The Atlas of North American English

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Phonetics, Phonology and Sound Change

A Multimedia Reference Tool

by
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Preface

The Atlas of North American English [ANAE] is a report on the regional phonology of the English of the United States and Canada. Based on a telephone survey carried out in the years 1992–1999 [Telsur], it provides a portrait of the phonology of the continent at one rather extended moment in its history. The view that it provides of English dialects is dynamic rather than static. The main focus of the Atlas is on the mechanism, the causes, and the consequences of linguistic change. Dialects are defined by changes in progress more than changes completed and boundaries between them represent the outer limits of ongoing change.

A major aim of the Atlas is the re-establishment of the links between dialect geography and general linguistics. The Atlas provides considerably more data on the general principles of chain shifting and merger than has been available before. There is extensive information on the role of gender, age, and city size in the development of sound change in North America. The findings of the Atlas bear on many synchronic issues as well: the status of the phoneme as an abstract and unitary symbol; the existence of subsystems and their hierarchical arrangement; the uniformity of co-articulatory effects; the role of duration in phonological contrast.

In many respects the data of dialect geography provide more decisive evidence on general linguistic questions than studies of single speech communities. However, it is not the same kind of data. Studies within the local community focus on variation, rather than the homogeneous structural framework in which that variation is defined. The Atlas charts the distribution of such frameworks across the landscape: that is why the dialect regions defined here have such high ratings in homogeneity and consistency.

Many users of this Atlas will be interested in the portrait of phonology and sound change in their local region, while others will want to take advantage of the continental view provided and develop its implications for sound change on other continents and other languages. It is hoped that both directions of development will occur. One of the primary aims of the Atlas is to stimulate a series of local studies that will fill in the broad schema provided with more detailed and accurate data and supplement the studies of the major urbanized areas with investigations of the smaller cities in the interstices. There is also much to be done with the data that the Telsur project has provided. We hope that the unanalyzed maps of Chapter 10, and the complete spread sheets of Telsur data provided on the CD, will be useful to those who would like to adapt these materials to their own theoretical framework.

Acknowledgments

One must recognize two groups of predecessors on whose work the Atlas is built: dialect geographers on the one hand, and students of change in progress on the other.

Almost every chapter of the Atlas refers to the work of Hans Kurath and Raven McDavid. The fundamental divisions they made into North, Midland and South, and the connections they made with settlement history, stand up well in the light of current developments. Their insights were extended by the work of Roger Shuy, A. L. Davis, Harold Allen, Albert Marckwardt and Craig Carver's work with DARE materials.

Three studies anticipated the central themes of Atlas methodology, focusing on the geographic dispersion of changes in progress: Trudgill's study of the sound changes in the Hemnesberget peninsula (1974b), Callary's report on the raising of /æ/ in northern Illinois (1975), and Bailey's telephone surveys of Texas (Bailey and Ross 1992) and Oklahoma (Bailey, Wikle, Tillery and Sand 1993).

The Atlas would not have been possible without the financial support of the National Science Foundation, the National Endowment for the Humanities and Bell Northern (Nortel) Corporation. We are particularly grateful for the initial guidance of the program officers of NSF and NEH, Paul Chapin and Helen Aguerra, and the head of the Nortel research group, Matthew Lennig. The various grants and contracts that supported the Atlas are listed in detail in the description of various stages of the Atlas in Chapter 4.

Thirteen telephone interviewers were responsible for the creation of the database of 805 recorded interviews, reduced finally to the 762 data points of Chapters 7–9): Joyce Albergottie, Sharon Ash, Atissa Banuazizi, Charles Boberg, Crawford Feagin, Alice Goffman, Janet Hill, Shawn Noble Maeder, Christine Moisset, Marc Mostovoy, Carol Orr, Tara Sanchez, and Hillary Waterman.

The acoustic analysis of the 439 interviews that form the data base for Chapters 10–20 was largely the work of Boberg, with the initial impetus from Ash. Maciej Baranowski, David Bowie, Jeff Conn, and Ken Matsuda made important contributions to this work.

The principles of chain shifting have their origin in early work at Columbia University by myself and Benji Wald. Wald's exploratory interviews in Chicago have played an important role in our interpretation of the time sequence of the Northern Cities Shift, and his insights are gratefully acknowledged.

We are particularly indebted to Terry Nearey, and the log mean normalization program that he developed and first tested. Though no normalization program can be considered perfect, our ability to track change quantitatively across age and gender rests upon the success of this algorithm in eliminating differences in formant values that are the result of differences in vocal tract length, without eliminating those differences in sex and age that are intrinsic to the speech community.

It would be impossible to overstate our indebtedness to our publisher, Mouton de Gruyter, who has with great patience and fortitude supported the project with technical, editorial and moral support from 2001 to its completion in the present year. Our editor Anke Beck has been the guiding spirit of this enterprise. Mouton engaged our linguistic engineer, Jürgen Handke of the University of Marburg. He and his staff have developed the ANAE web site and the CD well beyond our original conception.

The finished version of the Atlas is the joint work of three authors, following several years of intensive discussion, revision, and exchange of ideas. But in even the closest collaboration, there remain the marks of original contributions that persist in the finished product. The original design of the telephone interview and the construction of the sample of North American speakers is largely the work of Ash, and she is the primary author of Chapter 4. Ash was also responsible for the adaptation of Kaye Elemetric's CSL program that made it possible to analyze more than half of the vowel systems in the Telsur data base. The lion's share of

the acoustic analysis of the 439 subjects was done by Boberg, whose speed, accuracy, and phonetic sensitivity were essential factors in the completion of the Atlas and its success in tracking sound change in progress. He is the primary author of Chapter 5, Chapter 15 on Canada, and the analysis of Western New England in Chapters 14 and 16. Beyond this, his critical thinking is present at every step of the way. Ash and Boberg together discovered the phenomenon of "Northern Breaking" (Chapter 13), one of the most remarkable and unexpected findings of the Atlas. Much of the analysis and the main lines of interpretation were first written by me, but not without many cycles of correction and revision from my co-authors. While we have consistently developed the many connections between the Atlas data and the general theory of sound change, we have preferred to remain on the conservative side in both notation and interpretation. The phonological, phonetic and historical implications of the Atlas findings will be pursued in publications to follow.

William Labov
October 2005

Table of contents

Preface ... v
List of maps, figures, and tables ... x
Abbreviations ... xv

Part A Introduction and methods

1. Introduction ... 3

1.1. The scope and goals of this work ... 3
The separation of linguistics and dialect geography ... 4
The renewal of the connection ... 4
1.2. A brief history of American dialect geography ... 5
1.3. The design of the Atlas of North American English ... 7
The Telsur design ... 8
Technical developments ... 8
Stages of research and sources of support ... 9
1.4. Data to be presented and questions to be answered ... 9
1.5. Organization of the Atlas ... 10

2. The North American English vowel system ... 11

2.1. Long and short vowels ... 11
2.2. Unary vs. binary notation ... 11
2.3. Initial position ... 12
2.4. Description of the word classes ... 13
2.5. Vowels before /r/ ... 14
2.6. The linguistic status of the initial position ... 15

3. Principles of chain shifting and mergers ... 16

3.1. General principles of chain shifting ... 16
3.2. Long/short, tense/lax, peripheral/non-peripheral ... 16
3.3. Acoustic evidence for the Peripherality Hypothesis ... 17
3.4. Movements across subsystems ... 18
3.5. General principles of merger ... 19

4. Sampling and field methods ... 21

4.1. The pilot project ... 21
4.2. Expansion of the project ... 21
4.3. Selection and recruitment of speakers ... 22
National ancestry ... 23
Race ... 24
4.4. Methods of recruitment ... 24
4.5. Records of calls required for successful interviews ... 25
4.6. Contacting speakers: pinpointing the ideal speaker ... 27
4.7. Age and gender distribution of the sample ... 27
4.8. The Telsur interview ... 28
4.9. The second interview ... 29
4.10. Impressionistic coding ... 29
4.11. The socio-economic index ... 30
Appendix 4.1. Zones of influence, Central Cities, and UA populations 30
Appendix 4.2. Sample interview form ... 32
Appendix 4.3. Sample word list ... 35

5. Methods of acoustic analysis ... 36

5.1. The philosophy of measurement involved ... 36
5.2. Equipment ... 36
5.3. Acoustic analysis of telephone interviews compared to face-to-face interviews ... 37
5.4. Selection of tokens for analysis ... 37
5.5. Selection of points of measurement ... 37
5.6. Format and content of vowel files ... 39
5.7. Normalization ... 39
5.8. Analyzing and displaying vowel systems with the Plotnik program .. 40

6. The construction of isoglosses ... 41

6.1. Criteria for selection ... 41
6.2. Drawing isoglosses ... 41
6.3. Isogloss relations ... 43

Part B Mergers and contrasts

7. The restoration of post-vocalic /r/ ... 47

The expansion of /r/ in the South ... 47

8. Nearly completed mergers ... 49

8.1. The merger of /hw/ and /w/ ... 49
8.2. The merger of /ohr/ and /ɔhr/ ... 49

8.3. The merger of /ahr/ and /ɔhr/ . . . 51
8.4. The merger of /iw/ and /uw/ . . . 53
8.5. Merger before intervocalic /r/ . . . 54

9. North American mergers in progress . . . 58

9.1. The low back merger . . . 58
Progress of the low back merger by region . . . 62
9.2. Conditioned mergers . . . 65
Comparison of mergers before /l/ . . . 69
Other mergers before /l/ . . . 73

Part C North American English vowels

10. The vowels of North American English: Maps of natural breaks in F1 and F2 . . . 77

Introduction . . . 77
Appendix 10.1. Summary statistics for Maps 10.1–10.38 . . . 116

Part D Overviews of North American dialects

11. The dialects of North American English . . . 119

11.0. Introduction . . . 119
Criteria for defining dialect regions . . . 119
11.1. The dialects of North American English . . . 121
The Inland North . . . 121
The Mid-Atlantic States and New York City . . . 124
The South . . . 125
Characteristics of the major isoglosses . . . 125
The outer limits of the South and the Southern Shift . . . 125
Dialects within the low back merger area . . . 130
Eastern New England . . . 130
Defining the outer limits of the North . . . 133
Between the North and the South . . . 133
The West . . . 137
The larger Southeastern region . . . 137
Eastern New England (Chapter 16.1) . . . 137
Western New England (Chapter 14.2) . . . 141
The Atlantic Provinces (Chapter 15) . . . 141
Transitional areas . . . 141
Linked behavior of /ow/ and /ʌ/ . . . 143
11.2. North American dialects classified by the fronting of /uw/ and /ow/ 143
11.3. Regions and dialects of North America . . . 145
11.4. Principal components analysis of North American regions . . . 146
11.5. The hierarchical structure of North American dialects . . . 147
11.6. Relation to previous studies . . . 149
Appendix 11.1. Isogloss parameters . . . 151

12. The fronting of back upgliding vowels . . . 152

12.1. The fronting of /uw/ . . . 152
12.2. The fronting of /ow/ . . . 155
12.3. The fronting of /aw/ . . . 157
Social and phonological constraints on /aw/ . . . 160
12.4. Individual vowel systems . . . 163
12.5. Overview . . . 167

13. The short-*a* and short-*o* configurations . . . 169

13.1. Short-*o* configurations . . . 169
The realization of the short-*o* class . . . 169
Representation of the merged classes . . . 172
13.2. Short-*a* configurations . . . 173
The split system . . . 173
The broad-*a* system . . . 174
The nasal system . . . 174
The raised /æh/ system . . . 175
Northern breaking . . . 177
Southern breaking and the Southern drawl . . . 178
Continuous short-*a* systems . . . 180
Differentiation of the voiced stops . . . 180
The merger of /æg/ and /eyg/ . . . 181
Distribution of short-*a* systems . . . 181

Part E Regional patterns

14. The North . . . 187

14.1. The North as a whole . . . 187
14.2. The Northern Cities Shift . . . 187
History of the Northern Cities Shift . . . 190
14.3. Telsur subjects in the Inland North . . . 191
14.4. Mapping the Northern Cities Shift . . . 191
The Northern Cities Shift patterns in the Natural Break maps of Chapter 10 . . . 191
The raising and fronting of /æ/ . . . 192
The fronting of /o/ . . . 195
The lowering and fronting of /oh/ . . . 197
The lowering and backing of /e/ . . . 197
Canadian raising in the North . . . 205
The North/Midland isogloss bundle . . . 205
14.5. The city of Erie . . . 205
14.6. Vowel systems of Inland North speakers . . . 208
The vowel system of James W. from Chicago: Figure 14.16 . . . 208
The vowel system of Steve A. from Ann Arbor: Figure 14.17 . . . 208
The vowel system of Martha F. from Kenosha: Figure 14.18 . . . 209
The vowel system of Sharon K. from Rochester: Figure 14.19 . . . 209
The vowel system of Libby R. from Detroit: Figure 14.20 . . . 210
The vowel system of Joanna R. from Detroit: Figure 14.21 . . . 210
14.7. Summary of real-time evidence on the Northern Cities Shift . . . 211

14.8. The social parameters of the Northern Cities Shift . . . 211
14.9. Western New England . . . 212
14.10. The origins of the Northern Cities Shift . . . 214

15. Canada . . . 216

15.1. The English-speaking population of Canada . . . 216
15.2. General features of Canadian English . . . 216
15.3. Data for acoustic analysis . . . 217
15.4. Focus of this chapter . . . 217
15.5. Mergers and the phonemic inventory of Canadian English . . . 217
15.6. The geographic distribution of phonetic features of Canadian English 220
15.7. Raising of /æ/ before nasals and /g/ . . . 221

16. New England . . . 225

16.1. New England in earlier Atlas studies . . . 225
16.2. Vocalization of /r/ . . . 226
16.3. The contrasts of /ohr/ and /ɔhr/ in New England . . . 226
16.4. The low back merger in Eastern New England . . . 228
16.5. The fronting of /ahr/ and /ah/ . . . 228
The fronting of /ah/ . . . 230
The distribution of the /ah/ ~ /o/ distinction in Eastern New England 230
The east–west New England line . . . 230
16.6. The conservative position of Providence . . . 230
16.7. Short-*a* systems . . . 232

17. New York City and the Mid-Atlantic states . . . 233

17.1. New York City . . . 233
17.2. The Mid-Atlantic states . . . 236
Baltimore . . . 238
An intermediate short-*a* system: Trenton and environs . . . 238

18. The South . . . 240

18.1. Earlier studies of the South . . . 240
18.2. Relics of older Southern phonology . . . 241
18.3. The Southern Shift . . . 242
Internal conditioning of the Southern Shift . . . 253
18.4. The Back Upglide Shift . . . 254
18.5. Overall view of the South . . . 256
18.6. Southern Shift vowel systems . . . 256
18.7. The Charleston dialect . . . 259
18.8. The City of New Orleans dialect . . . 260
18.9. Atlanta . . . 261
18.10. Settlement history of the Inland South . . . 261

19. The Midland . . . 263

19.1. Geographic distribution of Midland features . . . 263
The fronting of /ow/ . . . 263
Glide deletion in the Midland . . . 266
The fronting of /ʌ/ in the Midland . . . 266
19.2. The Midland vowel systems: Columbus and Kansas City . . . 266
19.3. Pittsburgh . . . 271
The low back merger in Pittsburgh . . . 271
The Pittsburgh chain shift . . . 271
Glide deletion of /aw/ in Pittsburgh . . . 273
19.4. Cincinnati . . . 275
19.5. St. Louis . . . 276

20. The West . . . 279

20.1. The definition of the West . . . 279
The fronting of /ow/ in the West . . . 279
/aw/ in the West . . . 279
Southern features in the West . . . 279
The DARE subdivisions of the West . . . 284
20.2. The position of the West among North American dialects . . . 284
20.3. The merger of vowels before /l/ . . . 285

Part F Other views of regional differences

21. Lexical and grammatical maps . . . 289

21.1. Terms for 'carbonated beverage' . . . 289
21.2. /u/ and /uw/ in *roof* . . . 291
21.3. The geographical distribution of positive *anymore* . . . 293
21.4. *needs* with past participle *needs*+PPtc . . . 293

22. African-Americans . . . 297

22.1. Ongoing mergers in the African-American community . . . 297
22.2. Acoustic analysis of African-American speech . . . 299
22.3. Comparison with rural and small town African-American speakers 301

23. The findings of the Atlas of North American English: An overview . . . 303

How successful is the ANAE sampling method? . . . 303
The definition of dialects on the basis of sound changes in progress 303
The major new findings of ANAE . . . 303
Directions of change in progress . . . 304
Unexpected findings and unsolved problems . . . 304

References . . . 307
Index of subjects, city names, and persons . . . 314

List of maps, figures, and tables

1. Maps

Map 1.1. The dialect divisions of the Eastern United States 5
Map 1.2. Linguistic Atlas Projects of the United States, 1931–1998 . . . 6

Map 7.1. *r*-vocalization in the eastern United States 48

Map 8.1. The merger of /hw/ and /w/ 50
Map 8.2. The merger of /ohr/ and /ɔhr/ 52
Map 8.3. The merger of /iw/ and /uw/ 55
Map 8.4. The merger of /ey, e, æ/ before intervocalic /r/ 56

Map 9.1. The low back merger 60
Map 9.2. Resistance to the low back merger 61
Map 9.3. The relative advance of production and perception in the low back merger 63
Map 9.4. The development of the low back merger from the 1930s to the end of the twentieth century 66
Map 9.5. The merger of /i/ and /e/ before nasals 68
Map 9.6. Merger of /u/ and /uw/ before /l/ 70
Map 9.7. Merger of /i/ and /iy/ before /l/ 71

Map 10.1. The relative height (F1) of /i/ in *bit*, *hid*, etc. 78
Map 10.2. The relative fronting and backing (F2) of /i/ in *bit*, *hid*, etc. . . 79
Map 10.3. The relative height (F1) of /e/ in *bet*, *bed*, etc. 80
Map 10.4. The relative fronting and backing (F2) of /e/ in *bet*, *bed*, etc. 81
Map 10.5. The relative height of /æ/ in *bat*, *bad*, etc. 82
Map 10.6. The relative fronting and backing of /æ/ in *bat*, *bad*, etc. 83
Map 10.7. The relative height of /æ/ before nasals in *man*, *ham*, *Spanish*, etc. 84
Map 10.8. The relative fronting and backing of /æ/ before nasals in *man*, *ham*, *Spanish*, etc. 85
Map 10.9. The relative height of /o/ in *hot*, *god*, etc. 86
Map 10.10. The relative fronting and backing of /o/ in *hot*, *god*, etc. 87
Map 10.11. The relative height of /ʌ/ in *but*, *run*, etc. 88
Map 10.12. The relative fronting and backing of /ʌ/ in *but*, *run*, etc. 89
Map 10.13. The relative height of /u/ in *put*, *good*, etc. 90
Map 10.14. The relative fronting and backing of /u/ in *put*, *good*, etc. . . . 91
Map 10.15. The relative height of /iy/ in *seat*, *seed*, *see*, etc. 92
Map 10.16. The relative fronting and backing of /iy/ in *seat*, *seed*, *see*, etc. 93
Map 10.17. The relative height of /ey/ in *bait*, *made*, *may*, etc. 94
Map 10.18. The relative fronting and backing of /ey/ in *bait*, *made*, *may*, etc. 95
Map 10.19. The relative height of /ay/ in *wide*, *buy*, etc. 96
Map 10.20. The relative fronting and backing of /ay/ in *bite*, *wide*, *buy*, etc. 97
Map 10.21. The relative height of /oy/ in *voice*, *oil*, *boy*, etc. 98
Map 10.22. The relative fronting and backing of /oy/ in *voice*, *oil*, *boy*, etc. 99
Map 10.23. The relative height of /Tuw/ in *soon*, *too*, *do*, etc. 100
Map 10.24. The relative fronting and backing of /Tuw/ in *soon*, *too*, *do*, etc. 101
Map 10.25. The relative height of /Kuw/ in *boot*, *move*, etc. 102
Map 10.26. The relative fronting and backing of /Kuw/ in *root*, *move*, etc. 103
Map 10.27. The relative height of /ow/ in *boat*, *road*, *go*, etc. 104
Map 10.28. The relative fronting and backing of /ow/ in *boat*, *road*, *go*, etc. 105
Map 10.29. The relative height of /aw/ in *out*, *loud*, *now*, etc. 106
Map 10.30. The relative fronting and backing of /aw/ in *out*, *loud*, *now*, etc. 107
Map 10.31. The relative height of /oh/ in *caught*, *cause*, *law*, etc. 108
Map 10.32. The relative fronting and backing of /oh/ in *caught*, *cause*, *law*, etc. 109
Map 10.33. The relative height of /ahr/ in *bar*, *card*, etc. 110
Map 10.34. The relative fronting and backing of /ahr/ in *bar*, *card*, etc. 111
Map 10.35. The relative height of /ɔhr/ in *short*, *cord*, *for*, etc. 112
Map 10.36. The relative fronting and backing of /ohr/ in *short*, *cord*, *for*, etc. 113
Map 10.37. Difference in height of /ay/ before voiced and voiceless consonants 114
Map 10.38. Difference in height of /aw/ before voiced and voiceless consonants 115

Map 11.1. The geographic relation of the low back merger to short-*a* configurations 122
Map 11.2. Three mechanisms for avoiding the low back merger 123
Map 11.3. Stage 1 of the Southern Shift: glide deletion of /ay/ 126
Map 11.4. Stages 2 and 3 of the Southern Shift 128
Map 11.5. Monophthongization before voiceless consonants 129
Map 11.6. Structure of the South by dialect levels 131
Map 11.7. Three dialects in the low back merger area: Canada, Eastern New England, and Western Pennsylvania 132
Map 11.8. The outer limits of the North 134
Map 11.9. The Midland and the Mid-Atlantic regions 136
Map 11.10. Defining the West 138
Map 11.11. The Southeastern super-region 139
Map 11.12. The Northeast 140
Map 11.13. The North Central and transitional areas 142
Map 11.14. The North/Midland boundary and linked movements of /ʌ/ and /ow/ 144
Map 11.15. An overall view of North American dialects 148
Map 11.16. Comparison of the ANAE dialect boundaries with Carver's lexical boundaries based on DARE 150

Map 12.1. Fronting of /uw/ after coronals (Tuw) 154
Map 12.2. Fronting of /uw/ after non-coronals (Kuw) 156
Map 12.3. The fronting of /ow/ in North America 158
Map 12.4. The geographic distribution of /aw/ 159
Map 12.5. The relative frontness of /aw/ and /ay/: The AWY line 161
Map 12.6. The status of /iw/ 162
Map 12.7. Fronting of /uw/ before /l/ 164

Map 13.1. Front–back position and phonemic status of /o/ in North American dialects 170
Map 13.2. Relations of /o/ and /ah/ in North America 171
Map 13.3. Differences in height between allophones of /æ/ before nasals and elsewhere in North American dialects 176
Map 13.4. Geographic distribution of Northern and Southern breaking 179
Map 13.5. Short-*a* systems in North America 182

Map 14.1. The relative fronting of /aw/ and /ay/ and the AWY line . . . 188
Map 14.2. The ON line 189
Map 14.3. Thematic map of the raising of /æ/ 193
Map 14.4. The raising of /æ/ 194
Map 14.5. The fronting of /o/ 196
Map 14.6. The EQ measure in the Inland North 200
Map 14.7. The ED measure of the Northern Cities Shift 201
Map 14.8. The backing of /ʌ/ and the UD measure 203
Map 14.9. Inland North features combined 204
Map 14.10. Canadian raising of /ay/ 206
Map 14.11. A detailed view of the cities of the Inland North and the relation of eight isoglosses to the North–Midland boundary 207
Map 14.12. Northern features in Western New England 213

Map 15.1. *above* The low back merger before nasals in Canada 218
Map 15.2. *below* The low back merger before /t/ in Canada 218
Map 15.3. *above* The merger of /e/ and /æ/ before intervocalic /r/ 219
Map 15.4. *below* The Canadian Shift 219
Map 15.5. *above* Canadian raising 222
Map 15.6. *below* Fronting of /ahr/ in the Atlantic Provinces 222
Map 15.7. Inland Canada 224

Map 16.1. *r*-vocalization in Eastern New England 227
Map 16.2. The distinction between /ohr/ and /ɔhr/ in Eastern New England 227
Map 16.3. The low back merger in New England 229
Map 16.4. Fronting of /ahr/ in Eastern New England 229
Map 16.5. Fronting of /ah/ in Northeastern New England 231
Map 16.6. The conservative treatment of back upgliding vowels in Providence 231
Map 16.7. The New England short-*a* system 232

Map 17.1. New York City and the Mid-Atlantic short-*a* systems 233

Map 18.1. Relics of older Southern phonology 243
Map 18.2. Percent glide deletion of /ay/ 245
Map 18.3. The South defined by glide deletion of /ay/ before voiced and voiceless consonants 246
Map 18.4. The geographic diffusion of /ay/ glide deletion in the southeastern U.S. 247
Map 18.5. The second stage of the Southern Shift 249
Map 18.6. The third stage of the Southern Shift 250
Map 18.7. Glide deletion of /oy/ 252
Map 18.8. The Back Upglide Chain Shift 255
Map 18.9. Overview of the South 257

Map 19.1. The low back contrast in the Midland 264
Map 19.2. The fronting of /ow/ in the Midland 265
Map 19.3. The fronting of /aw/ in the Midland 267
Map 19.4. Glide deletion of /ay/ in the Midland 268
Map 19.5. The fronting of /ʌ/ 269
Map 19.6. Glide deletion of /aw/ in North America 274

Map 20.1. The West and its neighbors 280
Map 20.2. Differential fronting of /ow/ within the West 281
Map 20.3. Fronting of /aw/ in the West 282
Map 20.4. Glide deletion of /ay/ in the Southwest 283
Map 20.5. Lexical subdivisions of the West 284

Map 21.1. Geographic distribution of terms for ‘carbonated beverage’ 290
Map 21.2. The distribution of /u/ and /uw/ in *roof* 292
Map 21.3. Geographic distribution of positive *anymore* 294
Map 21.4. Geographic distribution of the *needs*+PPtc construction . . . 295

Map 22.1. Distribution of African-American subjects 298

2. Figures

Figure 1.1. DARE map, with state areas proportional to population 7

Figure 3.1. Peripheral and non-peripheral tracks in English phonological space 16
Figure 3.2. Location of initial position vowels in acoustically defined space 16
Figure 3.3. Directions of movement in chain shifts along peripheral and non-peripheral tracks 16
Figure 3.4. The articulatory space of North American English vowels . . 17
Figure 3.5. Peripheral and non-peripheral tracks in the mean file diagram of 14 vowels for the 22 dialects defined in Chapter 11 17
Figure 3.6. Movements across and within subsystems in the Southern Shift and Back Upglide Shift 19
Figure 3.7. Movements along peripheral and non-peripheral tracks in the Southern Shift 19
Figure 3.8. The Canadian Shift 19

Figure 4.1. Age distribution of Telsur speakers in the five largest regions 28
Figure 4.2. Distribution of Telsur speakers by gender and age 28
Figure 4.3. Regional variants of the Telsur interview form 28

Figure 5.1. Format of data token 39

Figure 6.1. Constraints on isogloss construction 42

Figure 8.1. Back vowels before /r/ in the vowel system of Alex S., 42 51
Figure 8.2. Back vowels before /r/ in the vowel system of Judy H., 57 53
Figure 8.3. Back upgliding vowels of Lillian S., 58 54

Figure 9.1. Perception of /o ~ oh/ minimal pairs by region compared to acoustic distance 62
Figure 9.2. Production of /o ~ oh/ minimal pairs by region compared to acoustic distance 62
Figure 9.3. The low back merger in Indianapolis and Columbus 64
Figure 9.4. Vowels before /l/ in the system of Henry K., 61 69
Figure 9.5. Vowels before /l/ in the system of Horace P., 43 72
Figure 9.6. Vowels before /l/ in the system of Belle M., 61 72
Figure 9.7. Vowels before /l/ in the system of Sheldon M., 31 73

Figure 11.1. The Northern Cities Shift 121
Figure 11.2. The Southern Shift 125
Figure 11.3. The Back Upglide shift 127
Figure 11.4. The Canadian Shift 130
Figure 11.5. Mean values for the fronting of /uw/ after coronals and the fronting of /ow/ for North American regions 145
Figure 11.6. Mean values for the fronting of /uw/ after coronals and the fronting of /ow/ for North American dialects 145
Figure 11.7. Scattergram of first two principal components of mean values of 21 vowel measures for 439 Telsur subjects 146
Figure 11.8. Scattergram of first two principal components of mean values of 21 vowel measures for 13 regions and dialects . . 147
Figure 11.9. Hierarchical structure of North American dialects 147

Figure 12.1. Distribution of F2 of /uw/ for all of North America 152
Figure 12.2. Distribution of F2 of /uw/ not before /l/ for all of North America 152
Figure 12.3. Distribution of F2 of /uw/: not before /l/ for all of North America 153
Figure 12.4. Distribution of /ow/ vowels for all of North America 155
Figure 12.5. Distribution of /ow/ tokens not before /l/ for all of North America 155
Figure 12.6. Mean values for the fronting of /uw/ after coronals and the fronting of /ow/ for North American regions 157
Figure 12.7. Second formant of /Tuw/ and /uw/ before /l/ by Region . . . 163
Figure 12.8. Absence of Vw fronting in vowel system of Alex S., 42 . . . 165
Figure 12.9. Canadian pattern of /Tuw/ fronting in vowel system of Lena M., 34 165
Figure 12.10. Western pattern of Vw fronting in system of Ira H., 55 165
Figure 12.11. Fronting of all Vw in the vowel system of Danica L., 37 . . 166
Figure 12.12. Conservative /ow/ in the vowel system of Alice R., 32 166
Figure 12.13. /iw/ distinct from /uw/ in the vowel system of Matthew D., 45 166
Figure 12.14. Fronting of all /Tuw, Kuw, iw/ in the vowel system of Fay M., 34 167
Figure 12.15. Fronting of /uwl/ in the vowel system of Mary K., 71 167
Figure 12.16. Meanfile diagram of Vw vowels for 22 dialects 168

Figure 13.1 a, b The distinction between /ah/ and merged /o, oh/ in the vowel system of Denise L., 21 172
Figure 13.2. Distinction between /o/ and /ah/ in the NYC system of Pat M., 48 172
Figure 13.3. Short-*o* configurations 173
Figure 13.4. Following environments for /æh/ class in New York City and Philadelphia 173
Figure 13.5. Split /æ/–/æh/ system of Nina B., 62 174
Figure 13.6. Split /æ/–/æh/ system of Rosanne V., 30 174
Figure 13.7. Low vowels of Dana L., 21 174
Figure 13.8. The nasal short-*a* configuration in the vowel system of Danica L., 35 175
Figure 13.9. Raised /æ/ system of Randall R., 24 175
Figure 13.10. Formant trajectories for lax *sack* of Rosanne V., 30 177
Figure 13.11. Formant trajectories for ingliding tense vowel in *pants* of Sharon K., 35 177
Figure 13.12. Formant trajectories for broken /æ/ in *that* of Sharon K., 35 177
Figure 13.13. Formant trajectories for broken /æ/ in *sad* of Joseph K., 53 178
Figure 13.14. Distribution of broken short-*a* vowels by region 178
Figure 13.15. Spectrogram and formant trajectory for Southern breaking of nucleus of *pants*, spoken by Thelma M., 31 178
Figure 13.16. Southern breaking of /æ/ in spectrogram and formant trajectories for *past*, Thelma M. 178
Figure 13.17. Four short-*a* tokens for Thelma M. with Southern breaking 180
Figure 13.18. Continuous short-*a* system of Lorraine K., 35 180
Figure 13.19. Relative advance of /g/ over /d/ in the short-*a* system of Duncan D., 29 180
Figure 13.20. Merger of /æg/ and /ey/ in vowel system of Jan X., 14 181
Figure 13.21. F1(æ) Regression coefficients for F1 means of /æ/ by region, place and manner of coda 183
Figure 13.22. Regression coefficients for F1 of /æ/ by place, manner and voice for /g/ > /d/ area of Map 13.4 vs. all others 183

Figure 14.1. The Northern Cities Shift 190
Figure 14.2. Stages 1 and 2 of the Northern Cities Shift by age and social class in Detroit 190
Figure 14.3. Vowel system of Carol M., 16 [1968], Evergreen Park 191
Figure 14.4. Vowel system of Mike S., 18 [1968], Chicago 191
Figure 14.5. Regression coefficients for raising of /æ/ along the front diagonal in the North [N = 3619] and elsewhere 195
Figure 14.6. Regression coefficients for the second formant of /o/ for the North [N = 3354] and elsewhere 195
Figure 14.7. Regression coefficients for the second formant of /e/ for the North [N = 2918] and elsewhere 197
Figure 14.8. Relative positions of F1 and F2 of /e/ and /æ/ 198
Figure 14.9. Quadrant 1 NCS vowels for Beatrice S., 62 198
Figure 14.10. Quadrant 2 NCS vowels for TS 55, James W., 78 198
Figure 14.11. Quadrant 2 NCS vowels for TS 115, Steve A., 43 198
Figure 14.12. Quadrant 3 NCS vowels for TS 359, Sharon K., 35 198
Figure 14.13. Quadrant 3 NCS vowels for TS 3, Martha F., Kenosha, WI 199
Figure 14.14. Regression coefficients for backing of /ʌ/ in the North and elsewhere 202
Figure 14.15. Distribution of F2(o) – F2(ʌ) for all North [N = 119] and Midland [N = 79] speakers 202
Figure 14.16. Vowel system of James W., 78 208
Figure 14.17. Vowel system of Steve A., 43 209
Figure 14.18. Vowel system of Martha F., 28 209

Figure 14.19. Vowel system of Sharon K., 35 210
Figure 14.20. Vowel system of Libby R., 42 210
Figure 14.21. Vowel system of Joanna R., 14 211
Figure 14.22. Vowel system of Jesse M., 57 212
Figure 14.23. NCS in the vowel system of Phyllis P., 63 214
Figure 14.24. Settlement patterns based on house building practices 215

Figure 15.1. The Canadian Shift 220
Figure 15.2. Distribution of F1/F2 means for ten regions 220
Figure 15.3. Central position of /ahr/ in system of David B., 35 221
Figure 15.4. Short-*a* pattern of Cindy M., 26 223

Figure 16.1. The regions of New England 225
Figure 16.2. The /ohr/ ~ /ɔhr/ distinction of Joseph T., 42 226
Figure 16.3. Low back distinction of /o/ and /oh/ for Alex S., 42 228
Figure 16.4. Low vowels of Adrienne M., 75 230
Figure 16.5. Short-*a* system of Natalie M., 45 232

Figure 17.1. Short vowels of Nancy B., 65 234
Figure 17.2. Vy and Vw vowel systems of Nancy B., 65 234
Figure 17.3. Long and ingliding vowels of Nancy B., 65 235
Figure 17.4. Stylistic stratification of long and ingliding vowels for Florence O., 70 235
Figure 17.5. The differentiation of /o/ and /oh/ in vowel system of Florence O., 70 236
Figure 17.6. Vowels before /r/ for Pat M., 48 236
Figure 17.7. Back upgliding vowels of Rosanne V., 30 237
Figure 17.8. Front upgliding subsystem of Rosanne V., 30 237
Figure 17.9. Long and ingliding vowels of Rosanne V., 30 238
Figure 17.10. Backing of /er/ and fronting of /ʌr/ for Rosanne V., 30 . . . 238
Figure 17.11. Ingliding vowel subsystem of Mark D., 43 239
Figure 17.12. Short-*a* system of Peg M., 66 239

Figure 18.1. Back chain shift before /r/ 242
Figure 18.2. Parallel fronting of back upgliding vowels 242
Figure 18.3. The Southern Shift 244
Figure 18.4. Superposition of /iy, ey, ay, oy/ normalized means for 402 Telsur speakers 248
Figure 18.5. Means of Vy vowels for 21 dialects 251
Figure 18.6. Distribution of the Stage 2 measure, F2(e) – F2(ey) + F1(ey) – F1(e) 253
Figure 18.7. The Southern Shift in the system of Thelma M., 31 256
Figure 18.8. The fronting of back upgliding vowels in the system of Thelma M., 31 258
Figure 18.9. Back upglide shift in the vowel system of Thelma M., 31 . . 258
Figure 18.10. Nuclei, medial and final glides of /æw/ in vowel system of Thelma M., 31 258
Figure 18.11. The Southern Shift in the vowel system of Lucy C., 34 . . . 259
Figure 18.12. Vowel system of Peggy C., 40 259
Figure 18.13. Front upgliding vowels of Edith G., 38 260
Figure 18.14. Long and ingliding vowels of Edith G., 38 260
Figure 18.15. Vowel system of Malcolm C., 27 261
Figure 18.16. Distribution of half-dovetail log notching in the South 262

Figure 19.1. Low short vowels of Danica L., 37 270
Figure 19.2. Back upgliding vowels of Danica L., 37 270
Figure 19.3. Fronting of /ʌ/ in the vowel system of Danica L., 37 270
Figure 19.4. Low short vowels of Sonya O., 40 271
Figure 19.5. Back upgliding vowels of Sonya O., 40 271
Figure 19.6. The Pittsburgh chain shift 272
Figure 19.7. The Pittsburgh chain shift in the vowel system of Kenneth K., 35 272
Figure 19.8. Mean values of low vowels for 20 dialects 272
Figure 19.9. Glide deletion of /aw/ and lowering of /ʌ/ for Henry K., 61 273
Figure 19.10. Durations in ms. of monophthongal /aw/ and /ʌ/ for Henry K., 61 275
Figure 19.11. The back chain shift before /r/ in the vowel system of Cecila S., 62 275
Figure 19.12. Low vowels of George K., 61 275
Figure 19.13. Low vowels of Lucia M., 58 276
Figure 19.14. The corridor from St. Louis to Chicago along Interstate Highway I-55 276
Figure 19.15. Back vowels before /r/ for Judy H., 57 277
Figure 19.16. Back vowels before /r/ for Joyce H., 53 277
Figure 19.17. Back vowels before /r/ for Martin M., 48 278
Figure 19.18. Back vowels before /r/ for Rose M., 38 278
Figure 19.19. Northern Cities Shift in the vowel system of Martin H., 48 278
Figure 19.20. Mean vowel positions for Martin H., 48 278

Figure 20.1. The position of the West among North American dialects . . 284
Figure 20.2. The Western vowel system of Ernest P., 24 285
Figure 20.3. High vowels before /l/ for Jessie M., 23 285
Figure 20.4. High vowels before /l/ of Kate A., 14 286

Figure 21.1. Distribution of *pop* for ‘carbonated beverage’ in DARE . . . 291
Figure 21.2. Distribution of *soda*, *pop* and *coke* in an internet survey . . 291
Figure 21.3. DARE informants who use positive *anymore* sentences . . . 293

Figure 22.1a. Vowel system of Kathy F., 46 300
Figure 22.1b. Vowel system of Daniel W., 46 300
Figure 22.2a. Vowel system of Elizabeth C., 40 300
Figure 22.2b. Vowel system of Linda B., 35 301

3. Tables

Table 1.1. Achievements of Linguistic Atlas Projects in the United States 6

Table 2.1. Phonemes of American English in broad IPA notation 11
Table 2.2. The North American vowel system 12
Table 2.3. Keywords for the phonemes of Table 2.2. 12
Table 2.4. Wells’ view of “General American” vowel classes 13
Table 2.5. Initial position for vowels before intervocalic /r/ 14
Table 2.6. Initial position for vowels before tautosyllabic /r/ 15

Table 4.1. Population by social class in selected cities 23
Table 4.2. National ancestral groups identified in first response to Telsur questionnaire 24

Table 4.3. Percentage of outcomes of dialing the telephone in five cities or regions . . . 26
Table 4.4. Percentages of refusal and success in obtaining interviews 26
Table 4.5. Age distributions of Telsur speakers . . . 28
Table 4.6. Distribution of Telsur speakers by gender and age . . . 28

Table 7.1. Regression analysis of *r*-constriction in formerly *r*-less areas 48

Table 9.1. Distribution of open-*o* classes in North American English by following segment . . . 58
Table 9.2. Isogloss parameters for the low back merger . . . 59
Table 9.3. Age coefficients for the low back merger by region . . . 59
Table 9.4. Distribution of asymmetrical low back merger reports within and outside the low back merger area . . . 64
Table 9.5. Distribution of minimal pair responses for allophones of /o/ and /oh/ in Indianapolis and Columbus . . . 64
Table 9.6. Distribution of pronunciation and judgments of the contrast of /i/ and /e/ before nasals . . . 67
Table 9.7. Isogloss parameters for the low back merger . . . 67
Table 9.8. Regression coefficients for the merger of /i/ and /e/ before /n/ 67
Table 9.9. Distribution of /il/ ~ /iyl/ and /ul/ ~ /uwl/ contrasts . . . 69
Table 9.10. Minimal pair judgments for 14 Pittsburgh subjects . . . 72

Table 11.1. Mean formant values of /o/ and /oh/ for three regions resistant to the low back merger . . . 125
Table 11.2. Age coefficients for /ʌ/ and /ow/ in the North and Midland 143
Table 11.3. Aggregate populations of Metropolitan Statistical Areas (MSAs) represented in the Telsur sample (in thousands) . . . 149

Table 12.1. Regression coefficients for F2 of /uw/ for all of North America . . . 153
Table 12.2. Regression analysis of F2 of /uw/ of vowels not before /l/ by region . . . 153
Table 12.3. Regression coefficients for F2 of /uw/ and /ow/ for all of North America . . . 155
Table 12.4. Regression analysis of F2 of /ow/ of vowels not before /l/ by region . . . 157
Table 12.5. Isogloss parameters for the AWY line and /aw/ < 1500 line 160
Table 12.6. Regression analysis of F2 of /aw/ by region . . . 160
Table 12.7. Regression analysis of F2 of /uw/ before /l/ in the South . . . 163

Table 13.1. Distribution of low back rounded forms of /o/ . . . 169

Table 14.1. Distribution of Inland North Telsur subjects by gender, education, and age . . . 191
Table 14.2. Regression coefficients for raising of /æ/ along the front diagonal in the North [N = 3619] and elsewhere . . . 195
Table 14.3. Regression coefficients for the second formant of /o/ for the North [N = 3354] and elsewhere . . . 195
Table 14.4. Regression coefficients for the second formant of /e/ for the North [N = 2918] and elsewhere . . . 197
Table 14.5. Regression coefficients for the second formant of /ʌ/ for the North [N = 1794] and elsewhere [N = 5122] . . . 199
Table 14.6. Social parameters of NCS variables for the Inland North based on vowel tokens . . . 211
Table 14.7. Social parameters of NCS variables for the Inland North based on mean values for individual speakers [N = 72] . . . 212

Table 15.1. Age coefficients for the vowels involved in the Canadian Shift . . . 221
Table 15.2. Cartesian distance between /æ/ before nasals and elsewhere by province . . . 223

Table 18.1. Mean age by number of distinctions made for three relic variables by 100 Southern subjects . . . 242
Table 18.2. Numbers of Southern speakers who are consistently the same or different in perception and production for three relic variables . . . 242
Table 18.3. Regression coefficients for the first two stages of the Southern Shift . . . 253
Table 18.4. Addition of geographic factor “Inland South” to Table 18.3 253
Table 18.5. Significant regression coefficients for internal factors for three elements of the Southern Shift. . . . 253
Table 18.6. Number and percentages of inglides recorded for /o/ by region . . . 254

Table 19.1. Social factors from the regression analysis of fronting of /ow/ in the Midland . . . 266
Table 19.2. Social factors in the regression analysis of fronting of /aw/ in the Midland . . . 266
Table 19.3. /ay/ tokens of Roger W., 39 . . . 266
Table 19.4. Mean F1 of /ʌ/ by dialect . . . 272
Table 19.5. Occurrences of glide deletion of /aw/ outside of Pittsburgh . . 273
Table 19.6. Populations studied in the St. Louis corridor . . . 277

Table 21.1. Isogloss parameters for four ‘carbonated beverage’ isoglossses . . . 291
Table 21.2. Isogloss parameters for the /u/ in *roof* boundary . . . 293
Table 21.3. Isogloss parameters for two Midland grammatical features . . 296

Table 22.1. Comparison of Whites and African-Americans for minimal pairs and *r*-vocalization in six cities of the South and four outside of the South . . . 299
Table 22.2. Percent realization of phonological features of Southern English for Whites and African-Americans . . . 302

Abbreviations

ANAE	*Atlas of North American English*
DARE	Cassidy 1985–, *Dictionary of American Regional English*
AE1	The isogloss defining systems with F1(æ) < 700 Hz
AWY	The isogloss defining systems with the nucleus of /aw/ backer than /ay/
AYM	The isogloss defining the South with glide deletion of /ay/ before obstruents
CA	Canada
CS	Charleston
ED	The isogloss defining systems with close approximation of /e/ and /o/ on the front-back dimension: F2(e) – F2(o) < 375 Hz
ENE	Eastern New England
EQ	The isogloss defining systems with /e/ higher and fronter than /æ/
F1	first formant, an acoustic measure corresponding to vowel height
F2	second formant, an acoustic measure corresponding to vowel fronting
FL	Florida
Hz	Hertz
IN	Inland North
LAGS	*Linguistic Atlas of the Gulf States*
LAMSAS	*Linguistic Atlas of the Middle and South Atlantic States*
LANE	*Linguistic Atlas of New England*
LYS	Labov, Yaeger, and Steiner 1972, *A Quantitative Study of Sound Change in Progress*
M	Midland
MA	Mid-Atlantic
ms	milliseconds
N	North
NCS	Northern Cities Shift
NWNE	Northwestern New England
O2	The isogloss defining systems with fronted /o/: F2(o) > 1450 Hz
PEAS	Kurath and McDavid 1961, *The Pronunciation of English in the Atlantic States*
PI	Pittsburgh
SENE	Southeastern New England
SWNE	Southwestern New England
TS	Texas South
UD	The isogloss defining systems with /ʌ/ backer than /o/
W	West
WNE	Western New England
WPA	Western Pennsylvania

Part A Introduction and methods

1. Introduction

1.1. The scope and goals of this work

This *Atlas of North American English* [ANAE] is a record of the regional dialects of English spoken in the urbanized areas of the United States and Canada in the years 1992 to 1999.[1] It provides the first comprehensive view of the pronunciation and phonology of English across the North American continent. The Atlas builds on the work of American dialectologists from 1933 to the present, particularly the work of Hans Kurath and Raven McDavid in the Atlantic States. ANAE represents new departures in American dialectology in several respects: it provides information on perception as well as production, on acoustic measurements as well as impressionistic ratings, on the realization of phonemic categories as well as phonetic forms, and on phonological systems as well as individual phonemes. Most importantly, it provides a view of the systematic sound changes in progress that are responsible for increasing diversity among the regional dialects of North America.

The design of the Atlas is a response to the fact that traditional methods of sampling the United States produced only a fragmentary view of American linguistic geography. The methodical procedures of traditional dialect geography – the creation of a spatial grid, the training of field workers, the selection and interviewing of informants – were completed for the eastern United States, but for not more than a scattering of other states and areas. Furthermore, the conservative character of these methods in both sampling and analysis inhibited recognition of the vigorous linguistic changes taking place in large cities. Recent sociolinguistic studies show that extensive changes can go to completion within two or three generations.[2] It follows that a valid study of the phonology of the North American continent would have to be completed within five or ten years. Otherwise, the differentiation of regional dialects could not be distinguished from different temporal stages of a common process.

The Atlas is based upon the Telsur telephone survey (Chapter 4), which uses the technology of telephone interviewing to create a sample sensitive to both population and geography. The basic sample represents all urbanized areas of North America with a population of over 50,000; a number of smaller cities are added to achieve a more even geographic coverage. The total number of speakers of English represented is 68 percent of the population of North America (Table 11.2). This limitation to urbanized areas means that the Atlas contains no information on rural and small town areas that are important to an understanding of the development of North American English; such enclaves as Martha's Vineyard, or the Outer Banks of North Carolina, or the rural southeastern area of Ohio are not represented. The Atlas view of any one urbanized area is limited to a small number of speakers – two in most cases – so that it cannot be considered definitive for any one community. A sample of two or three speakers for a given city cannot reveal the social differentiation of linguistic variables, although it may show that the city is representative of a larger region. For these larger regions, the diversity of age and education in the speakers sampled will provide a limited report on social differentiation. The Atlas is designed to produce an overall view of regional patterns that will guide and stimulate local studies to provide a more detailed view of the sociolinguistic and geographic variation in a given area.[3]

Given the mobility and diversity of the American population, it seems unlikely that the Telsur sampling procedure would produce clear regional patterns. In 1990, 39.2 percent of the U.S. population was born in a different state from the one in which they then lived, with considerable variation by state (from Pennsylvania, at 19.8 percent to Nevada, at 78.2 percent).[4] In some areas, Atlas interviewers had to contact a great many individuals to find one local person (Chapter 4). Moreover, the speakers who are the targets of the Telsur survey are in frequent contact with people born in other areas, and it might seem that such interaction would lead to leveling and confusion of local dialect patterns. One might therefore want to limit the search to relatively isolated individuals who have had minimal contact with outsiders. Nevertheless, the Atlas design is based on the premise that the first two local residents to answer their telephones – people who were born or raised in the speech community – could be taken to represent adequately the linguistic pattern of that community. It was proposed to the funding agencies – NSF, NEH, and Nortel – that such a telephone inquiry would yield coherent geographic patterns, rather than a random mixture of traits derived from a variety of dialects in contact. In fact, the Atlas data does show clearly defined and relatively homogeneous patterns of regional distribution of phonological and phonetic features. This can be seen most clearly in the maps of Chapter 10, which display unselected geographic distributions of formant values for all vowels. These and other maps to follow will allow users themselves to judge whether the Atlas strategy has succeeded in locating geographic patterns of interest.

If the ANAE sampling method has in fact succeeded, it must be asked, how is such success possible? Sociolinguistic studies of large cities like New York, Detroit, Memphis, or Philadelphia have shown that a minimum of 25 speakers is needed to give a clear record of the socio-economic stratification of linguistic variables, and 80 to 100 subjects are needed if gender and ethnic differentiation are to be considered as well. ANAE, however, is not a study of social variation within individual cities. The Atlas traces the geographic distribution of the dynamic patterns that determine the direction of change for the regional dialect, defined by the larger phonological or phonetic patterns that are common across it. Regional dialects like the North, South, West, or Midland are represented by fifty to several hundred speakers. Within these larger units, ANAE can trace social differentiation by gender, social class, and age, although the sampling of most cities is not large enough to detect these effects at the city level.

The Atlas focus upon linguistic changes in progress entails that the sample cannot be insensitive to age. Chapter 4 will elaborate the sampling procedure in this respect. The telephone numbers are not selected at random, but are chosen from names that are clearly identifiable with the major ethnic groups in that ur-

1 The work as a whole will be referred to as ANAE or "the Atlas." Earlier atlases of American English will be referred to by their abbreviations [LANE, LAMSAS, etc.].
2 As in New York City (Babbitt 1896; Labov 1966) and Philadelphia (Tucker 1944; Labov 1994).
3 A number of such local studies have been completed in recent years. See for example Fridland's studies of the Southern Shift in Memphis (1998, 1999) and Gordon's examination of the Northern Cities Shift in two small Michigan towns (2001).
4 U.S. Census State of Residence in 1990 by State of Birth: 1990 (90pob).

banized area. The final sample has a common age distribution across regions and gender (Tables 2.2–3), but an excess of women between 20 and 40, a product of a selection policy to include at least one woman in the 20 to 40 age range – the group that has generally been found to be in the forefront of change. Additional subjects were often interviewed to help fulfill this criterion, and it also governs the selection of subjects for acoustic analysis (439 out of 762) in the main sample.

In the North, the Midland, and the West, the Telsur sample is centered primarily on the Euro-American population of North America, the chief exponents of the active sound changes that define regional dialects. Only a few of the speakers in these areas are African-American or Latino. While African-American and Latino populations of many Northern cities are very large, and in some cases form the majority of the population, it has been consistently reported that they participate to only a limited extent in local and regional dialects (see Section 4.5.2). The most striking aspect of African-American Vernacular English is its supralocal character, so that the many studies of this dialect have found parallel results in New York, Philadelphia, Washington, Chicago, San Francisco, and Los Angeles. In the South, it is a different matter, and any representative sample of regional speech must include African-Americans. In the five largest Southern cities, the Telsur sample will allow us to compare local African-Americans with the Euro-American population (Chapter 22).

Finally, it should be noted that the Atlas is primarily a study of the stressed vowels of North American English, since it is the vowel patterns that differentiate regional dialects of English on this continent. There is data on the vocalization of tautosyllabic /r/, but not the vocalization of /l/, since the telephone signal does not give us reliable information on that process. Chapter 21 contains maps of grammatical and lexical variables. But the main focus of the Atlas is on the vowel systems of each region, and the mergers, splits, and chain shifts that are taking place within those systems.

The separation of linguistics and dialect geography

In the nineteenth century, the results of dialect geography were of major concern to historical linguists, and the relations of diffusion in time and diffusion in space were much discussed. This was partly the consequence of the reliance of the Neogrammarians on the evidence of dialect geography to support their view of the regularity of sound change (Osthoff and Brugmann 1878; Winteler 1976) and the use of dialect data in reactions against that view (Gilliéron 1918; Malkiel 1967; Labov 1994). But the link between dialect geography and general linguistics all but disappeared, and for the largest part of the nineteenth and twentieth centuries, dialect atlases were produced as works of reference without any immediate connection with the issues that concerned theoretical or descriptive linguistics. Many of the editors of dialect atlases took as their explicit goal the systematic compilation of data without reference to theoretical issues (e.g. Orton and Dieth 1962).

The separation of dialect geography from linguistic concerns is not unjustified. It responds in part to the desire of scholars to minimize the distortion of the data by theoretical preconceptions (Kretzschmar 2000: 280) and the conviction that the primary task of dialect geography is to present the data.

> The business of the linguistic atlas is to provide the evidence, not verdicts ... Those of us on the inside have a responsibility to get the data out, and this we will do, in time, as clearly, fully and objectively as possible. (McDavid et al. 1986: 404–05, cited in Kretzschmar 2000: 208)

It is now generally recognized that theory cannot be avoided so easily, and that theoretical assumptions are bound to enter into the design of the sample and the questionnaires. To the extent that dialect geography has addressed general issues, it has acted more as a branch of cultural history than of linguistics. The major aim of most dialect geographers has been to explain dialect patterns by settlement history (Haag 1898; Kurath 1949, 1972). Traditional dialect geography uses spatial diffusion to reconstruct the external history of the language, rather than its internal history.

The distance from linguistic issues is evident in the design of fieldwork procedures, which rarely take into account the Saussurian principle that language is not a set of forms, but a set of categorical oppositions. The interview schedules of traditional dialectology do not include questions about minimal or near-minimal pairs. One of the major changes taking place in North America is the low back merger – the unconditioned merger of the category /o/ in *cot*, *Don*, *stock* with the category /oh/ in *caught*, *dawn*, *stalk*. The Linguistic Atlas protocols, starting with LANE, do not ask subjects to give their pronunciations of any of these word pairs or their judgments on whether they were the same or different. To decide whether a given subject has the merger or not, it is necessary to make inferences from phonetic forms that were recorded for other purposes. We must therefore operate with the forms given for the words *law*, *salt*, *dog* and *oxen* in the maps of *The Pronunciation of English in the Atlantic States* (Kurath and McDavid 1961 [PEAS]).

The task of interpreting these data is not an easy one, because these words are not matched as minimal pairs, and differences in the consonantal environments may be responsible for any phonetic differences recorded. The number of PEAS maps designed to represent general phonological patterns is limited. The majority represent the lexical incidence of phonemes, data that are useful in tracing settlement patterns but of less value for determining the larger phonological patterns of North America.

An atlas is properly a work of reference and not a theoretical tract. One would hope that a successful atlas would be followed by a stream of analytical papers. But the substantial findings of Kurath (1949) and PEAS were not followed by many papers that built on the linguistic implications of their results. While dialect geographers have never been opposed to efforts to account for their data by linguistic or historical principles, the tasks of collecting, processing and classifying has taken precedence over interpretation. Kretzschmar notes with acute insight that "the failure of dialectologists to provide analysis of their materials has actually *prevented* publication of the data" (2000: 281), since reviewers of their proposals for funding did not necessarily share their priorities. He also notes that the greatest contribution of American dialectology has been through preliminary analyses published before most of the data were collected. The same can be said of the *Language and Culture Atlas of Ashkenazic Jewry* [LCAAJ] (Weinreich 1963).

The renewal of the connection

Among early counter-examples to the general avoidance of theoretical matters were studies of the dialect geography of Swiss German by Moulton (1960, 1962), strongly supporting Martinet's functional theories of sound change (1952, 1955). In 1963, S. J. Keyser published an insightful review of PEAS, which called attention to the value of data on dialect variation for theories of rule ordering.

The renewed connection between dialect geography and general linguistics was stimulated to a degree by the development of sociolinguistic research and the systematic study of variation within speech communities. The evidence of dialect geography was a major part of the program for developing an empirical foundation for the theory of language change by Weinreich, Labov, and Herzog (1968), drawing upon LCAAJ (Weinreich 1963; Herzog 1965).

This connection has been slow in realization. Sociolinguistic studies of large urban communities in the 1960s began with close attention to the stratification of linguistic variables by age, gender, social class, ethnicity, and network density. Most of these studies were of the largest city in the country or urban regions of more than a million in population: New York (Labov 1966), Panama City (Cedergren 1973), Sao Paolo (Tarallo 1983), Montreal (Sankoff and Sankoff 1973), Paris (Lennig 1978), Amman (Abdel-Jawad 1981), Belfast (Milroy and Milroy 1978), Teheran (Modaressi 1978), Seoul (Hong 1991; Chae 1995), Tokyo (Hibiya 1988), Cairo (Haeri 1996). These large cities have been found to have their own characteristic patterns of social and stylistic stratification; they influence the surrounding territory more than they are influenced by it. The relation of the city's dialect to neighboring speech communities was therefore not in focus. (An exception is Modaressi's adjoined study of the neighboring community of Ghazvin.)

The earliest sociolinguistic studies tended to examine the social correlates of isolated linguistic variables but more recent research has focused on structurally related parallel changes and chain shifts. The formulation of general principles governing such shifts was based on a review of long-term historical cases and the close study of a small number of changes in progress (Labov, Yaeger, and Steiner 1972 [LYS]; Labov 1994). LYS reported the Northern Cities Shift to be active in Chicago, Detroit, Buffalo, Rochester, and Syracuse. But it was not possible to say if this major chain shift involved a continuous territory or how it affected the intervening cities. The Southern Shift, moving in the opposite direction, was identified by studies in Knoxville, the Outer Banks, Birmingham, Atlanta, and central Texas, but there was then no clear indication of how far it extended and where – if anywhere – it confronted the Northern Cities Shift.

One of the most important problems in the study of such chain shifts is the explication of their internal mechanism. One theoretical issue concerns the distinction between a drag chain – motivated by a gap in phonological structure – and a push chain, motivated by a decrease in the margin of security between two phonemes. Studies of individual cities rely upon the evidence of age distributions in apparent time and scattered evidence from earlier studies in real time, but these arguments are often uncertain. Dialect geography offers a much clearer type of evidence, since the diffusion of a change outward typically shows the ordering of successive stages as a series of concentric rings around the originating center, with the initial change diffused most widely.

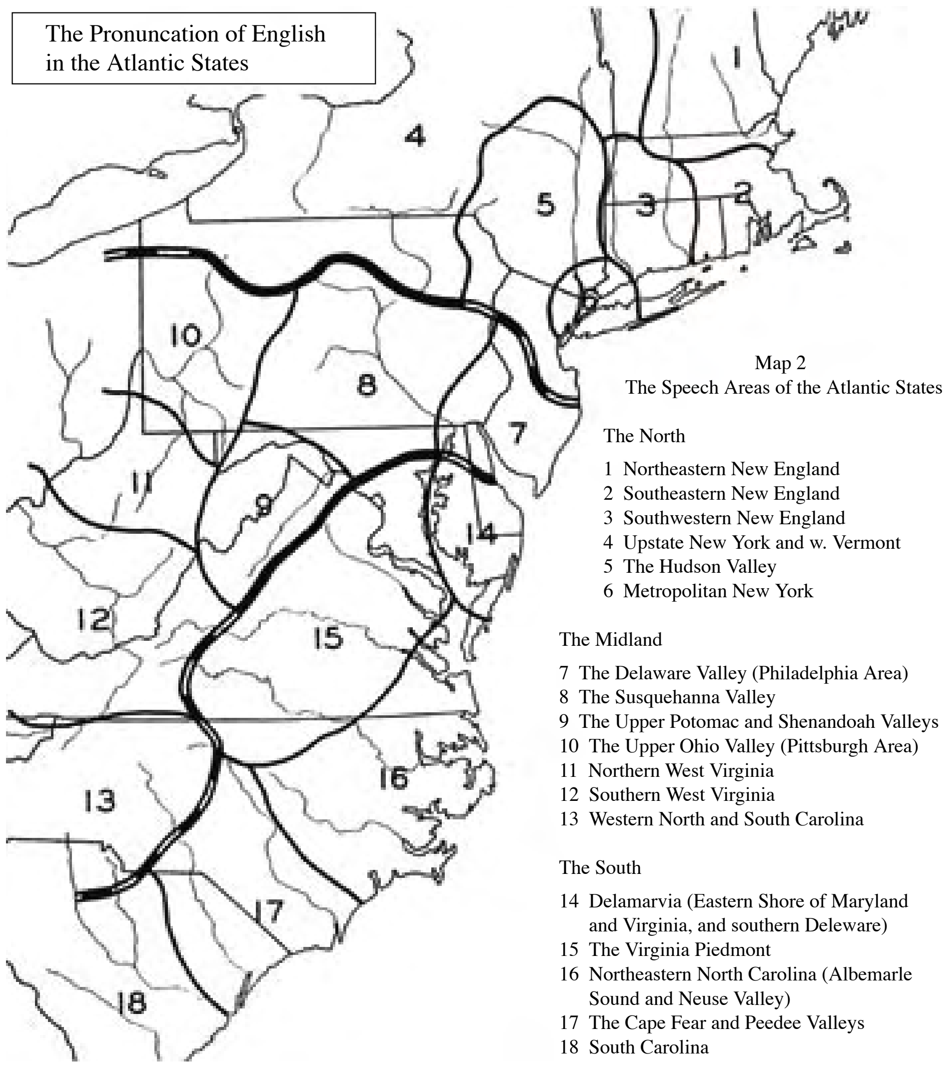
Dialect geography offers insight into the larger sociolinguistic setting of a change in progress. PEAS shows that (in the 1940s) all of the major cities of the Eastern Seaboard except Philadelphia and Baltimore had adopted the *r*-less pronunciation that was the London standard at the end of the eighteenth century. The sociolinguistic study of New York City (Labov 1966) began with a detailed examination of the effects of a reversal of this norm in favor of a constricted /r/ in formal speech, beginning apparently at the end of World War II. Informal observations indicated that similar trends could be found in Boston and Atlanta. But without a comprehensive re-study of the Eastern United States, it was impossible to say whether these events were local or national and whether they were driven everywhere by the same general forces (Chapter 7).

The Atlas results also bear upon the relative strength of internal and social factors in generating dialect patterns, the origin of regional differentiation and the relation of present-day boundaries to lines of communication. Atlas evidence is pertinent to many internal linguistic issues concerning the units of linguistic structure and their hierarchical relations. The Atlas will not attempt to explore these issues in detail, but it lays the the foundation for further studies that will strengthen the relations between dialect geography and linguistic theory.

1.2. A brief history of American dialect geography

The plan for mapping the dialects of North American English was first set in motion in the early 1920s, when the Linguistic Atlas of New England (Kurath et al. 1941, [LANE]) was initiated by a group of scholars that included some of the most prominent American linguists of the time. It was designed on the model followed by Romance dialectologists, specifically the methods of Jaberg and Jud (1928–1940). Field workers traveled to a pre-selected grid of communities, located informants who satisfied one of three demographic profiles, interviewed them with lengthy schedules that were organized loosely around semantic fields, and recorded their responses in an IPA notation modified to fit the phonetic features of the American vowel system. LANE was completed by the end of the decade, and its publications (Kurath and Bloch 1939; Kurath et al. 1941) are the most complete in the history of American dialectology. The detailed maps showed the actual phonetic form of the words and phrases representing the responses of informants.

LANE was followed by the Linguistic Atlas of the Middle and South Atlantic States [LAMSAS] under the direction of Hans Kurath, with a single field worker



Map 1.1. The dialect divisions of the Eastern United States (from Kurath 1949 and Kurath and McDavid 1961)

(first Guy Lowman, then Raven McDavid). The first publication was *A Word Geography of the Eastern United States* (Kurath 1949), which established the major and minor dialect divisions on the basis of regional vocabulary. Kurath replaced the traditional North/South/General American view of American dialects with a division of the eastern seaboard into Northern, Midland, and Southern regions.

Twelve years later, Kurath and McDavid (1961) published the corresponding volume dealing with phonetic forms, *The Pronunciation of English in the Atlantic States* [PEAS]. The basic map of Kurath 1949 was reproduced without change (and is here shown as Map 1.1). Systematic inventories of the phonetic realization of phonemes were provided for a selection of cultivated informants, while the maps showed the distribution of major variants of key words. The initial maps report pronunciations of key words that represent major word classes. The pronunciation of short-*o* words, for example, is represented by the variants used in the word *oxen* in Map 15. The legend of Map 15 appears as

○ [ɑ - ɑ$^{<}$ - a$^{>}$]
⏀ [ɑ$^{>}$]
● [ɑ - ɑ$^{>}$]
▲ [ɒ - ɔ] = /ɒ/

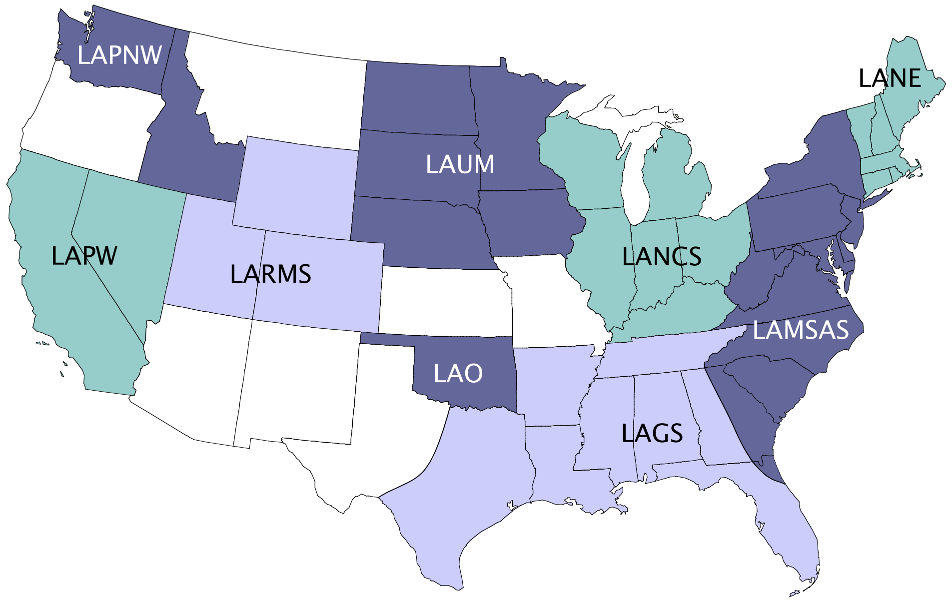
The open circle groups three low back to low central vowels; the barred circle identifies a backed version of the unrounded back vowel, one step backer than any of the three categories symbolized by the open circle; the solid circle indicates two further stages of backing, still unrounded; and the triangle identifies any back rounded vowel, from low back to lower mid. The phoneme after the "=" sign indicates the view of the analyst that any such rounding of the vowel in *oxen* demonstrates a merger with long open-*o* (since it is the unrounding of the vowel that preserves the distinction). Map 15 of PEAS shows a heavy concentration of such triangles in two areas: Western Pennsylvania and Eastern New England. Later studies have confirmed the accuracy of the PEAS for that region, but in Texas, it is the unrounding of long open-*o* words that signals the merger (Bailey, Wikle, and Sand 1991).

It is not a simple matter to use these phonetic maps to chart the present state of phonemic distinctions in the United States. The impressionistic transcriptions cannot be checked against more objective data; there is no information on the speakers' perceptions or judgments, and the data is now quite old. Yet current studies that include perceptual data and acoustic measurements confirm the mergers indicated in PEAS (Chapter 9).

The key decisions made by Kurath were based on lexicon, not phonology. It will also appear that the dialect boundaries constructed from ANAE data largely coincide with the dialect divisions established in Map 1.1 above, based on lexical evidence (Map 14.11). The words selected by Kurath as diagnostic of the Northern, Midland, and Southern regions became the criteria for extending the boundaries westward, and the identification of the Northern, Midland and Southern components of the regional lexicon became the central task of dialect research. One of the most important published results of the Linguistic Atlas of the North Central States [LANCS] was a paper by Shuy on the extension of the North/Midland isogloss through Ohio, Indiana, and Illinois (1962). Carver (1987) re-draws this boundary with additional lexical evidence but with no important changes. (See Chapters 11 and 14 for the continuity of this work with ANAE findings.)

A complete record of American projects in dialect geography is shown in Map 1.2, adapted from the LAMSAS homepage.

At first glance it appears that much of the territory of the United States was covered during this period, but the map actually indicates areas where field work was done rather than results published. The achievements of American dialectology are summarized in Table 1.1, along with comparative data for the Atlas of North American English.



Map 1.2. Linguistic Atlas Projects of the United States, 1931–1998

Table 1.1. Achievements of Linguistic Atlas Projects in the United States

		Field-work begun	Field-work ended	No. of subjs.	Lexi-cal pub'n.	Phon-etic pub'n.	Maps
LANE	Linguistic Atlas of New England	1931	1933	416	1943	1943	Yes
LAMSAS	Linguistic Atlas of the Middle and Atlantic States	1933	1974	1162	1949	1961	Yes
LANCS	Linguistic Atlas of the North Central States	1933	1978	1564			No
LAGS	Linguistic Atlas of the Gulf States	1968	1983	1121	1993	1993	
LAUM	Linguistic Atlas of the Upper Midwest	1949	1962	208	1976	1976	No
LAO	Linguistic Atlas of Oklahoma	1960	1962	57			
LARMS	Linguistic Atlas of the Rocky Mountain States	1988			[1971]		No
LAPW	Linguistic Atlas of the Pacific West	1952	1959	300	1971		No
LAPNW	Linguistic Atlas of the Pacific Northwest	1953	1963	14			No
ANAE	Atlas of North American English	1992	1999	762		2005	Yes

Source: Linguistic Atlas Projects web site information pages

The Linguistic Atlas fieldwork covers a period of 52 years, from 1931 to 1983 (though the LARMS fieldwork is continuing). Most of the projects used modifications of the worksheets of LANE and LAMSAS, and these records are generally available (see the LAP website). The sixth and seventh columns show the year of publication. Five of the nine projects have published lexical data (the LARMS publication is Hankey's *Colorado Word Geography*, 1960). Four of the nine have published phonetic information, but only two have published maps to interpret these data. McDavid's goal of complete publication of Atlas results has been realized to only a limited extent.

Nevertheless, the achievements of the Linguistic Atlas Projects provide a substantial and reliable base for further investigation of American linguistic changes in progress. Bailey, Wikle, Tillery, and Sand (1991) found that the LAGS data fit in with earlier and later records to give a coherent record of linguistic change in real time. The sociolinguistic studies of New York and Philadelphia have built profitably upon prior LAMSAS records, and ANAE will refer to Linguistic Atlas data in almost every chapter. At the same time, it must be admitted that no national map of the pronunciation of English was created by Linguistic Atlas projects, nor is it likely that the Linguistic Atlas materials now stored in various archives can be the basis of such a map, since the records are spread too widely across time and do not represent a view of American dialects at any one stage.

A national survey of the regional vocabulary of American English has been completed by the Dictionary of American Regional English [DARE], under the original direction of Frederic Cassidy. In the years 1965 to 1970, field workers for DARE gathered data on regional vocabulary in all 50 states, and four volumes have been published to date [up to the letter S]. The DARE sample was based on population rather than geography, and DARE maps are a reconfiguration of American states with areas proportional to their population (Fig. 1.1).

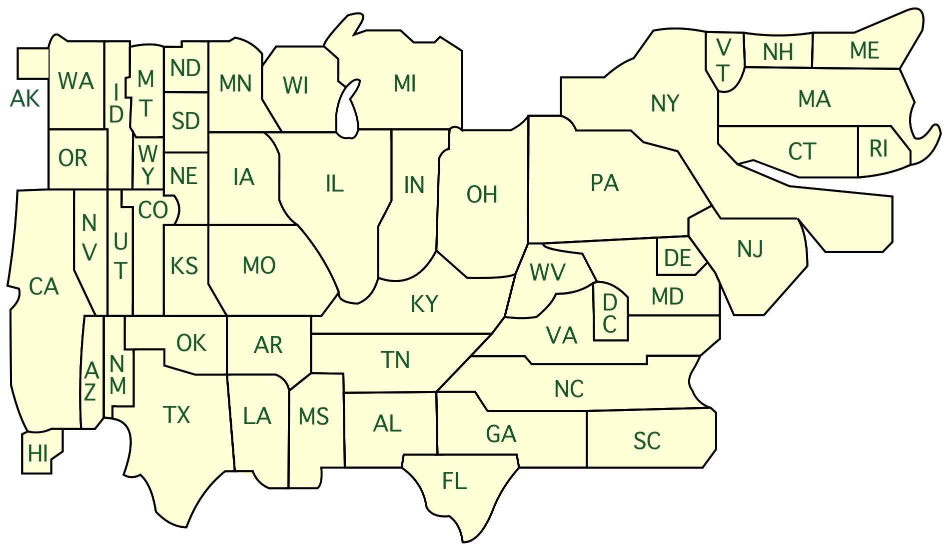


Figure 1.1. DARE map, with state areas proportional to population

A comprehensive analysis of the DARE regional vocabulary was used by Craig Carver to produce a new national map of the dialects of the United States: *American Regional Dialects: A Word Geography* (1987). In several ANAE chapters, the boundaries drawn by Carver will be compared to the boundaries established by phonological isoglosses.

1.3. The design of the Atlas of North American English

The last section presented an overview of linguistic atlas work showing that in spite of the substantial achievements of American dialectology, no national map of any linguistic feature has been produced. While DARE is close to completing a national view of American vocabulary, the continental distribution of the phonetic and phonological features of North American English remains unknown. Section 1.1 outlined the need to develop a large-scale geographic survey of linguistic changes in progress. The difficulties to be overcome were the product of established practices of traditional dialectology, which are as a rule well motivated. They can be identified under four headings.

The efficiency problem

(a) The methods adopted by LANE in 1931 produced the most satisfactory and reliable results, but the cost of extending these methods over the entire country was prohibitive.
(b) Even if a national survey could be completed using the methods of the Linguistic Atlas, the time required to complete it would be so great that informants from one part of the country could not be compared to those in another.

The sampling problem

(c) The sampling grids designed by Linguistic Atlas projects were representative of geography rather than population, and they underrepresent the majority of the population who live in the larger cities.
(d) Linguistic Atlas informants were concentrated in the rural and small town strata of the population in order to trace settlement history. The linguistic changes in progress that were discovered from 1960 to 1990 were concentrated in large cities. Several followed the "cascade" model, spreading from the largest cities downward by community size (Callary 1975; Trudgill 1974; Bailey, Wikle, Tillery, and Sand 1993).
(e) Linguistic Atlas informants representing the larger cities were usually middle-aged and cultivated (well-educated) persons. Sociolinguistic studies have found that the most advanced speakers were younger and more representative of the majority culture.

The obsolescence problem

(f) The regional vocabulary in Linguistic Atlas protocols has a heavy concentration of rural and agricultural terms and other words and phrases that are no longer current. The stream of evidence for dialect differentiation therefore shrinks over time, and contributes to the widespread impression that regional dialects are disappearing.

Problems of reliability and validity

(g) Where Linguistic Atlas phonetic transcriptions could be compared with recordings or other phonetic records, they tended to be conservative. Throughout the Eastern United States, no short-*a* words were recorded in LAMSAS records with any nucleus higher than raised [æ^], while other evidence showed that this vowel was merged with the mid-front vowel of *bared* as early as 1896 (Babbitt 1896; Labov 1966). In the Southern Shift, the vowels of *bit* and *bet* are often raised and fronted to the tense position occupied by *beat* and *bait* in other dialects, but LAMSAS records always show lax nuclei for these ingliding forms (Chapter 18).

(h) Linguistic Atlas protocols do not inquire directly into phonological contrasts, so it is difficult at best to trace the progress of the many mergers in progress (Chapters 8, 9).

(i) The protocols of the Linguistic Atlas are question and answer routines that produce "consultative" style, and do not focus on the matters of maximum interest that generate the free flow of spontaneous speech.

The Telsur design

The major impetus which led to ANAE was a proposed solution to the efficiency problem (a, b). To capture the current state of sound changes now in progress, it was argued that the time gap between the first and last interviews should be less than half a generation. Instead of dispatching a field worker to a pre-arranged series of geographically scattered communities, it was proposed to contact subjects more quickly and directly by telephone.

Telephone surveys have been used successfully at several points in the history of American dialectology.

(1) A national map of one feature of American phonology was constructed in 1966 by W. Labov through calls to long-distance telephone operators. The map showed progress of the merger of /o/ and /oh/ obtained through the operators' pronunciations of the words *hock* and *hawk* and their judgments as to whether these two words were the same or different (Map 9.4).[5]

(2) The study of Linguistic Change and Variation in Philadelphia in the 1970s used a telephone survey as its principal means of random selection. The main database was not a random sample, but long-term studies of a judgment sample of ten neighborhoods. The telephone survey of 60 individuals was carried out by Donald Hindle (1981). Speakers were selected randomly from the white pages of the telephone book. Although the telephone interviews were much shorter and more formal than the neighborhood interviews, the results showed good agreement with the neighborhood data (Labov 1994, 2001).

(3) The Texas Poll is an annual telephone survey conducted by the Public Policies Resources Laboratory at Texas A&M. It polls a sample of 1,000 Texans over the age of 18, asking questions for governmental, business, and academic agencies. Guy Bailey obtained permission to add questions on nine linguistic variables to this survey in 1989 (Bailey, Wikle, and Sand 1991). The results included good information on age, gender and history of residence, but since the sample was proportional to population rather than area, it did not give a systematic view of the geography of Texas. In a later Oklahoma telephone survey, Bailey corrected this problem by stratifying for area as well as population (Bailey et al. 1991).

The initial proposals for the Telsur survey extended the target range to all of English-speaking North America. This step was motivated by the fact that from a linguistic point of view, the evolution of Canadian English is of equal interest to the study of English in the U.S. It is also clear that the influence of state or national boundaries can only be assessed if they are not set as arbitrary limitations to the field of study. It was therefore decided to avoid confining the scope of the survey by any political frontier and to sample all English-speaking communities on the continent of North America.

The sampling limitations (d) of traditional dialectology are a natural outcome of the concentration on the history of settlement of the rural population. The findings of sociolinguistic research on new urban sound changes led to the proposal to reverse this traditional concentration. Telsur samples the urbanized areas where changes in progress were expected to be most advanced, focusing on that part of the population that had been given least attention in earlier studies (Chapter 4). This initial approach was then modified to construct a sample sensitive to both population and geography, adding smaller communities to the sample whenever large, sparsely populated (or non-urban) areas were unrepresented in the sample of urbanized areas.

The solution to the sampling problem was simultaneously a solution to the efficiency problem. By limiting the Telsur survey to urbanized areas of 50,000 or more, it was possible to cover the entire continent in less than ten years. A representative sample of smaller towns and villages would require a much longer period of time.

The obsolescence problem (f) was not an issue for the Telsur project, since the field methods were designed to study phonological changes that were actually in progress. Some of the variables studied in the Atlas are distinctions that have almost disappeared, but the areas where they are still present form clear geographic patterns (Chapter 8).

Problems of reliability and validity were a major issue in planning the Telsur survey. In the early stages, strenuous efforts were made to increase the reliability of impressionistic transcriptions, especially when the analysts' judgments of 'same' and 'different' differed from the subjects' judgments. It was finally concluded that acoustic analysis must be added to impressionistic judgments to obtain satisfactory reliability levels. The problem of overcoming the effects of formal observation (and tape recording) was a formidable one, especially since the Telsur survey was explicitly focused on language and devoted considerable time and attention to eliciting pronunciations of particular words. Although the central goal of sociolinguistic research is to record the vernacular – the style used with intimate friends and family – it was recognized that the Telsur surveys could not hope to match longer face-to-face sociolinguistic interviews in this respect, especially in the areas of greatest linguistic self-consciousness like New York City or the South.

Technical developments

Solutions to the efficiency and validity problems depend upon technical developments in recording and measurement. The history of Linguistic Atlas projects shows a gradual adaptation to the introduction of the magnetic tape recorder following World War II (Voegelin and Harris 1951).[6] From 1950 on, some subjects were recorded, but most projects continued to take as their basic data the notations made by the field worker in person. As the study of sound change in progress matured, the advantage of recording and acoustic analysis of speech data

5 This survey was a by-product of the use of long-distance telephone operators to obtain pronunciation of the names of cities that had recently reached a population size of 2,000 and so were to be included in the 2nd edition of the Columbia Encyclopedia. Operators were asked for the number of *Harry Hock*, the second word pronounced with an unrounded central vowel [hak]. When the result was negative, they were asked to look up H-A-W-K; those with the most complete merger had usually already looked up this spelling. Further questions obtained more detailed pronunciations and judgments.

6 A limited number of recordings were made by Miles Hanley in the 1930s on aluminum disks.

became increasingly clear. This is particularly true when the trajectory of the sound changes depends crucially on small differences in fronting and backing. While traditional phonetic transcription records as many as 16 degrees of height, it is more difficult to get agreement on the diacritics that register degrees of fronting and backing.[7] More generally, the impressionistic phonetician is confined to the use of a small set of discrete symbols and must recognize the well-documented variation in human capacity to agree on the use of these symbols (Ladefoged 1957).

The history of acoustic analysis has registered a steady increase in accuracy and efficiency. At the outset, an electro-mechanical device such as the Kay Sonograph took a minimum of five minutes to create a spectrogram; measurements of formant centers on that spectrogram had margins of errors equivalent at best to 1/4 of a pitch period – 50 Hz for female speakers. The development of linear predictive coding (LPC) and its software implementation has led to a rapid increase in speed and accuracy and the ability to separate the effects of the supra-glottal tract – the position of the tongue and the lips – from the glottal spectrum.

The acoustic analysis of 439 Telsur speakers was made possible only by the advances in speed, efficiency, and accuracy of the CSL program developed by Kay Elemetrics, using methods described in detail in Chapter 5. Telsur procedures obtained measurements of 300 to 500 tokens of the vowel system of a speaker in a single day. This can be compared to the week's effort that was required to produce – and correct – 120 tokens in the original studies of sound change in progress of LYS. Subsequent to the acoustic analysis, further analytical tools were required for dealing with the complexity of English vowel systems. The most important of these is the Plotnik program for plotting, analyzing, and superimposing vowel systems in a two-dimensional, computerized display. ANAE will make extended use of Plotnik displays.

Stages of research and sources of support

The first stage of the Telsur project was a pilot project supported by NSF from 1991 to 1993 [BNS91-11637], under the title of "A Survey of Sound Change in Progress." This pilot project was designed to test the proposition that sound changes could be traced rapidly and effectively through telephone interviews (Chapter 4). It was followed by a larger project "A Telephone Survey of Sound Change in Progress", designed to trace sound changes in progress throughout the Midwest, supported by NSF from 1993 to 1994 [SBR 92-22458]. A grant from NEH from 1994 to 1998 made it possible to extend the Telsur project to cover North America as a whole, under the title of "A Phonological Atlas of North American English" [RT-21599-94]. During this period of data collection and analysis, the project also received support from Bell-Northern Laboratories, the research and development division of Bell Canada and Northern Telecom (now Nortel).

From 1998 to 2003, further grants from NSF made it possible for the project to explore two areas in greater detail. Between 1998 and 2000, the project studied age and social stratification in Midland cities, focusing particularly on Pittsburgh, Columbus, and Indianapolis ("Linguistic Diversity in the North American Midland" [SBR 98-11487]). During the period from 2000 to 2003, the project explored the diffusion of change from large cities to small towns in the region from New York to Baltimore, in the project "A Study of Linguistic Change and Diffusion in the Mid-Atlantic Region" [BCS 0002225]. The great majority of the ANAE data was gathered from 1992 to 1999, but some data derived from these more detailed studies will appear, insofar as it contributes to the study of the phonology of the major urbanized areas.

1.4. Data to be presented and questions to be answered

This Atlas will respond both to the traditional questions of dialect geography and to linguistic questions concerning the causes and mechanisms of language change. It will present systematic data on the phonology of the urbanized areas of North America in a form that ideally would be accessible to all those interested in North American English. However, much of the discussion in the printed version of the Atlas is necessarily technical, since there is no non-technical vocabulary to describe changes in the acoustic and auditory character of vowel sounds. The CD-ROM and website accompanying this volume include extensive glossaries and explanations, along with sound samples to provide direct acquaintance with the dialect forms and changes taking place in North American English.

The Atlas will address certain primary questions of dialect geography:

- How many dialects of North American English are there?
- What phonological features define them?
- What are their boundaries?

The ANAE approach to these questions will develop issues that are specific to the study of linguistic change and variation:

- What are the trajectories of change in NAE dialects?
- In what ways are NAE dialects converging or diverging at the phonetic and phonological levels?
- How do current changes in NAE dialects conform to or modify the general principles that govern the evolution of sound systems?

Though the last of these questions will be integrated into the presentations of Atlas maps, the full treatment of the more general theoretical issues will be reserved for further publications. Atlas findings will also bear upon the broader questions of causation that are specific to dialect geography:

- How is settlement history reflected in the current location of dialect boundaries and isogloss bundles?
- What internal, structural factors lead to the expansion of dialect boundaries beyond their historical origin?
- How do current patterns of communication affect the development of sound change and the location of dialect boundaries?

These questions will be considered in the Atlas chapters, but the thorough consideration of historical and demographic factors will be reserved for future treatment.

All of these questions take on a more acute form in the light of the remarkable clarity of the dialect differentiation emerging from the ANAE maps. The data developed by ANAE does not reflect the dialect continuum projected by many exponents of traditional dialectology.

7 The syllabi of LANE, PEAS, and LAUM show an unusually high frequency of fronting and backing diacritics, so that a total of nine degrees can be recorded on this dimension. However, the maps of PEAS do not make use of this distinction. The PEAS syllabi show backing diacritics for three Southern cultivated speakers (a crucial characteristic of the Southern Shift), but no such distinction appears in the maps for *day* or *bracelet* (PEAS Maps 18, 19).

> A map of language variation is merely a static representation of a phenomenon whose most salient characteristic is its fluidity. It is an almost seamless fabric covering the land. (Carver 1987: 19)

In contrast, ANAE will show many sharp and well-defined boundaries dividing the major regional dialects, in which a number of phonological isoglosses are tightly bundled. Archetypical of such boundaries is the North/Midland line. In other areas, particularly in the West, dialect boundaries are less discrete and the definitions of dialect areas are correspondingly complex. The ANAE data will also indicate a drift towards the increasing differentiation of the dialects on either side of these boundaries. Such evidence of change in progress will be drawn largely from age distributions (apparent time), since real-time data are not available for most of the urbanized areas studied. These divergent trends are due to the operation of chain shifts moving in radically different directions: the Northern Cities Shift, the Southern Shift, the Canadian Shift, the Back Upglide Shift, and the Pittsburgh Shift.

Divergence and differentiation are not the whole story. While the larger regional dialects show solidification and further development, many smaller local dialects are weakening or have almost disappeared, giving way to the more general regional patterns. In this sense, ANAE shows convergence as well as divergence. The convergence shown is not a movement towards a national norm, but rather towards broader regional patterns.

1.5. Organization of the Atlas

Part A (Chapters 1–6) presents a detailed account of the methods of the Atlas for collecting and analyzing data.

Part B (Chapters 7–9) will report the progress of a wide variety of ongoing mergers in North America, based on data from all 762 Telsur subjects. Chapter 7 deals with the importation of consonantal /r/ in areas that were formerly *r*-less, with a consequent reduction in the long and ingliding vowel system. Chapter 8 presents data on mergers that are almost complete, where the relevant distinction is maintained in only a few communities. Chapter 9 considers the progress of ongoing mergers that involve roughly half of the North American territory. For each variable, the relations of perception and production are considered, along with the extent to which these developments exemplify the general principles that have been found to govern mergers (Labov 1994: Ch. 11).

Part C (Chapter 10) presents 38 maps that summarize quantitative data on the pronunciation of the stressed vowels of English for 439 subjects, based on the acoustic analysis of 134,000 vowels. The maps present the data in a form that is neutral to any theoretical issue and available for inspection with minimum interference from the perspective of the investigators. The accompanying CD-ROM contains a complete database of reported judgments, measurements, and the Plotnik vowel plotting program that will allow any reader to continue the analysis in their own perspective, along with extensive sound samples.

Part D (Chapters 11–13) deals with the regional dialects of North America, beginning with definitions of dialect areas on the basis of current changes in progress (Chapter 11). Chapter 12 examines those changes in progress that affect the entire continent, beginning with the large-scale fronting of the back upgliding phonemes /uw, ow, aw/. Chapter 13 deals with the diverse patterns of raising and fronting of short-*a*, concluding with a continental map of short-*a* systems.

Part E (Chapters 14–20) takes up successively the individual regions defined in chapter 11: the North, Canada, Eastern New England, the Mid-Atlantic States, the South, the Midland, and the West. These chapters deal with the progress of the chain shifts that define each region, their relation to general principles of linguistic change, and the ways in which the various components of the shift relate to each other and to the region's boundaries.

Part F (Chapters 21–23) presents information on a limited number of lexical and grammatical variables, comparing their boundaries to the boundaries established by phonological processes and comparing the vowel systems of African-American with white speakers in the larger Southern communities. A final chapter summarizes the findings of the Atlas.

2. The North American English vowel system

The general framework used by ANAE for the description of North American vowel systems is presented in this chapter. These vowel systems all show some relatively stable vowel classes and other classes that are undergoing change in progress. A systematic description of the sound changes will require a point of departure or *initial position* that satisfies two criteria:

(1) each of the current regional vowel systems can be derived from this representation by a combination of mergers, splits, shifts of sub-system or movements within a sub-system, and
(2) the differential directions of changes in progress in regional dialects can be understood as the result of a different series of changes from the initial position.

Within the evolutionary and historical perspective of this Atlas, we are free to take up any point in the history of the language as an initial position to trace the evolution of a given set of dialects. The degree of abstraction of these initial forms depends upon the nature and extent of the sound changes that differentiated the dialects. If mergers are involved, the initial position will show the maximum number of distinct forms; if splits are involved, it will be the minimum. For conditioned sound changes, such as the vocalization of postvocalic /r/, the initial position will show the undifferentiated forms, for example, /r/ in all positions. Since chain shifts by definition preserve the original number of distinctions, the initial representations will be identical in this respect; but if the chain shift has crossed sub-systems, it may have introduced a different set of phonetic features in that system and is not in that sense structure-preserving.

An initial position is an abstraction that may not correspond to any actual uniform state of the set of dialects in question, since other intersecting sound changes, including retrograde movements, may have been operating at an earlier period. Its major function is to serve as the basis for an understanding of the internal logic of the patterns of change now taking place in North American dialects and to show the relations among the various mergers and chain shifts that drive regional dialects in different directions.[1]

2.1. Long and short vowels

The classification of any English vowel system must begin by recognizing the distinction between the **short** vowels of *bit*, *bet*, *bat*, *pot*, etc. and the **long** vowels of *beat*, *bait*, *boat*, etc. This is not because the members of the first set are shorter than the members of the second, though they frequently are. In some English dialects, like Scots, the phonetic length of a vowel is determined entirely by the consonantal environment, not the vowel class membership. But Scots, like other dialects, is governed by the structural distinction between long and short vowel classes, which is a product of the vocabulary common to all dialects.

English short vowels cannot occur word-finally in stressed position, so there are no words of the phonetic form [bɪ, bɛ, ba, bo or bʊ]. Long vowels can occur in such positions, in a variety of phonetic shapes. The word *be* can be realized as [bi, bi^{1}, bɪi, bi^{j}, bɨ^{j}], etc. Thus in English, long vowels are *free* while short stressed vowels are *checked*. It follows that a short vowel must be followed by a consonant.[2] The checked–free opposition is co-extensive with the short–long distinction that is common to historical and pedagogical treatments of English, and it is central to the ANAE analysis of North American English as well.

2.2. Unary vs. binary notation

In the tradition of American dialectology initiated by Kurath, a simplified version of the IPA was adapted for phonemic notation, choosing the phonetic symbol that best matches the most common pronunciation of each vowel in a particular variety. In this *unary* notation, both checked and free vowels are shown as single symbols, except for the "true" diphthongs /ai, au, oi/.

Table 2.1. Phonemes of American English in broad IPA notation (Kurath 1977: 18–19)

Checked vowels				Free vowels					
Front		Back		Front		Central		Back	
bit	/ɪ/	/ʊ/	*foot*	*beat*	/i/			/u/	*boot*
bet	/ɛ/	/ʌ/	*hut*	*bait*	/e/	/ɜ/	*hurt*	/o/	*boat*
bat	/æ/	/ɑ/	*hot*					/ɔ/	*bought*
				bite	/ai/			/au/	*bout*
				quoit	/oi/				

A similar notation, resembling broad IPA, is found in many other treatments of modern English, particularly those with a strong orientation towards phonetics (Ladefoged 1993) or dialectology (Thomas 2001; Wells 1982).

Such a unary approach to phonemic notation was rejected for the Atlas on the basis of several disadvantages. First, it is a contemporary, synchronic view of vowel classes that differ from one region to another.[3] This limits its capacity for representing pan-dialectal vowel classes that are needed for an overview of the development of North American English. The historical connection between modern /ɑ/ and Middle English short-*o* is not at all evident from the transcription of Table 2.1.

Second, it makes more use of special phonetic characters than is necessary at a broad phonemic level, contrary to the IPA principle that favors minimum deviation from Roman typography.

1 The concept of initial position is not unrelated to the synchronic concept of *underlying form*, the representation used as a base for the derivation of whatever differences in surface forms can be predicted by rule. An initial position is a heuristic device designed to show the maximum relatedness among dialects as a series of historical events.

2 There are very few counter-examples to this principle. In New York City, words like *her* and *fur* are frequently realized with final short vowels: [fʌ, hʌ]. In unstressed syllables, conservative RP used final short /i/ in words like *happy* and *city*, but that is now being replaced by /iy/ among younger speakers (Fabricius 2002).

3 Kurath differentiates three American systems, one of which is identical with British English. He follows this presentation with a perspective on the historical development of these systems.

Third, and most important, the unique notation assigned to each vowel fails to reflect the structural organization essential to the analysis of the chain shifts that are a principal concern of this Atlas. Though the vowels are listed as "checked" and "free" in Table 2.1, the notation represents all vowel contrasts as depending on quality alone.

For these reasons, the transcription system used by ANAE was based instead on the binary notation that has been used by most American phonologists, beginning with Bloomfield (1933), Trager and Bloch (1941), Bloch and Trager (1942), and Trager and Smith (1951). Hockett's (1958) textbook and Gleason's (1961) textbook both utilized a binary notation for English vowels. The feature analysis of Chomsky and Halle (1968) incorporated such a binary analysis, and a binary analysis of English long vowels and diphthongs is a regular characteristic of other generative treatments (e.g. Kenstowicz 1994: 99–100; Goldsmith 1990: 212).[4]

A binary notation makes two kinds of identification. Front upglides of varying end-positions [j, i, ɪ, e, ɛ] are all identified as /y/ in phonemic notation. Similarly, the back upglides [w, u, ʊ, o, ɤ] are identified uniformly as /w/. Secondly, the nuclei of /i/ and /iy/, /u/ and /uw/ are identified as 'the same.' Such an identification of the nuclei of short and long vowels is a natural consequence of an approach that takes economy and the extraction of redundancy as a goal. The same argument can be extended to the nuclei of /e/ and /ey/, /ay/ and /aw/.[5] In the binary system, short vowels have only one symbol, which denotes their nuclear quality, while long vowels have two symbols. The first denotes their nuclear quality, the second the quality of their glide. There are three basic types of glide at the phonemic level: front upglides, represented as /y/, back upglides (/w/), and inglides or long monophthongs (/h/).[6]

Another important generalization made by the binary system is that, at a broad phonemic level, the traditional representation of the lax–tense difference between short and long vowels such as /ɪ/ vs. /i/, /ʊ/ vs. /u/, etc., is redundant. Both /ɪ/ and /i/, for instance, share a high-front nucleus. The exact quality and orientation of these nuclei differ from one dialect to another. What consistently distinguishes them phonologically is the presence or absence of a front upglide. The vowel of *bit* can therefore be represented simply as /bit/, and that of *beat* as /biyt/. At the phonetic level, these are often realized as [bɪt] and [bit], depending on the dialect, but at the phonemic level, the use of a special character for *bit* can be dispensed with.

2.3. Initial position

Table 2.2 presents the initial position of North American dialects, showing in binary notation the maximal number of distinctions for vowels (not before /r/). Table 2.2 identifies three degrees of height and two of advancement.[7] The six short vowels are accompanied by eight long upgliding vowels and two long ingliding vowels.[8] Rounding is contrastive only in the ingliding class.[9] The word-class membership of these phonemes is illustrated in Table 2.3, with words in the *b__t* frame wherever possible.

Table 2.2. The North American vowel system

	SHORT		LONG					
			Upgliding				Ingliding	
			Front upgliding		Back upgliding			
	V		Vy		Vw		Vh	
nucleus	front	back	front	back	front	back	unrounded	rounded
high	i	u	iy		iw	uw		
mid	e	ʌ	ey	oy		ow		oh
low	æ	o		ay		aw	ah	

Table 2.3. Keywords for the phonemes of Table 2.2.

	SHORT		LONG					
			Upgliding				Ingliding	
			Front upgliding		Back upgliding			
	V		Vy		Vw		Vh	
nucleus	front	back	front	back	front	back	unrounded	rounded
high	*bit*	*put*	*beat*		*suit*	*boot*		
mid	*bet*	*but*	*bait*	*boy*		*boat*		*bought*
low	*bat*	*cot*		*bite*		*bout*	*balm*	

Following the logic of binary notation, this representation greatly reduces the number of special symbols necessary for the phonemic transcription of the vowel contrasts in English dialects. Furthermore, it captures important generalizations about the sub-systemic organization of the vowel space that are missed by a more phonetically based transcription. It is not linked to typical phonetic values of one arbitrarily selected reference dialect, since its relation to the phonetic values of IPA symbols is abstract and historical rather than concrete and descriptive.

In addition to transcribing each vowel phoneme, the occurrence of marked allophonic variation often makes it necessary to add a symbol to indicate the presence, absence, or quality of following consonants. The allophone of /ay/ before voiceless consonants is designated /ay0/ as opposed to the residual category /ayV/. The checked allophone of /ey/ is sometimes shown as /eyC/ as opposed to the free allophone /eyF/.

The use of /h/ to indicate a class of long and ingliding vowels, which show no formant movement or move in a centering direction, was a prominent feature of the binary analysis introduced by Bloch and Trager. It is not as generally used as /y/ and /w/.[10] Instead, one often finds along with /iy, ey, uw, ow/ the symbol /ɔ:/ for the class of *caught*, *law*, etc. or /a:/ for the class of *father*, *pa*, etc. This special

4 Recent treatments of English vowels in Optimality Theory tend to show binary representations at a lower level of abstraction. Thus /ey/ frequently appears in Rutgers Optimality Archive papers as [eɪ] and /ow/ as [oʊ].

5 In the most commonly accepted notation, the mid-back nuclei of /ʌ/ and /ow/ are not transcribed with the same nuclei, and the redundant phonetic difference in rounding is preserved. Nevertheless, Chapter 14 will develop the argument that at least in the eastern United States, these nuclei are structurally identified and move together in the course of Northern and Midland sound changes.

6 The /h/ glide is an abstract notation indicating either a lengthened vowel or an inglide towards schwa. These are generally in complementary distribution: low back vowels are generally long monophthongs, while high and mid vowels are ingliding.

7 The /a/ in /ay, aw, ah/ is frequently represented by a low central vowel in many dialects, but at the abstract level of the initial position, it is a back vowel, opposed to /æ/. In the majority of North American dialects, the nucleus of /aw/ is front of center. Chapter 18 will show that a chain shift in Southern English, initiated by the diphthongization of long open-*o* words, forces a structural reinterpretation of initial /aw/ as /æw/.

8 These positions can be represented as a set of binary features in which the nuclei are combinations of [+voc, −cons, ±high, ±low, ±back, ±round] and the glides are combinations of [−voc, −cons, ±back, ±high].

9 Table 2.2 omits several marginal classes that are limited to a few words, like /eh/ in *yeah*, /ih/ in *idea* and *theatre*, /uh/ in *skua*.

10 Gleason (1961) substituted a capital /H/ for /h/, to avoid the implication that this centering glide was 'the same' as initial /h/. Although initial and final /h/ are in complementary distribution, it can be argued that the phonetic differences are not motivated by the environmental difference.

notation captures the phonetic character of the word classes involved. But it does not reflect the generalization that English words with final stress must end with a glide or a consonant. By writing /oh/, /ah/, for the long and ingliding sub-system, we incorporate this generalization, which plays a central role in the description of mergers and chain shifts in the chapters to follow.[11]

As noted above, a binary notation is more favored by North American than British linguists. This is largely due to the different status of diphthongization in British and American dialects. Diphthongization of all long vowels, especially in final position, is the general rule in North America. Monophthongal /e:/ and /o:/ do occur, but only in limited areas. Wells (1982) uses monophthongal symbols for the long high vowels /i:/ and /u:/, a representation that seems useful for RP. Many regional British dialects have consistently monophthongal long vowels, as well as the Caribbean dialects strongly represented in Britain today. To apply the notation /iy, ey, ow, uw/ to this range of British dialects would seem artificial at best. On the other hand, Wells's use of /i:/, /u:/, and /o/ for the phonemes of "General American"[12] is an odd extension of the British system. Nevertheless, the organization of vowels presented by Wells in his 1982 overview of English dialects is strikingly similar to the ANAE initial position. Wells divides English vowels into long and short (checked and free). Furthermore, he separates the long vowels into front upgliding, back upgliding and ingliding (without using those labels). Table 2.4 shows the relations of the two representations by inserting the labels for lexical sets introduced by Wells, now widely adopted in British dialectology, into the framework of Table 2.2.3.[13]

Table 2.4. Wells' view of "General American" vowel classes

	SHORT		LONG					
			Upgliding				Ingliding	
			Front upgliding		Back upgliding			
	V		Vy		Vw		Vh	
nucleus	front	back	front	back	front	back	unrounded	rounded
high	KIT	FOOT	FLEECE			GOOSE		
mid	DRESS	STRUT	FACE	CHOICE		GOAT	NURSE	THOUGHT
low	TRAP			PRICE	MOUTH		PALM, LOT	

2.4. Description of the word classes

The vowel classes labeled in Table 2.2 are defined in the following section. Historical vowel classes are indicated in boldface, modern lexical reflexes in italic. Conventional labels for phonemes are given in quotes. In each case, the historical word class is composed of a core set or sets of reflexes of Old English and Middle English words, along with a variety of loan words, principally from French and Latin, but from other sources as well.

/i/ "short-*i*", derived primarily from M.E. short **i**, in *bit*, *sit*, *will*, *tin*, *bitter*, *dinner.*

/e/ "short-*e*", derived primarily from M.E. short **e**, in *bet*, *set*, *red*, *ten*, *better*, etc. along with a number of shortened M.E. **ea** words in *head*, *dead*, *lead*, *breakfast,* etc.

/æ/ "short-*a*", derived primarily from M.E. short **a**, in *bat*, *sat*, *had*, *man*, *batter*, etc. along with foreign **a** loan words that may or may not alternate with /ah/: *fact*, *lamp*, *cab*, *jazz*, *pasta*, *Mazda*.

/o/ "short-*o*", derived primarily from M.E. open **o** or **ɔ** in *cot*, *rot*, *odd*, *Tom*, *hotter*, etc. In most British dialects, this is the short back rounded vowel realized

on a non-peripheral track (see below). In most North American dialects, it was unrounded and lowered to [ɑ] by the nineteenth century (Barton 1832). It was then merged with the small sub-class of words with /a/ after initial /w/ (*watch*, *wander*, *warrant*) and generally with the /ah/ class (*balm = bomb*, see below). In Eastern New England, Pittsburgh and some Canadian communities, /o/ remained as a rounded vowel, and merged with /oh/. /o/ does not remain in its original back rounded position as a separate phoneme in any North American dialect.

In those dialects that retained the opposition between /o/ and /oh/, a large number of /o/ words shifted to the /oh/ class, before back nasals, as in *strong*, *song*, *long*, *wrong*, etc.; before voiceless fricatives (in *loss*, *cloth*, *off*, etc.), and irregularly before /g/, as in *log*, *hog*, *dog*, *fog*, etc. This process occurred by lexical diffusion, leaving many less common words in the /o/ class, such as *King Kong*, *Goth*, *doff*, etc.

/ʌ/ "wedge", derived primarily from M.E. short **u** in *but*, *bud*, *come*, *some*. The North American mid-back unrounded vowel is the result of the unrounding of the majority of M.E. short **u** words. In addition, two M.E. long **u:** words were unrounded to /ʌ/: *flood*, *blood*.

/u/ "short-*u*". A certain number of M.E. short **u** words did not undergo this unrounding, largely after labials and before /l/: *put*, *push*, *bush*, *full*, *wool*, *bull,* as opposed to *putt*, *hush*, *mush*, *dull*, *gull*, etc. Some M.E. long **o** words were shortened to join this class, largely before /k/ and /d/: *hook*, *cook*, *look*, *good*, *hood*, *stood* and also *foot*, *soot*.

/iy/, "long-*e*", derived primarily from M.E. **e:** after merger with M.E **ea:**, in *see*, *seed*, *sea*, *bead*, etc. This vowel was raised by the Great Vowel Shift to high front position and diphthongized to /iy/. In hiatus position, M.E. **i:** remained in high front position and joined this class (*idiot*, *maniac*). A large number of recent loan words with [i] in other languages are now a part of this class: *machine*, *visa*, *diva*.

/ey/, "long-*a*", derived primarily from M.E. **a:** after merger with M.E. **ai:**, in *made*, *name*, *maid*, *say*, etc. This was raised from a low front to a mid front position by the Great Vowel Shift and diphthongized to /ey/.[14]

/ay/, "long-*i*", derived primarily from M.E. **i:**, undergoing diphthongization and nucleus-glide differentiation in the Great Vowel Shift: *sigh*, *high*, *buy*, *ride*, *die*, *bite*, *time*, etc.

/oy/, a small class from early French loans, in *soil*, *boil*, *choice*, *noise*, etc., along with a number of common words of uncertain origin: *boy*, *toy*, etc.

/uw/, "long-*u*", derived primarily from M.E. **o:** in *mood*, *food*, *fool*, *room*, *too*, *do*, etc., excluding words that were shortened before /d/ and /k/ (see /u/ above). This vowel was raised to high position by the Great Vowel Shift and diphthon-

11 It can be pointed out that the use of /h/ to represent a free vowel is well entrenched in English orthography. Spellings such as *yeah*, *huh*, *ah* and *oh* are found in place of *ye*, *hu*, *a*, and *o*; monophthongal /ay/ is normally spelled *ah* for *I* and *mah* for *my*. In Pittsburgh, monophthongal /aw/ is regularly spelled *ah* as in *dahntahn*. Users of this every-day practice are not troubled by the fact that in *huh*, final /h/ is phonetically distinct from initial /h/.

12 This term has not been used by American dialectologists to any extent since the appearance of Kurath (1949), but it continues to be used in Europe. The exact referent is difficult to determine, but it almost always indicates a rhotic, non-Southern dialect.

13 This table does not correspond precisely to the initial position of Table 2.3, but rather reflects the typical American dialect in which /o/ has merged with /ah/ (Chapter 14) and /iw/ has merged with /uw/ (Chapter 8). Wells represents the mid-central nucleus in the NURSE class as a vowel /ɜ/, as in British English, whereas ANAE places this constricted nucleus with other vowels before tautosyllabic /r/ (see Table 2.6). Wells uses /o/ as the vowel of the GOAT set in America, where ANAE uses /ow/, while his notation for the British GOAT set is the diphthong /əʊ/

14 Some scholars believe that M.E. **ai**, **ay** did not merge with monophthongal **a:** but retained its separate status until M.E. **a:** reflexes were diphthongized in the seventeenth century.

gized in most dialects. Words with M.E. **u:** that did not undergo the Great Vowel shift are joined with this class (*soup*, *you*, etc.).

/ow/, "long-*o*", from M.E. open **o:**, in *boat*, *road*, *soap*, as well as M.E. diphthongal **ow**, in *stow*, *flow*, *know*, *bowl*, etc.

/aw/, from M.E. **u:**, respelled in the French style as **ou**, diphthongized with further nucleus-glide differentiation in the Great Vowel Shift, in *house*, *mouth*, *proud*, *now*, *cow*. This process did not affect vowels before labials or velars or after /y/, which remain in the current /uw/ class: *you*, *your*, *youth*, *soup*, *group*, etc.

/iw/, from a wide variety of M.E. and French sources, spelled *u*, *eau*, *ew*, *ui*, which were generally realized with a palatal onglide as /juw/. The loss of the glide after coronals in North America created the opposition of /iw/ and /uw/ in *dew* vs. *do*, *suit* vs. *shoot*, *lute* vs. *loot*, *rude* vs. *rood*, etc.

/oh/, "long open-*o*". This class has a highly skewed distribution that reflects the complex and irregular history of its composition. It is the result of monophthongization of **au** in *law*, *fault*, *talk*, *hawk*, *caught*, in turn derived from O.E. **aw** (*thaw*, *straw*, *claw*); O.E. **ag** (*maw*, *saw*, *draw*); O.E. **ah**, broken to **eah** (*fought*, *taught*); O.F. **a + u** in the next syllable (*brawn*, *pawn*), M.E. **av** (*hawk*, *laundry*); O.F. **au** (*applaud*, *fraud*, *because*); O.F. **am**, **an** (*lawn*, *spawn*). In addition, some long open-*o* words are descended from O.E. **oht** (*thought*, *daughter*, *brought*). Its current distribution is largely limited to final position and words terminating in /t, d, k, n, l, z/. The lengthening of /o/ before nasals and voiceless fricatives enlarged the /oh/ class considerably, but did not materially affect the number of environments where contrast with /o/ is to be found.

/ah/ "broad-*a*". Original O.E. **a:** was raised to a mid-back vowel **oa.** When a new M.E. **a:** was created by lengthening in open syllables, it was raised to a mid front vowel which became modern /ey/. A residual **a:** class is centered about the unique word *father* with **/ah/** in an open syllable, joined by a few words with word-final /ah/: *pa*, *ma*, *bra*, *spa*, and a number of marginal onomatopoetic and affective forms, *rah rah*, *haha*, *tra la*, *blah blah*, etc. Words with vocalized /l/ formed a part of this class: *calm*, *palm*, *balm*, *almond*, though a large number of North Americans have retained or restored the /l/. To this small nucleus is joined a very large number of "foreign a" words: *pasta*, *macho*, *lager*, *salami*, *nirvana*, and *karate*, though some of these are assigned instead to /æ/ in some dialects (Boberg 2000). As noted above, /o/ has merged with this class for most North American dialects. In traditional Eastern New England speech, some members of the British broad-*a* class have been added, so that some words before voiceless fricatives and nasal clusters appear with /ah/: *half*, *pass*, *aunt*, *can't*, etc.

2.5. Vowels before /r/

The keywords of Table 2.3 are almost all before /t/; the vowel phonemes are in direct contrast in the same environment. Other such sets, before /d/, /g/, or /s/ will show similar contrasts. The discussions of chain shifts in the chapters to follow will confront the question as to whether vowel contrasts operate primarily between allophones or phonemes. If the former, then one might expect to find allophonic chain shifting, where vowels rotate before /n/ but not before /t/. In fact, there is very little evidence of such shifts. Chapters 12 to 20 will show that following consonants are responsible for many strong co-articulatory effects and many categorical constraints. There are fewer distinctions before nasal consonants than before oral consonants. The diphthongs /aw/ and /oy/ do not occur before labials and velars. But in general, there is little difficulty in identifying vocalic allophones before various consonants with the general schema of Table 2.2. Native speakers find it easy to identify the vowels in *beat*, *bean*, *bead* and *beak* as 'the same.'[15] This is not true, however, for vowels before /r/. In some dialects, it is not immediately evident whether the vowel of *bore* is to be identified with the vowel of *boat* or the vowel of *bought*, or whether *bare* belongs with *bait* or *bet*.[16] As a result, sets of vowels before /r/ show a puzzling array of mergers and chain shifts quite distinct from those operating in the rest of the vowel system.

In fact, there are only minor problems in assigning vowels before intervocalic /r/. They are centralized in comparison to the corresponding allophones before obstruents, but can be identified with the categories of Table 2.2, as shown in Table 2.5.[17] This shows the maximal set of oppositions, which are greatly reduced in many dialects. Before intervocalic /r/, /iy/ and /i/, /uw/ and /u/ are merged in most current dialects. Chapter 9 will show that for the majority of North American speakers, there is complete merger of /ey/, /æ/, and /e/ in *Mary*, *marry*, *merry*. Philadelphia preserves these distinctions, but suspends phonemic contrast of *merry* and *Murray* in a near-merger (Labov 1994: 397–418). Great lexical variation is shown in the assignment of words to the /or/ or /owr/ classes, as in *moral*, *coral*, *tomorrow*, *borrow*, etc.

Table 2.5. Initial position for vowels before intervocalic /r/

	SHORT		LONG			
			Upgliding			
			Front upgliding		Back upgliding	
	V		Vy		Vw	
nucleus	front	back	front	back	front	back
high	/i/ *mirror*	/u/ *jury*	/iy/ *nearer*			
mid	/e/ *merry*	/ʌ/ *Murray*	/ey/ *Mary*	/oy/ *Moira*		/ow/ *story*
low	/æ/ *marry*	/o/ *morrow*		/ay/ *spiral*		/aw/ *dowry*

While the vowels before intervocalic /r/ show an opposition of short to long vowels, no such opposition can be found for vowels before a tautosyllabic /r/ that cannot be assigned to syllable-initial position. The high and mid short vowels in *fir*, *her*, *fur*, and words with *-or-* after /w/ have all merged to syllabic /r/ which falls structurally into the mid-back unrounded position.[18] While upglides can occur before intervocalic, syllable-initial /r/ as in *Mary*, they never occur before tautosyllabic /r/, where the transition to full /r/ constriction is through an inglide. Vowels before tautosyllabic /r/ fall naturally into the sub-class of long and ingliding vowels. When syllable-final /r/ is vocalized, the small group of two ingliding vowels /ah/ and /oh/ in Table 2.2 is augmented with /ih, eh, uh/.

Table 2.6 presents vowels before tautosyllabic /r/. As on the right side of Table 2.2, there is a rounded–unrounded distinction among the back vowels and a three-way distinction of height among the back vowels. This is the result of the

15 Techniques for investigating mergers developed by Di Paolo (1988) make use of this capacity of subjects to identify vowels in one context with vowels in another.

16 Such identifications are problematic to a lesser degree for vowels before /l/, where many mergers are now in progress (Chapter 8). But in most dialects, the vowel of *fall* will be easily identified with the vowel of *fought* rather than the vowel of *foal*. Di Paolo (1988) asks subjects to identify vowels across allophones to trace the merger of vowels before /l/.

17 In Table 2.5, the long and ingliding class is eliminated. However, it would not be unreasonable to assign the vowel of *nearer* to /ih/, *Mary* to /eh/, *story* to /oh/. These vowels usually do not show upglides, and they are phonetically closer to the long and ingliding set. From a structural viewpoint, the assignments of Table 2.5 are simpler.

18 Here too the contrast with the situation in Great Britain can be striking. Scots preserves the distinction between *fir* and *fur*, *kernel* and *colonel*.

continuation of the opposition of M.E. close-*o* and open-*o* in the set of *mourning* vs. *morning*, *four* vs. *for*, *ore* vs. *or*, *port* vs. *storm*. Chapter 7 will show that this distinction has almost disappeared in North American English. Nevertheless, there are enough remnants to require it to be represented in the initial position of Table 2.6.

Table 2.6. Initial position for vowels before tautosyllabic /r/

	Ingliding Vh		
	front	back	
		unrounded	rounded
high	/ihr/ *fear*		/uhr/ *moor*
mid	/ehr/ *fair*	/ʌhr/ *fur*	/ohr/ *four*
low		/ahr/ *far*	/ɔhr/ *for*

2.6. The linguistic status of the initial position

The presentation of the English vowel system began with the schemata developed by Bloomfield, Bloch, and Trager. Although their approach to phonological analysis is remote from current practice in many respects, it is immediately relevant to the task of the Atlas, for several reasons. They explored the logic of the binary notation explicitly, and they were concerned with accounting for the range of dialect diversity that is the subject matter of the Atlas. Their references to the dialects of the Eastern United States, which were then well charted, are accurate and relevant, though their references to Southern or "mid-western" dialects must be revised in the light of current knowledge. They were not concerned with the structural relations among the phonemes that form the basic inventory for any one dialect, which (following Martinet 1955) must be the central focus of the present work. The configuration of the six short vowels of Table 2.2 represents a set of oppositions that are fully operative in most American dialects, although the low vowels frequently migrate from the V sub-system of checked vowels to the Vh sub-system of free vowels. The members of the Vy and Vw sub-systems are intimately related internally in ways that are fully exemplified in chain shifting and parallel shifting.

Table 2.2 has many empty cells, indicating unrealized combinations of vowels and glides. Sound changes that move a single phoneme without affecting the inventory could therefore be represented by a change of notation. For example, when the nucleus of /aw/ moves from back of center to front of center, it might well be written as /æw/. This implies a phonemic change for what might be considered a low-level phonetic shift in the realization of a phoneme. The Atlas will not make such changes of notation, but will retain the original notation to preserve the identity of the historical word classes of Table 2.2. Changes in notation will occur only when structural shifts in neighboring phonemes require it. For example, Southern /aw/ in *house* will be written with the /a/ nucleus as long as the word class /oh/ is realized with a rounded nucleus and a back upglide. But when the nucleus of /oh/ is unrounded, it assumes the structural identity of /aw/, and this is only possible if the original /aw/ has assumed the identity of /æw/.

The initial position therefore represents a balanced set of contrastive oppositions which functioned effectively for North American English dialects at the outset and continues to function in this way for a limited number of dialects. The weak points of the initial position that became the loci of change are:

(1) The skewed distribution of /oh/ and its limited contrast with /o/
(2) The skewed distribution of /ah/ and its limited contrast with /o/
(3) The skewed distribution of /iw/ and its limited contrast with /uw/
(4) The skewed distribution of /ohr/ and its limited contrast with /ɔhr/

Chapters 9 and 11 will deal with the consequences of the instability noted in (1); Chapters 11 and 14 will explore the consequences of (2); and Chapter 12 will discuss the massive continental changes that followed from the instability of (3). Chapter 8 will show that the instability of (4) has led to the almost complete elimination of this contrast.

3. Principles of chain shifting and mergers

Chapter 2 developed the binary notation for English vowels that is used throughout the Atlas. A major motivation for this notation proceeds from the principles governing chain shift that were first stated in LYS 1972.

3.1. General principles of chain shifting

(1) In chain shifts,

I. Long vowels rise.
II. Short vowels and nuclei of upgliding diphthongs fall.
III. Back vowels move to the front.

These unidirectional principles operated in the historical record to produce the initial position of Table 2.2. They operate on regional dialects to drive vowels further along these unidirectional paths. As Chapter 11 will show, ANAE defines regions and dialects on the basis of these dynamic tendencies – the changes in progress now taking place in each region and the initial conditions for those changes.

3.2. Long/short, tense/lax, peripheral/non-peripheral

In the formulation of (1), the categories *long* and *short* refer to the opposition of long and short monophthongs as they are usually inferred from the historical record and in some synchronic descriptions. More specific phonological features are needed to understand the directions of sound change in particular regions.

In West Germanic languages (German, Dutch, Frisian, English), long and short vowels enter into a phonological opposition of *tense* vs. *lax* vowels. The feature [±tense] is a cover term for a complex of phonetic features: extended duration and extreme articulatory position with an accompanying increase of articulatory effort. This is realized acoustically as an F1/F2 location near the outer envelope of the available acoustic space. The phonological space available to North American English vowels is defined acoustically in Figure 3.1, where both front and back regions show peripheral and non-peripheral tracks.

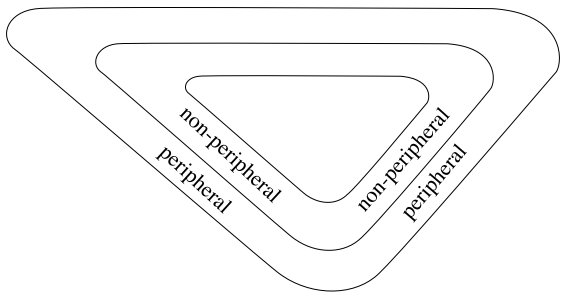


Figure 3.1. Peripheral and non-peripheral tracks in English phonological space

In the initial position of North American English vowels, the nuclei of the upgliding vowels are tense – that is, located on the peripheral tracks. The nuclei of short vowels are located on the non-peripheral tracks, though they frequently shift to non-peripheral position, as illustrated in Figure 3.2.[1]

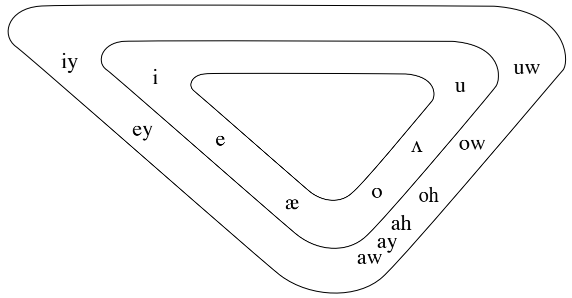


Figure 3.2. Location of initial position vowels in acoustically defined space

Location in this acoustic space is relevant to the direction of movement of vowels when change is in progress. The general principles of chain shifting can be restated as:

(2) In chain shifts,

I. Tense nuclei move upward along a peripheral track.
II. Lax nuclei move downward along a non-peripheral track.

Figure 3.3 illustrates the typical direction of movement in chain shifts. The arrows represent the typical directions of movement if the nuclei remain in their initial position; in North American English, they often shift peripherality.

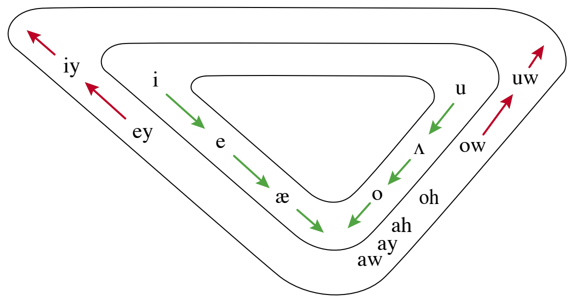


Figure 3.3. Directions of movement in chain shifts along peripheral and non-peripheral tracks

1 In this figure, the three vowels /ah, ay, aw/ are shown as peripheral low vowels back of center. It may be assumed that /aw/ moved forward to /æw/ some time in the formative period of the South and Midland, since current U.S. dialects show a sharp opposition of back /aw/ in the North and front /aw/ elsewhere. However, it is possible that the North and the other areas differed in this respect from the outset, so that the South and Midland had /æw/, not /aw/ in this notational scheme.

The general principles governing movement can also be defined in an articulatory space, derived from X-ray measurements of the highest point of the tongue, shown in Figure 3.4. Here phonological space appears in an ovoid shape, without any high back corner: the two anchor points are the high front /iy/ and low back /o/. The figure plots ten vowels of a conservative speaker from the North Central states. To these are added arrows indicating the typical directions of movement in chain shifts.

In this articulatory space, the fronting of /uw/ appears as a continuation of a raising process, since the high point of the tongue for /uw/ is considerably lower than the high point for [i]. The backing of /e/ and /i/, which will play a major role in Chapters 11, 14, and 15, now appears as a downward movement through the non-peripheral space of the center.

In this space, we can define the movements of vowels in a somewhat different manner. In chain shifts,

I. Peripheral vowels move upward along a peripheral track.
II. Non-peripheral vowels move downward along a non-peripheral track.[2]

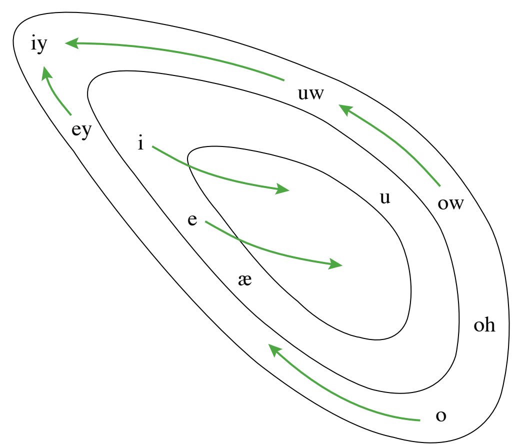


Figure 3.4. The articulatory space of North American English vowels, based on X-ray measurements of the highest point of the tongue. Based on Lindau 1978

In discussing chain shifts, the Atlas will continue to use the acoustically defined space of Figures 3.1–3.3, since the data are derived from acoustic measurements. However, the logic of Figure 3.4 will be cited in relating movements within individual chain shifts to the more general principles of chain shifting.

3.3. Acoustic evidence for the Peripherality Hypothesis

The foregoing discussion can be summed up as the *Peripherality Hypothesis*. It asserts two distinct propositions:

(a) The formant space in which English vowels move contains a peripheral and a non-peripheral area in both the front and the back.
(b) In chain shifting, vowels rise in peripheral areas and fall in the non-peripheral areas.

The final section of this chapter will present further empirical support for (1); Chapters 11–20 will provide further data to support (2).

Past discussions of the peripheral and non-peripheral tracks have been based upon the study of individual vowel systems, and the definitions of peripherality have been abstracted from displays of 300 to 500 vowels. The data assembled for ANAE has greatly enlarged the field of evidence, now consisting of measurements of 134,000 vowels. The application of this database to the empirical confirmation of the hypothesis depends upon the success of the normalization procedure which converts the 439 speakers to a common grid. This log mean normalization (Chapter 5) is generally effective in eliminating the acoustic differences that are the result of variation in vocal tract length, while preserving those social differences that are characteristic of the speech community (Nearey 1978; Hindle 1978; Labov 1994: Ch. 5; Adank 2003).

Figure 3.5 is a Plotnik mean file diagram for the 22 dialects to be defined in Chapter 11. The mean values for 14 vowels are shown for each dialect. Each symbol represents the mean value for a given dialect. The light green lines represent the grand means of F1 and F2. Some vowel distributions are globular, like that for /ʌhr/ just above and back of the mid-center position (tan squares with vertical crosses). For most dialects, this vowel class is stable. The light blue circles with arrows pointing to upper right are the symbols for /uw/ means. These show a very different distribution: a continuous band of high vowels stretching from back to front. This is a reflection of the general fronting of /uw/ in all but a few dialects, a continent-wide process discussed in Chapter 12.

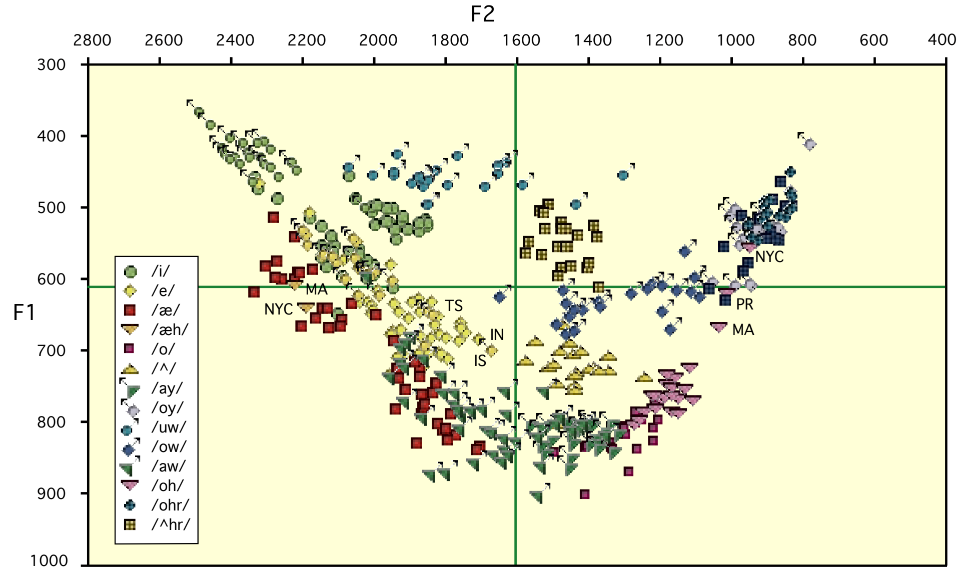


Figure 3.5. Peripheral and non-peripheral tracks in the mean file diagram of 14 vowels for the 22 dialects defined in Chapter 11

The front peripheral track

The front peripheral track is clearly outlined by two phonemes which are extended along the outer diagonal path leading from low front to high front. The red squares represent means for /æ/, which has in part or whole shifted to the peripheral track for various dialects, and undergone varying degrees of raising

2 Chapter 8 of Labov 1994 condensed these two statements into the proposition that in chain shifts, *peripherality and openness dissimilate*.

and fronting (Chapter 13). Separate means are calculated for /æ/ before nasal consonants and in all other environments. The upper set in Figure 3.5 consists largely of means for /æ/ before nasal consonants, which are generally further along the peripheral path. The two orange triangles labeled "NYC" and "MA" are the special subsets of tensed /æh/ in New York City and the Mid-Atlantic States, which are the result of a lexical split between lax and tense short-*a* characteristic of those dialects only (Chapter 17). Over half of the tokens in this category are before oral consonants, but they occupy the same position along the peripheral track as the pre-nasal allophones. The peripheral path is not therefore a property of nasal allophones, but it can be said that nasal allophones favor peripherality.

The lower section of the front peripheral track is also occupied by the mean tokens for /aw/, which is seen to be moving towards mid front position for many dialects.[3]

The front non-peripheral track

The front non-peripheral track is defined here by two vowels, following opposite distributions for the various dialects. The yellow diamonds are the means for /e/, which moves along the non-peripheral track, down and towards the center, in the course of the Northern Cities Shift (Chapter 14). The most advanced dialect in this respect is the Inland North, the lowest and most central mean symbol labeled IN in Figure 3.5. Other yellow diamonds along this track have arrows pointing to the upper left; these are the mean symbols for /ey/. For the majority of dialects, the nucleus of /ey/ has shifted to upper mid non-peripheral position. Only a few /ey/ tokens follow the downward non-peripheral path: these are the Southern dialects following the Southern Shift (see below). The lowest and most central symbol is that for the Inland South, the area where the Southern Shift is most complete; it is labeled IS in Figure 3.5. Behind this is the symbol for the other advanced Southern dialect, the Texas South (TS).

This discussion of a non-peripheral track is necessarily in acoustic terms. We do not have enough information on the articulatory correlates to know how the movements of the tongue through the central, non-peripheral space might be organized.

The back peripheral path

The back peripheral track is outlined by the /oh/ class. The great majority of mean symbols form a globular distribution in lower mid back position, but three dialects show higher and backer values of /oh/: Mid-Atlantic (MA), Providence (PR) and New York City (NYC). The NYC symbol is located squarely within the mid to high back distribution characteristic of /oy/ and /ohr/. This track is also occupied by back vowels before /l/, which are not shown here. The peripheral position of /uwl/ and /owl/ is used as a basis for measuring the degree of fronting of the main body of /uw/ and /ow/ words (Chapter 12).

The back non-peripheral path

In the current state of North American English, there is only one example of a sound change along the back non-peripheral path. In Pittsburgh, /ʌ/ has shifted downward in the course of the Pittsburgh Chain Shift (Chapter 19). In many Southern British dialects, particularly in London, /ow/ moves downward along this track to become a low non-peripheral vowel (Sivertsen 1960, LYS) The pattern shown for North American dialects in Figure 3.5 shows a slight downward movement, but it essentially shows fronting of /ow/ to central position.

3.4. Movements across subsystems

The principal finding of the Atlas is that regional diversity is increasing as a result of opposing movements within vowel systems. Since the principles of chain shifting are unidirectional, it is not immediately obvious how they can drive dialects in different directions to achieve such a result. Since they operate within subsystems, it might appear that their continued operation could only lead to the uniform result that all long vowels are high, all short vowels are low, and no vowels are back. In fact, it is well known that the opposite is the case: vowel systems tend to show maximal dispersion, making maximal use of phonological space to maintain distinctions (Liljencrants and Lindblom 1972; Lindblom 1988; Flemming 1996). The diversification of phonological systems and dispersion in phonological space is the result of a combination of the principles of chain shifting with others that govern movement across subsystems (Labov 1994, Ch. 9). One such principle which is active in North American English, is

The Lower Exit Principle
In chain shifting, low non-peripheral vowels become peripheral.

Non-peripheral vowels that have descended in accordance with Principle II so far as to reach the bottom of the non-peripheral track, if pressured to move further, have nowhere to go but the lower peripheral track, where they change subsystems and become subject instead to Principle I. This happened with /æ/ and /o/ in most NAE dialects: as shown in Fig. 3.5, these are now peripheral vowels in most regions. Peripheralized /o/ has in fact merged in these regions with originally peripheral /ah/, as first discussed in Chapter 2. In the Northern Cities Shift, /æ/ and /o/ rotate as /æh/ and /ah/ along the peripheral track. Since peripheral vowels are longer than non-peripheral vowels, the lengthening that accompanies the peripheralization of short vowels can reduce the margin of security with neighboring long vowels. Such a lengthening of low central /a/ is the event that triggered the Swedish chain shift (Labov 1994: 281; Benediktsson 1970). The lengthening of /a/ in open syllables was among the most general processes of Early Modern English (Jespersen 1949: 3.3.4, 4.2.1),[4] and the resultant set of *name*, *shade*, *snake*, *acre*, *lane*, *bathe*, *ale*, etc. was integrated into the general chain shifting of long vowels in the Great Vowel Shift, following Principle I, as [a:], [æ:] rose to [e:].

The Great Vowel Shift also embodied another of the principles governing movement across subsystems (Labov 1994: 281–284):

The Upper Exit Principle
In chain shifting, one of two high peripheral morae becomes non-peripheral.

This principle operates upon bimoraic high vowels and appears to be specific to the West Germanic languages.[5] By this principle, [i:] can become either [ɪʲ] or [iə], as the first or second mora becomes lax/non-peripheral. The vowel leaves the subsystem of long monophthongs to create or join a subsystem of ingliding or upgliding diphthongs. In the Great Vowel Shift, the first option was selected, and

3 The means for /aw/ before nasals are again calculated with separate values, and these are also shifted further along the peripheral path.

4 But see Minkova (1982) for the suggestion that the lengthening was the result of incorporating final schwa within the stressed syllable. This possibility brings the historical process closer to the current development of short /æ/ in Chapter 14.

5 Kim and Labov (forthcoming) recognize such diphthongization in a number of Indo-European languages outside of West Germanic (Polabian, Old Czech, Latvian, Romantsch, etc.) but argue that all such cases are the result of intimate contact and influence from German.

the lax nucleus [ɪ] of /iy/ was then progressively lowered under Principle II to the current diphthong [aɪ] as a realization of /ay/.[6] A parallel development affected M.E. /u:/, which became /uw/ and then modern /aw/.

The same principle continues to operate upon diphthongal /iy, ey, uw, ow/ that resulted from the seventeenth-century diphthongization of the long vowels raised by the Great Vowel Shift. As the binary notation indicates, there is a difference in quality between the first and second mora of the long vowels in initial position. Under the operation of the Upper Exit Principle, the nuclei of these vowels shift to the non-peripheral track.

The operation of either the Lower and Upper Exit Principles can be the initiating event of a chain shift, since they both create vacant slots in the original subsystem. Thus the diphthongization of M.E. **i:** was followed by the raising of the other long vowels in the subsystem of long monophthongs in the Great Vowel Shift.

The opposite direction of change occurs when the Lower Exit Principle applies to diphthongs in the Vy subsystem. In the Southern United States, glide deletion of /ay/ converts the diphthong [ai] to a long monophthong [a:] and inserts it into the subsystem of long and ingliding vowels. This is the initiating event for the Southern Shift. As the red arrows in Figure 3.6 show, this triggers the downward shift of /iy/ and /ey/ under Principle II as part of the Southern Shift (Chapters 11, 18). A close parallel is found in Central Yiddish, where /ay/ becomes a monophthong, and /ey/ falls to /ay/ (Labov 1994: 286; Herzog 1965).

Figure 3.6 also shows (blue arrows) the Back Upglide Shift: a migration of /oh/ from the ingliding Vh set to back upgliding /aw/ in the Vw set, with an accompanying shift of /aw/ to /æw/ within the Vw subsystem.

	V		Vy		Vw		Vh	
	−back	+back	−back	+back	−back	+back	−round	+round
high	i	u	iy		iw	uw		
mid	e	ʌ	ey	oy		ow		oh
low	æ	o		ay	æw	aw	ah	

Figure 3.6. Movements across and within subsystems in the Southern Shift (red) and Back Upglide Shift (blue)

The combination of movements across subsystems and movements within subsystems operates to move languages or dialects in different directions. If a hole in the pattern of long vowels is created by the Upper Exit principle, then the remaining long vowels will rise. A hole in the pattern created by the Lower Exit principle will be followed by a downward movement, as the nuclei of the front upgliding vowels become lax and fall along the non-peripheral track, illustrated more concretely in Figure 3.7. In the Southern Shift, the laxing of /iy, ey/ is accompanied by a compensating shift of the short vowels to the peripheral track, where they are subject to Principle I and begin to rise, switching relative positions with their long counterparts as shown in the figure.

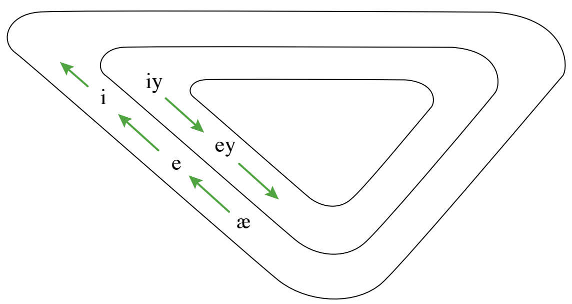


Figure 3.7. Movements along peripheral and non-peripheral tracks in the Southern Shift

3.5. General principles of merger

A chain shift by definition maintains the number of oppositions and phonemic categories that existed at the outset. The obverse of chain shifting is merger, where just the opposite happens. Mergers are also unidirectional processes, governed by two closely related principles (Labov 1994: 311–313):

Garde's Principle
Mergers are irreversible by linguistic means.

Herzog's Corollary
Mergers expand at the expense of distinctions.

The first principle concerns the sequence of events in the history of any one dialect. The second principle is the spatial reflection of these events as they affect neighboring dialects. In any case, a merger will have the same effect as an exit movement in altering the functional economy of a subsystem. The initiating event for a chain shift is often a merger which may create a vacant position in the subsystem or increase margins of security among the remaining elements.

One of the major events in the differentiation of North American dialects is the low back merger of /o/ and /oh/. In some areas, particularly Canada, this event triggers a chain shift among the front short vowels, which have been relatively stable over long periods of English history. The Canadian Shift, shown in Figure 3.8, is triggered by this merger, whereby short-*o* becomes a long open /oh/, migrating from the short subsystem to the long and ingliding subsystem (Clarke et al. 1995).

	V		Vy		Vw		Vh	
	−back	+back	−back	+back	±back	+back	−round	+round
high	i	u	iy		iw	uw		
mid	e	ʌ	ey	oy		ow		oh
low	æ	o		ay		ɑw		

Figure 3.8. The Canadian Shift

Most of the arrows in the preceding diagrams are a reflection of observed phonetic movements. In the case of the low back merger, it is not immediately obvious in which direction the arrow should be drawn. Is the result of the low back merger a member of the short vowel subsystem or a member of the long and ingliding system, as in Figure 3.8? As Chapter 2 pointed out, the long vowels in English are defined by privileges of occurrence in word structure. Long vowels

6 Among high vowels, the organization of long, ingliding and upgliding vowels involves different groupings to produce binary oppositions. There is usually no stable opposition between [i:] and [iə] or between [i:] and [ɪi]. Once the system of diphthongs develops, the monophthong can be interpreted as a variant of the upgliding diphthong or of the ingliding diphthong, but not as an independent unit contrasting with both.

occur in word-final position, while short vowels do not. When /o/ merges with /oh/, it becomes by definition a member of the long and ingliding subsystem. The vowel of *cot*, *rock*, *stop* is then a member of the class that includes *saw*, *law*, *draw*, and is logically represented as /koht, rohk, stohp, soh, loh, droh/.

A similar conclusion must be drawn from the merger of /o/ with /ah/. /o/ is a short vowel which cannot occur in word-final position. When it merges with /ah/ it is then a member of a category that occurs freely in word-final position. *Sod* and *sob*, with /o/, have the same vowel as *facade* and *Saab*, with /ah/, and therefore also as *spa* and *bra*, with /ah/ in final position. The resulting merged phoneme must be considered a member of the long and ingliding system. But to preserve clarity of comparison across dialects, the Atlas chapters retain the initial position of Table 2.2. The forward movement of the *got*, *rock*, *odd*, *doll* class is described as a fronting of /o/, even when /o/ is merged with /ah/ and is a member of that class.

4. Sampling and field methods

4.1. The pilot project

The Telephone Survey "Telsur" and Atlas project "ANAE" began as a pilot study of dialect differentiation in North American English, conducted from November, 1991 to April, 1993.[1] The area chosen for study consisted of all or parts of six states: Illinois, Wisconsin, Minnesota, Iowa, Nebraska, and South Dakota. This project aimed to contribute both to the specific geography of American dialects and to the study of the principles of sound change. The specific area to be studied was chosen because it included major regional boundaries and new phenomena that had not previously been mapped. Sampling in communities with a range of sizes was undertaken in order to represent both the dimensions of geographic dispersion and population density. First, seven focal places were targeted: Chicago, IL; Milwaukee, WI; Duluth, MN/Superior, WI; Minneapolis/St. Paul, MN; Des Moines, IA; Sioux Falls, SD; and Omaha, NE. Four of these are dominant metropolises with a 1990 population over 300,000: Chicago, Milwaukee, Minneapolis/St. Paul, and Omaha. The remaining three were selected to provide geographical coverage; they all have a population over 100,000, and they provide points 150 miles or more from the four larger cities.

The sample design for the pilot project entailed the selection of places within this 150-mile radius of each of the focal cities. In each area, eight cities were to be selected, two in each of four ranges of population:

50,000 to 200,000
10,000 to 50,000
2,000 to 10,000
under 2,000

Cities were selected within a 150-mile radius of the largest cities first. Where the territory of focal cities overlapped, sampling was frequently reduced because not enough cities of the requisite size existed.

Each of the focal cities was to be represented by two subjects, with the exception of Chicago, which was to be represented by four speakers. The smaller towns within the 150-mile radius of the focal cities were each represented by one speaker. In the course of the pilot project, 52 speakers were interviewed in 41 communities ranging in population from 2,605 (Lena, IL) to 6,793,132 in the urbanized area of Chicago, IL in 1992 and 1993.

4.2. Expansion of the project

The acoustic analyses of the first set of speakers showed a clear differentiation of the dialect regions of the Inland North, the North Central region, and the Midland, generally in accordance with the dialect boundaries established by other researchers, but showing a level of detail, precision, and consistency not previously achieved. The next phase of the project extended the territory to a fifteen-state region, from Ohio to the Continental Divide and from the Canadian border to the Ohio River, with Missouri, Kansas, and Colorado forming the southern tier of states west of the Mississippi River (1993–1994).[2] In the third phase, coverage was extended to the entirety of English-speaking North America (1994–1998).[3] As that sample approached completion, more detailed investigation of a set of cities in the Midland region was undertaken (1998–2000) to try to account for the extensive variation found among them. In addition, in 1997 and 1998, interviews of a sample of 41 African-American speakers were conducted in 15 cities with a high proportion of African-Americans.[4]

The sampling strategy for the Telsur/Atlas project was designed with the goal of representing the largest possible population, with special attention to those speakers who are expected to be the most advanced in processes of linguistic change. It has been established that most sound changes are initiated in urban centers (Trudgill 1974; Callary 1975; Bailey et al. 1991); thus the first tier of communities to be sampled consisted of places with the greatest concentration of population. Each community was selected as the focal point of an area, and the areas were determined so as to cover all the territory of English-speaking North America. Three defining terms are involved: Zones of Influence (ZI), Central Cities, and Urbanized Areas (UA). The selection of places to be sampled involves intersecting characteristics of the three levels, as will be explained below. The terms will first be defined, and then the selection criteria that produced the overall sampling plan will be described.

Zone of Influence

A Zone of Influence (ZI) is a set of counties. It is derived from the 1992 County Penetration Reports of the Audit Bureau of Circulations (ABC). ABC audits data from member organizations on the circulation of newspapers and other publications. For every county with at least 100 households, the County Penetration Report lists the name of each member newspaper, gives its circulation, and indicates whether it is a daily or weekly and morning or evening publication. A ZI, defined for the Telsur/Atlas project, is determined by Central Cities (see below). A county belongs to the ZI of a given Central City if, in that county, the circulation of the newspaper(s) from that city is greater than the circulation of the newspaper(s) from any other city that has been designated a Central City for the purposes of the research project.

Once the Central Cities have been selected, it is in theory possible to assign every county to a ZI. In practice this is not true, because some counties have fewer than 100 households and so are not listed in the County Penetration Reports. In most cases, such counties can confidently be assigned to a ZI on the basis of

1 This project was supported by NSF under grant BNS91-11637, "A Survey of Sound Change in Progress".
2 The second phase of the Atlas was supported by NSF under grant SBR 92-22458, "A Telephone Survey of Sound Change in Progress".
3 The third phrase of the Atlas was supported by grant RT-21599-94 from NEH, "A Phonological Atlas of North American English".
4 The study of the Midland was supported by grant SBR 98-11487 from NSF, "Linguistic Diversity in the North American Midland".

the ZI assignment of surrounding counties. In a few cases, the assignment of a given county could arguably be made to either of two ZIs. In those instances, the assignment was made on the basis of considerations such as proximity to the Central City.

Central City

This term is used in two senses. First, it is used as a synonym for the U.S. Census Bureau's definition of a Central Place as the defining feature of larger census units, including the Standard Metropolitan Statistical Area (SMSA) and the Urbanized Area (see below). The second sense is defined for the Telsur/Atlas project: a Central City is the central place of a Zone of Influence. As in the Census Bureau definition, a Central City may actually consist of more than one city: examples are Minneapolis/St. Paul, MN and the Quad Cities on the Mississippi River (Moline and Rock Island in Illinois and Davenport and Bettendorf in Iowa). The basic criterion for the selection of a Central City of a ZI is that it is a place for which the Urbanized Area (see below) has a population of at least 200,000 according to the 1990 census. Due to low populations in some areas, it was necessary to designate a number of cities smaller than this limit as Central Cities, such as Burlington, VT, Roanoke, VA, and Boise, ID. Three of the Central Cities are even smaller than the threshold of 50,000 which is used by the Census Bureau as a criterion for status as the Central Place of an Urbanized Area; they were assigned the designation of Central Cities for the same reason as the other Central Cities with a population under 200,000: to provide well-motivated geographic coverage. The status of such towns as regional centers is demonstrated by the existence of a local newspaper that has wide circulation in the area. The three Central Cities which are not UAs are Minot, ND, Aberdeen, SD, and Rutland, VT. Thus a Central City serves as the defining place of a Zone of Influence, and at the same time it is the Central Place of an Urbanized Area.

Urbanized Area

This term is defined by the U.S. Census Bureau in order to provide a better separation of urban and rural population than is given by the SMSA, which takes the county as its building block. It consists of a central city or cities and the surrounding densely settled territory. By definition, it has a population of at least 50,000. The densely settled surrounding area consists of contiguous incorporated or census designated places having either a population of 2,500 or more, a population density of 1,000 persons per square mile, a closely settled area containing a minimum of 50 percent of the population, or a cluster of at least 100 housing units. Further details on the definition of an Urbanized Area may be found in the Census Reports. The composition of each Urbanized Area is shown on maps in the series of census reports *1990 CPH-2: Population and Housing Unit Counts*.

In the design of the Telsur/Atlas sample, the Urbanized Area is taken to be a conservative estimate of the territory of the speech community of the corresponding Central City. If a speaker is a native of any place within the Urbanized Area of a Central City, he or she is taken to be linguistically representative of the Central City's speech community. The areal extent of the UAs as mapped by the Census Bureau is quite restricted, which allows us to be confident that this is a valid sampling decision.

The Central Cities selected to define ZIs are further divided into four types by population of the corresponding UA and by area of the ZI, as follows:

p1 UA population > 1 million;
p2 UA population > 200,000, non-restricted (area > 5,000 square miles);
p3 UA population > 200,000, restricted (area < 5,000 square miles);
p4 UA population < 200,000.

These four levels are used to differentiate the amount of sampling to be done in smaller cities within each ZI. At the level of the Central Cities, the only difference in sampling is between the p1 cities and all others: in p1 cities, at least four speakers were to be interviewed, while in all others, at least two were to be interviewed. Furthermore, in every city, an effort was made to insure that at least one speaker would be a woman between the ages of 20 and 40.

Appendix 4.1 lists the 145 Central Cities that were selected for sampling and gives the corresponding ZI and UA populations. The figures show that 54 percent of the population of the United States lives in the 145 Urbanized Areas (or smaller cities) that were selected for sampling. Thirty-three of the UAs have a population over one million, and 112 have a UA population under one million. Thus the total minimum number of speakers to be represented in the completed national sample of the United States would be 356 speakers. A similar sample, consisting of about 40 speakers, was designed for Canada. A sizable number of speakers from smaller towns were interviewed in the course of the pilot project, and it occasionally happened that a speaker in one place was actually a good representative of a different speech community – small or large – and had moved to her/his present community recently. Thus many "extra" speakers were interviewed: the Telsur sample of North America consists of 762 speakers. The additional speakers add greatly to the depth and richness of the data, and they provide further confirmation of the validity of the methods employed through the consistency of the findings that they yield.

4.3. Selection and recruitment of speakers

Once a place was selected, the next step was to locate representative speakers. This was accomplished by searching local telephone directories for names marked by the most prominent national ancestry groups. In most of the pilot project area, the largest group of Euro-Americans is of German ancestry. English and Irish ancestry are also reported widely, Scandinavian ancestry is frequent in the northern region, and Polish ancestry is prevalent in the industrial centers. To maximize the likelihood of reaching speakers who are native to their places of residence, names were selected that occurred in clusters. Ideally, names were chosen that were listed as "Jr." when the senior with the same name was also listed. The initial interchange with a person who answered the telephone was the identification of the interviewer by name, giving the affiliation with the University of Pennsylvania; the explanation that a study of communication among people from different parts of the country was being conducted; and the question of whether the speaker had grown up in the town where he or she was located. If the answer was affirmative, permission to conduct the interview was requested. If the speaker agreed, permission to record the interview was requested. The complete script of this introduction, as well as the entire interview schedule, is given in Appendix 4.2. The make-up of the interview schedule will be discussed below.

Bias in Telephone Listings

By using published telephone listings to locate prospective speakers, we introduce the possibility of bias from the exclusion of those with unpublished telephone numbers. Labov (2001) reports that in the Philadelphia neighborhood study of sound change in progress conducted from 1973 to 1977 (LCV), a strong negative correlation was found between social class and the rate of unlisted telephone numbers, as follows:

Social class	% unlisted telephone numbers
Lower working class	80
Upper working class	56
Lower middle class	44
Middle middle class	31
Upper middle class	0
Upper class	0

This finding was understood by the fieldworkers to stem from the varying degree to which the different groups felt the need or wish to be available to the outside world. The effect of this bias on the study of sound change in progress was tested in the LCV study. Telephone listing for the subjects in the neighborhood study was entered as a variable in the regression analysis of the first and second formants for all the vowels under investigation, and this was compared with the results of a complementary survey of sound change in progress carried out by telephone (Hindle 1980). If telephone listing biased speakers towards either greater or less advancement of sound change, it would appear as a significant effect on the normalized vowel formant value. No such effect was found for any vowel.

While we can therefore assume with reasonable confidence that we are not likely to be misled as to the direction of sound change in the present study by relying on telephone listings to locate speakers, we must recognize that the pool of accessible speakers is reduced as we descend the social scale. This may not alter our finding as to the progress of sound change, but it is likely to affect the speaker sample's representation of the population as a whole. In this work, we have employed the Socio-economic Index (described below) developed by Duncan (1961) and updated most recently by Nakao and Treas (1992) to rank speakers on the social scale. Indeed, the distribution of the Telsur/Atlas speakers by Socio-economic Index appears to be weighted towards those who are higher on the social scale. Table 1 compares the social class distribution of the population in a selection of cities of varying sizes and locations with the social class distribution of the Telsur/Atlas sample as a whole.[5]

Table 4.1. Population by social class in selected cities

	Population	Upper middle	Middle middle	Lower middle	Upper working	Middle working	Lower working
New York City CMSA	8,716,770	16	25	13	30	11	5
San Francisco CMSA	3,239,687	17	26	12	29	11	5
Dallas CMSA	2,010,378	14	24	13	32	12	6
Miami CMSA	1,500,947	13	23	12	33	13	6
Minneapolis/St. Paul, MN	1,329,371	15	24	13	31	12	5
Cleveland, OH	1,266,993	13	22	12	33	13	7
St. Louis, MO-IL	1,154,922	14	23	13	32	13	6
Denver, CO	975,817	16	26	13	30	11	4
Kansas City, MO	777,523	14	23	13	32	12	6
Montgomery, AL	128,656	13	23	13	33	12	7
Muskegon, MI	65,424	10	18	11	36	15	10
Monroe, LA	58,100	13	23	12	33	14	6
All (N)	21,214,588						
Percent		15	24	13	31	12	5
Telsur speakers (N)	633	98	250	65	114	57	49
Percent		15	39	10	18	9	8

Table 4.1 shows that the Middle Middle Class is over-represented in the Telsur/Atlas sample as compared to the general population, and the upper working class is under-represented. The skewing found here is much less than the skewing of telephone listings by social class, however, and, most importantly, all the social classes are well represented. While it is thus evident that the speakers interviewed for the Telsur project do not precisely reflect the social class distribution of the population at large, this does not interfere with the investigation or analysis. The aim of ANAE is to determine those structural patterns that differentiate communities rather than those that differentiate speakers within the community. Various tables throughout the Atlas will take advantage of the distribution of social parameters throughout a dialect or regional area to establish their influence on the progress of a change. In these multivariate analyses, regression coefficients for education and occupation are generally much lower and less significant than those registering the effects of age, gender, and city size

Sociolinguistic studies of large cities show that centrally located social groups – lower middle and upper working class speakers – are the initiators of those sound changes internal to the system, which operate below the level of consciousness. Though these changes eventually affect the entire community, these centrally located speakers are more advanced in ongoing sound changes than are speakers at the extremities of the social scale. With two-thirds of the Telsur speakers falling into the upper working, lower middle, and middle middle classes, we can have some confidence that newly emerging sound changes will be represented in the data. As a further brake on any bias of the sample towards higher-class speakers, in the last stages of interviewing to complete the sample, special techniques were developed to locate speakers who satisfied the strictest criteria of nativity and social class. These will be detailed below.

National ancestry

The methods described in Section 4.4 are appropriate for a study of the central tendencies of speech communities, but not for a detailed examination of social differentiation within a community. Over the past two hundred years, large numbers of immigrants have entered most of the cities studied here; the great majority of them have become speakers of the current local dialect in the second and following generations. Even when a majority of the population consists of groups of foreign stock, the doctrine of First Effective Settlement applies: the new groups assume the cultural patterns of the smaller groups who preceded them (Zelinsky 1992; Mufwene 1996). In order to maximize the chances of recruiting local speakers, the Telsur method tended to focus on the majority ethnic groups in each area.

Table 4.2 gives the overall distribution of the major ethnic groups in the sample by the regions established in Chapter 11. In response to the question, *What's your own family's national ancestry?* (Appendix 4.2), 79 responded "White", "American", "European", or some other non-specific information. These are summed up as "White" in Table 4.2. The other figures show only the first identification given.

Most of the subjects named more than one nationality in response to this question (418 out of 762). Table 4.2 shows only the first response given; the overall proportions of national ancestral groups are similar for second, third, and fourth items given. The bold figures show the mode for each region. The right-hand column gives the percentages of each group in the 2000 U.S. Census for all Americans.

5 The data in Table 4.1 are based on figures given for occupation of employed persons 16 years old and over in Table 18, "Labor force and disability characteristics of persons: 1990" from the census volume series CPH-3.

In general, the proportions of national ancestral groups are ordered similarly to the census. The largest single identification is German. In the Telsur sample, the German group is by far the largest in the Midland, the North, and the West. There is a much more even distribution of ethnic groups in the South, with a heavier representation of English and Scots-Irish. The Scots-Irish are the modal group in Canada. The Mid-Atlantic region (which includes New York City, Philadelphia, Wilmington, and Baltimore) is the only region in which Italians are the predominant ancestral group.[6]

The emphasis of the Telsur method on the predominant ethnic group is seen most clearly in the high numbers of subjects of German background; the proportion is about twice as high (28%) as in the Census (15%). So far, German nationality has not been associated with the greater or lesser development of the phonology of the Midland and the North, but this bias in the population must be borne in mind. The Telsur method has not led to the elimination of smaller ethnic groups. Lithuanian, Finnish, Welsh, and Lebanese are represented in the 22 speakers in the "Other" category. Considering all responses, 14 of the Telsur subjects identify Jewish ethnicity in their background. A much larger number mention some Native American group. In terms of primary identification, the greatest number of Native Americans are found in the South.

Table 4.2. National ancestral groups identified in first response to Telsur questionnaire. Bold figures indicate largest group in a region.

	Canada	Midland	Mid-Atlantic	North	South	West	Transitional	Total	2000 Census %
English	5	11	2	19	23	9	3	72	8.7
Scots-Irish	**11**	7	2	7	21	2	0	50	1.5
Irish	3	17	5	14	16	1	2	58	10.8
German	4	**80**	7	**67**	**29**	**29**	1	**217**	**15.2**
Dutch	1	5	1	5	1	2	0	15	1.6
Scandinavian	0	4	0	20	2	10	0	36	3.5
French	4	5	1	12	5	4	0	31	3.0
Canadian French	0	0	0	4	2	1	0	7	0.8
Italian	0	7	**13**	16	12	2	1	51	5.6
Jewish	1	2	0	2	2	1	0	8	
Polish	1	6	2	11	2	2	0	24	3.2
Other Slavic	5	8	2	9	4	0	0	28	.25
Other	1	4	2	3	3	0	0	13	
"White"	1	17	0	23	27	11	1	80	
Hispanic	0	0	0	2	5	6	0	13	12.5
African-American	0	2	5	7	27	4	0	45	12.9
Native American	1	4	0	1	7	1	0	14	1.5
Total	38	179	42	222	188	85	8	762	

Race

Although thirteen subjects gave some Hispanic or Latino identification in response to the question on ethnicity, the Telsur survey did not focus on the 12.5 percent of the U.S. population that is Hispanic. The studies of Latino/a English that have been carried out in the last several decades indicate that there are some common features of the second generation dialect that differentiate it from others (Santa Ana 1992; Bayley 1994). Detailed sociolinguistic studies have found that Latino speakers are subject to several competing influences: traditional Spanish, AAVE, and the local white dialects (Wolfram 1974; Poplack 1978; Fought 2003). A thorough and accurate study of geographic differences in the English of Latinos from the Caribbean and various countries of Central and South America is beyond the scope of the current work. It is not likely that the Telsur interview would be able to trace the many variable tendencies in these English dialects, where consistent dialect patterns are still in the process of formation.

The study of geographic differentiation among African-American speakers raises a different set of questions. Studies of AAVE have shown a remarkable geographic uniformity in those grammatical and phonological features that are distinctive to this dialect (NYC: Labov et al. 1968, Labov 1972; Detroit: Wolfram 1969, Edwards 1992; Washington DC: Fasold 1972; Mississippi: Wolfram 1974, Loman 1967; North Carolina: Anshen 1969; Los Angeles: Baugh 1983; San Francisco: Mitchell-Kernan 1969). In general, African-American speakers do not participate in the regional sound changes that are the main focus of ANAE (Labov 1966; Labov and Harris 1986; Veatch 1992; Labov 2001: 506–508; Thomas 2001). Thomas finds a remarkable uniformity of vowel systems among African-Americans throughout the U.S. (p. 165), even in the South (p. 170).[7] At the same time, there are consistent differences between African-Americans and whites in the South, even in the earliest records.

Even in those Northern cities in which African-Americans form the majority (e.g. Detroit), African-Americans do not appear to have had any influence on the evolution of the white vernacular, either in the city or the surrounding suburbs. For this reason, the Telsur survey did not specifically search for African-American speakers in the North, the Midland or the West. In those areas, 22 subjects identified themselves as having African-American ethnicity, in whole or in part.

The procedure in the South was the opposite. Using the special methods for locating speakers of a given background discussed in Section 4.7 below, African-American subjects were targeted in five major cities: New Orleans, Jackson, Birmingham, Atlanta, and Durham. Chapter 22 reports on the phonological inventories and phonetic patterns of these speakers, comparing them with the white subjects in the same cities. The chapter includes a summary of the phonetic analyses of rural and small-town African-Americans by Erik Thomas.

4.4. Methods of recruitment

Understandably, many speakers are wary of an unsolicited telephone caller who begins speaking from a prepared script. Telsur interviewers were trained to initiate the interview in a slow speech style to achieve maximum clarity in explaining the purpose of the call. The overt purpose of the interview was explained in the following initial script:

> *Hi, my name is ______. I'm calling from the University Pennsylvania in Philadelphia. We're doing research on communication between people from different parts of the country, so we're looking for people who grew up in one place to help us by telling us a little about how people say things in your area. Did you grow up in ______? If yes: Can you take a few minutes now to answer some questions?*

---

6 There are 11 subjects in New York City: three are Italian and three are Irish, one German, one Scots-Irish, one Dutch and two African-American.

7 In the North, some recent studies show partial movements of African Americans in the direction of the white regional pattern (Thomas 1989/93 in Ohio, Deser 1990 in Detroit, Henderson 2001 in Philadelphia). Studies of African-American English in Northern cities show stylistic variation in the vocalization of /r/ and monophthongization of /ay/ (Myhill 1988). In the South, African-Americans show vowel systems that are related to general Southern patterns, though the earliest records show consistent differences between African-American and white speech. Many of the older black speakers show monophthongal [e:] and [o:] for the vowel classes of long *e* and *o*, and /aw/ is consistently further back than in white speech (Labov, Graff, and Harris 1986).

If the respondent asked to know more about the purpose of the interview, the interviewer proceeded as follows:

> *People across the country are talking to each other more and more, and at the same time we know that local accents are getting more different, in spite of the fact that we all watch the same TV programs. We want to find out how people talk in each region of the country and whether local ways of talking are changing in any way.*

Since North Americans have a general interest in the existence of dialect differences within American speech, refusal rates were low by comparison with other telephone surveys (see Table 4.3).

Permission to record. The following routine was followed closely in securing permission to record over the telephone.

> *In order to be able to keep track of everything you can tell us, I need to be able to make a tape recording of this conversation. Is that all right with you? (If informant is hesitant: I can assure you that this information is used only by our research group for our reports about general trends in American English, and no information identifying individuals is ever released.* If still hesitant: *If we come to a question you don't think you want to answer, just tell me and we'll skip it. I don't think you'll have a problem with any of the questions I'm going to ask you.)* If permission is given, turn tape recorder on and tell informant you have done so.

In the small number of cases where the person did not agree to be recorded (7 to 16%), the interviewer was instructed to thank the person for their time and terminate the interview.

Though the Telsur interview did not as a rule reach the levels of intimacy and rapport characteristic of the best sociolinguistic interviews, a large part of it was designed to replicate friendly conversation. The interviewer was trained to call upon all of his or her knowledge and experience of the place where the speaker lived. With each successive interview in a given place, the interviewer was better informed about that place and could converse more effectively with people local to the place. The interviewer was trained to be sensitive to the level of interest shown by the subject in order to maximize the flow of spontaneous speech.

Sensitivity to questioning was most likely to arise in the section on demographic data, which was positioned at the end of the interview. It includes the speaker's age and occupation and also the speaker's parents' occupations. Speakers occasionally declined to give some of this information, but the refusal rate was low. Most speakers had already talked about their own occupations by the time the interviewer reached this section, so the question was a matter of filling in details.

4.5. Records of calls required for successful interviews

The Telsur project kept detailed records of all telephone calls made, in order to trace regional differences in the difficulty of locating local speakers and rates of refusal and acceptance. The ease or difficulty of achieving a successful interview varied greatly. The first phone call of the Atlas was made to Sioux Falls, SD, at 3:30 in the afternoon on February 24, 1992. A woman answered the phone and listened politely to the investigator's request for an interview. She explained that she had a day care center in her home, so she was not free to talk during the day. The interviewer thanked her and dialed a second number in Sioux Falls. This call was answered by a man who agreed to be interviewed after asking, "It doesn't cost anything, does it?" The ensuing tape was labeled TS 1. The last interview, TS 835, was conducted by the same interviewer on November 14, 2001, in San Diego, CA. This interview, with a roommate of the college student in whose name the phone was listed, was achieved after dialing the telephone 142 times. The outcomes of these calls to San Diego were as follows:

Frequency	Result
9	No answer (6%)
54	Answering machine (38%)
7	Busy signal (5%)
12	Phone disconnected (9%)
5	Call screening, fax machine, modem (4%)
42	Respondent not local (30%)
10	Interview refused – not interested, busy, refused recording, etc. (7%)
2	Respondent asked interviewer to call back later (1%)
1	Successsful interview (< 1%)
142	Total calls

These two interviews, the first and the last of the Telsur project, represent the extremes of the task of garnering a successful interview. (There were also occasional instances of getting a good interview on the first phone call to a city or town.) In general, the most difficulty was encountered in places where there was a high proportion of non-local residents. City size was not necessarily a problem. In Chicago, for instance, the following record was made in February, 1993, without any special screening for census districts:

Frequency	Result
1	No answer (6%)
5	Answering machine (29%)
3	Interview refused – not interested, busy, refused recording, etc. (18%)
4	Respondent asked interviewer to call back later (24%)
4	Successful interview (24%)
17	Total calls

In a sampling of cities in the Midwest, another investigator made recordings between January, 1993 and April, 1994 in Wisconsin (Hayward, Steven's Point, and Oconto), Minnesota (Chisholm, St. James, and Minneapolis), Iowa (Grinnell and Denison), South Dakota (Redfield), Nebraska (Wayne and Falls City), Illinois (Lena and Fairbury), and Ohio (Cleveland and Cincinnati). These are mostly small towns, but a number of large cities are included as well. The results were as follows:

Frequency	Result
12	No answer (14%)
8	Answering machine (9%)
3	Busy signal (3%)
7	Phone disconnected (8%)
13	Respondent not local (15%)
14	Interview refused – not interested, busy, refused recording, etc. (16%)
5	Respondent asked interviewer to call back later (6%)
4	No adults at home (5%)
20	Successsful interview (23%)
86	Total calls

In another part of the Telsur region, the state of Texas, three interviewers working together made the following record between June, 1996 and January, 1997, in calls to Austin, Amarillo, Houston, and Dallas:

Frequency	Result
34	No answer (14%)
66	Answering machine (27%)
6	Busy signal (2%)
19	Phone disconnected (8%)
19	Fax machine, business, etc. (8%)
62	Respondent not local (26%)
22	Interview refused – not interested, busy, refused recording, etc. (9%)
3	Respondent asked interviewer to call back later (1%)
1	No adults at home (< 1%)
9	Successsful interview (4%)
241	Total calls

In yet another region, the following record was made by two interviewers during April and May, 1995. These calls were made in New York State (Syracuse, Albany, Rochester, and Buffalo) and Pennsylvania (State College, Harrisburg, Pittsburgh, Erie, and Scranton):

Frequency	Result
19	No answer (14%)
50	Answering machine (36%)
4	Busy signal (3%)
9	Phone disconnected (7%)
2	Fax machine, business, etc. (1%)
26	Respondent not local (19%)
8	Interview refused – not interested, busy, refused recording, etc. (6%)
3	Respondent asked interviewer to call back later (2%)
17	Successsful interview (12%)
138	Total calls

These records are summarized for purposes of comparison in the following table of percentages of outcomes of each dialing of a telephone number.

Table 4.3. Percentage of outcomes of dialing the telephone in five cities or regions

	San Diego	Chicago	Midwest	Texas	NY & PA
No answer	6	6	14	14	14
Answering machine	38	29	9	27	36
Busy signal	5	0	3	2	3
Phone disconnected	8	0	8	8	7
Not a residence	4	0	0	8	1
Respondent not local	30	0	15	26	19
Interview refused	7	18	16	9	6
Call back later	1	24	6	1	2
No adults at home	0	0	5	<1	0
Successful interview	1	24	23	4	12
Total number of calls	142	171	86	241	138

Overall, the table reflects the relative difficulty of accomplishing a successful interview in terms of the number of times it is necessary to dial the telephone. There is partial comparability among the different places defined here, but there are also differences, as was stated above. The table registers two general types of outcome, which can be considered separately: the first five lines are outcomes in which the phone is not answered by a live person, and the last five lines are outcomes in which the interviewer speaks to a potential interviewee.

Table 4.4 summarizes the frequencies of outcomes in which the interviewer reached a person, in order to assess the rate of actual refusal and success. The case of no adults being at home – when a child under the age of 18 answers the phone – is not included, since those are cases of the interviewer not reaching a potential participant.

It must be kept in mind that speakers were screened as quickly as possible for locality status, in order to weed out non-local speakers with a minimum investment of time and effort. Respondents were told, “We’re looking for speakers who grew up in one place to help us by telling us a little about how people say things in each area. Did you grow up in ______?”

Non-local respondents are not candidates to be a Telsur speaker. However, they still have the opportunity to refuse to be interviewed, without divulging their locality status, by cutting off the phone call before the interviewer is able to determine that they are non-local. (Some respondents simply hung up the phone during or immediately after the interviewer’s request for participation. Others had reactions such as “Heaven’s sakes!” or “We can’t help you. Bye”, before hanging up.) The number of flat refusals of the total number of adults reached by phone, including non-locals, is given first, as the minimum refusal rate. In another sense, the refusal rate is the number of refusals out of those who either refused after the request for participation was made or who terminated the interaction before responding to the interviewer at all; this calculation is given on the second line of refusal rates. The “true” refusal rate must be somewhere in between.

The success rate may also be judged by several criteria. The most realistic measure from the standpoint of the interviewer is the rate of successfully completed interviews in relation to the number of live people contacted; this is the proportion given as success rates in the last line of the table.

Table 4.4. Percentages of refusal and success in obtaining interviews

	San Diego	Chicago	Midwest	Texas	NY & PA
Respondent not local	42		13	62	26
Interview refused	10	3	14	22	8
Call back later	2	4	5	3	3
Successful interview	1	4	20	9	17
Refusal rate, incl. Non-locals	18	27	27	23	15
Refusal rate, excl. Non-locals	77	27	36	65	29
Success rate, incl. Non-locals	2	36	38	9	31

These variations in refusal and success rates are related to differences in regional histories and population mobility. The greatest differences between regions are in the proportions of non-locals, reflecting the well-known migration patterns in the U.S. towards the Sun Belt. Chapters 11 and 20 will show that the defining features of the West as a dialect area are more complex and less consistent than for other areas, and the high proportion of non-locals in San Diego is correlated with this situation. Large-scale inmigration to the largest Texas cities is reflected as well in the variable realization of Southern features in that state (Chapter 18).

Finally, we must confront the fundamental question of any sampling procedure: to what extent does the sample represent the population of local speakers? Are the local speakers who refused the interview different linguistically from those who agreed to be interviewed? The early study of New York City included a method of sampling those who refused face-to-face interviews by means of a telephone interview, and found no such bias (Labov 1966, Appendix D), but there is no practical way of re-sampling those who refused the telephone interview. It is possible that persons with greater linguistic insecurity are more likely to refuse the Telsur interview, or that leaders of linguistic change are more likely to accept it. We have no way to estimate such biases. The major way of assessing the representativeness of the sample is through the regularity of the results, in the form of homogeneity and consistency of isoglosses (Chapter 6).

4.6. Contacting speakers: pinpointing the ideal speaker

As we approached the end of the interviewing, we found that we needed a few more speakers in places where experience had demonstrated that it was difficult to locate speakers of the traditional vernacular. One example is New York City, where the status of preconsonantal /r/ is a crucial issue. /r/-vocalization is waning fast among upper middle class speakers, and we needed to determine its status in the working and lower middle class, where vocalization historically has been very high. Yet finding a white, native, working or lower middle class New Yorker in a city of seven million people by choosing names from a telephone directory is difficult. In a borough where such speakers are most likely to be found, such as Queens, 28 percent of the residents are not native-born Americans, 22 percent are African-American, and 20 percent are Hispanic. In several sociolinguistic studies, it has been found that African-American and Hispanic speakers do not participate in the major sound changes in progress that are the focus of ANAE. The problem of ethnicity can largely be circumvented by selecting names from the telephone directory that are marked for national ancestry as Irish, Italian, German, Slavic, Jewish, or other European nationalities that are well represented in the area of interest. We exclude English names, as those are prevalent among African-Americans, and Spanish names. But the problem of locating a native-born speaker from centrally located social classes remains a difficult one.

The same problem arises in Sunbelt cities such as Atlanta, GA and Dallas, TX. These places are populated largely by native-born Americans, but the rate of inmigration from the North and from the surrounding regions raises a serious obstacle to locating natives of the respective cities. Furthermore, under the pressure of so much outside influence, it becomes even more important to interview speakers who participate in relatively closed social networks and thus are less subject to the leveling influence of imported dialects; these speakers, again, are those from the interior social classes.

It may seem paradoxical that it is difficult to locate speakers with the desired characteristics when the goal is to represent the speech patterns of the community as a whole. But it is not uncommon to find that the main stream of vernacular tradition is obscured by the presence of large numbers of recent arrivals in the adult population. Studies of the formation of new communities (Payne 1980; Kerswill and Williams 1994) have shown that the children of these recent migrants adopt the local vernacular with great regularity, confirming the Doctrine of First Effective Settlement (Zelinsky 1992). The future course of any speech community cannot be traced from the diverse patterns of adults whose children reject their non-local dialect. Thus the original study of New York City was based on 81 of the 700 subjects interviewed in the primary social survey (Labov 1966).

Two strategies for reaching speakers who satisfy these criteria present themselves. One is to make many phone calls and to be very particular about which respondents are interviewed. However, the years of interviewing had demonstrated that it is frustrating to the interviewer to have to make an enormous number of phone calls in order to obtain a satisfactory interview. It is also wasteful, in that each telephone call incurs an expense. Most importantly, we do not systematically elicit the information necessary for classification by social class, occupation and education, until the end of the interview. Asking a respondent for this personal information as part of a screening process would likely produce an intolerably high refusal rate.

An alternative method is to identify neighborhoods in the city where the desired speakers live and to restrict calls to those neighborhoods. The 1990 census reports contain a wealth of detailed information on social characteristics of the population, which is listed by census tract in the series *1990 CPH-3: Population and Housing Characteristics for Census Tracts and Block Numbering Areas*. A census tract is a rather small area, usually having a population of 2,500 to 8,000 and averaging about 4,000. If the interviewer can identify census tracts in which a high proportion of the residents satisfy the necessary criteria, it is likely that a much higher success rate can be attained in reaching the desired speakers. In the CPH-3 set of census reports, the most useful tables for this purpose are Tables 8, 16, and 20, dealing with race, ancestry, and social and labor-force characteristics.

The order in which the tables are consulted depends on the nature of the area under consideration. To locate speakers in New York, the county of Queens was selected. A list was made of all the census tract numbers which satisfied the criterion of 10 percent or less foreign born white persons (Table 20). From that list, those who did not satisfy the criterion that two-thirds of the population should be white (Table 8) were eliminated. Table 20 contains data on only about 225 of the approximately 670 census tracts that are listed in Table 8, so many tracts that would otherwise be candidates for consideration were not reviewed. Returning to Table 20, the census tracts still on the list were examined for the percentage of the population holding a bachelor's degree or higher; those in which the rate was greater than about 20 percent were eliminated. Finally, Table 16 was consulted for the predominant national ancestries of the targeted census tracts. There were eight census tracts that satisfied the criteria well, and ten more that were somewhat marginal.

Obtaining telephone listings for the targeted areas requires further steps. The atlas of the census tracts is consulted to locate the boundaries of the tracts. A further resource is the Census Tract Street Locator on the website of the Census Bureau,[8] which locates streets by census tract and gives the corresponding zip code, as well as other information. From commercially available databases of telephone listings, phone numbers are easily searched by zip code.

Using this extensive preparation, telephone listings of a number of Jewish and Irish names were printed for parts of Queens, NY. In three sessions, the phone was dialed 19 times. In eleven cases, no one answered the phone. Of the eight people contacted, four refused to be interviewed and two were not native New Yorkers. Two highly successful interviews were completed with women having precisely the desired social histories. In addition, an arrangement was made to interview the daughter of one of the women a few days later. This and subsequent applications of the method proved to offer a very high rate of return for the time invested.

4.7. Age and gender distribution of the sample

The sampling methods discussed above produced a range of subjects from age 12 to 89. It is not important for the goals of ANAE that all ages be equally represented; as noted above, emphasis was put on the early adult years. It is important that the age range be roughly equivalent for all geographic regions. If not, a

8 The web address for this utility is http://tier2.census.gov/ctsl/ctsl.htm. This and other Census Bureau databases are listed at http://tier2.census.gov/dbappweb.htm.

constant difference in age-grading in the population might appear as a regional difference. Table 4.5 shows the age distribution of the Telsur sample in decades for seven regions.[9] A graphic comparison of the five major regions appears in Figure 4.1. All regions show a heavy concentration in the young adult period, 20 to 40 years. The major differences that appear are differences between the South – with more older subjects. and a modal range of 40 to 49 – and the West, with a modal range of 20 to 29. The three other regions are intermediate, with modes in the 30 to 39 range.

Table 4.6 and Figure 4.2 show the distribution of the sample by gender. The excess of women over men is apparent, and is also the parallel distribution across decades of age. The ratio of women to men is 1.7:1. The chief departure from this is in the concentration of women in the 20 to 29 age range as against the relatively high proportion of men in the decade from 40 to 49. For the decade from 20 to 29, the ratio of women to men is 1.9:1; for age 40 to 49, it is 1.2:1.

Table 4.5. Age distributions of Telsur speakers

Age	Canada	ENE	Midland	Mid-Atl	North	South	West	Total
10–	4	1	13	6	12	26	13	75
20–	10	1	30	4	26	24	24	119
30–	14	0	52	5	57	34	20	182
40–	6	2	36	8	46	47	11	157
50–	3	1	19	6	33	14	11	87
60–	1	1	20	7	17	21	8	75
70	1	2	14	4	20	15	4	60
Total	39	8	184	40	211	181	91	762
Mean	35	48	41	45	44	41	47	42

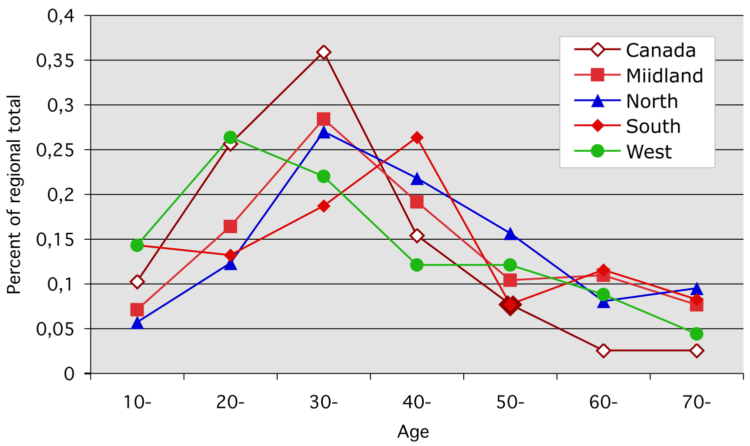


Figure 4.1. Age distribution of Telsur speakers in the five largest regions

Table 4.6. Distribution of Telsur speakers by gender and age

	Age by decade								
	10–	20–	30–	40–	50–	60–	70–	80–	Total
Female	54	80	119	87	55	48	28	9	480
Male	21	41	65	70	34	28	19	4	282
Total	75	121	184	157	89	76	47	13	762

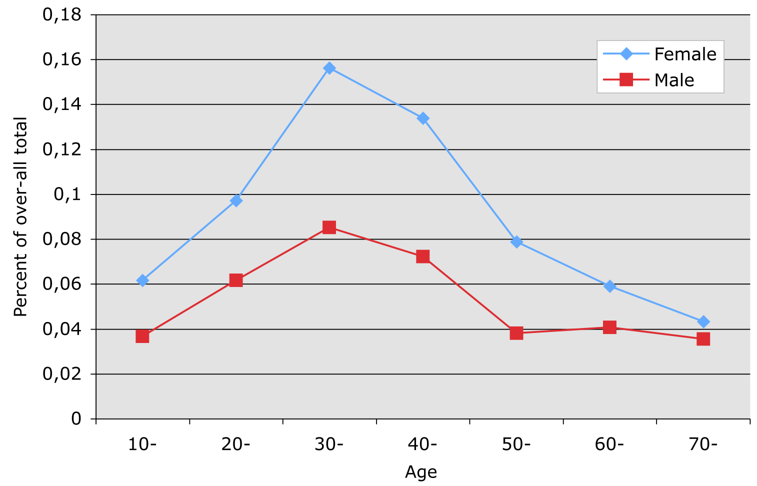


Figure 4.2. Distribution of Telsur speakers by gender and age

4.8. The Telsur interview

The original interview questionnaire was designed for the six-state pilot project area, which encompassed parts of three dialect areas and thus was written to include most of the variables that are of interest in North American English. The same form was used in the next phase of data collection in the fifteen-state area comprising the agricultural and industrial heartlands of the United States, corresponding to most people's idea of the Midwest. With the expansion of the survey to all of English-speaking North America, variants of the original inter-

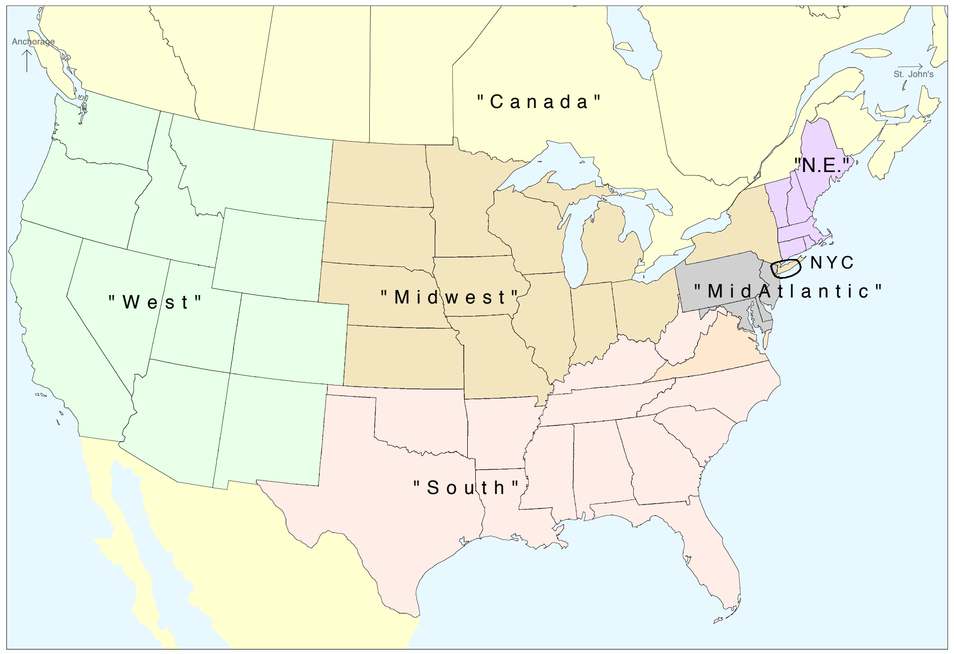


Figure 4.3. Regional variants of the Telsur interview form

9 See Chapter 11 for the distinction between dialects and regions. The region is the larger unit under which dialects are grouped.

view schedule were introduced, resulting in six forms of the questionnaire. They all share most of the same variables, but there are a number of modules which are included only in certain forms to tailor them to the different regions of North America: South, West, Mid-Atlantic, New England, Midland, and Canada. Since the dialect boundaries of Chapter 11 had not yet been established, state boundaries were used in selecting the variant forms of the interview schedule.

Following the introduction described in Section 4.5 above, which establishes that the respondent is a native of the community where she or he lives and that recording is permissible, the interview is divided into six sections.

1. *Demographic information*. Information on the native and local status of the respondent: place of birth, complete residence history, father's and mother's places of birth, and languages spoken.
2. *Spontaneous speech*. The largest portion of spontaneous speech is obtained from a discussion of recent developments in the city, the state of the downtown area, and travel outside the city. If a topic of special interest to the speaker is raised, it is pursued to the fullest extent possible. Speakers often talk about their jobs, hobbies, or other interests in this portion of the interview.
3. *Word lists*. Sequences of words that do not require reading: counting, days of the week, articles of clothing, breakfast foods, and others.
4. *Linguistic variables*. This section includes, first, *minimal pairs* in the form of judgments on rhyming (*hot*/*caught*) or 'same' versus 'different' (*dawn*/*Don*). In each case, the respondent is prompted to say words described but not pronounced by the interviewer (e.g. *What is the opposite of cold?* as the prompt for *hot*), then asked to give a judgment on contrast or identity of the pairs of sounds. The respondent is then asked to say the two words again. This procedure was designed to elicit two instances of production as well as a judgment of each contrast under study.

   Spontaneous pronunciations of crucial lexical items are obtained through the use of the *semantic differential* technique (Labov 1984), which uses questions about differences in meaning between two words, such as *cot* vs. *bunk* and *pond* vs. *pool*. Subjects put considerable effort into answering these questions, producing several highly stressed tokens of each word without attending to their pronunciation. Previous research shows that the use of the variables in the semantic differential approaches the values of spontaneous speech quite closely (Labov 1989).

   A series of grammatical variables was included. They were introduced with the following protocol: *I'd like to ask you to tell me what you think of a few sentences I'm going to read you. These are sentences that sound fine to people in some parts of the country but a little strange to people in other parts of the country. For each sentence I read you, I'd like you to tell me whether you think it sounds like something you could say yourself, or something you've heard around your area but you wouldn't say, or something you've never heard before*.

   Responses to grammatical features were coded on a three-point scale: 1 "could say yourself", 2 "heard but wouldn't say", and 3 "never heard".

   A small number of *regional vocabulary* items were included in the Telsur interview form. These are of the simple form, "What do you call ______?" where the interviewer gives a definition of the variable in question. For example, *couch*/*sofa* was elicited with the question, "what do you call a large piece of furniture that seats three people?".
5. *Demographic background*. More detailed information on the demographic background of the subject is gathered, including occupation, education and national ancestry.
6. *Continuation*. The final section was the request for the respondent to continue participation in the research by reading a word list, which is to be mailed to the speaker. This required that the speaker provide his or her name and address. A small number of speakers declined to give this information or refused to participate in this second part of the interview, and some asked for additional reassurance that they would not be subject to solicitations from salespeople or other unwanted callers. Most speakers readily agreed to the follow-up interview and greeted the interviewer as a familiar acquaintance when he or she called again.

   The interview form also contains suggested answers to questions that subjects often ask: "So what's this study all about again?"; "Why is this important?"; "Who is paying you to do this?"; "What are you going to do with the results?"; "Can I see some of your results?". See Appendix 4.2 for these suggested answers.

The duration of the Telsur interview averages about 30 to 45 minutes. The total volume of speech obtained proved to be more than we expected from the previous results of Hindle (1980). In the acoustic analysis of vowel systems, the mean number of vowel tokens was 306. Only 10 percent had fewer than 200 tokens.

4.9. The second interview

The second interview is designed to obtain more specific information on lexical distribution through the reading of a word list and more detailed information on contacts outside the community. Respondents are asked to read a full-page list of words, which is sent to them in the mail after the first interview. The word list is designed to cover the areas of variable contrast and variable lexical distribution in the speaker's region. A sample word list is given in Appendix 4.3. The second interview also goes more deeply into the patterns of travel, friendship, kinship, and communication that relate the respondent to other cities of interest.

4.10. Impressionistic coding

The first stage of analysis is the transcription of all demographic data, recording of lexical choices and judgments of syntactic constructions, and the coding of the speaker's pronunciation of diagnostic words in the formal part of the interview. Like the interview questionnaire, the impressionistic coding form is tailored to the speaker's region. For the phonological variables, the analyst records the speaker's judgments of 'same' and 'different', and then enters a fine-grained phonetic transcription of the speaker's pronunciation. Finally, the analyst codes the result in a four-cell table:

		Judged	
		Same	Different
Pronounced	Same	a	b
	Different	c	d

Cell (a) represents full merger, and cell (d) registers a clear distinction. Cell (b) is usually the result of the mistaking of orthographic differences for pronunciation differences. Cell (c) is the case of near-mergers, where speakers consistently make a difference between two sounds but do not judge them as different and do not use the difference for semantic interpretation (LYS; Milroy and Harris 1980; Harris 1985; Di Paolo and Faber 1990, 1995).

4.11. The socio-economic index

Occupation is widely viewed as the best single determiner of social class. Unlike other factors such as income and house value, it is an acceptable subject of inquiry and conversation between strangers. Ratings of occupational prestige, beginning with those published for 90 occupational titles by the National Opinion Research Council (NORC) in 1947, have been widely used for the ranking of occupations in terms of social standing.

In 1950 the Census Bureau began collecting data on income and education for incumbents of certain occupations, of which 270 were listed in 1950. Duncan (1961) addressed the need for a ranking of the social status of occupations by calculating a Socio-economic Index (SEI) – intended to mimic but not replicate the NORC occupational prestige score – for all 270 occupations listed by the Census. He accomplished this by performing a multiple regression of NORC prestige ratings on the income and educational levels for those occupations that were common to both the NORC and the Census listings and then extrapolating to occupational titles listed by the Census but not included in the NORC study.

Duncan's work has been updated, most recently in 1989. The NORC has reported prestige ratings (Nakao and Treas 1989) for the 503 occupational titles on which the Census Bureau gathered data in 1980, and they also report SEI assignments for those occupations (Nakao and Treas 1992), using the methods developed by Duncan, with adjustments made for current levels of educational attainment and income. In the assessment of speakers for the Atlas, it was observed that the SEI has the advantage of taking into account not only the prestige assigned to occupational titles by a sample of raters but also the objective and additional important factors of income and education associated with the respective occupations. Therefore, the calculated SEI scores are used to rank the Atlas speakers, rather than the raw Occupational Prestige scores.

Problems in carrying out the task of assigning an SEI to each speaker stem mainly from two sources: inadequate data elicited from the speaker and difficulty in matching the speaker's occupation to one of the 503 occupations in the NORC/Census list. Some speakers, queried about their occupations, give answers such as "I work for Raytheon" or "I work in an office". The interviewer did not always pursue the subject in order to determine an appropriate occupational title for the speaker. Women who report themselves as homemakers are appropriately assigned the SEI corresponding to their husbands' jobs, but often that information was not obtained. High school and junior high school students are assigned the SEI corresponding to the family's breadwinner's occupation, so the interviewer had to be careful to elicit this information. College undergraduates and graduate students are a more difficult problem: they cannot properly be assigned the SEI associated with their family's breadwinner, but it is incorrect to assign them to an occupation which they have not yet entered, associated with their field of study. When clear information on occupation is obtained, it is still often difficult to decide how the information given by the speaker best matches the occupational titles listed by the NORC survey. For all speakers where an SEI assignment is made, the Census category number is also recorded, so that the assignment can be reviewed and revised if necessary.

Appendix 4.1. Zones of influence, Central Cities, and UA populations

	Zone	Zone pop.	UA pop. 1990	Per cent in UA	Zone abbrev.	Zone area (sq miles)
Alabama	Birmingham	2,395,674	621,703	25	Br	24,978
	Mobile	772,068	301,197	39	Mb	11,820
	Montgomery	735,752	210,060	28	Mt	12,996
Alaska	Anchorage	550,043	221,745	40	An	152,040
Arizona	Phoenix	2,754,669	2,006,568	72	Ph	91,983
	Tuscon	910,559	579,155	63	Tu	22,016
Arkansas	Little Rock	2,031,485	305,498	15	LR	47,361
California	Bakersfield	543,477	302,823	55	Bk	8,149
	Fresno	1,183,272	453,186	38	Fr	15,859
	Los Angeles	12,557,743	11,402,955	90	LA	26,142
	Modesto	597,381	231,045	38	Mo	5,767
	Riverside-SanBrndino	2,588,793	1,169,839	45	RSB	27,408
	Sacramento	2,043,240	1,097,313	53	Sa	27,520
	San Diego	2,607,319	2,348,106	90	SD	8,760
	San Francisco	5,871,470	3,629,864	61	SF	34,545
	San Jose	1,764,008	1,434,803	81	SJ	3,143
Colorado	Colorado Springs	441,755	353,026	79	CS	4,227
	Denver	3,199,682	1,517,803	47	Dn	173,268
Connecticut	Bridgeport	827,645	414,254	50	Br	665
	Hartford	1,655,252	546,074	32	Hr	3,722
	New Haven	804,219	451,486	56	NH	629
Delaware	Wilmington	737,515	450,080	61	Wl	2,424
District of Colum.	WashingtonDC	4,976,573	3,363,047	67	DC	15,522
Florida	Ft. Lauderdale	1,255,488	1,238,109	98	FL	1,220
	Jacksonville	1,420,761	738,593	51	Jc	14,673
	Miami	2,613,305	1,914,689	73	Mm	7,321
	Orlando	2,113,451	887,968	42	Or	7,630
	Pensacola	531,720	253,717	47	Pn	4,529
	Tallahassee	608,901	156,072	25	Tl	11,145
	Tampa	3,622,316	1,708,966	47	Tm	14,652
	West Palm Beach	1,177,580	795,033	67	WPB	5,955
Georgia	Atlanta	4,773,058	2,157,344	45	At	31,669
	Augusta	526,695	286,205	54	Ag	7,119
	ColumbusGA	462,445	220,651	47	CGA	6,632
	Savannah	620,623	198,609	32	Sv	9,287
Hawaii	Honolulu	1,108,229	632,498	57	Hn	6,443
Idaho	Boise	809,096	168,056	20	Bs	67,564
Illinois-Iowa	Quad Cities	556,615	264,181	47	QC	5,397
Illinois	Chicago	9,262,154	6,793,132	73	Ch	21,396
	Peoria	603,433	242,547	40	Pe	7,923
	Rockford	450,746	207,693	46	Ro	3943
Indiana	Evansville	631,670	182,908	28	Ev	9,285
	Fort Wayne	763,258	248,686	32	FW	6,190
	Indianapolis	2,893,819	914,426	31	In	19,217
	South Bend	817,583	237,481	29	SB	4,196
Iowa	Des Moines	2,364,603	293,446	12	DM	51,275
Kansas	Wichita	1,242,284	338,562	27	Wi	60,722
Kentucky	Lexington	1,277,067	221,116	17	Lx	16,186

	Zone	Zone pop.	UA pop. 1990	Per cent in UA	Zone abbrev.	Zone area (sq miles)
	Louisville	2,085,014	755,013	36	Ls	21,678
Louisiana	Baton Rouge	1,250,108	365,647	29	BR	12,136
	New Orleans	1,843,595	1,040,300	56	NO	11,328
	Shreveport	1,001,158	256,727	25	Sh	19,883
Maine	Bangor	453,541	61,374	13	Bn	24,965
	PortlandME	774,387	120,271	15	PME	8,299
Maryland	Baltimore	2,620,641	1,890,518	72	Ba	5,720
Massachusetts	Boston	4,879,886	2,774,717	56	Bo	5,943
	Springfield	812,322	532,341	65	Sp	2,853
	Worcester	709,705	315,698	44	Wr	1,581
Michigan	Ann Arbor	282,937	221,766	78	AA	725
	Detroit	6,552,441	3,697,424	56	Dt	42,232
	Flint	574,997	326,452	56	Fl	1,850
	Grand Rapids	1,024,815	436,033	42	GR	6,177
	Lansing	432,674	265,151	61	Ln	1,713
Minnesota	Duluth	389,042	122,945	31	Du	22,643
	Minneapolis	4,407,548	2,079,255	47	Mn	74,436
Mississippi	Jackson	1,524,375	289,199	18	Jk	29,231
Missouri	Kansas City	2,794,595	1,275,083	45	KC	39,830
	SpringfieldMO	590,008	159,594	27	SMO	14,637
	St. Louis	4,161,434	1,946,047	46	SL	44,618
Montana	Billings	374,142	88,206	23	Bl	87,675
	Great Falls	278,941	63,531	22	GF	56,766
	Missoula	212,007	57,006	26	Ms	24,580
Nebraska	Lincoln	309,515	192,578	62	Ln	5,976
	Omaha	1,464,098	544,273	37	Om	77,519
Nevada	Las Vegas	764,359	697,078	91	LV	40,499
	Reno	440,792	213,835	48	Rn	71,091
New Hampshire	Manchester	723,764	115,105	15	Mn	7,172
New Jersey	Trenton	325,824	298,939	91	Tr	228
New Mexico	Albuquerque	1,159,298	496,833	42	Aq	87,355
New York	Albany	1,220,151	509,196	41	Al	11,308
	Binghamton	525,354	159,059	30	Bn	6,610
	Buffalo	1,638,215	953,867	58	Bf	8,593
	New York	17,647,736	16,044,493	90	NY	11,103
	Rochester	1,238,165	620,214	50	Rc	5,486
	Syracuse	1,617,775	388,411	24	Sy	15,,638
North Carolina	Asheville	524,471	110,658	21	As	6,434
	Charlotte	2,044,904	455,386	22	Ct	11,312
	Durham	400,368	205,439	51	Dr	2,355
	Fayetteville	620,915	241,291	38	Fy	5,814
	Greensboro-/Wnstn-Salem	1,442,014	379,022	26	Gr	8,400
	Raleigh	1,846,799	305,820	16	Rl	15,555
North Dakota	Bismarck	172,140	66,607	38	Bk	26,662
	Fargo	420,712	121,351	28	Fr	28,910
	Minot	139,742	34,544	24	Mi	19,251
Ohio	Akron	791,885	527,780	66	Ak	1,908
	Canton	494,281	244,637	49	Cn	1,964
	Cincinnati	1,980,761	1,212,260	61	Ci	6,854
	Cleveland	2,104,587	1,677,554	79	Cl	3,156
	Columbus	2,410,609	944,744	39	COH	15,137

	Zone	Zone pop.	UA pop. 1990	Per cent in UA	Zone abbrev.	Zone area (sq miles)
	Dayton	1,173,945	613,314	52	Dy	4,009
	Lorain-Elyria	404,145	224,007	55	LE	1,271
	Toledo	1,097,126	489,469	44	Tl	5,463
	Youngstown-Warren	697,141	361,366	51	YW	1,960
Oklahoma	Oklahoma City	2,045,951	784,367	38	OC	54,309
	Tulsa	1,232,648	475,044	38	Tu	15,328
Oregon	Portland-Vancouver	3,183,569	1,171,834	36	PV	93,817
Pennsylvania	A'town-Bthlm-Easton	1,271,505	410,244	32	ABE	3,743
	Erie	466,172	177,661	38	Er	3,427
	Harrisburg	1,394,937	293,442	21	Hr	6,736
	Philadelphia	5,802,466	4,222,377	72	Ph	6,322
	Pittsburgh	3,911,581	1,680,112	42	Pt	19,466
	SCollege-Williamsprt	320,804	118,946	37	SCW	4,397
	Scranton/Wilkes-Barre	684,514	388,610	56	SWB	3,476
Rhode Island	Providence	1,003,464	845,725	84	Pr	1,207
South Carolina	Charleston	624,369	393,302	62	CSC	5,733
	Columbia	1,266,203	328,148	25	Cl	12,743
	Greenville	1,015,409	248,525	24	Gv	5,771
South Dakota	Aberdeen	88,260	24,927	28	Ab	16,987
	Rapid City	227,134	61,077	26	RC	42,434
	Sioux Falls	430,693	100,851	23	SF	27,441
Tennessee	Chattanooga	747,891	296,882	39	Cg	7,171
	Knoxville	1,441,478	303,713	21	Kn	11,,822
	Memphis	2,190,209	825,425	37	Me	28,362
	Nashville	1,701,163	573,154	33	Nv	17,659
Texas	Amarillo-Lubbock	858,350	345,913	40	AL	52,346
	Austin	1,190,558	563,025	47	Au	11,921
	Corpus Christi	470,406	269,878	57	CC	10,617
	Dallas-Ft. Worth	6,363,453	3,198,199	50	DFW	107,873
	El Paso	897,938	571,079	63	EP	39,242
	Houston	5,358,382	2,902,449	54	Ho	42,248
	San Antonio	2,575,411	1,128,966	43	SA	44,801
Utah	Ogden	200,343	259,148	129	Og	6,970
	Provo-Orem	269,407	220,560	81	PO	5,538
	Salt Lake City	1,265,185	789,720	62	SL	69,100
Vermont	Burlington	369,128	86,873	23	Bl	6,221
	Rutland	157,785	18,230	11	Ru	2,717
Virginia	Norfolk	1,701,413	1,323,039	77	Nr	9,155
	Richmond	1,439,553	590,352	41	Rc	14,713
	Roanoke	934,433	178,384	19	Rn	11,268
Washington	Seattle	3,727,330	1,743,796	46	Se	35,857
	Spokane	1,006,349	278,939	27	Sk	50,644
West Virginia	CharlestonWV	1,063,487	393,302	36	CWV	16,337
	Huntington-Ashland	431,583	169,323	39	HA	4,405
Wisconsin	Madison	823,218	244,335	29	Md	10,747
	Milwaukee	3,627,343	1,226,060	33	Ml	33,105
Totals	Count	145				
	Sum	248,709,873				
	Average	1,715,241				

Appendix 4.2. Sample interview form

A TELEPHONE SURVEY OF SOUND CHANGE
IN PROGRESS IN NORTH AMERICAN ENGLISH
Linguistics Laboratory, University of Pennsylvania

– MID-ATLANTIC VERSION –

0. Approach

Hi, my name is ____. I'm calling from the University Pennsylvania in Philadelphia. We're doing research on communication between people from different parts of the country, so we're looking for people who grew up in one place to help us by telling us a little about how people say things in your area. Did you grow up in ____? *If yes*: Can you take a few minutes now to answer some questions?

(*If speaker is hesitant* People across the country are talking to each other more and more, and at the same time we know that local accents are getting more different, in spite of the fact that we all watch the same TV programs. We want to find out how people talk in each region of the country and whether local ways of talking are changing in any way.)

In order to be able to keep track of everything you can tell us, I need to be able to make a tape recording of this conversation. Is that all right with you? (*If informant is hesitant*: I can assure you that this information is used only by our research group for our reports about general trends in American English, and no information identifying individuals is ever released. *If still hesitant*: If we come to a question you don't think you want to answer, just tell me and we'll skip it. I don't think you'll have a problem with any of the questions I'm going to ask you.)

Turn tape recorder on and tell informant you have done so.

1. Residential and language background

Confirm place of birth: Now, were you actually born in ____?
Full residence history and approximate ages in each location.
Where mother born.
Where father born.
Languages spoken in family while growing up.
Second language learning.

2. Conversation

2.1. Communication experience and travel

– Have you noticed that people in different parts of the country talk differently from yourself? What sort of differences have you noticed?
– Have you ever had a problem understanding people in other parts of the country because of their accent or because of different words they used?
– Where have you travelled?

2.2. Local color

– What's your town like? Would you say it's a nice place to live?
– What do most people do for a living in your area?
– Are there any big local industries?
– Is the economy doing OK?
– Have there been lay-offs in your area?
– Are people moving in or moving out?
– Are there lots of new houses going up?
– What do you do for fun on the weekends?
– What sports teams do you support?
– What newspapers do you read?
– What other cities do you go to for recreation or shopping?
(*Pick 2 or 3 largest cities in vicinity and explore the choice between them for different activities.*)

2.3. Downtown

– Does your city have a good downtown section?
– Are businesses moving in or out of downtown?
– Are there still some big department stores downtown?
– Are there any new buildings downtown?
– Do people hang out downtown after 5:00 on a weekday?
– Are there things to do downtown?
– Is it safe to walk around downtown at night?
– Can you find parking downtown? Is it expensive?
– Is the city doing anything to make people want to go downtown?
– Do you shop downtown or at the malls? Why?

3. Word lists

Now I'm going to ask you to say a few things for me that will help us with our study.

(a) First of all I'd like you to count for me from 1 to 10.
(b) And would you please say the days of the week?
(c) And now could you please list as many articles of clothing as you can think of.
If necessary, elicit:
– PANTS: what's another word for slacks?
– COAT: what's another word for jacket? (longer, dressier)
– HAT/CAP: what would you wear on your head?
– BOOTS: what does a construction worker or a cowboy wear on his feet?
(d) And now could please tell me what sort of things people around your area eat for breakfast, especially if they go out for a big breakfast on the weekend?
If necessary, elicit:
– EGGS: What are omelettes made of?
– BACON/SAUSAGE/HAM: What meats do people eat with eggs?
– TOAST: What do you put butter or jam on?
– COFFEE/TEA: What do people drink with breakfast?
Are there any special local foods or dishes that your area is known for?
(e) And finally could you list as many farm animals as you can think of?
If necessary, elicit:
– DUCK(S): what (other) kinds of bird might you find on a farm?

4. Formal elicitation of linguistic variables

Now I need you to say certain words, but I don't want to say them first because that might influence the way you say them. So I'll ask you questions that get you to say the words and then we'll talk about whether certain words sound the same or different to you. OK? (It's not a test or anything; it's just a way of getting you to say certain words. I'll give you as many clues as you need.)

4.1. (o – oh)

(a) If a mother deer is called a doe, what would you call a baby deer? [FAWN]
(b) What's another word for sunrise, or for the first part of the day when the sun's just coming up? [DAWN]
(c) Do those words rhyme? (Could you use them to rhyme in a poem?)
(d) Can you think of any boy's names that rhyme with those words? [DON, RON, JOHN?]

If necessary, elicit:
– DON: What's the first name of Walt Disney's famous duck?
What's short for that?
(e) Does that name sound the same as the word for *sunrise* you just said? (If someone said those two words to you over the phone, could you tell them apart?)
(f) Can you say them again for me? (*If necessary*: which one was first?)
(g) What's another boy's name that starts with D and ends with N? [DAN]

(a) What's the past tense of *catch*? (Like if today I catch the ball, yesterday I ...?) [CAUGHT]
(b) What's the opposite of *cold*? [HOT]
(c) Do those words rhyme?
(d) Can you say them for me one more time?

(a) What's the opposite of *shorter* (if you're talking about the height of people)? [TALLER]
(b) How much money do four quarters make? [DOLLAR]
(c) Do those words rhyme?
(d) Can you say them for me one more time?

(a) What's the opposite of *off*? [ON]
(b) What's the opposite of *up*? [DOWN]

4.2. Semantic differentials (1)

Now I have a few questions about the meanings of different words. Tell me, in your opinion,
(b) What's the difference between a HOME and a HOUSE?
(d) What's the difference between a DECK and a PORCH?
(e) What's the difference between to SIT and to SET?

4.3. Lexicon

(a) What's the general term you use for a carbonated beverage in your area? [POP, SODA, COKE, etc.] (*If unsure*: if you were going to buy a can of Coke or Pepsi or Sprite out of a machine, what would you call the machine?)
(b) What do you call it when you prepare meat outside over a charcoal fire in the summertime? [GRILL(ING) (OUT), BARBECUE, COOKOUT]
(c) Do grilling and barbecuing mean the same thing? *If no*: what's the difference? [SAUCE]
(d) *If not already answered:* What kinds of things would you barbecue? Grill?
(e) What do you call a large piece of furniture that seats three people? [COUCH, SOFA, etc.]
(f) What do you call the top part of a house, that keeps the rain out? [ROOF]

4.4. (i – e/_N)

(a) What would you use to sign a check with? [PEN]
(b) What would you use to fasten a cloth diaper? (A safety ...) [PIN]
(c) Do those words sound the same to you?
(d) Say them again for me and tell me which one's which.

(*If* pin *and* pen *are close or the same*:
(a) If you gave a book to Mary you'd say I gave it to *her*; if you gave it to John you'd say I gave it to ... [HIM]
(b) What do you call the bottom part of a dress where it's folded up and sewn in place? [HEM].
(c) Do those words sound the same to you?
(d) Say them again for me and tell me which one's which.)

4.5. (tense ~ lax contrasts before /l/)

(a) What's the opposite of *empty*? [FULL]
(b) What's another word for an idiot or a stupid person? (Begins with F as in Frank). [FOOL]
(c) Do those words sound the same to you?
(d) Say them again for me and tell me which one's which.

(*If* full *and* fool *are close or the same*:
(a) What's a place where you go swimming in the backyard? [POOL]
(b) What's the opposite of *push*? [PULL]
(c) Do those words sound the same to you?
(d) Say them again for me and tell me which one's which.)

(a) What's a word for a little mountain? [HILL]
(b) What do you call the back part of the bottom of your foot? [HEEL]
(c) Do those words sound the same to you?
(d) Say them again for me and tell me which one's which.

(*If* hill *and* heel *are close or the same*:
(a) What's a word for the skin of an orange? [PEEL]
(b) What's the little thing you swallow when you take aspirin? [PILL]
(c) Do those words sound the same to you?
(d) Say them again for me and tell me which one's which.)

4.6. (oh – ow/_r)

(a) What kind of animal runs in the Kentucky Derby (what does a cowboy ride)? [HORSE]
(b) What do you call the way you feel when your throat is kind of scratchy and sore so you can't talk very well? [HOARSE]
(c) Do those words sound the same to you?
(d) Say them again for me and tell me which one's which.

(*If* horse *and* hoarse *are close or distinct*:
(a) What do you call the first part of the day, before noon? [MORNING]
(b) When someone is grieving because somebody close to them has just died, you say they're in ... [MOURNING].
(c) Do those words sound the same to you?
(d) Say them again for me and tell me which one's which.)

4.7. (æ/_g, d) – Semantic differentials (2)

(a) What's the difference for you in meaning between a BAG and a SACK?
(b) What's the difference between a LABEL and a TAG?
(c) What's the difference between a BAD person and an EVIL person?
(d) What's the difference between being UNHAPPY and being SAD?

4.8. Aspirated glides – (hw, hj)

(a) What's a great big animal like a fish except it's a mammal (lives in the ocean and spouts water)? [WHALE]
(b) What do you call a sound like a siren or a baby's cry, also starts with W? [WAIL]
(c) Do those words sound the same to you?
(d) Say them again for me and tell me which one's which.

(a) If someone can laugh at a good joke, you say he has a good sense of ... [HUMOR]
(b) What's a word that means very, very big, or enormous, starts with H? [HUGE]

4.9. (ey – e – æ/_rV)

(a) In the nursery rhyme, who's the girl who had a little lamb? [MARY]
(b) What's a word that means happy, that people say when they greet one another at Christmas? [MERRY]
(c) Do those words sound the same to you?
(d) Say them again for me and tell me which one's which.
(e) When a man gets down on one knee and pops the question to the woman he loves, what does he say? Will you ... [MARRY]
(f) Does that sound like the word people say with Christmas?
(g) Say those two again and tell me which one's which.

4.10. (uw – juw/[+cor]_)

(a) If you're getting married, what do you say when you're asked if you take the other person to be your wife or husband? [DO]
(b) What do you call the moisture that's on the grass in the early morning? [DEW]
(c) Do those words sound the same to you?
(d) Say them again for me and tell me which one's which.

4.11. Southern Shift items

(a) What's a hot drink you might put milk, sugar or lemon in? [TEA]
(b) What's a small, round green vegetable that comes in a pod? [PEA]
(c) What do 24 hours make (what are there seven of in a week)? [DAY]
(d) What's the letter in the alphabet after J? [K]

4.13. *r*-lessness module

(a) What's the past-tense of *fight*? [FOUGHT]
(b) What do you call a military outpost, like in the Old West, with wooden walls and towers? [FORT]
(c) Do those words sound the same to you?
(d) Say them again for me and tell me which one's which.)

(*If* fought *and* fort *are close or the same*:
(a) What's the sound a lion makes? [ROAR]
(b) How do you describe meat or vegetables before they've been cooked? [RAW]
(c) Do those words sound the same to you?
(d) Say them again for me and tell me which one's which.)

(a) What's the organ in the body that pumps blood? [HEART]
(b) What's the opposite of *cold*? [HOT]
(c) Do those words sound the same to you?
(d) Say them again for me and tell me which one's which.

(*If* heart *and* hot *are close or the same*:
(a) What's the shortest nickname for *Robert*? [BOB]
(b) What's a nickname for *Barbara*? [BARB]
(c) Do those words sound the same to you?
(d) Say them again for me and tell me which one's which.)

5. Syntactic variables

Now I just have one more section of language questions for you. In this section I'd like to ask you to tell me what you think of a few sentences I'm going to read you. These are sentences that sound fine to people in some parts of the country but a little strange to people in other parts of the country. For each sentence I read you, I'd like you to tell me whether you think it sounds like something you could say yourself, or something you've heard around your area but you wouldn't say, or something you've never heard before. OK? So here's the first one:

(a) What if there were crumbs on the kitchen floor and someone said, "The floor needs swept"?
(b) What if a mother said to her child, "Your hair needs cut"?
(c) What if you were looking at the price of a new car and someone said, "Boy, cars are sure expensive anymore!"?
(d) What if someone said, "It's real hard to find a good job anymore"?
(e) What if someone said, "I used to watch football, but anymore I watch baseball"?
(f) What if someone asked you, "I'm going to the store; d'you wanna come with?"
(g) What if someone asked, "Do you want for me to go downtown today?"
(h) What if someone asked, "Would you like for me to pick up some milk on the way home?"

6. Personal history/demographic data

Those are all the language questions I have for you. Now I just need to ask you a couple more things so that we can place you properly in our sample.

(a) What year were you born?
(b) Where did you go to high school?
(c) What were the main racial and ethnic groups in your school? (*approx. %, if appropriate*)
(d) What's your own family's background in terms of national ancestry? (→ *conversation*?)
(e) What is/was your father's occupation? Your mother's? (→ *conversation*?)
(f) Did you take any schooling beyond high school? What, where?
(g) What's your occupation? (→ *conversation*?)
– Do you enjoy your job?
– What exactly does it involve?
– So tell me, since you're an expert in this, I've always wondered . . .?
– *etc., as appropriate*.

7. Continuing contact

There's just one other thing I'd like to ask you to do. As you can tell, we try to get everybody we talk to to say certain words and the easiest and quickest way to do that is to mail out a list of words that people can read back to us over the phone, which takes about five minutes. If I mailed you a wordlist and then called you back in a couple of weeks, do you think you could spare five minutes to read me the list over the phone? *If yes*: Great, then I'll just need to get your name and address so I can send you the list. ... What would be a good time to get hold of you?

Well, once again, my name is ____, and I'm at the University of Pennsylvania in Philadelphia, and I'd like to thank you very much for the time you've taken to do this interview. You've really been a big help!

8. Answers to closing questions

Q: So what's this study all about again?
A: This is a survey of changes in the way American English is spoken across the country. We're interested in finding out what changes are going on in different regions and how fast they're progressing. For instance, one of the things I was asking you about was how you said words like *hot* and *caught*, or *sock* and *talk*. This is one of the major differences between the way people talk in different parts of the country. Most people in the West say those words the same, as do people in Canada and in a couple of other areas (Pittsburgh and Boston), whereas people in the South, the Midwest and the East mostly say them different. We want to know where the borders are between these areas and whether they are

shifting: our research suggests that the area where people say *hot* and *caught* the same may be slowly expanding.

Q: Why is this important?
A: It's important for several reasons. First, it's important to linguists who want find out more about the way language changes. (Like how did the English language evolve from Old English to the language of Shakespeare to the language of today, and why do Americans talk differently from British people?) Second, it's important to people who study dialects, because while major European countries like Britain, France, and Germany have national maps of linguistic variation the U.S. does not. Our project is the first attempt to study differences in the sounds of regional speech across the whole country. Third, it's important in developing more effective teaching methods, either in teaching English to adults or in teaching reading and spelling to children. (These strategies need to be sensitive to dialect variation, such as whether or not children will make a difference between *pin* and *pen*.) Fourth, it's important to the speech technology industry, because if computers are going to be taught how to understand human language, they have to be able to cope with different dialects. (Example: a computer at the phone company that needs to understand callers from one area who say *Don* and *Dawn* differently and callers from another area who say them the same.) We can provide some of the information that the computer designers need to create effective speech recognition technologies.

Q: Who is paying you to do this?
A: Our work is supported by a combination of public and private sector funding. We have grants from the National Science Foundation and the National Endowment for the Humanities with matching funds from a telecommunications technology company called Bell-Northern Research.

Q: What are you going to do with the results?
A: Eventually, we're working towards the publication of an atlas of American English, which will include a series of maps showing how people talk in different parts of the country. In the meantime, we'll be publishing papers on various aspects of our research in academic journals and making presentations at conferences.

Q: Can I see some of your results?
A: Certainly. I'd be happy to send you a couple of maps showing some of our results so far.

Appendix 4.3. Sample word list

The following word list is in analytic form – that is, words are grouped according to the phonemes that are being studied or the sets of phonemes or allophones under examination. The word list that is mailed to subjects is a randomized list of these words with no such structure.

The sample list in this appendix is prepared for subjects from the Mid-Atlantic dialect region. Sections modified or introducted for this geographic region are indicated with a dotted border, with words of particular interest in red.

The Mid-Atlantic word list includes an expanded list of short-*a* words for tracing the intricate pattern of the short-*a* split into /æ/ and /æh/. It also includes an extended section on contrasts before intervocalic /r/, examining the contrast between *furry* and *ferry*, *hurry* and *merry*, as well as other vowels. There is an elaborated section on contrasts between *moor* and *more*, *lure* and *lore*, which are merged for most speakers in this area. Words with /ay/ before voiced and voiceless finals are focused on, since a rapid increase in "Canadian raising" before voiceless consonants has been discovered. The lists of /aw/ words is expanded, to trace the strong fronting and raising of the nucleus of that phoneme. Back vowels before /l/ are included, to establish the contrast between the back position of these words and the strong fronting of others. (*Pal* and *Hal* are included since in this area, these words are often homonymous with *Powell* and *howl* and, with /l/-vocalization, with *pow* and *how*.) A special list of words with two /r/s is added to trace the pattern, specific to this area, of r-vocalization in dissimilating environments, though /r/ in codas is normally constricted.

Telsur WL PA

/æ/	**/o, ah, oh/**	**/ay, aw, oy/**	**/iy, ey, uw, ow/**	**before /l/**	Distinctions **/uwr, owr/**	Incidence **/ohg, og/**
batch	block	ice	bee	tool	moor	fog
cat	bomb	sight	see	fool	more	log
bat	calm	fight	Kay	bowl	lure	smog
mat	palm	eyes	say	goal	lore	clog
cap	pajama	side	bay	cold	boor	job
sat	father	tie	go	old	bore	dog
sad	pa	file	hoe	pal*		cog
cab	paw	fire	do*	Hal*	**/ohr, ɔhr, ahr/**	frog
bad	cot	time			four	bog
badge	caught	sign			for	hog
mad	Don	my			far	flog
bad	Dawn		**/uw, iw/**		oar	log
glad		out	do*		or	goggles
black	**/e/**	about	dew		are	soggy
bag	get	mountain	stew			toggle
laugh	bet	loud	goof			
staff	bed	mouse	tooth			**/or, ohr/**
math	leg	house	toot			tomorrow
bath	beg	down	hoop		**/eyr, er, ær/**	sorry
ask	egg	downtown	shoot		Mary	orange
cash	step	now	noose		merry	horrible
hash	set				marry	forest
man					ferry	borrow
ant	aspirin		**/Vg/**		furry	
aunt	after		fish		hairy	**/wo, woh/**
ham	asterisk		bush		hurry	watch
camera	alas		vision	**Dissimilating**		wash
Janet	adze		measure	Charlie		water
planet	tin can			sorcerer	**/iyr, ir/**	walrus
began	I can			forward	nearer	Washington
thing	ran			ordinary	mirror	
sing	swam	**Unstressed**	**/_lC/**	quarter		**/uw, u/**
sang	planning	**vowels**	film	extraordinary		roof
pal*	classics	parted	milk	corner		coop
Hal*	classify	rabbit		order		route
alley	Lassie	Mexico				room
Alice	Annie				**/uw, iw/**	root
personality	gas				do*	coupon
	math				dew*	

*Appears twice in analytical table

5. Methods of acoustic analysis

The *Atlas of North American English* [ANAE] presents two principal kinds of data on the vowels of North American English: the presence or absence of phonemic distinctions between vowels, and the precise place of articulation of vowels in phonological space. The data on mergers and splits come mainly from participants' productions and perceptions of word pairs, which are coded as 'different', 'close', or 'the same', by means of auditory impressionistic analysis (Chapter 4). The data on place of articulation, and on the operation of chain shifts affecting the articulation of whole sets of vowels, come from acoustic analysis. Acoustic analysis also serves to clarify cases of merger or split where auditory impressionistic analysis is not decisive. This chapter describes the methods of acoustic analysis used for ANAE.

5.1. The philosophy of measurement involved

The Telsur project and its product, ANAE, were driven by a philosophy of measurement that requires greater accuracy and also greater efficiency than is normally demanded in laboratory research. For much experimental work on categorization, discrimination, habituation, etc., margins of error of ±50 Hz are often satisfactory, and are usually obtained by measuring vowels at the mid-point of the resonant portion, or averaging over the whole nucleus. The close study of variation across dialects and age groups within dialects needs finer resolution, both in the location of the central tendency of formants and in locating the point in time of measurement. Methods for obtaining this increased accuracy are discussed below.

The goal of the Telsur project was to represent the ongoing sound changes in the urbanized areas of North America, and the project interviewed 805 persons, of whom 762 were ultimately selected as satisfying Telsur criteria for local speakers. The goal of the acoustic measurement program was to measure the vowel systems of as many of these subjects as possible and, at the same time, obtain a complete and accurate inventory of the phonemes and allophones involved in sound change. This meant raising the number of vowels measured from the 150 characteristic of the early studies of Labov, Yaeger & Steiner [LYS] to a typical level of 300, or in some cases much more. In the final analysis, 439 speakers and 134,000 vowels were measured. This entire data bank of measured formants is available to users of the Atlas on the accompanying CD.

This increase in the volume and accuracy of the data was in part the result of the efficiency and accuracy of the CSL system used for LPC measurement. It was also the result of decisions made early in the project to collect for the great majority of vowels a single F1/F2 measurement as the best indication of the central tendency of each nucleus. In the interests of describing the widest possible range of communities and sound changes, measurements of F3, F0, duration, intensity, and bandwidth were not collected. As noted below, a great deal of supplementary information is contained in the Plotnik vowel files that are available to ANAE users. The field registering lexical information contains special codes indicating the presence, absence and direction of glides; stylistic context; observations of the analyst on marked auditory qualities of the signal, number of poles used in measurement, and other information bearing on the reliability of the signal.

Much of the time spent on measurement consists of locating the words of interest and storing these segments. More than one member of our research staff has projected a program for automatic location, segmentation, and measurement of vowel nuclei, but so far, all such attempts have led to an increase in gross error rates of several orders of magnitude. At present, we find there is no effective substitute for the careful examination and measurement of the formant trajectories of each individual vowel token by an analyst relying on both auditory and visual information, double-checking the computer's analysis against auditory impressions. More recent software programs like Praat reduce the time required for segmentation, but the same combinaton of auditory and visual inspection is necessary to reduce gross errors.

The discussion that follows assumes a basic knowledge of acoustic phonetics. This chapter will be principally concerned with issues surrounding the selection of a single point of measurement that best represents the central tendency of a vowel. Readers who need to review basic principles of sound spectrography and vowel formant identification are referred to an introductory phonetics textbook such as Ladefoged (1993).

5.2. Equipment

All of the Telsur interviews were conducted over the telephone and recorded by means of a telephone signal splitting device, first one sold by Radio Shack and later a Hybrid Coupler made by Gentner Communications Corporation. The early interviews were recorded on analog reel-to-reel tape using a Nagra IV, a Nagra E, or a Tandberg Model 9021. The later interviews were recorded on digital cassette tapes (DAT) using SONY TCD-D8 DAT recorders.

All acoustic analysis was carried out with the Computerized Speech Lab (CSL) program developed by Kay Elemetrics. The version used was 4300B, running in DOS. The interview tapes were digitized at a sampling rate of 11,000 Hz using the CSL digitization hardware and software.

The use of the telephone was an essential element of the Telsur method, permitting the collection of speech samples from across North America over a period of a few years without incurring the long delays and high costs of sending field workers to every city in North America. This benefit did not come without a cost. The telephone line limits the frequency range of the transmitted signal to about 300 to 3,000 Hz, and it also significantly reduces the dynamic range. Still, the signal is satisfactory for conversation all over the world. The quality of sound obtained by recording from the telephone line is clearly not comparable to that obtained in face-to-face interviews recorded with a high-quality microphone. However, in the vast majority of cases, the sound quality of the digitized speech signals was found to be high enough to permit acoustic analysis with a satisfactory degree of confidence and reliability. The signals were often accompanied by varying levels of background or mechanical noise, yet spectrograms made from these signals usually produced clearly interpretable formant structures.

5.3. Acoustic analysis of telephone interviews compared to face-to-face interviews

The study of language change and variation in Philadelphia utilized a series of 60 telephone interviews to obtain a geographically random sample of the city (Hindle 1980). Comparisons of these recordings with recordings of face-to-face interviews are reported in Labov 1994: Ch. 5. Telephone recordings were shorter and more formal than the face-to-face neighborhood recordings and obtained results that were less advanced in the direction of the sound changes being studied. To the extent that this finding applies to the data of the Telsur survey, the findings on the extent of sound changes in progress may be understated.

The Philadelphia study found the most significant differences in measurements of the high vowels, which were lower in the telephone recordings by 30–50 Hz. For the Telsur survey, a face-to-face interview was conducted with one speaker who had been interviewed by telephone, a 32-year-old man in Cedar Rapids, Iowa. This study confirmed the previous finding that telephone recordings registered lower values for F1. The mean difference between telephone recording and face-to-face recording values for F1 was 41 Hz. Insofar as this tendency is general, it will not affect the results of the analysis, since all comparisons are made across telephone interviews, and the normalization routine discussed in Section 5.6 will compensate for any skewing from one telephone handset to another. There are two exceptional cases to be noted. For /e/ before nasals, telephone recordings showed higher F1 values. Thus raising of /e/ in this environment is apt to be understated by the effect of telephone recording. However, the major sound change affecting this allophone is the merger of /i/ and /e/ before nasals, which is traced through minimal pair judgments rather than acoustic measurement (Chapter 9).

The largest differences in the comparisons made between telephone and direct recording are found in /iy/, where F1 was lower and F2 higher in telephone recordings. Lowering and backing of the nucleus of /iy/ is a defining feature of the third stage of the Southern Shift, so the bias of telephone recording will understate the extent of that sound change. The bias will be most important when face-to-face recordings are compared directly to telephone recordings without normalization, where we can expect face-to-face recording to show stronger movement in this third stage.

5.4. Selection of tokens for analysis

Segmentation. The words containing the target vowels were extracted from 20-second sections of digitized speech and stored in CSL's .NSP format in a directory established for each speaker. They were of four types, each representing a different style of speech (see Chapter 4 for the structure of the Telsur interview):

1. elicited minimal pairs (e.g. *cot* and *caught*; *pin* and *pen*);
2. elicited semantic differential items (e.g. *unhappy* and *sad*; *pond* and *pool*);
3. elicited word lists (e.g. counting from 1 to 10; days of the week; breakfast foods);
4. spontaneous speech (e.g. responses to demographic questions and discussion of issues of local interest, such as the state of downtown).

In the spontaneous speech category, only fully stressed tokens, bearing the primary stress of a phrase as well as primary syllable-stress within the word, were selected for analysis. This was to ensure that automatic processes of vowel reduction and centralization in non-primary stress environments would not interfere with the analysis of regional patterns and that each token studied would provide an opportunity to observe the maximum extent of the sound changes under study.

Given that much of the data came from spontaneous speech, it was not possible to obtain an identical set of data from each speaker. The selection of tokens for analysis was constrained by the set of words that occurred in 20–30 minutes of conversation. Within this constraint, the analyst aimed at segmenting a similar balance of vowels and allophones for each speaker. As a general principle, each vowel phoneme or allophone was represented by no fewer than three tokens. In most cases, five to ten tokens of each vowel and allophone were collected. Collection of the most frequently occurring allophones was limited to approximately ten tokens, in order to prevent skewing of the representation of the speaker's vowel space by an over-representation of one or two vowels. By these methods, approximately 300 tokens were selected for each speaker. Some speakers had as few as 200 tokens, where conversation was limited, or low signal quality prevented the analysis of parts of the interview. Others had 400 to 500 tokens, where sound quality was good and conversation lengthy. The total number of measurements for 439 speakers was 134,000, an average of 305 tokens per speaker.

5.5. Selection of points of measurement

Once tokens from a speaker's interview had been digitized and saved as .NSP files, each token was called up in turn for spectrographic and linear predictive coding (LPC) analysis. The bandwidth of the spectrograms was 500 Hz, and the LPC analysis was computed at either 8, 10, 12, or 16 poles, depending on the strength of the signal. Where formants appeared to be missing, the number of poles was increased; where there were too many formants, the number was decreased.

While it is possible to measure many different aspects of vowel articulation using a spectrogram, Telsur accepted the findings of DeLattre et al. (1952), Cooper et al. (1952), and Peterson and Barney (1952), that the quality of most English vowels can be adequately represented by the frequency of the their first and second formants, reflecting their height and advancement, respectively. Duration, rounding, nasality, pitch, tone, and laryngeal tension can also play an important role in vowel quality, but LYS demonstrated that a plot of F1 against F2 illustrates the most salient regional and social differences in the pronunciation of the vowels of North American English, including both vowel shifts and differences in phonemic inventory.

The general principle followed by Telsur is that no means of instrumental analysis can be considered reliable without some degree of auditory confirmation. LPC analysis is more precise than auditory impressions in some respects, but it is also subject to errors much greater than those found with auditory analysis, particularly when an incorrect number of formants is identified. Analysts continually use their knowledge of acoustic–auditory relations in deciding whether an appropriate number of formants has been located and in choosing the correct point in the time series for measurement (see below). Nevertheless, it is not possible for the analyst to recognize some gross errors until the analysis is completed and the entire vowel system is projected. For each of the 439 speakers analyzed acoustically, the F1/F2 plots produced by Plotnik (see below) were closely compared with auditory impressions. Two types of measured values were examined most closely. Outliers from the main distribution were re-played and compared to samples from the main distribution. They were accepted as valid tokens only if the auditory impressions differed in ways comparable to the measured differences. Secondly, special attention was given to cases where vowels from different word classes showed the same F1/F2 values. (In such cases, word class assignment is typically disambiguated by an offglide.) Though in most cases these were valid indications of merger, there are configurations where differences are heard that do not correspond to F1/F2 differences, indicating the limitations of the two-formant axes in defining vowel timbre.[1]

There are many possible approaches to the measurement of F1 and F2. A series of paired measurements taken at every pitch period would provide a wealth of detail on every movement of the tongue over the course of the vowel, including the nature of opening and closing transitions, and of on-glides and off-glides. While it is easy to plot an array of sequential measurements of a single vowel, plotting 300 such trajectories for a single speaker would obscure any pattern and preclude the goal of describing the vowel systems of North America. Moreover, inter-speaker comparisons, the central concern of dialectological or sociolinguistic research, are not feasible with trajectories, since precise points of comparison would be difficult to establish and quantitative analysis is problematic. For these reasons, the Telsur project followed the practice of LYS in representing the central tendency of each vowel with a single pair of F1/F2 values. The best choice of a single point of measurement therefore became the central methodological issue in the acoustic analysis that underlies the Atlas.

One approach to the representation of a vowel with a single measurement of F1 and F2 would be to take an average of the frequency of these formants over the whole course of the vowel's nucleus. While this technique has the advantage of reducing the likelihood of erroneous measurements, it runs the risk of missing important information about details of vowel articulation that can distinguish one region or speaker from another. Where a vowel's nucleus is characterized by a steady state in both formants, a nuclear average would seem adequate, as long as it did not include pre- or post-nuclear transitional values. However, many vowels involve a clear point of inflection in one or both formants at a specific point in the nucleus. A point of inflection indicates the moment when the tongue stops its movement away from an initial transition into the vocalic nucleus and begins moving away from the nucleus, either into a glide (in the case of a diphthong) or toward the position required for the next segment. As such, it is also the best representation of the vowel's overall quality, and gives a more accurate portrayal of the extent to which a speaker participates in a sound change than a nuclear average. Listeners appear to be sensitive to such points of inflection, perhaps because they are the best indication of the vowel's target.

The identification of points of inflection depends on an analysis of the central tendency of each vowel – the main trajectory of the tongue during its articulation. The central tendency of most short vowels and many long upgliding vowels is a downward movement of the tongue into the nucleus, followed by a rise out of the nucleus into the glide or following segment. The acoustic reflection of this fall and rise is a rise and fall in F1, with a maximal value of F1 representing the lowest point reached by the tongue. Vowels displaying this tendency were therefore measured at the point where F1 reached its maximal value. F2 was then measured at the same point, since measuring it at any other point would suggest a vowel quality that did not in fact occur.

The major exception to the principle of using the F1 maximum as a point of measurement occurs with those vowels whose central tendency is not so much a lowering and raising of the tongue as a movement of the tongue towards and then away from the front or rear periphery of the vowel space; these are ingliding vowels. In these cases, a point of inflection in F2, indicating maximum displacement toward the front or back periphery, was used as the point of measurement, with F1 measured at the corresponding point. Vowels whose tendency was movement toward and away from the front periphery were measured at their F2 maxima; those moving toward and away from the rear periphery were measured at their F2 minima.

In North American English, ingliding vowels typically arise in two situations. The first type comprises both historically long and ingliding vowels, like /æh/ and /oh/ in the Mid-Atlantic region, and originally short vowels that have been tensed and raised along the peripheral track, like /æ/ in the Northern Cities Shift, and /e/ and /i/ in the Southern Shift. The second case is that of high upgliding vowels followed by liquids (*fear*, *pool*). The liquids are articulated in mid-central position and therefore have some of the same characteristics as central inglides. Depending on the height of the nucleus and inglide of ingliding vowels, the maximum value of F1 may in fact occur in the glide rather than in the nucleus. A point of inflection in F2 rather than the F1 maximum is therefore the best measure of their nuclear quality. The trajectory of F2 was also used in some cases to identify a more precise point of measurement within a steady-state in F1, especially when a point of inflection in F2 appeared to indicate the maximal distance from consonantal transitions on either side of the vowel.

The most obvious inadequacy of single-point nuclear measurement is its failure to indicate the presence and quality of offglides. While some offglides are purely phonetic, having no contrastive function, others have phonemic status and play an essential role in distinguishing one vowel from another, as in the contrast between /ay/ and /aw/ in many English dialects. Moreover, while many of the most striking differences between English dialects involve variation in the position of the nucleus, others – including some of the best known – involve variation in the presence and quality of glides. The monophthongization of /ay/ in the Southern United States is the most obvious example, but subsequent chapters will reveal several other cases in which glides are as important as nuclei – in a few cases more important – in the differentiation of North American English dialects. Despite the importance of glides, in most cases it was found that the presence or absence and quality of glides could be effectively indicated with a code included in the comments attached to the measurements of nuclear quality, and that an actual measurement of the glide target was not necessary. These codes were used where the nature of the glide deviated from the norm for the vowel class or dialect in question, as when an upgliding vowel was monophthongal or a short vowel had developed an inglide. They were also used where the presence of a glide was one of the local features under study, as with the monophthongization of /ay/ in the South, or of /aw/ in Pittsburgh, or the development of a back upglide in Southern pronunciations of /oh/.

Though the normal practice was not to measure the endpoint of glides, the vowel files do include several thousand such measurements.[2] Glide measurements were made particularly for back glides that are shifted frontwards,[3] the midpoints and endpoints of "Southern breaking",[4] and the "Northern breaking" of short-*a* into two morae of equal length.[5]

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1 In such residual cases, the normal course is to consider additional measurements of duration, F0, F3, or bandwidths, but the use of these well-known parameters has not in general proved useful in accounting for anomalies in F1/F2 measurements.

2 In the vowel files provided with the accompanying ANAE CD, this coding appears in curly brackets following the word identification. The codes {f,b,i,m} represent front upgliding, back upgliding, ingliding and monophthongal vowels respectively. {s} represents shortened monophthongs, {br} the second half of a broken /æ/. The notation {g} is used whenever the measurement represents the endpoint of a glide.

3 Chapter 12 notes that "The 7036 Telsur records of /uw/ include 42 tokens where such a fronted upglide was noted by the analyst."

4 Often referred to as the Southern drawl; see Chapter 18.

5 Chapter 13 presents a detailed analysis of this phenomenon, which includes the 1,025 measurements of the second half of such tokens.

5.6. Format and content of vowel files

Log files of the vowel analysis conducted using CSL were produced, facilitated by macros written for the Telsur implementation. These log files were transformed into the six-field format used by the Plotnik program, which produces the displays of vowel systems in this volume. These 439 files are found in the **Telsur/pln** folder on the ANAE CD.

The input format for PLOTNIK is a comma-delimited text file which may be read with a text editor like Word, or a spreadsheet like Excel, saving the data as text with comma delimiters between items (Excel's CSV format). The file begins with the following format:

line
1 Thelma M., 31, Birmingham, AL TS 341
2 560,6.992571
3 480,1808,,1.1118,1,slip {i}
4 539,1531,,1.1121,1,fib2 {g} -5-
5 364,2188,,1.1121,1,fib2 {i} -5-
6 378,2246,,1.14264,1,kidney2 {i}
7 451,2173,,1.16123,1,mixed2 -- 8p
8 524,2173,,1.16123,1,mixed -- 8p; hi pitch; F1 from spectrogram"
.. ....

The first line is a **header** with information on the speaker's name, age, place of origin and an identifying number.[6] The second line gives the number of vowels measured (number of tokens) and the group log mean for normalization. The third and all following lines contain the tokens themselves. Each token consists of six items separated by a comma.

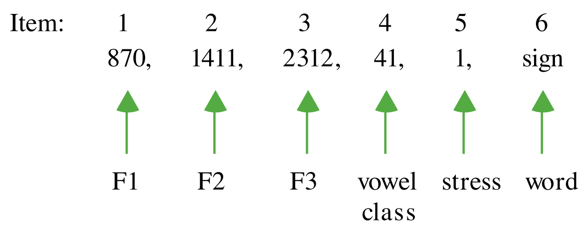

Figure 5.1. Format of data token

The first three items are integral formant measurements in Hertz; F3 is blank in the Telsur files.

The fourth item is the vowel class, a number or letter code for the structural category of which the particular token is an instance. These numerical codes, based on the subsystems of the initial position in Chapter 2, are explained in detail in the documentation for the ANAE CD.

The fifth item in the string is reserved for impressionistic ratings of **Stress,** with values of 1 (primary), 2 (secondary), or 3 (unstressed). This is always 1 in Telsur files.

The sixth item is a descriptive comment. It begins with the standard orthographic representation of the word in which the vowel token occurs, and also contains information on the presence or absence of a glide along with its direction, contextual style, and observations of the analyst on any unusual auditory or acoustic aspects of the signal. The sixth item might read:

bad {i} -4- 10p; interp. F2.

This indicates that the word being analyzed is *bad*; that there was an inglide after the nucleus; that the contextual style was 4, the semantic differential (see Chapter 4); that the analysis was done at 10 poles, rather than the 12 poles that was the default filter order for this speaker; and that the measurement of F2 was interpolated between two neighboring LPC points, because the F2 point corresponding in time to the desired F1 point was missing. The majority of entries are not this complex, and contain no more than the numerical and orthographic identification of the token.

5.7. Normalization

An essential feature of all ANAE analyses and comparisons of vowel systems is normalization, the adjustment of all vowel systems to a common framework that eliminates differences in acoustic realization that are due to differences in vocal tract length. Studies such as Peterson and Barney 1952 illustrate the fact that men, women, and children have very different physical realizations of vowels that sound "the same" to a listener. The task of normalization is to find a mathematical function that does the same work as the normalizing ear of the listener, compensating for the physical differences in articulatory systems. At the same time, we must preserve those differences in phonetic realization that are actually present in the speech community; the sound changes that ANAE is designed to study may be realized as actual differences between the speech of men, women, and children.

Although several studies have shown that the relationship between men's, women's, and children's vowel systems is not exactly linear, several linear functions give a good approximation. One of these is the log-mean normalization explored by Nearey (1977). Labov (1994) reports the studies of four normalization methods by the Philadelphia project on language change and variation. Of the various methods tested, the log-mean normalization was most effective in eliminating male–female differences due to vocal tract length and preserving the social stratification of stigmatized variables that had been established by auditory impressions.

The log-mean normalization is a uniform scaling factor based on the geometric mean of all formants for all speakers.

$$G = \frac{\sum_{k=1}^{p}\left(\sum_{j=1}^{m}\left(\sum_{i=1}^{n}\ln(F_{i,j,k})\right)\right)}{m * \sum_{i=1}^{p} n_i}$$

Here p is the number of speakers measured; m is the number of formants, which for the Telsur data is 2; and n is the number of tokens measured for a given speaker. To normalize any given speaker, the group log mean G is subtracted from the individual log mean S for that speaker:

$$S = \frac{\sum_{j=}^{m}\left(\sum_{i=1}^{n}\ln\left(F_{i,j}\right)\right)}{m * n}$$

6 More complete identifying information is found on the Telsur/Master.wks spreadsheet under the TS number.

The anti-log of this difference is the **uniform scaling** factor F for that individual.

$$F = \exp(G - S)$$

For a man, the scaling factor F will be a number greater than 1, and his system will be expanded; for a woman, F will be less than 1, and the system will be contracted. The end result is a series of vowel systems that can be superimposed on a single grid, where differences in the means of different vowels display the course of the sound change in progress.

In the course of the Telsur project, the parameter G was successively updated as the number of subjects increased. Beyond n = 345, no significant change in G was found, and the group log mean was kept at the figure calculated for these 345 subjects, G = 6.896874.

Unnormalized Telsur files have the extension .plt; normalized files are identified with the extension .pln.

For a recent view and comparison of methods of normalization, see Adank 2003.

5.8. Analyzing and displaying vowel systems with the Plotnik program

Plotnik is a program developed at the University of Pennsylvania Linguistics Laboratory by W. Labov for the display and analysis of complex vowel systems in English and other languages. The vowel charts found in Chapters 12–20 of ANAE are outputs of the Plotnik program, which is included on the ANAE CD along with a tutorial, and internal and external documentation. At present it is compatible only with Macintosh operating systems, and is supplied in both OS 9 and OS X versions.

Plotnik normally takes as input a Telsur file with the extension .plt or .pln. The program then displays all vowel tokens, tokens for a single vowel or any subset, with or without means or median values displayed. The program automatically codes each token for environmental features, reading from the orthographic representation. A single keystroke will display any of the subsystems of the initial position of Chapter 2. Function keys highlight vowels before nasals, liquids, before voiceless consonants, or in final position.

Plotnik calculates and displays means and standard deviations for all or some vowels, and for any two vowel means, it calculates a t-test of the statistical significance of the difference between any two vowel means. The program operates upon any subset defined by environment, style or stress. Endpoints of glides may be plotted and connected with their nuclei.

For the rapid analysis of a given subset of vowels across the entire population being studied, Plotnik will open new files and plot only the last set of vowels examined. This permits a survey of a given phonological feature for many individual speakers.

Specific configurations that are labeled and equipped with a legend may be saved and retrieved.

6. The construction of isoglosses

6.1. Criteria for selection

Dialect geography has traditionally been concerned with the search for a principled basis for dividing dialects and drawing the boundaries (or isoglosses) between them (Bloomfield 1933; Petyt 1980; Chambers and Trudgill 1980; Kretzschmar 1992). This section concerns one aspect of this problem: the criteria used to select the particular variables or boundaries that will serve as the basis for establishing dialects. The following section will deal with methods of defining the spatial location of these boundaries once the criteria have been established.

All dialect geography begins with the search for geographic differentiation. Perhaps the most important consideration in selecting a parameter for dialect classification is the degree of spatial differentiation it displays. Any examination of candidates for dialect markers must reject those that appear to be randomly distributed in space in favor of those with the greatest regional differentiation, no matter how particular or general they are.

Given a certain degree of geographic differentiation, what kinds of linguistic differences provide the best evidence for defining dialects? No one linguistic criterion can be considered optimal. In North American English, the major choice is between phonological boundaries and lexical boundaries, where the lexical boundary may mark alternative terms for the same referent (*darning needle* vs. *mosquito hawk* for "dragonfly") or the choice of a particular phoneme in a word (/aw/ vs. /uw/ in *route*).[1] The regional vocabulary of North American English includes a very large number of words and phrases, first presented in Kurath's *Word Geography* (1949), and assembled systematically in DARE (1985–). Much of this vocabulary is closely linked to settlement history and helps to relate dialects to the earlier shifts of population that are responsible for the patterns we observe today. Some lexical isoglosses bundle together, reflecting the joint history of the users of the language. However, the selection of particular regional words to define boundaries has been criticized as arbitrary (Kretzschmar 1992) and it is sometimes asserted that if all regional vocabulary were plotted on a single map, no geographic pattern at all would emerge. As a result, those who define dialect boundaries on the basis of lexicon have been modest in their claims for the relative priority or the discreteness of these boundaries.[2]

The Atlas of North American English is largely based upon phonological materials,[3] which have several advantages over lexical items in the search for clearly defined dialect regions. They do not suffer obsolescence and they are of high frequency in the stream of speech. Most importantly, they are drawn from a relatively small, closed set of features that are closely linked by the functional economy of the system (Martinet 1955), so that a change in one element of the system frequently is followed by a change in another. Regional dialects emerge clearly when some or all of the boundary patterns are superimposed, since many of them are tightly clustered.[4] These structural variables are of three types:

1. Differences in phonemic inventory that are the result of splits and mergers
2. Differences in the membership of a subsystem that are the result of shortenings, lengthenings, and the deletion and addition of glides
3. Differences in the position of phonemes or allophones within a subsystem that are a response to asymmetries created by (2)

All three of these are involved in the chain shifts discussed in Chapter 3. The discussion of the principal dialect areas of North America in Chapter 11 will begin with type (1), splits and mergers, since these sound changes will provide the basic motivation and rationale for the changes of type (2) and (3) that follow. However, the isoglosses created by ongoing mergers will not be used to define the major regional dialects, since they are driven by Herzog's principle to expand across previously established frontiers. In fact, one merger that played a central initiating role in the massive fronting of back vowels across all of North America has now expanded to cover almost the entire continent (the merger of /iw/ and /uw/, Map 8.3).

The low back merger of /o/ and /oh/ in *cot* and *caught,* etc. covers more than half of the North American territory. The differentiation of the major dialect regions of North America (Chapter 11) does not however begin with the expansion of this merger, but rather with three distinct bases for resistance to it. These types of resistance are associated with sound changes that involve dialect differences of types (2) and (3). The resulting isoglosses form tightly linked bundles separating dialects in which the expansion of a sound change in one area is blocked by the expansion of sound change in the other area, moving in an opposite direction.

On the whole, the isogloss bundles that emerge from this procedure coincide well with the isoglosses drawn on the basis of regional vocabulary, reinforcing our confidence that the settlement history of North America continues to influence the development of the language. Our confidence in the social and linguistic reality of these boundaries is reinforced by the tight bundling or nesting of isoglosses, as well as the consistency and homogeneity of the dialect regions defined by sound changes in progress.

The initial procedure establishes the outer boundary of a dialect area. Once the defining sound changes are recognized, one can also isolate core areas in which the changes are most advanced and peripheral areas where the sound changes are incipient. The isoglosses so constructed have a dynamic character, which can be related to the evidence from real and apparent time studies.

6.2. Drawing isoglosses

Every dialect geographer yearns for an automatic method for drawing dialect boundaries which would insulate this procedure from the preconceived notions

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1 The choice is more limited in North American English than in other languages since there are only a few geographic boundaries based on morphological, syntactic, or semantic alternations.
2 See the quotation from Carver (1987) at the beginning of Chapter 11.
3 A few phonological items are lexically specified. The alternation of /o/ and /oh/ in the single word *on* will play an important role in the description of the Northern Cities Shift in Chapter 14.
4 See the coincidence of isoglosses in Maps 14.9 and 14.11 and the principal components diagrams of Section 11.4.

of the analyst. No satisfactory program has yet been written. Yet ANAE has introduced a reasonable degree of systematicity into the delineation of dialect boundaries, following the steps outlined below.

The following definitions and procedures relate to a map of points distributed in a two-dimensional geographic space, where each point represents the linguistic system of a given speaker, and each group of points represents the linguistic systems of a locally defined speech community. A dialect area or region is defined by an *isogloss* that represents the outer limit of the communities that share a given linguistic feature. If a point on the map where the feature is marked as present is a *hit*, and one where it is absent a *miss*, the isogloss is drawn as the outer limit of the area in which hits predominate over misses. Such an isogloss may be a closed polygon or a simple line dividing a territory into two parts, but it always has an *inside* (the side with the greater proportion of hits) and an *outside* (the side with the greater proportion of misses).[5] The task of drawing an optimal isogloss has five stages.

1. Selecting a linguistic feature that will be used to classify and define a regional dialect
2. Specifying a binary division of that feature[6] or a combination of binary features[7]
3. Drawing an isogloss for that division of the feature, using the procedures to be described below
4. Measuring the *consistency* and *homogeneity* of the isogloss by the measures to be discussed below
5. Recycling through steps 1-4 to find the definition of the feature that maximizes consistency or homogeneity

The motivation behind the decision of step 1 has been discussed above. Step 2 begins an iterative process, which may begin with any arbitrary decision. Step 3 uses the following procedure:

The isogloss is drawn as a set of nodes connected by straight lines[8] which maximizes the proportion of inside hits to outside hits under the following constraints:

a. All contiguous groups (communities) that consist of more than 50 percent hits are included in the isogloss. Contiguity is defined as a spatial relation that does not require the addition of more than two nodes to the isogloss for inclusion.
b. The isogloss may be extended to include any group with 50 percent hits (transitional groups) if no more than one additional node is required.
c. Groups with less than 50 percent hits are contained within the isogloss only if they are entirely surrounded by groups with hits.

Figure 6.1 illustrates these constraints. The blue polygon surrounds all contiguous groups of 100 percent hits, and the green additions include the transitional groups. The speech communities represented by groups b and c are included within the isogloss. For group b, one node is moved and no additional node is required; for group c, only one additional node is needed. Groups of two with one hit and one miss are typical of the transitional communities we can expect to find along a boundary, since the Telsur design calls for two subjects for the majority of urbanized areas (Chapter 4).

In Figure 6.1, the red additions to the isogloss are not made. Group e has 100 percent hits, but is not included since six additional nodes would be required. The red line surrounding group e is illustrative of extreme extensions that constraint (a) is designed to correct. An unconstrained polygon might include every hit within the isogloss, but such gerrymandering would create unrealistic configurations that defy any explanation in terms of settlement history, communication patterns or linguistic diffusion. The same constraint operates to exclude the addition of the transitional group f, which would require two additional nodes, and thus remains outside of the isogloss.[9]

The isogloss of Figure 1 then includes two misses, groups g and h, which are entirely surrounded by hits, and excludes one hit, group i, which is entirely surrounded by misses.

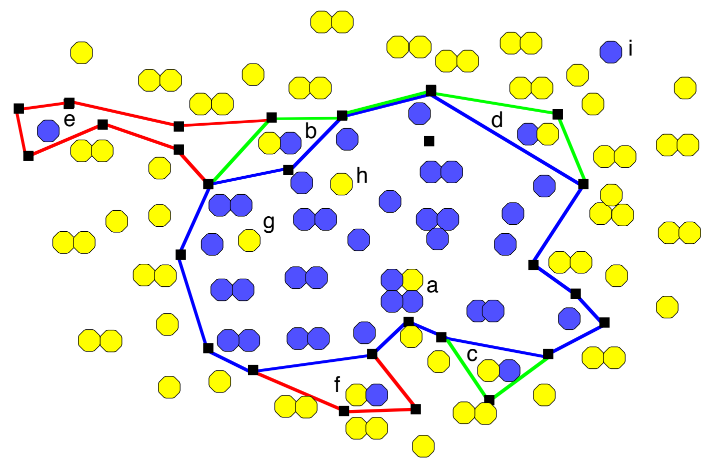

Figure 6.1. Constraints on isogloss construction. Blue: inclusion of groups with more than 50% hits; green: inclusion of transitional groups; red: non-inclusion due to topographic complexity. a: inclusion of group with 75% hits. b, c: inclusion of transitional group with no additional node; d: inclusion of transitional group with one additional node; e non-inclusion of 100% group requiring six additional nodes; f non-inclusion of transitional group requiring two additional nodes; g, h inside misses: groups with less than 50% hits contained within the isogloss; i outside hit: group with 100% hits outside of the isogloss.

Step 4 evaluates the isoglosses drawn by step 3. It takes into account two different desiderata of isoglosses. First, we want the area defined to be as uniform as possible: the proportion of hits to misses should be maximized. Second, we want as high a proportion of hits as possible to be located within the isogloss. This is a measure of how consistently the isogloss defines the distribution of hits. The two measures that are to be maximized are therefore:

Homogeneity = total hits within the isogloss/total speakers within the isogloss
Consistency = total hits within the isogloss/total hits

5 If an inside and outside cannot be so defined, the distribution is random and the isogloss is discarded.
6 The feature may be inherently binary, like the presence or absence of a glide, or it may be a binary division of a continuous quantitative scale, such as the second formant value of /aw/.
7 In our procedures, all combinations will be conjunctive (*and* ...) rather than disjunctive (*or* ...)
8 In map production the lines are then smoothed with a spline algorithm of the Mapinfo program used to draw the maps, so that the nodes are not visible.
9 If a change is spreading by the "cascade" model (Trudgill 1974; Callery 1975), one might expect to find discontinuous patterns. In that case, the points e, i would each be the center of a new distribution. See the maps of Trudgill (1974) and Chambers and Trudgill (1980) to see how the method used here can be used to trace hierarchical movement from the largest to the next largest city.

A third measure, *Leakage*, will be defined as the complement of consistency, the proportion of hits out of all points outside the isogloss. Though we would want this measure to be minimized, it is not considered a criterial feature in the iteration of step 5.

Why two measures?

For several reasons, it is not desirable to define optimal isoglosses by a single criterion. Homogeneity applies to a region: it is a measure of how much variation exists within the region defined by the isogloss. Consistency is a property of a linguistic variable: it is a measure of how strongly the variable is concentrated within a given region. Different stages of the process of dialect differentiation will show different values on these two measures. A given region may have optimal conditions for a given sound change, which may affect almost all speakers. This is the case with the Canadian Shift, involving a retraction of /e/ and /æ/ (Map 11.7); it is especially favored in Canada because the low back merger that triggers the shift takes place well to the back of the vowel space for almost everyone. Homogeneity for the Canadian Shift isogloss, which stops at the Canadian border, is .84 (21 of the 25 speakers within the isogloss). But the same process takes place occasionally throughout other areas of low back merger in the U.S., so that consistency for the Canadian isogloss is only .34. Outside of Canada, the instances of this phenomenon are scattered throughout a much larger population, and leakage is only .10. Homogeneity is the crucial measure for the dynamics of the Canadian vowel system.

On the other hand, a feature may be highly characteristic of a region, in that it is rarely used outside of it, even when it competes with other possibilities within that region. Thus the term *coke* for “carbonated beverage” is a marked feature of the South and rarely used outside of the South in this sense, though other terms like *soda*, *soft drink*, *pop* occur within the Southern region (Chapter 21). Consistency is high (.81) but not everybody uses it: homogeneity is low (.49).

In general, linguistic features that have taken on a marked regional character will show high consistency but not necessarily high homogeneity. Linguistic changes that are driven by unidirectional principles will eventually attain high homogeneity within a given region, but since they are rarely confined within that region, they will show low consistency. In order to achieve reasonable consistency, it may be necessary to create a conjunctive definition that excludes other inconsistent processes. Thus the Inland North (Chapters 11, 14) is defined by the approximation of the second formants of /e/ and /o/ (a difference less than 375 Hz). This condition achieves as it stands a homogeneity in the Inland North of .87. A consistency of .62 is achieved only by adding the condition that /r/ is not vocalized, /æ/ is not split, and /ay/ does not suffer glide deletion. This eliminates those speakers who satisfy the first condition in New England, the Mid-Atlantic States, and the South.

In a few cases, homogeneity and consistency are both maximal, as in the definition of the South as the area of glide deletion of /ay/ before obstruents, with .90 homogeneity and .99 consistency.

Recycling

The optimization of homogeneity or consistency in step 5 may proceed in two different ways. One way is to specify a new binary division of a feature under Step 2. This may be a change in the frequency threshhold of a feature defined as a hit (a percentage of monophthongization of /ay/ required to define the South), or it may involve adjusting the environment in which that feature is located (glide deletion of /ay/ before obstruents instead of glide deletion of /ay/ in general). The net result may be an increase in the number of inside hits or a reduction of outside hits and inside misses with a net gain in homogeneity and/or consistency. Since the analysis of vowel systems is largely based on the measurement of formant values in a continuous space, many of these adjustments will involve a binary cut along the F1 or F2 dimension, as, for example, the criterion for the fronting of /uw/ after coronals that the second formant be greater than 1900 Hz. One may adjust this value to maximize either homogeneity or consistency.

The second possibility for improving these measures is to recycle through step 1, as in the case of the Inland North above: an additional feature is selected to be combined with the first in a conjunctive definition of the isogloss. This may reduce the number of hits and increase the number of misses within the isogloss, since there will be more requirements for each point to satisfy, but will also reduce the number of hits outside the isogloss. If the reduction of outside hits is greater than the reduction of inside hits, the net result will be an isogloss with greater homogeneity or consistency.

It must be recognized that some dialect regions are more diffuse than others. This is the expected situation for regions that have been formed more recently as the result of population shift from several dialect areas, as in the West. We would therefore expect to find more complex definitions for their isoglosses and lower criterial values. Given the high mobility of American populations, one might think that this state would be characteristic of all dialects. The most surprising finding of this Atlas, perhaps even more surprising than the prevalence of ongoing change, is the high degree of homogeneity of dialect regions throughout the continent.

6.3. Isogloss relations

Isoglosses are not isolated features of a dialect map, but may be related to other isoglosses in three distinct ways: bundling, complementation, and nesting.

Bundling. The bundling of isoglosses is the degree of coincidence among isoglosses that are defined by separate features (as opposed to the combination of features in defining a single isogloss). Such bundles have long been considered a major criterion in the selection of isoglosses to define major and minor dialect areas (Kurath 1949). They also play a major role in the search for the explanation of isogloss location. Structural relations among the isoglosses in a bundle may account for their coincidence and indicate that the individual isoglosses may have expanded across a territory together because they are structurally linked. Such connections will play a major role in the chapters dealing with the mechanism of chain shifts. Conversely, a lack of structural connection among isoglosses in a bundle may be used to argue for their dependence on settlement history. Bundles of this kind may provide evidence for the earlier history of a language which is no longer apparent in structurally independent isoglosses that have expanded across the territory together. In any case, the clarity of the argument will depend upon the simplicity of the definition of each individual isogloss concerned.

Complementation. The complementation of isoglosses is the degree to which they do not overlap, defining mutually exclusive dialect areas. Chapter 11, which deals with an overall classification of North American dialects, presents a set of complementary dialect boundaries that cover almost the entire continent. It is not to be expected that dialects will be entirely complementary, or that all locations will be clearly included in one dialect region or another. The nature of ongoing linguistic change predicts that some communities located in the peripheral areas surrounding dialect regions will escape classification. Our maps of North America show a number of such points, communities that are not included within any isogloss (Map 11.13), a situation to be resolved by future studies.

Nesting. A third relation among isoglosses is *nesting*. Isoglosses are nested when the spatial distribution of one feature is contained entirely within that of another, establishing an implicational relationship. This is a common situation when isoglosses are defined by the percent occurrence of a given feature. In the South, the isogloss for communities with at least 50 percent back upglides with /oh/ will obviously form an area nested within the isogloss for communities with at least 20 percent upglides. This could of course be transformed into a complementary relationship by defining the first as 50 to 100 percent and the second as 20 to 49 percent, but the nested formulation expresses the relationship of the two areas in a more direct and informative way. A more important kind of nesting relationship emerges when the nested items represent qualitatively different stages of a chain shift. Thus the third stage of the Southern Shift is nested within the second stage which is nested within the first stage (Maps 11.4, 18.5, 18.6).