8

Divergence

Chapter 7 opened the discussion of divergence with the two-step model of Figure 7.1, and then focused on the bidirectional changes that make up the first half. The present chapter will focus on the second step in the model: the unidirectional changes that lead directly to divergence. The aim is to advance a general schema for divergence that may be useful for the study of change in other languages and in other societies.

8.1 Continuous and Discrete Boundaries

Divergence implies more than differentiation. Within a large territory there may be a continuous accumulation of small differences that result from the fact that a given change started in one area within the territory. The *Survey of English Dialects* (Orton and Dieth 1962–7) shows such a pattern as the result of the differential development of the Great Vowel Shift, which started in southeast England.[1] The divergence to be discussed here is of a more discrete type, the result of linguistic change moving in opposite directions on either side of a sharp boundary.

It must be observed that dialectologists often show very little confidence in the boundaries they draw. Typical is Carver's summary of his efforts to assemble the lexical evidence from the *Dictionary of American Regional English*:

> 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. A person traveling southward from Superior, Wisconsin, to Mobile, Alabama, would be aware of the differing speech patterns but would not be able to say at what points along the route the changes occurred [. . .] What follows, then, is not the definitive description of regional dialects of America, because such a description is impossible. It is merely one attempt to seize the linguistic river as it flowed through. (Carver 1987: 19)

I quote this at length because it is so eloquent; similar statements on the continuous character of dialect boundaries are to be found throughout the literature (see also Chambers and Trudgill 1980; Kretzschmar 1992, Davis 2000). Some recent methods for dealing with dialect boundaries involve the mathematical description of continua (Heeringa and Nerbonne 2001), the typical result of the application of Bloomfield's principle of accommodation, as speakers mutually influence each other (see Ch. 1, [1]). Such continua may be stages in the process of dialect leveling that leads to general convergence.

The cases of divergence to be discussed here have a different character. They show sharp cleavages in the phonology of adjoining regions, with tight bundling of structurally related isoglosses.

8.2 The North/Midland Boundary

The deepest and most abrupt division in North American phonology is the boundary between the North and the Midland dialect regions, first delineated in the discussion of the westward extension of the Northern Cities Shift in Chapter 5. There we saw the coincidence of the lexical North/Midland boundary with one measure of the NCS, the UD criterion. In Figure 5.19 the North/Midland boundary, as defined by ANAE, coincided with the extension of the boundary between the North and the Midland, as defined by Kurath in the Eastern United States on lexical criteria (Kurath 1949). This lexical boundary is a cultural reflection of the settlement history of the region (see Figure 10.4).

The extent of divergence between the North and the Midland requires an assessment of the degrees of rotation of the set of vowels involved, as displayed in Figures 1.4 and 5.15. ANAE's exploration of geographic patterns found that relational criteria within the NCS gave more coherent measures of homogeneity and consistency than measures of individual sound changes. The four systematic measures used by ANAE are shown in Figure 8.1.

1 AE1 This criterion is the only one that does not involve the relations of two phonemes. It concerns the triggering event of the NCS: the general raising

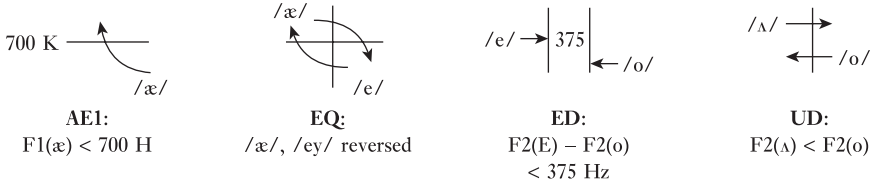

Figure 8.1 Four criteria for the advancement of the Northern Cities Shift

of /æ/. It is important to note here that this involves the mean of /æ/ only before oral consonants. While /æ/ is raised to upper mid position before nasal consonants in many dialects of North American English, a distinguishing feature of the Inland North is the minimal difference between oral and nasal submeans. The figure of 700 Hz yields maximum homogeneity for AE1 (.84).[2] In the normalized system used in ANAE, 700 Hz generally corresponds to the division between vowels perceived as high and vowels perceived as mid. The same value serves to distinguish the degrees of raising of the corresponding back vowel: the speakers who have mean F1 of /oh/ below 700 Hz are confined to a narrow belt along the East Coast, from Providence to Baltimore.

2 EQ In conservative North American dialects, /e/ is higher and backer than /æ/, as in the positions of cardinal vowels in IPA charts. The general raising of /æ/ in the NCS is accompanied by a lowering and backing of /e/, so that their relative positions as measured by mean F1 and mean F2 are reversed.

3 ED For most North American dialects, /e/ is a front vowel and /o/ is a back vowel. The mean F2 for /e/ for all dialects is 1927 Hz in the normalized system, and for /o/ 1302 Hz: a difference of 625 Hz. With the backing of /e/ and fronting of /o/, this separation shrinks. For the Inland North, the mean F2 values for /e/ and /o/ are respectively 1707 and 1491 Hz, a difference of only 216 Hz. The ED criterion that yields the greatest homogeneity (.87) is that, for assignment to the Inland North, this difference should be less than 375 Hz.

4 UD For most North American dialects, /ʌ/ is located only slightly back of center, while /o/ – whether rounded or unrounded – is well to the back of center. In the NCS, /o/ shifts to the front, and /ʌ/ to the back. Maximum homogeneity (.87) and consistency (.85) are achieved by the criterion that /ʌ/ is further back than /o/.

Figure 8.2 shows the location of the means for the twenty-one North American dialects defined by ANAE for four NCS vowels, with the Inland North labeled. The extreme differentiation of the Inland North from all other dialects appears in the high front position of /æ/ (AE1), the backing of /e/ and fronting of /o/ (ED), and the backing of /ʌ/ (UD). One can also observe that /æ/ is higher and fronter than /e/ (EQ).

Figure 8.3 maps the Inland North with the four NCS isoglosses superimposed, adding AE1, EQ and ED to the UD isogloss of Figure 5.19. The lexical isogloss first seen in Figure 5.19 is also included. The four NCS isoglosses follow somewhat different paths to the east and west of the Inland North, but they coincide almost completely on the North/Midland boundary. The AE1 line dips south to include Fort Wayne in Indiana, and some variation appears in Northeastern Pennsylvania. Other than that, we have strict coincidence along this deep division, separating Inland from Midland cities.

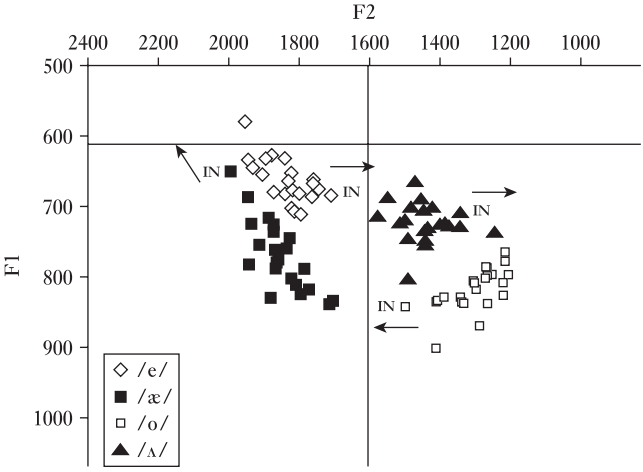

Figure 8.2 Position of Inland North means for four Northern Cities Shift vowels in relation to twenty other North American dialects. IN = Inland North

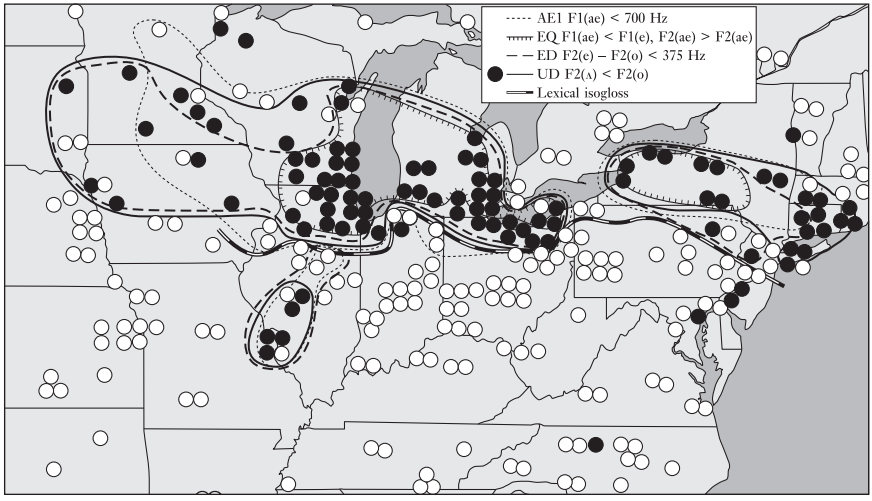

Figure 8.3 The coincidence of measures of the Northern Cities Shift along the North/Midland boundary

The city of Erie in the northwest corner of Pennsylvania deserves special comment. The lexical boundary plainly includes Erie within the North; but, of the NCS criteria, only ED includes Erie – and only by one of the two speakers.

Lexical and phonological data from the 1950s mark Erie as a consistently Northern city; it is the only community that has switched allegiance in the intervening period. Northern cities never show the low back merger in *cot* and *caught*. Erie has the merger, suggesting a pattern of Pittsburgh influence (ANAE: 205). The history and background of the eccentric behavior of Erie has been investigated in some detail by Evanini (2009).

The North/Midland boundary is linked to another deep division in North American English phonology: the fronting of /ow/. The fronting of the nucleus of /ow/ is strongly inhibited in the North and maximally promoted in the Midland (see Figure 10.3 and ANAE, Ch. 12). This correlation of the movements of /ow/ and /ʌ/ reflects an identification of the nuclei /o/ and /ʌ/ that holds for the entire Eastern half of the United States.

The divergence of the North and the Midland is seen most clearly in the development of /ʌ/ across age levels. In regression analyses on F2 of /ʌ/, the age coefficient is 1.37 for the North and –2.43 for the Midland, both significant at $p < .05$. That is, the younger the speaker is in the North, the further back the vowel: for every twenty-five years of decreasing age, one can expect F2 to be 34 Hz lower. In the Midland, the situation is the reverse: a speaker younger by twenty-five years will have an F2 greater by 53 Hz.[3]

Figure 8.4 is a scattergram of the relations of /ʌ/ and age in the Inland North and in the Midland. The horizontal axis shows the age of the speaker, the vertical

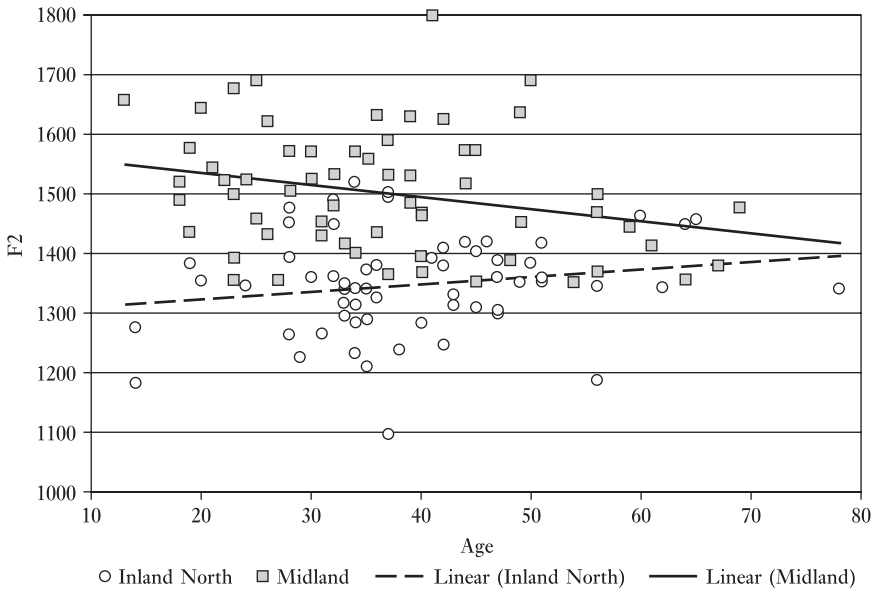

Figure 8.4 Divergence in the fronting and backing of /ʌ/ by age for the Inland North and the Midland

axis the F2 of /ʌ/. The lines show the general trends in the two regions. For the Inland North, the younger the speaker, the lower the F2 and the further back the vowel. For the Midland it is just the opposite: the younger the speaker, the higher the F2 and the fronter the vowel. No example of divergence more dramatic than this could be constructed. For the oldest speakers the two vowels are the same. For speakers aged 20 and under there is no overlap.

8.3 Communication across the North/Midland Boundary

Following Bloomfield's principle of density, first cited in Chapter 1 of Volume 2, one possible explanation of the sharp dialect differences across the North/Midland boundary is that this boundary is a natural product of discontinuities in the network of communication:

> The inhabitants of a settlement, village, or town [. . .] talk much more to each other than to persons who live elsewhere. When any innovation in the way of speaking spreads over a district, the limit of this spread is sure to be along some lines of weakness in the network of oral communication, and these lines of weakness, in so far as they are topographical lines, are the boundaries between towns, villages, and settlements. (Bloomfield 1933: 426).

Studies of average daily traffic flow show that this prediction holds for most of the dialect boundaries in the Eastern US, including that part of the North/Midland boundary that passes through Pennsylvania (Labov 1974).

This is demonstrated by recent studies of communication through a much larger data base. Thiemann et al. (2010) construct a proxy network for human mobility from the movements of 8.97 million banknotes in the United States, collected at the online bill-tracking study, wheresgeorgecom. The network, linking the 3,109 counties of the United States is defined by the flux matrix W whose elements w_{ij} quantify the number of bills exchanged between counties i and j per unit time. The major patterns of communication that emerge are shown in Figure 8.5. Here too we see that the cities of Western New York State communicate primarily with New York City, and the major connections from Chicago reach out equally into the North and the Midland.

Figure 8.6 shows the communication boundaries for the Northeastern United States from the national map constructed by Thiemann et al. on the basis of these bank note patterns. The Pennsylvania portion of the North/Midland boundary is reproduced again. But the larger Midland area in the Midwest is not separated from the North. Instead, minor boundaries run north and south, dividing the larger North/Midland areas into several east–west divisions, orthogonal to the North/Midland isogloss.

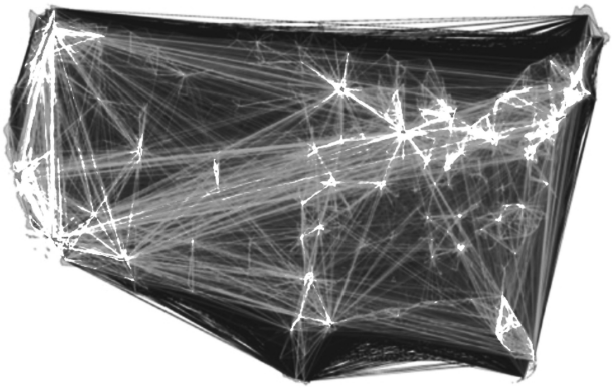

Figure 8.5 A proxy network for multi-scale human mobility, illustrating the flux *mij* of bank notes between 3,109 counties (Thiemann et al. 2010, Figure 1). Reproduced with the authors' permission

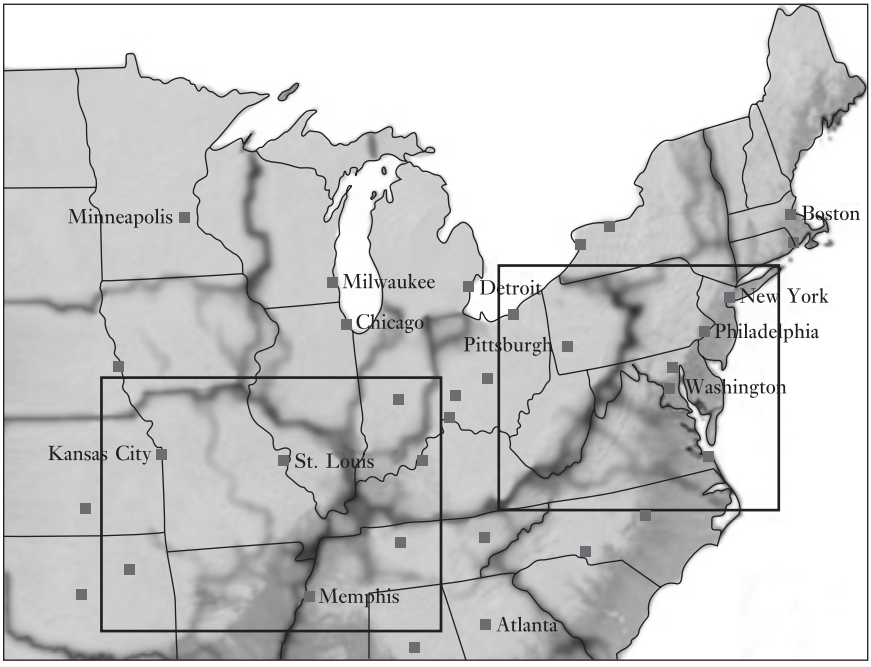

Figure 8.6 Effective subdivisions and borders in the Northeastern United States. Emergence of effective borders by linear superposition of all maps in the ensemble. Intensity encodes border significance (i.e. the fraction of maps that exhibit the border) (Thiemann et al. 2010, Figure 2). Reproduced with the authors' permission

We are therefore confronted with the situation first described in Chapter 1, [2b], and repeated below as [3]:

[3] When two speech communities are in continuous communication, linguistic convergence is expected, and any degree of divergence requires an explanation.

What, then, is the mechanism that leads to such surprising divergence between neighboring areas?

8.4 The Two-Step Mechanism of Divergence

The previous chapter introduced the concept of a linguistic *fork in the road*: a choice between two directions of change that are equally likely to be selected in an unstable situation. Given this equally balanced choice, any number of small and accidental factors can lead to the initial differentiation. These choices are *bidirectional* and *reversible*: the same groups may move back and forth between them.

Chapter 7 showed that, in the history of English, the low vowels have been involved in many such unstable situations. The vowel /a/ has shifted back and forth phonetically more than once, from low front [æ] to central [a] and back again. Similarly, /o/ has shifted to /ɑ/ to [ɒ] and [ɔ] and back again many times.

Chapter 6 provided the theoretical basis for such instability. The low vowels are not marked for peripherality and are not subject to the imperatives of the principles of chain shifting. In this chapter the question of interest is how such a fluctuating situation can result in the permanent separation and the continued divergence of neighboring dialects. The two-step model put forward in Figure 7.1, reproduced here as Figure 8.7, states that such separation will occur when the bidirectional change is succeeded by a unidirectional change. In the phonological domain, unidirectional changes are of two types: chain shifts and mergers. I will first examine the merger of the low back vowels /o/ and /oh/, then return to the chain shifts that define the North/Midland boundary.

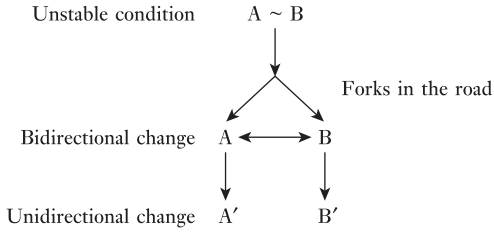

Figure 8.7 The two-step model of dialect divergence

8.5 Unidirectional Change: The Low Back Merger

The merger of long and short open *o* is the major unconditioned change taking place in the phonology of North American English, and it is one of the two major factors that differentiate North American dialects (Labov 1991). Chapter 5 projected the triggering event of this merger as a long series of historical accidents that led to the creation of the highly skewed and unstable long open-*o* class – a back rounded vowel, distinguished from short open *o* only by length.

One resolution of this unstable situation is the low back merger of /o/ and /oh/. As shown in Chapter 6, it is a solution that covers about 50 percent of the territory of English-speaking North America. The arrows in Figure 8.8 indicate the expansion of this merger from Eastern to Western New England, southwestward from Western Pennsylvania into West Virginia and Kentucky, southward from Canada into Minnesota, and eastward from the Southwest into Texas. The arrow in the lower section of New England corresponds to the most recent expansion in Southeastern Massachusetts reported in Johnson (2010). In addition, Dinkin (2009) finds that the low back merger is expanding into the Northern section of New York State adjacent to New England and is penetrating the areas of Eastern New York that are heavily influenced by the Northern Cities Shift. Given the general tendency for this merger to expand, one might conclude that it would ultimately eliminate divergence among dialects.

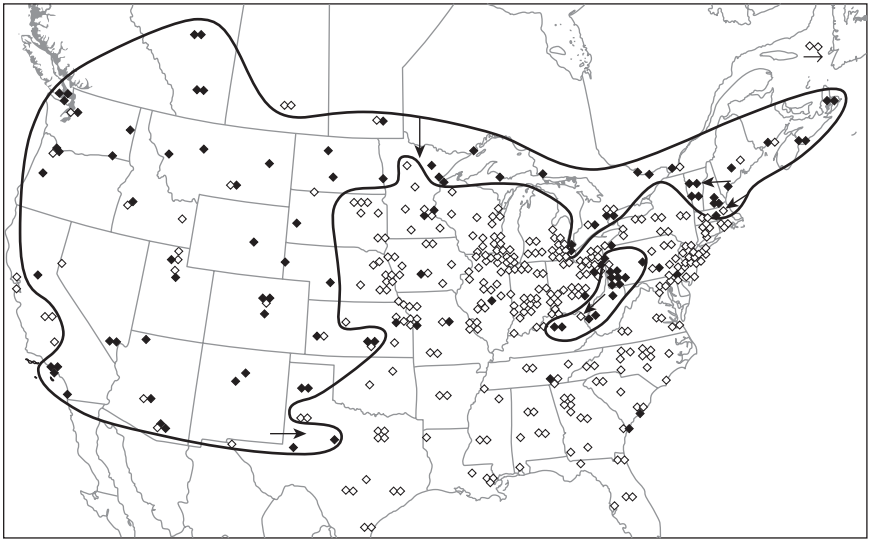

Figure 8.8 Expansion of the low back merger of /o/ and /oh/ in North America. Black tokens = merger in production and perception for all allophones. Arrows indicate direction of expansion in the second half of the twentieth century

8.6 Consequences of the Low Back Merger for the English Vowel System

8.6.1 The Canadian Shift

The low back merger is one possible outcome of a series of triggering events outlined in Chapter 5, but it is itself the triggering event for a variety of further consequences for the English vowel system. Figure 1.6 displayed the Canadian Shift, triggered by the low back merger. Like other initiating changes, the low back merger is a shift across subsystems (Figure 6.19): /o/ moves from the subsystem of short vowels to the subsystem of long and ingliding vowels. Merging with /oh/, it acquires allophones in free position, and so it is no longer a member of the short vowel subsystem. The loss of one of the six members in this subsystem then initiates a series of changes among the short vowels, following the principles discussed in Chapter 6, which govern movements within subsystems. The Canadian Shift is, then, a response to the impact of the low back merger on the short vowel subsystem: /æ/ moves back towards the position formerly occupied by /o/, and /e/ moves down towards the position formerly occupied by /æ/. In some accounts, /i/ shows a movement parallel to that of /e/.

8.6.2 The Pittsburgh Shift

In the two-step model of divergence, one or the other realization of a bidirectional change leads to a unidirectional change like the low back merger, and that merger has further consequences for the phonological system. The diversity of vowel systems is further developed by the options that follow. The mechanism of the chain shift depends upon the effect of the removal of /o/ from the subsystem of short vowels. But, as Figures 1.6 and 1.7 show, there are two possible consequences. The removal of the low back member will be followed by the shift of one neighbor, /æ/, or the other, /ʌ/. Chapter 5 has shown how this second option was taken up in the one area where the low back merger displays a discontinuous geographic distribution: Western Pennsylvania.

Figure 5.8 (reproduced here as Figure 8.9) is a plot of ANAE dialect means for the low vowels /æ/ and /ʌ/. The low position of Pittsburgh /ʌ/ compared to all other dialects is clearly indicated. On the other hand, Pittsburgh /æ/ shows none of the backing characteristics of Canadian /æ/.

The low back merger is evidently the conditioning event for the Pittsburgh Shift, just as it is for the Canadian Shift. Here, however, we have the same cause with two different effects. In the search for causes of linguistic change, it seems reasonable to expect that the same cause will have similar or comparable effects. Why is it that /ʌ/ moved instead of /æ/ into the empty space created by the back shift of /o/ and its merger with /oh/?

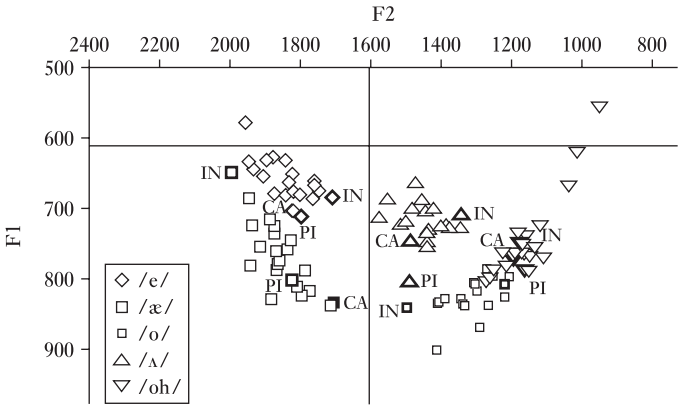

Figure 8.9 Mean positions of low vowels for twenty-one ANAE dialects, with Canadian Shift labeled for Canada [CA], Pittsburgh Shift labeled for Pittsburgh [PI] and Northern Cities Shift labeled for the Inland North [IN]

Among North American English sound changes there are other cases of two neighboring phonemes competing to fill the empty space in a pattern.[4] One might say that, in all these cases, the possibilities for either member in the pair fulfilling this role are equal, and it is a matter of chance which one was realized. But these choices are not equiprobable: as already noted, there are sixty communities which show evidence of the Canadian Shift, and only one city with the Pittsburgh Shift. We hypothesized above (Ch. 5, pp. 96–7) that the lowering of /ʌ/ in Pittsburgh was favored by its identification as the short counterpart of /ah/ – that is, of monophthongized /aw/. This monophthongization, a salient characteristic of the Pittsburgh dialect not found anywhere else in North America, thus acted as a second triggering event for the lowering of /ʌ/ rather than the backing of /æ/.

8.7 Resistance to the Low Back Merger

It was noted above that the end result of mergers might be a limitation rather than an increase in divergence. Since Herzog's corollary (Ch. 6) asserts that mergers will expand at the expense of distinctions, this phonological development in North American English might end in a situation where most of the continent is dominated by the low back merger. Indeed, many linguists feel that their great-grandchildren are destined to be integrated into this merger and into some of its consequences: the great majority would follow the Canadian Shift and a geographic minority would follow the Pittsburgh Shift. There is considerable support for this possibility. The Canadian Shift is quite uniform in Canada; but one may observe from Map 11.7

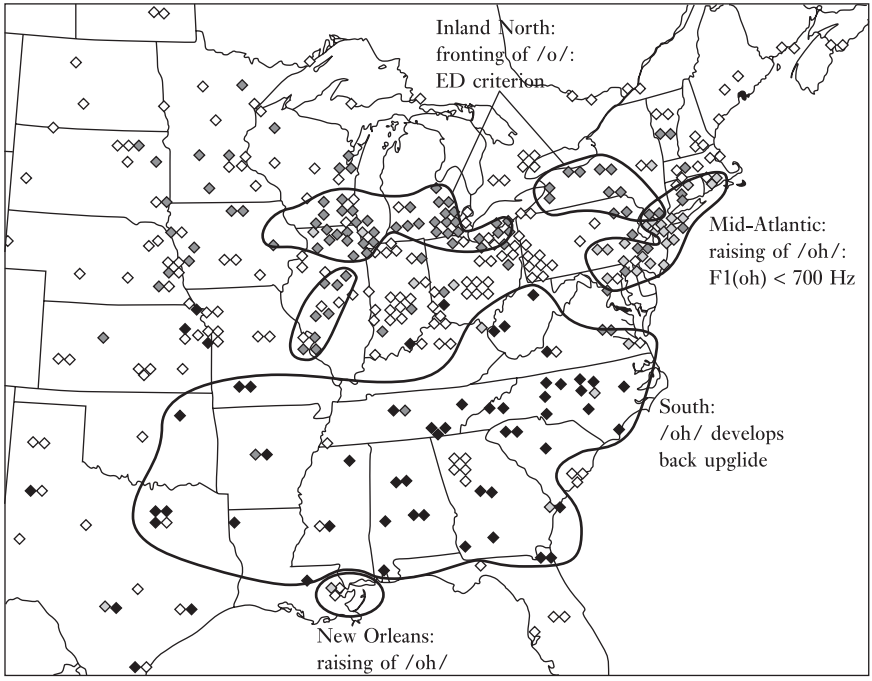

Figure 8.10 Areas of resistance to the low back merger in North America

of ANAE that ten of the 106 Telsur speakers in the West also satisfy the criteria for that shift (F2(o) < 1275, F2(æ) < 1825, F1(e) > 660). Though the Pittsburgh Shift is basically limited to its eponymous city, it shows some signs of expansion into West Virginia, along with the low back merger. Nevertheless there is some evidence that resistance to the low back merger is a fundamental characteristic of several large regions of the continent. The initial analysis of North American dialects in ANAE, Map 11.1 begins with a display of these regions; its salient features are extracted in Figure 8.10.

Among the bidirectional variables discussed in Chapter 7, the unstable relation of /o/ and /oh/ is accompanied by many fluctuations, and at any point this pair of vowels may be subject to the unidirectional process of merger. There are at this point three other processes that will make a merger much less likely, or forestall it altogether. They are all ways of increasing the phonetic distance between /o/ and /oh/.

1 The first of these processes is the raising of /oh/ to upper mid position. In a narrow strip of territory along the Eastern Seaboard, /oh/ is raised to a position with mean F1 less than 700 Hz.[5] This territory ranges from Providence, Rhode

Island to Baltimore, Maryland. In the early study of New York City (Labov 1966), raised /oh/ was subject to correction, but not as extensively as raised /æh/. In other parts of this Northeastern region, raised /oh/ is not a highly marked feature, but it is a salient identifier of the East Coast dialects for Westerners. The low back merger is not found in this territory.

There is no evidence as to when this raising was initiated. It is not mentioned in the earliest accounts of the New York City dialect (Babbitt 1896). In the 1960s, (oh) showed a slope in apparent time consistent with its increasing raising as a change in progress.

Raised /oh/ is found in only one section of the US outside of the Eastern Seaboard belt, and that is the city of New Orleans. The characteristic raised /oh/ of the New Orleans dialect is one of several pieces of evidence that point to extensive New York City influence. Though this influence could have taken many possible routes, the clearest documentation indicates extensive interaction and intermarriage alliances between New Orleans families and New York City cotton bankers in the nineteenth century (see Chapter 15).

2 An opposite form of the phonetic differentiation of /o/ and /oh/ is the fronting of /o/. This is reflected in Figure 8.1 as the ED criterion of the Northern Cities Shift: the reduction of the front–back difference between /e/ and /o/. As indicated in Figure 1.4, the fronting of /o/ is usually considered a second stage of the NCS, a response to the general raising of /æ/. Yet historically it must be linked to the prior step: the unrounding of [ɔ] to [ɑ] discussed in the last chapter. This unrounding extends beyond the Inland North: it is also found in the parts of the Eastern Seaboard belt where /oh/ is raised; in the Midland; in the North generally; and in the West.[6] The unrounding of /o/ may therefore be considered a precondition for the NCS (see the discussion of Michael Barton's discovery of this unrounding in Chapter 7). In any case, the further fronting of /o/, characteristic of the Inland North, seems to be required for resistance to the low back merger, since unrounded /o/ in the West does not inhibit this merger.

Chapter 6 found that low vowel shifts are not governed by unidirectional principles of chain shifting, since peripherality is not marked for low vowels. The bidirectional character of the movement of /o/ is further illuminated by the recent finding of Dinkin (2009) of a general backing of /o/ in New York State, both in areas fully dominated by the NCS and in fringe areas marginal to it. This phenomenon of backing appears to have occurred suddenly for those born in the 1960s. The backing of /o/ is accompanied by a weakening of the recognition of the /o/ ~ /oh/ distinction in minimal pairs in the fringe areas. Thus Dinkin finds that the resistance provided by the NCS to the low back merger is not as strong as the ANAE analysis asserts, and not as strong as that afforded by the raising of /oh/ on the East Coast. The backing of /o/ is not found in the larger Western part of the Inland North, where no influence of the NCS has been detected.

3 The Southern dialect region generally shows identical locations of /o/ and /oh/ in F1/F2 space, but differentiates /oh/ from /o/ by a glide in the high back direction, [ɔo], with the nucleus often unrounded to [ɑo]. Figure 8.10 shows the distribution of this feature in the South, where diphthongization is largely coextensive with the defining Southern isogloss: the monophthongization of /ay/ before voiced obstruents (solid line in Figure 5.11).

The unrounding of /oh/ to phonetic [ɑo] suggests a shift of phonemic notation to /aw/. However, in Figure 1.1 the notation /aw/ is reserved for the back upgliding vowel, in *out*, *south*, *down*, etc. Throughout the Midland and the South, the nucleus of /aw/ is well front of center, as [æo] and [eɔ], especially before nasal consonants; by contrast, in the North this nucleus is located back of center, as [ɑo]. By itself, this phonetic differentiation would not normally furnish sufficient motivation for a shift of phonemic notation, but the linkage of the Southern unrounded [ɑo] for /oh/ and fronted [æo] for /aw/ does provide such a motivation, yielding the chain shift (1). While the shifts of subsystems we have been considering up until now involve additions to the long upgliding subsystem, this is a reverse process, which adds to the inventory of the Vw subsystem.

(1) Southern Back Upglide Shift:
/oh/ → /aw/ → /æw/

Despite its firm location in the chain shift (1), the back upglide is variable in the extreme. As ANAE, Map 18.8 shows, the area where the back upglide occurs with a frequency from 50 to 100 percent is only a little larger than the Inland South; and, in much of the area shown here in Figure 8.10, it is present only 10–20 percent of the time. For the five speakers in Atlanta, the Southern city with the most North and Midland influence, the back upglide does not appear at all.

Though the back upglide is a source of resistance to the low back merger, it is not well enough entrenched to offer complete resistance. Feagin (1993) first reported the low back merger among young upper middle-class speakers in Anniston, Alabama; apparently this was a product of the complete abandonment of the back upglide. Irons (2007) found an unexpected frequency of the low back merger in Kentucky, and likewise attributed it to loss of the glide.

In contrast, the phonetic adjustments of /oh/ and /o/ in the (Western) Inland North and Mid-Atlantic areas offer consistent resistance to the low back merger. The fronting of /o/ and the raising of /oh/ are variable, but no more than any other change in progress. The mean values around which this variability is distributed are the parameters of interest. These are displayed in Figure 8.11, which shows the mean values for /i/, /e/, /æ/, /o/, /ʌ/, /oh/ for each of the twenty-one dialects and labels the items that are relevant to resistance to the low back merger.

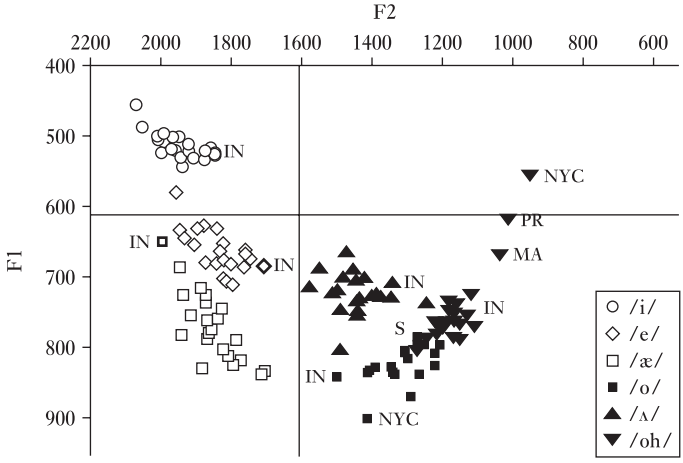

Figure 8.11 Resistance to the low back merger as shown by the distance between /o/ and /oh/ for the Inland North [IN], the South [S] and the dialects with raised /oh/: New York City [NYC], Mid-Atlantic [MA] and Providence [PR]

One can observe three degrees of raising of /oh/: in Mid-Atlantic to lower mid, in Providence to mid center, and in New York City, the most extreme, to lower high position. The great distance between NYC /oh/ and NYC /o/ is archetypical for that dialect. The /oh/ token labeled "IN" is at the upper end of the main /oh/ distribution.

The operation of the NCS is evident in the very front position of /o/ for the Inland North, the extreme position of Inland North /æ/, and the Inland North backing of both /i/ and /e/. On the other hand, there is no differentiation of /o/ and /oh/ for the South on the F1/F2 plane. The single label "S" indicates the mean value for both vowels, where F1 and F2 of /o/ and /oh/ coincide.

As a consequence of these phonetic shifts and rotations, the expected expansion of the low back merger has been blocked. Long-standing stability was the main finding in Johnson's study of the boundary between Eastern New England and Providence, as reviewed in the last chapter. This is what one would expect from the raised /oh/ of Providence. But the spread of the merger in the youngest generations and the backing of /o/ in New York State leave the long-term future of the low back merger an open question.

Although this volume is focused upon North American sound changes, it is relevant here to note that the raising of /oh/ is the basic mechanism operating in Southeastern England. While Received Pronunciation continues to differentiate

/oh/ from /o/ primarily by length, most popular dialects in that region raise /oh/ from lower mid [ɔ] towards cardinal [o].

8.8 Further Differentiation by Chain Shifts

In addition to the raising of /oh/ on the Eastern Seaboard, a further development along the back perimeter serves to differentiate these vowel systems from others. As /oh/ rises along the peripheral track beyond upper mid to high position in New York City, a parallel chain shift is engaged in the subset before /r/. Figure 8.12 shows schematically how vowels before /r/ rise, so that mean /ahr/ reaches the mid back position and mean /ohr/ rises to high position, merging with /uhr/. On the left is the New York City pattern, in which /oh/ rises to high position, in parallel with /ohr/ (Labov 1966). On the right, Philadelphia /oh/ is stable at mid position, and /ohr/ rises beyond it to the same merger with /uhr/.

Figure 8.13 traces the same process in individual speakers: one of the four ANAE subjects representing New York City above and one of the four subjects representing Philadelphia below. It is evident that the NYC /oh/ has reached high position, along with /ohr/ and /uhr/. One token of /uhr/ is embedded in the cluster of high vowels: the word *mature*, with F1 of 477 Hz and F2 of 821 Hz.

The raising of /ahr/ is considerably more advanced in Philadelphia, while /oh/ remains stable in mid position. We see that the nuclei of /ahr/ and /oh/ plainly coincide; this may contribute to the stability of /oh/ in Philadelphia. In the LVC study of the 1970s, /oh/ showed no significant coefficient in apparent time, but /ohr/ did (PLC, Vol. 2; Conn 2005). /ohr/ has now reached fully high position, as it has in New York City, merging with /uhr/. Since there is no trace of fronting of /u/ or /uw/ before /r/ in any North American dialect, it is inevitable that such a merger will take place if the mid vowel reaches high position.

The raising of /oh/ in the Northeastern coastal belt is thus accompanied by other movements along the back peripheral track, which carry these dialects further along their natural line of development.

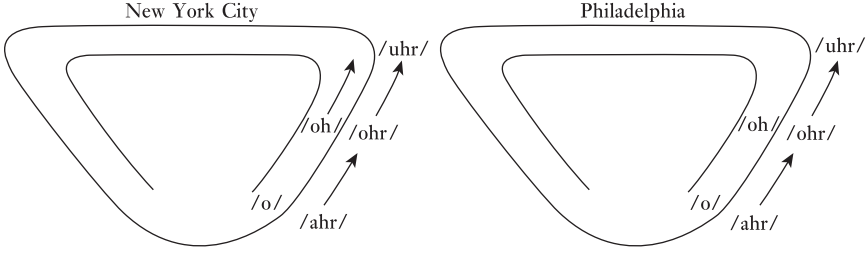

Figure 8.12 The Back Vowel Shift before /r/ in New York City and Philadelphia

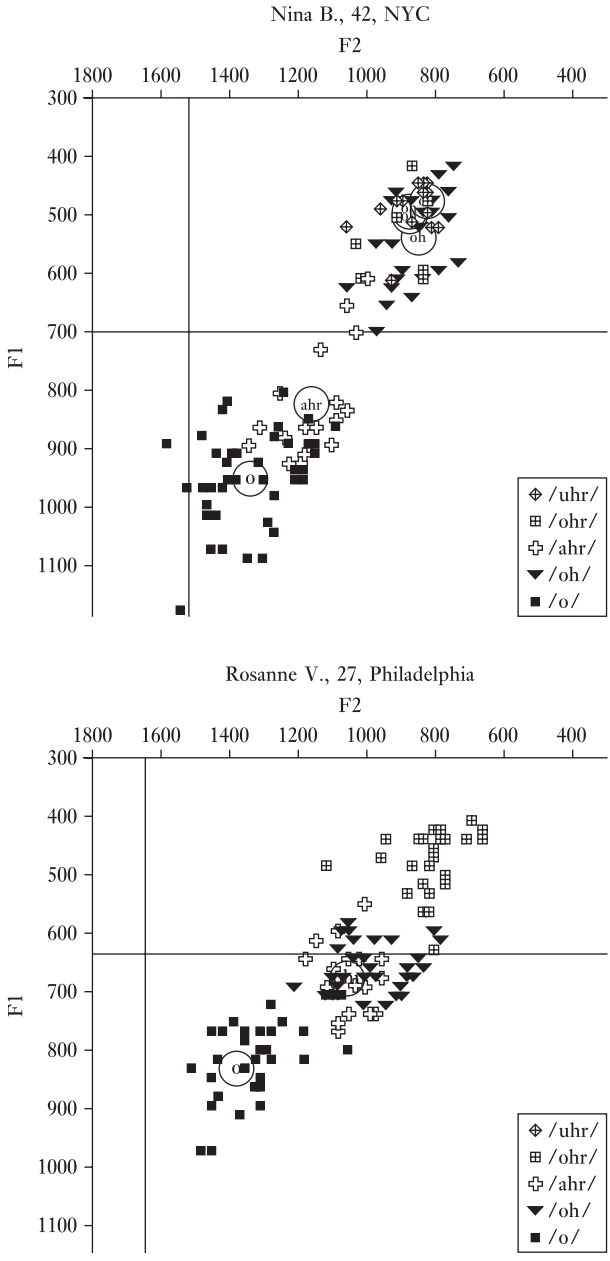

Figure 8.13 The Back Vowel Shift before /r/ in two individual speakers

8.9 A General View of Linguistic Divergence in North America

The various divergent developments that have been reviewed in this chapter are summarized in the single diagram of Figure 8.14. It considers the developments that spread from the unstable situation described in Chapter 5: the skewed opposition of /o/ and /oh/ in close approximation, in the nonperipheral and peripheral tracks of vowel space.[7] This opening scenario included a bidirectional shift: the unrounding or rounding of /o/. It was resolved in North American dialects by one of two options: on the left side of Figure 8.14, the unidirectional low back merger; on the right side, bidirectional shifts that increased the phonetic distance between /o/ and /oh/. Following the left-hand branch, we see dialects being further differentiated by one of two unidirectional shifts: the Canadian Shift or the Pittsburgh Shift.

The right-hand branch shows an even more complex differentiation. The phonetic distance between /o/ and /oh/ can be increased by one of three phonetic movements, all of which are bidirectional. The fronting of /o/ triggers one set of movements; the raising of /oh/ another; the addition of the back upglide a third. We know that the development of a back upglide can be followed by its loss, as demonstrated by the earlier history of English long open *o*, in Chapter 5, as well as by current developments in the South. These bidirectional shifts remain

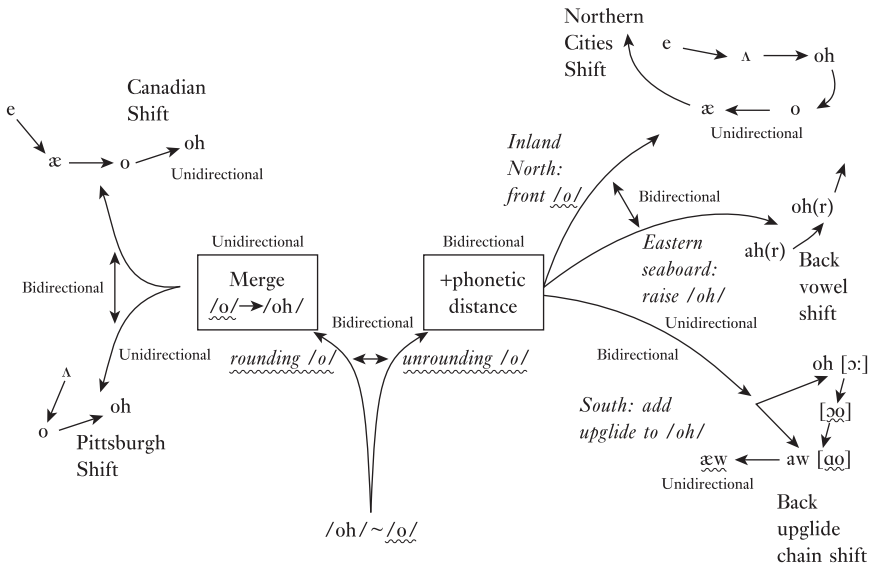

Figure 8.14 Development of divergence in North American English

bidirectional only until the vowels involved become engaged in chain shifts, as the nuclei move onto a peripheral track and become locked into the unidirectional mechanisms reviewed in Chapter 6.

The unidirectional character of chain shifts cannot be considered an absolute. As noted above, Dinkin (2009) finds a reversal of the fronting of /o/ in the Eastern portion of the Inland North. Lennig (1978) showed that the rotation of /a, o, u/ in vernacular Parisian French could be reversed, under social pressures from the upper middle class and as a structural consequence of the /a/ ~ /ɑ/ merger. ANAE finds that the Southern Shift is receding as a whole, in contrast to the other regional developments discussed here, and the attrition of the back upglide on /oh/ is one symptom of that recession. Nevertheless, chain shifts are not free to oscillate in either direction, since they are constrained by the governing principles reviewed in Chapter 6. Isolated sound changes are influenced by the same tendencies, but in a probabilistic manner that allows for considerably more fluctuation and more frequent exceptions.

The fundamental characteristic of the spreading tree of dialectal diversity is the alternation of bidirectional and unidirectional processes. If all sound changes were bidirectional, such divergence would not be expected between neighboring dialects, given Bloomfield's principle of accommodation. Nor would it be expected if, conversely, all changes were unidirectional, since every local region would be responding in the same way to basically the same constraints. Thus Figure 8.14 is an elaboration of Figure 8.7. The existence of forks in the road is a precondition for the permanent differentiation of A and B into A′ and B′.