SWIM SERBEST}}^{\text{ht, sq}}$

'Ali may swim.'

(F.145) ALI SWIM YAP

'Ali can swim.'

(F.146) $\overline{\text{ALI SWIM YAP}}^{\text{sq}}$

'Ali can swim.'

(F.147) $\overline{\text{ALI SWIM YAP}}^{\text{rhn}}$

'Ali can swim.'

(F.148) $\overline{\text{ALI SWIM YAP}}^{\text{ht}}$

'Ali can swim.'

(F.149) ALI SWIM $\overline{\text{YAP}}^{\text{hn}}$

'Ali can swim.'

(F.150) $\overline{\text{ALI SWIM YAP}}^{\text{ht, sq}}$

'Ali can swim.'

(F.151) $\overline{\text{ALI SWIM YAP}}^{\text{rhn, sq}}$

'Ali can swim.'

(F.152) ALI SWIM OLUMLU

'Ali can swim.'

(F.153) $\overline{\text{ALI SWIM OLUMLU}}^{\text{sq}}$

'Ali can swim.'

(F.154) $\overline{\text{ALI SWIM OLUMLU}}^{\text{ht}}$

'Ali can swim.'

(F.155) $\overline{\text{ALI SWIM OLUMLU}}^{\text{rhn}}$

'Ali can swim.'

(F.156) ALI SWIM $\overline{\text{OLUMLU}}^{\text{hn}}$

'Ali can swim.'

(F.157) $\overline{\text{ALI SWIM OLUMLU}}^{\text{rhn,sq}}$

'Ali can swim.'

(F.158) $\overline{\text{ALI SWIM OLUMLU}}^{\text{ht,sq}}$

'Ali can swim.'

(F.159) MERVE GUESS ALI SWIM

'Merve guesses that Ali swims.'

(F.160) $\overline{\text{MERVE GUESS ALI SWIM}}^{\text{sq}}$

'Merve guesses that Ali swims.'

(F.161) $\overline{\text{MERVE GUESS ALI SWIM}}^{\text{ht}}$

'Merve guesses that Ali swims.'

(F.162) $\overline{\text{MERVE GUESS ALI SWIM}}^{\text{rhn}}$

'Merve guesses that Ali swims.'

(F.163) MERVE GUESS ALI $\overline{\text{SWIM}}^{\text{hn}}$

'Merve guesses that Ali swims.'

(F.164) $\overline{\text{MERVE GUESS ALI SWIM}}^{\text{rhn, sq}}$

'Merve guesses that Ali swims.'

(F.165) $\overline{\text{MERVE GUESS ALI SWIM}}^{\text{ht, sq}}$

'Merve guesses that Ali swims.'

(F.166) MERVE KNOW ALI SWIM

'Merve knows that Ali swims.'

(F.167) $\overline{\text{MERVE KNOW ALI SWIM}}^{\text{sq}}$

'Merve knows that Ali swims.'

(F.168) $\overline{\text{MERVE KNOW ALI SWIM}}^{\text{ht}}$

'Merve knows that Ali swims.'

(F.169) $\overline{\text{MERVE KNOW ALI SWIM}}^{\text{rhn}}$

'Merve knows that Ali swims.'

(F.170) MERVE KNOW ALI $\overline{\text{SWIM}}^{\text{hn}}$

'Merve knows that Ali swims.'

(F.171) $\overline{\text{MERVE KNOW ALI SWIM}}^{\text{rhn, sq}}$

'Merve knows that Ali swims.'

(F.172) $\overline{\text{MERVE KNOW ALI SWIM}}^{\text{ht, sq}}$

'Merve knows that Ali swims.'

(F.173) MERVE TELL ALI SWIM

'Merve tells that Ali swims.'

(F.174) $\overline{\text{MERVE TELL ALI SWIM}}^{\text{sq}}$

'Merve tells that Ali swims.'

(F.175) $\overline{\text{MERVE TELL ALI SWIM}}^{\text{ht}}$

'Merve tells that Ali swims.'

(F.176) $\overline{\text{MERVE TELL ALI SWIM}}^{\text{rhn}}$

'Merve tells that Ali swims.'

(F.177) MERVE TELL ALI $\overline{\text{SWIM}}^{\text{hn}}$

'Merve tells that Ali swims.'

(F.178) $\overline{\text{MERVE TELL ALI SWIM}}^{\text{rhn, sq}}$

'Merve tells that Ali swims.'

(F.179) $\overline{\text{MERVE TELL ALI SWIM}}^{\text{ht, sq}}$

'Merve tells that Ali swims.'

(F.180) $\overline{\text{SWIM YAP}}^{\text{rhn}}$

'He can swim.'

(F.181) $\overline{\text{IX-1 SWIM YAP}}^{\text{rhn, sq}}$

'(I think) he can swim.'

(F.182) SWIM $\overline{\text{YAP}}^{\text{hn}}$

'He can swim.'

(F.183) $\overline{\text{SWIM YAP IX-3}}^{\text{rhn}}$

'He can swim.'

(F.184) $\underline{\qquad\qquad\qquad}^{\text{sq}}$
HOUSE $\overline{\text{GO OLABILIR}}^{\text{ht}}$

'She might have gone home.'

(F.185) $\overline{\text{HOUSE GO OLABILIR}}^{\text{rhn}}$

'She might have gone home.'

(F.186) $\underline{\qquad\qquad}^{\text{sq}}$
HOUSE GO $\overline{\text{OLABILIR}}^{\text{ht}}$

'She might have gone home.'

(F.187) $\overline{\text{HOUSE GO OLABILIR}}^{\text{sq}}$

'She might have gone home.'

G. MULTILEVEL MIXED EFFECTS RESULTS FOR EACH NONMANUAL MARKER WITH EACH SENTENCE TYPE

As seen in Tables G.2, the signer was found significantly less certain in declarative sentences with head tilt (p<.001), squint (p=.004), head tilt and squint (p<.001), repetitive head nod and squint (p<.001), and no nonmanual markers (p=.018) compared to head nod. The signer was also found significantly less certain in declarative sentences with head tilt (p<.001), squint (p<.001), head tilt and squint (p<.001), repetitive head nod and squint (p<.001), and no nonmanual markers (p=.002) compared to repetitive head nod. The signer was found significantly less certain in conditions where declarative sentences had head tilt (p<.001) and head tilt and squint (p=.017) compared to no nonmanual markers. The signer was found significantly less certain in conditions where declarative sentences had head tilt (p=.002) compared to squint. Lastly, the signer was found significantly less certain in declarative sentences with head tilt and squint (p=.029) compared to repetitive head nod and squint.

The signer was found significantly less certain in sentences with the matrix verb BIL with head tilt (p=<.001), squint (p=<.001), and head tilt and squint (p<.001) compared to repetitive head nod. The signer was also found significantly less certain in conditions where BIL had head tilt (p=.002), squint (p.005), and head tilt and squint (p<.001) compared to head nod. The signer was found significantly less certain in sentences with the matrix verb BIL with head tilt (p=.002), squint (p.004), and head tilt and squint (p<.001) compared to no nonmanual markers. Lastly, the signer was also found significantly less certain in conditions where BIL had head tilt and squint (p=.005) compared to repetitive head nod and squint.

The signer was found significantly less certain in sentences with the modal GEREK with repetitive head nod (p=.007), head tilt (p<.001), squint (p=.010), and head tilt and squint (p<.001) compared to head nod. The signer was also found significantly more certain in conditions where GEREK sentences had head nod (p<.001), repetitive head nod and squint (p=.014), and no nonmanual markers (p=.013) compared to head tilt. The signer was found significantly more certain in sentences with the modal LAZIM with head nod (p<.001), repetitive head nod (p<.001), squint (p=.002), repetitive head nod and squint (p<.001), and

no nonmanual markers (p=.003) compared to head tilt. The signer was found significantly more certain in conditions where LAZIM had head nod (p=.002) and repetitive head nod (p<.001) compared to head tilt and squint. The signer was also found siginificantly more certain in conditions where LAZIM had repetitive head nod and squint (p=.006) compared to head tilt and squint.

The signer was found significantly less certain in sentences with the modal MECBUR with head tilt (p<.001), squint (p<.001), head tilt and squint (p<.001), and no nonmanual markers (p=.015) compared to head nod. The signer was found significantly less certain in conditions where MECBUR had head tilt (p<.001), squint (p<.001), and head tilt and squint (p<.001) compared to repetitive head nod. The signer was found significantly less certain in conditions where MECBUR had squint (p=.002), head tilt (p<.001), and head tilt and squint (p<.001) compared to repetitive head nod and squint. The signer was found significantly less certain in sentences with the modal OLABILIR with head tilt (p<.001), squint (p<.001), head tilt and squint (p=.005), and no nonmanual markers (p<.001) compared to repetitive head nod. The signer was found significantly less certain in conditions where OLABILIR had head tilt (p<.001), squint (p<.001), head tilt and squint (p=.034), and no nonmanual markers (p=.002) compared to head nod. The signer was found significantly more certain in conditions where OLABILIR had squint (p=.028), head tilt and squint (p<.001), and repetitive head nod and squint (p<.001) compared to head tilt. The signer was found significantly less certain in conditions where OLABILIR had squint (p=.004) compared to repetitive head nod and squint.

As seen in Table G.2, the signer was found significantly less certain in sentences with the modal OL LAZIM with repetitive head nod (p=.029), head tilt (p<.001), and head tilt and squint (p=.022) compared to no nonmanual markers. The signer was found significantly less certain in conditions where OL LAZIM had repetitive head nod (p<.001), head tilt (p<.001), squint (p=.012), and head tilt and squint (p<.001) compared to head nod. The signer was found significantly less certain in conditions where OL LAZIM had head tilt compared to squint (p=.036), and repetitive head nod and squint (p=.006). The signer was found significantly more certain in sentences with the modal OLUMLU with head nod (p<.001), repetitive head nod (p<.001), squint (p=.003), repetitive head nod and squint (p=.001), and

no nonmanual markers (p=.025) compared to head tilt. The signer was found significantly more certain in conditions where OLUMLU had head nod (p=.036) and repetitive head nod (p=.029) compared to no nonmanual markers. The signer was found significantly more certain in conditions where OLUMLU had head nod (p=.003) and repetitive head nod (p=.002) compared to head tilt and squint.

The signer was found significantly more certain in sentences with the modal SERBEST with head nod (p<.001), repetitive head nod (p<.001), repetitive head nod ans squint (p<.001), and no nonmanual markers (p=.025) compared to head tilt. The signer was found significantly more certain in conditions where SERBEST had head nod (p=.027) and repetitive head nod (p=.029) compared to no nonmanual markers. The signer was found significantly more certain in conditions where SERBEST had head nod and repetitive head nod compared to squint (p=.004), and head tilt and squint (p<.001). The signer was found significantly more certain in conditions where SERBEST had repetitive head nod compared to squint (p=.013) compared to head tilt and squint. The signer was found significantly more certain in sentences with the matrix verb SOYLE with head nod (p<.001), repetitive head nod (p<.001), head tilt (p=.012), squint (p=.012), and repetitive head nod and squint (p<.001) compared to head tilt and squint. The signer was found significantly less certain in conditions where SOYLE had head tilt (p=.002), squint (p=.002), and no nonmanual markers (p<.001) compared to repetitive head nod. The signer was found significantly more certain in conditions where SOYLE had head nod (p=.033) and repetitive head nod (p<.001) compared to no nonmanual markers.

The signer was found significantly less certain in sentences with the matrix verb TAHMIN with head tilt (p=.007), squint (p=.019), and head tilt and squint (p=.018) compared to repetitive head nod. The signer was found significantly less certain in sentences with the modal YAP with head tilt (p<.001), squint (p<.001), head tilt and squint (p<.001), and no nonmanual markers (p<.001) compared to head nod. The same significance levels hold also for repetitive head nod except squint (p=.002). The signer was found significantly less certain in conditions where YAP had head tilt (p<.001), squint (p=.002), no nonmanual markers (p<.001), and head tilt and squint (p<.001) compared to repetitive head nod and squint. The signer was found significantly less certain in conditions where YAP had head tilt

and squint (p=.015) compared to squint, and squint (p=.002) compared to repetitive head nod and squint.

Table G.1. Effects of Nonmanual Markers and Sentence Types on Certainty Ratings - Part 1 - Detailed

Declarative

	non	hn	rhn	ht	sq	htsq	rhnsq
non							
hn	**.018**						
rhn	**.002**	n.s.					
ht	**<.001**	**<.001**	**<.001**				
sq	n.s.	**.004**	**<.001**	**.002**			
htsq	**.017**	**<.001**	**<.001**	n.s.	n.s.		
rhnsq	n.s.	**<.001**	**<.001**	**.029**	n.s.	n.s.	

BIL

	non	hn	rhn	ht	sq	htsq	rhnsq
non							
hn	n.s.						
rhn	n.s.	n.s.					
ht	**.002**	**.002**	**<.001**				
sq	**.004**	**.005**	**<.001**	n.s.			
htsq	**<.001**	**<.001**	**<.001**	n.s.	n.s.		
rhnsq	n.s.	n.s.	**.036**	**.051**	n.s.	**.005**	

GEREK

	non	hn	rhn	ht	sq	htsq	rhnsq
non							
hn	n.s.						
rhn	n.s.	**.007**					
ht	**.013**	**<.001**	n.s.				
sq	n.s.	**.010**	n.s.	n.s.			
htsq	n.s.	**<.001**	n.s.	n.s.	n.s.		
rhnsq	n.s.	n.s.	n.s.	**.014**	n.s.	n.s.	

LAZIM

	non	hn	rhn	ht	sq	htsq	rhnsq
non							
hn	n.s.						
rhn	n.s.	n.s.					
ht	**.003**	**<.001**	**<.001**				
sq	n.s.	n.s.	n.s.	**.002**			
htsq	n.s.	**.002**	**<.001**	n.s.	n.s.		
rhnsq	n.s.	n.s.	n.s.	**<.001**	n.s.	**.006**	

MECBUR

	non	hn	rhn	ht	sq	htsq	rhnsq
non							
hn	**.015**						
rhn	n.s.	n.s.					
ht	**.002**	**<.001**	**<.001**				
sq	n.s.	**<.001**	**<.001**	n.s.			
htsq	**.006**	**<.001**	**<.001**	n.s.	n.s.		
rhnsq	n.s.	n.s.	n.s.	**<.001**	**.002**	**<.001**	

OLABILIR

	non	hn	rhn	ht	sq	htsq	rhnsq
non							
hn	**.002**						
rhn	**<.001**	n.s.					
ht	n.s.	**<.001**	**<.001**				
sq	n.s.	**<.001**	**<.001**	**.028**			
htsq	n.s.	**.034**	**.005**	**<.001**	n.s		
rhnsq	**.007**	n.s.	n.s.	**<.001**	**.004**	n.s.	

Abbreviations in the table are: non - non nonmanual marker, hn - head nod, rhn - repetitive head nod, ht - head tilt, sq - squint, htsq - head tilt and squint, rhnsq - repetitive head nod and squint

Table G.2. Effects of Nonmanual Markers and Sentence Types on Certainty Ratings - Part 2 - Detailed

OL LAZIM

	non	hn	rhn	ht	sq	htsq	rhnsq
non							
hn	n.s.						
rhn	**.029**	**<.001**					
ht	**<.001**	**<.001**	n.s.				
sq	n.s.	**.012**	n.s.	**.036**			
htsq	**.022**	**<.001**	n.s.	n.s.	n.s.		
rhnsq	n.s.	n.s.	n.s.	**.006**	n.s.	n.s.	

OLUMLU

	non	hn	rhn	ht	sq	htsq	rhnsq
non							
hn	**.036**						
rhn	**.029**	n.s.					
ht	**.025**	n.s.	**<.001**				
sq	n.s.	n.s.	n.s.	**.003**			
htsq	n.s.	**.003**	**.002**	n.s.	n.s.		
rhnsq	n.s.	n.s.	n.s.	**.001**	n.s.	n.s.	

SERBEST

	non	hn	rhn	ht	sq	htsq	rhnsq
non							
hn	**.027**						
rhn	**.029**	n.s.					
ht	**.025**	**<.001**	**<.001**				
sq	n.s.	**.004**	**.004**	n.s.			
htsq	n.s.	**<.001**	**<.001**	n.s.	n.s.		
rhnsq	n.s.	n.s.	n.s.	**<.001**	n.s.	**.013**	

SOYLE

	non	hn	rhn	ht	sq	htsq	rhnsq
non							
hn	**.033**						
rhn	**<.001**	n.s.					
ht	n.s.	n.s.	**.002**				
sq	n.s.	n.s.	**.002**	n.s.			
htsq	n.s.	**<.001**	**<.001**	**.012**	**.012**		
rhnsq	n.s.	n.s.	n.s.	n.s.	n.s.	**<.001**	

TAHMIN

	non	hn	rhn	ht	sq	htsq	rhnsq
non							
hn	n.s.						
rhn	n.s.	n.s.					
ht	n.s.	n.s.	**.007**				
sq	n.s.	n.s.	**.019**	n.s.			
htsq	n.s.	n.s.	**.028**	n.s.	n.s.		
rhnsq	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	

YAP

	non	hn	rhn	ht	sq	htsq	rhnsq
non							
hn	**<.001**						
rhn	**<.001**	n.s.					
ht	n.s.	**<.001**	**<.001**				
sq	n.s.	**<.001**	**.002**	n.s.			
htsq	n.s.	**<.001**	**<.001**	n.s.	**.015**		
rhnsq	**<.001**	n.s.	n.s.	**<.001**	**.002**	**<.001**	

Abbreviations in the table are: non - non nonmanual marker, hn - head nod, rhn - repetitive head nod, ht - head tilt, sq - squint, htsq - head tilt and squint, rhnsq - repetitive head nod and squint