6

Governing Principles

6.1 The Constraints Problem

This chapter deals with the principles that constrain change in one direction or another. Given such a principle, we can predict, for a state A of the language, what state A′ would be like if change should occur. In a formal grammar, this would be equivalent to distinguishing "possible" from "impossible" changes. Although many of these principles are strongly confirmed by rich bodies of data, they do not have such an absolute character. They refer to ways in which speech communities evolve, in which fundamental cognitive abilities interact both with physical capacities and with cultural practices. Given the right cultural configuration, there are very few general patterns that cannot be reversed. Our principles give us an understanding of what is normal, general and typical; but attempts to use them to define the impossible will inevitably stumble upon counterexamples.

Changes governed by such principles can be called "irreversible" or "unidirectional." I prefer the second, since it does not imply the absolute character signaled by "irreversibility." Unidirectional changes can reverse direction, if rarely, and these cases are of great interest in that they allow us to search for the special circumstances that permit things to go the other way.

Some of these governing principles were presented in LYS in 1972, and several were developed in detail in Parts B and C of Volume 1. Because this volume deals with change in progress, and changes in progress in most varieties of North American English are almost entirely phonetic and phonological, most of the governing principles will concern sound change. But in recent years the search for unidirectional principles of change has been particularly active in the study of grammaticalization (Heine and Kuteva 2005, Hopper and Traugott 2003, Haspelmath 2004). In addition to the unidirectional character of particular clines (main verb > tense/aspect/mood marker, nominal adposition > case), the unidirectional character of grammaticalization as a whole has been a major focus of attention. An entire volume has been devoted to this issue (Fischer et al. 2004; see in particular Ziegeler 2004).

The discussion in this volume is directed by what has been learned from research on linguistic change in progress, through real time or apparent time studies. Almost all of these changes are phonological, and the governing principles to be discussed here are phonological in character.

6.2 The (Ir)Reversibility of Mergers

Chapter 11 of Volume 1 presented the case for the irreversibility of mergers, a principle clearly stated in Garde's paper on Slavic inflections:

> A merger realized in one language and unknown in another is always the result of an innovation in the language where it exists. Innovations can create mergers, but cannot reverse them. If two words have become identical through a phonetic change, they can never be differentiated by phonetic means. (Garde 1961: 38–9)

The cognitive rationale for what I have called "Garde's principle" is quite clear. It rests upon the arbitrary character of the linguistic sign. The reversal of a merger is equivalent to relearning the original assignment of each lexical item, assigning the merged category to one of two arbitrary sets. Though it is clearly possible for individuals in close contact with the unmerged dialect to achieve this result by paying close attention to the speech of those around them, it does not seem likely that an entire speech community can do so.

The obverse of Garde's principle appears in studies of the acquisition of a phonemic split by second dialect learners. Chapter 18 of PLC, Vol. 1 reviewed Payne's study of the acquisition of the Philadelphia short-*a* system by children of out-of-state parents: only one of thirty-four children reproduced the core pattern. We interpreted this to mean that such lexical distributions, unlike simple phonetic output rules, had to be acquired from one's parents. Yet it is important to note that one child did acquire the Philadelphia pattern. As we examine other cases of change that reverses the expected direction, we will find that individual variation is a characteristic feature of the process.

Garde's principle does not need extensive support from a catalog of sound changes which follow it. There are a very large number of mergers in the historical record which have been known to go to completion without being reversed, and many sound changes have been traced which follow the unmerged-to-merged pathway. The mechanisms of the much smaller number of phonemic splits have been much discussed (secondary split through the loss of the Polivanov conditioning factor,[1] lexical borrowing), and spontaneous separation is not among these.[2] In testing the irreversibility of mergers, the first line of inquiry is to search for evidence on whether individual second dialect learners are able to acquire a distinction that is not present in their home dialect.

The /u/ ~ /ʌ/ contrast in Northern England has been the focus of much attention, since upward social mobility is associated with the ability to realize *put*, *bush*, *full*, *bull* as /u/ and *putt*, *but*, *gull*, *bulk* as /ʌ/. Sankoff (2004) reported on the acquisition of this distinction by two of the subjects in the *Seven Up!* series, who have been filmed every seven years since the age of 7. Seven-year-old Nicholas had a total merger; but at 35, after fourteen years spent in Wisconsin, he displayed unrounding in all but one token of *some* and one token of *much*. Seven-year-old Neil from Liverpool showed a mixed pattern; but, after exposure to other dialects in Scotland and London, he emerged as a consistent user of the distinction. Neither showed any evidence of hypercorrection. It appears that some adults can separate such large vocabulary sets;[3] the question remains as to whether an entire community can do so.

In the vowel systems of North American English, we find two cases that challenge Garde's principle.

6.2.1 The subset of vowels before /r/

The two cases of merger reversal to be considered next concern North American English vowels before /r/. These form a separate subset, distinct from the four vowel subsets of Chapter 1.[4] The initial position of Figure 6.1a shows the distinction of /ohr/ ~/ɔhr/ reflected in the opposition of *hoarse* and *horse*, *mourning* and *morning*, *cored* and *cord*, *ore* and *or*. This distinction was quite general in the North and in the South in the 1950s, but not the Midland (Kenyon and Knott 1953, Kurath and McDavid 1961). Map 8.2 of ANAE shows that speakers with the

	(a)			(b)	
	Vowels before coda /r/			Vowels before coda /r/	
	Vhr			Vhr	
nucleus	unrounded	rounded		front	back
high	ihr	uhr		ihr	uhr
mid	ehr	ohr	→	ehr	ohr
low	ahr	ɔhr			ahr

high	*beer*	*boor*		*beer*	*boor*
mid	*bare*	*bore*		*bare*	*bore*
low	*bar*	*or*			*bar*

Figure 6.1 Vowels before /r/

distinction are to be found today only in a few scattered areas in Eastern New England, Southern Indiana and Illinois, South Carolina and the Gulf Coast. When this distinction collapses, the system is reorganized as a front/back system, conforming to that of the main vowel subsets of Figure 1.1, and Figure 6.1b is now the system for the great majority of speakers of North American English.

6.2.2 The reversal of the ahr/ɔhr merger in St Louis

The usual development in Figure 6.1 is not found everywhere in North America. A different pattern, which merges /ɔhr/ and /ahr/, while /ohr/ remains distinct, has been reported for three distinct areas: Utah (LYS, Bowie 2003), Eastern Texas (Bailey et al. 1991), and St Louis (Murray 1993, Majors 2004). Bowie's study of early Utah English shows that the merger was present among those born in mid-nineteenth century and that it gained in strength over the rest of the century. Earlier reports in Utah (Cook 1969, Lillie 1998) indicate that the merger is declining in favor of the distinction between /ahr/ and /ɔhr/ and the merger of /ɔhr/ and /ohr/. It is generally reported that the traditional St Louis dialect showed a firm merger of /ahr/ and /ɔhr/ (in mid back position rather than low central, as in the Texas reports). Many sources indicate that among younger speakers this is giving way to the norm for the surrounding territories: a separation of /ahr/ and /ɔhr/ and a merger of /ɔhr/ and /ohr/ (Murray 2002). We can examine the mechanism of such a reversal of merger through the acoustic analyses of the four ANAE speakers from St Louis whose vowel systems are charted in Figures 6.2–6.5. The Telsur interview was

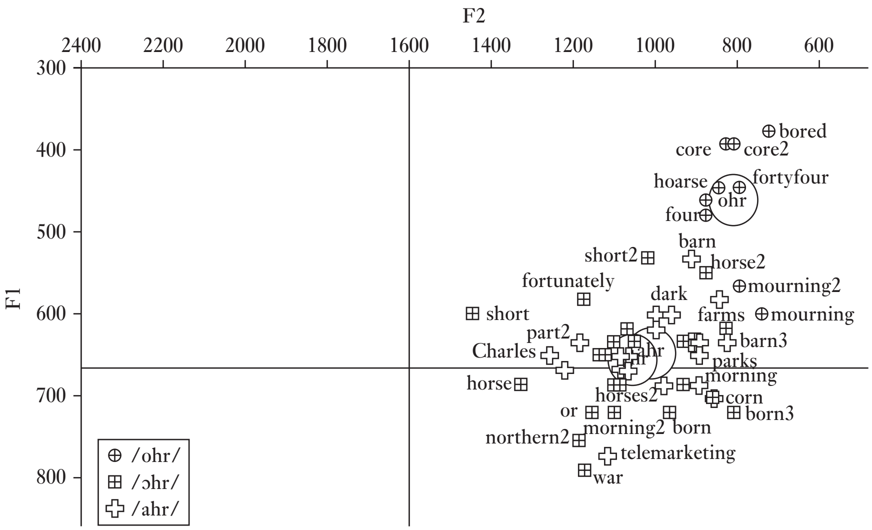

Figure 6.2 Back vowels before /r/ for Judy H., 57 [1994], St Louis, MO, TS 109

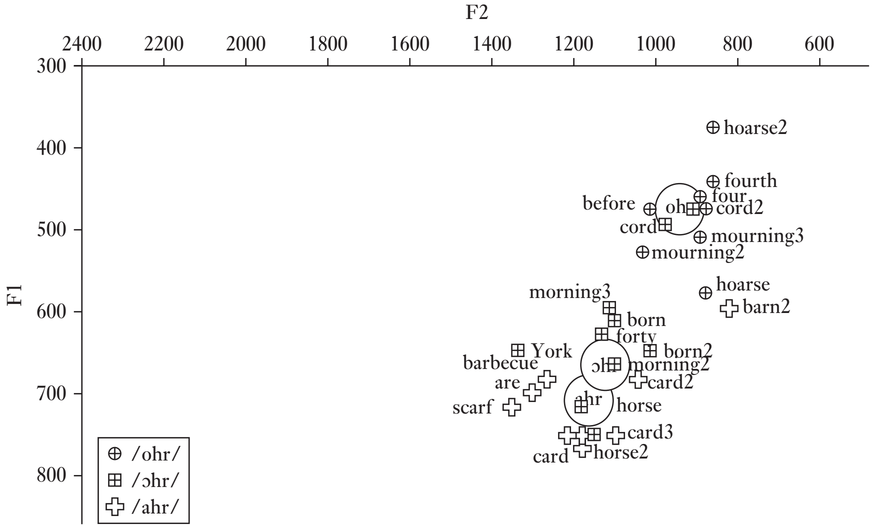

Figure 6.3 Back vowels before /r/ for Joyce H., 53 [1994], St Louis, MO, TS 167

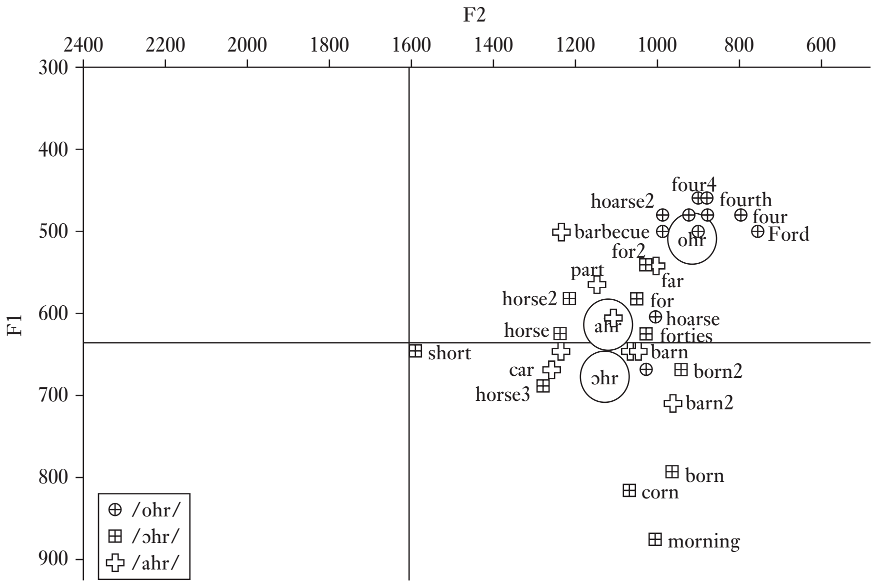

Figure 6.4 Back vowels before /r/ for Martin H., 48 [1994], St Louis, MO, TS 111

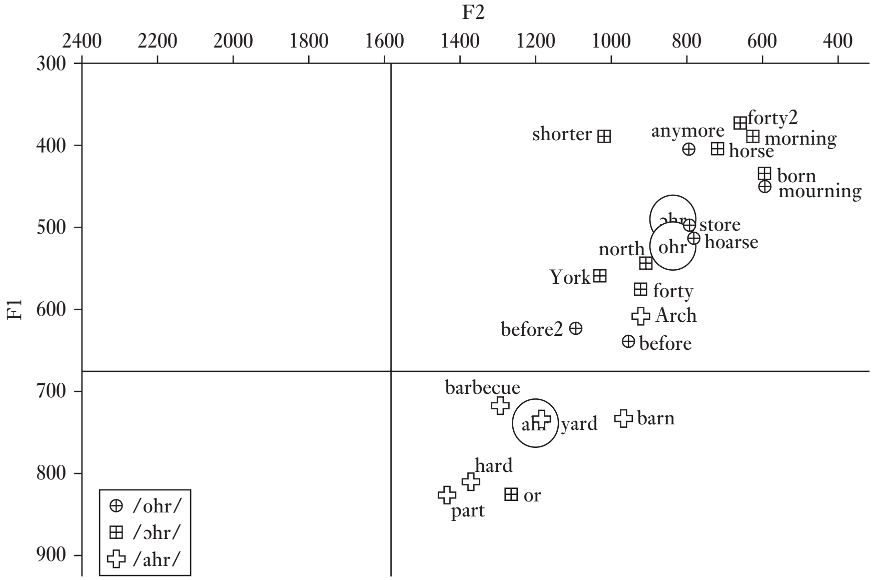

Figure 6.5 Back vowels before /r/ for Rose M., 38 [1994], St Louis, MO, TS 161

strongly focused on this area of the vowel system. *Hoarse* and *horse*, *mourning* and *morning*, *card* and *cord*, *barn* and *born* were elicited separately, and then pronounced and judged as minimal pairs.[5]

For the oldest speaker, Judy H. in Figure 6.2, the merger seems to be preserved with lexical fidelity. The /ohr/ cluster at the upper right overlaps the merged /ahr/ ~ /ɔhr/ distribution only for the two tokens of *mourning*, and these are well separated from the two tokens of *morning*, both from minimal pairs. The minimal pairs for *hoarse* ~ *horse* are also well separated. The merger of /ahr/ and /ɔhr/ is well attested by the relations of *barn* and *born*, where the two tokens of *barn* are higher than the two tokens of *born*.[6] In general, the elicited forms are concentrated in the peripheral area of the vowel space, as one would expect; but the clear separation of /ohr/ and merger of /ɔhr/ and /ahr/ are just as characteristic of the spontaneous forms as the elicited forms. In minimal pair tests, Judy H. judged that *hoarse* and *horse*, *mourning* and *morning* sounded different, and she heard *barn* and *born* as the same. The analyst's hearing confirmed this.

The same series of vowels is shown in Figure 6.3 for a second St Louis speaker, Joyce H., who is only four years younger. The clear merger of /ahr/ and /ɔhr/ and separation from /ohr/ is found. *Mourning* is included in the main /ohr/ group. However, the word *cord* plainly forms a part of the /ohr/ group, very far from the token of *card* at the bottom of the /ahr/ ~ /ɔhr/ distribution. In minimal pairs, Joyce H. agreed with Judy H. that /ohr/ and /ɔhr/ were different, but she heard /ahr/ and /ɔhr/ as "close," and the analyst agreed.

For the speaker Martin H., only five years younger, the vowel class distribution is preserved, but the distances are closer (Figure 6.4). The F1 difference between /ohr/ and /ɔhr/ is 200 Hz for the first two speakers, but only 160 Hz for Martin H. Martin's own judgment is that these two vowels are "close," while he still hears /ahr/ and /ɔhr/ as "the same."[7]

The youngest speaker in this series, Rose M., is only ten years junior to Martin H., but her Vhr system in Figure 6.5 is radically converted. /ohr/ and /ɔhr/ are now identified, both in her production and in her judgment, while /ahr/ is isolated in low position (mean F1 a good 250 Hz higher). There are remnants of the traditional St Louis pattern in the mid location of *arch* and, most strikingly, in the low position of *or*, an /ɔhr/ word.[8] Two of the nineteen words in Figure 6.5 are misassigned, which suggests (along with other examples) an error rate of about 10 percent in lexical identification.

This brief series of snapshots of the St Louis reversal was fortunately centered across the age range at which the change took place. The two older speakers confirm that the traditional St Louis system was consistent at one time, showing only occasional deviations from the identification of /ahr/ and /ɔhr/. The third speaker suggests the kind of phonetic approximation that Trudgill and Foxcroft (1978) identify as a mechanism of merger. The fourth speaker indicates the type of abrupt reorganization that Sankoff and Blondeau (2007) find in the shift of /r/ from apical to uvular in Montreal French. The inference from work on language change across the lifespan is that adults cannot make the radical readjustment of Figure 6.5. It seems most likely that Rose M. effected this change in her adolescent years or earlier.

The contrast between the fourth speaker and the first three leads us to believe that other reports of the reversal of the *card/cord* merger in St Louis are credible, *pace* Garde. The main argument for the unidirectionality of mergers is that reversal requires a word-by-word relearning, in other words a change that proceeds by lexical diffusion rather than by regular sound change. To the extent that the St Louis shift shows an approximation of /ohr/ and/ɔhr/, we can see regular sound change operating on the means of phonemic targets in an ongoing merger. But, to the extent that the separation of /ɔhr/ and /ahr/ shows lexical irregularities, we can recognize the mechanism of lexical diffusion. We must be alert to this issue in the next case of merger reversal.

6.2.3 The reversal of the fear/fair merger in Charleston

In a number of English dialects we find evidence of the merger of /ihr/ and /ehr/, so that *fear* and *fair*, *hear* and *hair*, *beer* and *bear* become homonyms: this happens in East Anglia (Trudgill 1974b), Newfoundland (Wells 1982), and New Zealand

(Gordon and Maclaglan 1989). The progress and mechanism of the ongoing New Zealand merger have been studied further in considerable detail (Holmes and Bell 1992, Maclaglan and Gordon 1996, Gordon et al. 2004, Hay et al. 2006, Shibata 2006), with findings quite consistent with Garde's principle. This merger has long been noted as a feature of the dialect of Charleston, South Carolina and its immediate environs (Primer 1888, O'Cain 1972, McDavid 1955, Kurath and McDavid 1961). Considerable variability is indicated in these earlier reports. Kurath and McDavid typically say that "*ear* sometimes rhymes with *care*" (1961: 22), and the merger is generally described as a relic feature, giving way to the distinction. If this case is relevant to the reversibility of mergers, it is important to know whether a total merger did exist at an earlier stage (see note 3).

Baranowski's study of the Charleston community, which involved 100 subjects in a socially stratified sample, devoted considerable attention to the /ihr/ ~ /ehr/ merger (2006, 2007). As prototypical of the older Charleston dialect, Baranowski took the speech of William McTeer, a sheriff from Beaufort, South Carolina, whom I interviewed in 1965. McTeer's /ihr/ and /ehr/ vowels are shown in Figure 6.6. The merger, in mid position, is evident, and the t-test table embedded in Figure 6.6 confirms the absence of any differentiation of the two vowels.

Baranowski's findings on minimal pair tests for the entire community is given in Figure 6.7, where complete merger is indicated by a level of 0 ("same" in production and perception) and consistent distinction by 2 ("different" in production and perception). Speakers whose ages fall into the two oldest decades are plainly merged, whereas those below 50 have a clear distinction, with a steep slope for those between

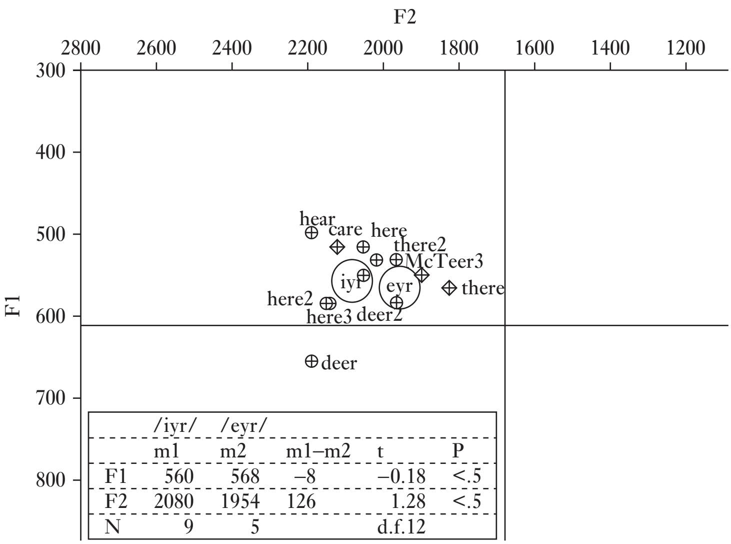

Figure 6.6 /ihr/ and /ehr/ vowels of William McTeer, Beaufort, SC [1965]

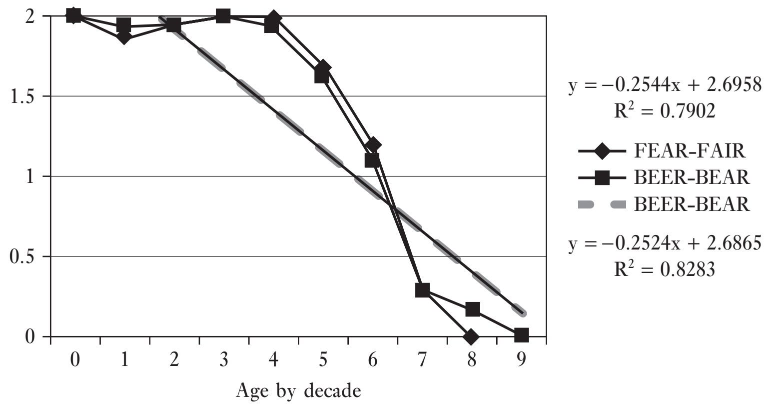

Figure 6.7 Reversal of the /ihr/ ~ /ehr/ merger as shown by two minimal pairs in Charleston, SC (Baranowski 2006, Fig. 6.25). Reprinted by permission of the University of Pennsylvania

50 and 79. There can be little doubt that the merger has been reversed. The broken line for *beer/bear* is a linear regression line for that pair. It is evident that the two pairs *fear/fair* and *beer/bear* follow identical s-shaped patterns of reversal. A logit transformation fits a straight line for both, with an r^2 greater than .99 (Baranowski 2007, Figures 6.26–6.27).

Baranowski's examination of individual speakers reveals several characteristics specific to the Charleston merger. Among the oldest speakers there is considerable variability. One 90-year-old woman has fully merged *beer* and *bear*, *fear* and *fair*, but makes a clear distinction between *here* and *hair* in spontaneous speech and minimal pair tests. The same pattern is repeated for an 85-year-old man, though others show a complete merger.

Across generations there is an abrupt change, which again suggests that children could grow up in a household with a solid /ihr/ ~ /ehr/ merger and arrive at adulthood with a clear distinction. Baranowski presents the case of an 82-year-old woman with no trace of a difference, while her 58-year-old daughter shows a merger for only one pair: *here* and *hair*.[9]

Charleston speakers also exhibit some degree of awareness of the opposition and its variability, rather than focusing on the phonetic position of one lexical item or the other. This appears in the remarkable exchange between Baranowski and a 42-year-old lower middle-class woman. The F1/F2 positions of the italicized words are indicated on Figure 6.8.

> *beer*2 and *bear*2, [pauses, smiles] sound different to me, though some people think [. . .], OK *beer*3 is something you drink and *bear*4 is an animal, [but] some people if

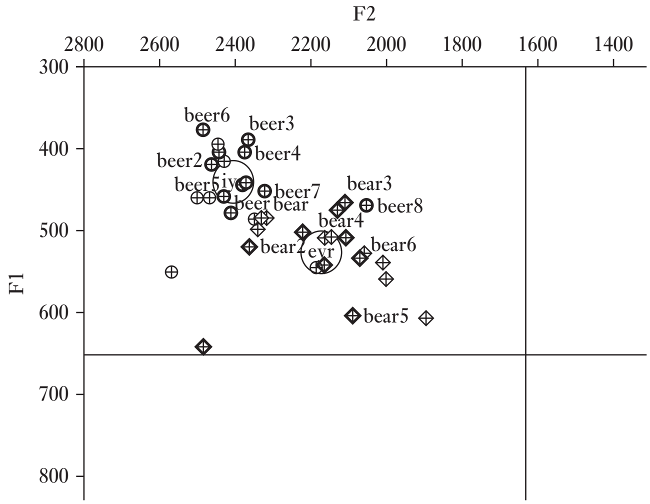

Figure 6.8 *Beer–bear* tokens of Kathy A., 42, Charleston, SC (Baranowski 2007, Figure 6.41). Reprinted by permission of Publications of the American Dialect Society

> they hear me say *bear*3 they think I'm saying *beer*4. That happens all the time. [If you say what?] If I'm saying *beer*5, they think I'm saying [or if I say *bear*5, they think I'm saying] *beer*6, like the drink. [. . .] For some reason I know when I say *bear*6, they go b- – they think I'm talking about *beer*7 and I'm not talking about *beer*8. (Kathy A., 42, Charleston, SC)

The original minimal pairs, labeled simply *beer* and *bear*, were quite close. As the discussion of the distinction proceeded, the two targets were widely separated until the very last token, *beer*8, which was realized in the middle of the *bear* class.

Kathy A. shows a keen awareness of the issue, but on the whole one cannot say that the merger receives a strong social evaluation in this city. An unusual feature of this Charleston sound change is the absence of any social class or gender differences. None of Baranowski's regression analyses shows a trace of such effects. This is in contrast with other Charleston sound changes, like the fronting of /ow/, where the upper class is strongly in the lead. In that sense, the merger of /ihr/ and /ehr/ is not socially evaluated.

These two cases of the reversal of mergers would seem to have put a considerable dent in Garde's principle. Again, we find that the reversal of the merger is accompanied by a moderate degree of lexical variation. But before considering how the principle might be further modified, we can turn to the spatial aspect of the irreversibility of mergers – Herzog's corollary.

6.3 The Geographic Expansion of Mergers in North America

To the extent that mergers are irreversible, it follows that they will not contract geographically, but can only expand from one area to another. This is the logical basis of Herzog's corollary to Garde's principle, which was originally illustrated by the outcome of the meeting of two geographic waves of merger in the Yiddish of pre-war Northern Poland: four phonemes merging into one (Herzog 1965, Weinreich et al. 1968).

ANAE provides a geographic view of eight mergers in North American English. Three show rapid expansion, almost to completion. The extent of the merger of /iw/ and /uw/, in *dew* and *do*, etc., was shown in Figure 5.11 (based on ANAE, Map 8.3). Similar patterns are displayed by ANAE for the merger of /hw/ and /w/ in *which* and *witch* (ANAE, Map 8.1) and for the merger of /ohr/ and /ɔhr/ discussed above (ANAE, Map 8.2). For these three, the area of merger has expanded from a limited area in PEAS records of the mid-twentieth century – largely the Midland area – to cover most of the Eastern US, as well as the rest of the continent. There is no trace of any tendency to reverse these mergers.

The conditioned merger of /ey/, /e/, /æ/ before intervocalic /r/ in *Mary*, *merry*, *marry* covers most of the continent but appears to be fairly stable. The area from Providence to Philadelphia, where all three words are distinct in pronunciation, remains intact in this respect, and the surrounding Eastern Seaboard area preserves the distinction between *merry* and *marry* (ANAE, Map 8.4).[10]

6.3.1 The pin/pen *merger*

The merger of /i/ and /e/ before nasals has been widely reported for the Southern states (Brown 1990, Bailey 1997). Bailey and Ross (1992) report that the distinction was present for some speakers born before 1875.[11] ANAE finds the merger all but complete in the Southern region (as defined by the monophthongization of /ay/ before obstruents). Only twelve of 143 speakers showed a clear distinction in minimal pair tests using *pin* and *pen*, *him* and *hem*.[12] Figure 6.9 shows that the area of the *pin/pen* merger has expanded considerably beyond the South, extending to Oklahoma and Southern Kansas and reaching up to the Hoosier apex in central Indiana. Northern Florida is also included. In that new area of *pin/pen* merger expansion, only five out of forty-six speakers show a clear distinction of /i/ and /e/ before nasals. In Charleston, which shares few of the dialect features of the South, the *pin/pen* merger is in progress and is complete in the youngest generation.

Figure 6.10 shows the mean values for the production and perception of the merger of /in/ and /en/ in minimal pair tests across the major dialect areas of North America. Values range from 0 for consistent "same" to 2 for consistent "different."

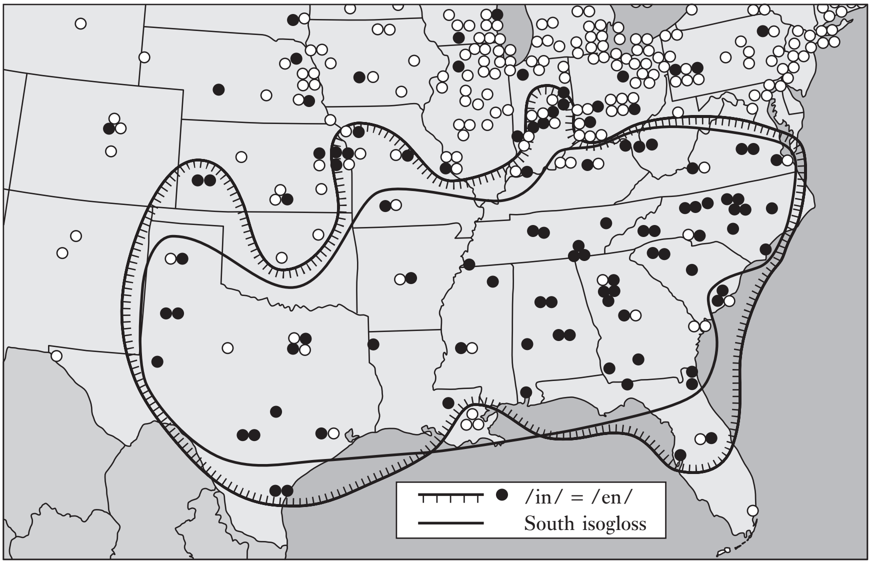

Figure 6.9 Expansion of merger of *pin* and *pen* beyond the South (ANAE, Map 9.5). *South isogloss* defines the South dialect region by monophthongization of /ay/ before obstruents. Solid circles: /in/ = /en/ in production of minimal pairs

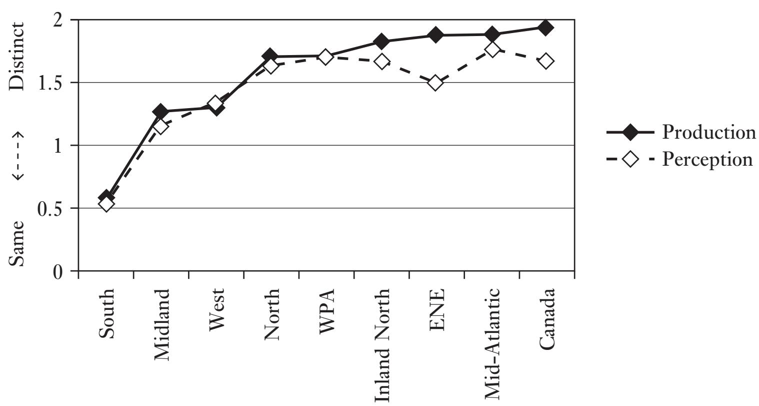

Figure 6.10 Mean values for minimal pair responses to the /in/ ~ /en/ contrast by region for production and perception. 0 = consistent "same" response; 2 = consistent "different" response

On the left, the South plainly has the most advanced and consistent form of the merger. Its two neighboring regions, the Midland and the West, show intermediate values which reflect the expansion of the merger. In Figure 6.10, the responses for production and perception are identical for those dialects affected by the merger, but perception shows slightly lower values for the four dialects that are most removed from the South, indicating a marginal awareness that *pin* and *pen* can be "the same." However, the *pin/pen* merger is not as socially marked as many other Southern features are. ANAE, Chapter 18 reports that elements of Southern phonology are receding in apparent time, some more than others. Unlike the Northern Cities Shift, the Southern Shift is inversely related to city size. The *pin/pen* merger, on the other hand, is directly correlated with city size (.42 per million on the 2-point scale, $p < .0001$).

6.3.2 Mergers before /l/

Two relatively new mergers have been reported in a series of sociolinguistic investigations in Utah, New Mexico and Texas: the merger of /i/ and /iy/ before /l/ in *fill* and *feel*; and the corresponding merger of the back vowels of /u/ and /uw/ in *full* and *fool* (LYS, Di Paolo 1988, Di Paolo and Faber 1990, Bailey 1997). The front vowel merger is primarily a Southern phenomenon, concentrated in those areas where the Southern Shift is most highly developed (ANAE, Map 9.7), while the back vowel merger is fully developed in Western Pennsylvania, where vocalization of final /l/ is also at its most extreme (ANAE, Map 9.6). Despite these differences in geographic location, the two mergers show strikingly similar distributions of minimal pair responses and, as Table 6.1 shows, they have almost identical profiles in apparent time. Regression analyses of both mergers across North America show an increase on the 2-point scale of more than 1 unit for every 25 years of age, indicating that the distinction is highly characteristic of older speakers and the merger of younger speakers. The merger of /il/ and /iyl/ is therefore quite independent of the Southern Shift, which is receding slightly in apparent time. Both mergers also show a sizable negative correlation with education.

Although we have no real-time data on the mergers before /l/, there is every reason to believe that they are expanding phenomena, at the opposite end of their life span from the almost completed mergers of /hw/ ~ /w/, /ohr/ ~ /ɔhr/ and /iw/ ~ /uw/.

Table 6.1 Regression coefficients for the merger of /i/ and /iy/, /u/ and /uw/ before /l/ in ANAE minimal pair data. Scale: 2 = distinct, 0 = same. p: * < .05, ** < .01, *** < .001

	/il ~ iyl/	/ul ~ uwl/
Age * 25 yrs	1.15**	1.12**
Education	0.468***	0.232*

6.3.3 The low back merger

The low back merger of /o/ and /oh/ represents the most substantial geographic division in North American English phonology, with many consequences for the rest of the phonological system. It is firmly documented from the 1930s for Eastern New England (LANE); from the 1940s for Eastern Pennsylvania (PEAS); and from the early 1970s for the West and Canada (Scargill and Warkentyne 1972, Terrell 1975). ANAE studied the low back merger through minimal and near-minimal pairs (*hot/caught*; *Don/dawn*; *sock/talk*; *dollar/taller*) well and through the acoustic measurement of distribution in spontaneous speech. Figure 6.11 shows the mean values for ANAE regions in both production and perception, in a display similar to Figure 6.10. North American dialects appear to fall into three groups. On the left are the four dialects that have traditionally been reported with the merger: Western Pennsylvania, Canada, the West and Eastern New England. In the middle are dialects in a transitional state, the Midland and the North outside of the Inland North, where /o/ and /oh/ are normally judged "close" in production and perception. At right are the three dialects with a phonological structure that resists the merger: the South, where /oh/ has a back upglide; the Inland North, where /o/ is strongly fronted; and the Mid-Atlantic region, where /oh/ is strongly raised. We also observe that the South is shifted down towards the transitional dialects. Again, the values for perception are slightly lower than those for production, except where the merger is the strongest.

Like most mergers, the low back merger of /o/ and /oh/ does not form a salient sociolinguistic variable. A series of regression analyses finds no significant effect for

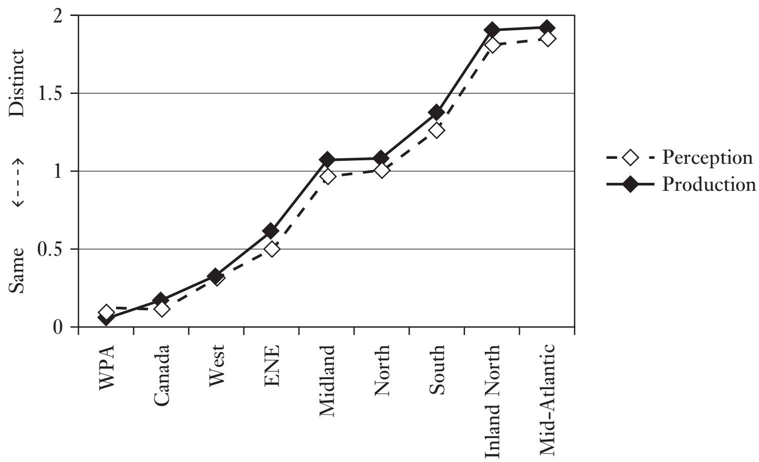

Figure 6.11 Mean values for minimal pair responses to the /o/ ~ /oh/ contrast by region for production and perception. 0 = consistent "same" response; 2 = consistent "different" response

Table 6.2 Significant regression coefficients for minimal pair responses to /o ~ oh/ opposition by region. Scale: 0–2. p: * < .05, ** < .01, *** < .001

	Midland	South	West
Age * 25 yrs	.23**	.29***	.15*
City population (in millions)		–.16*	
Education (years completed)		.06**	

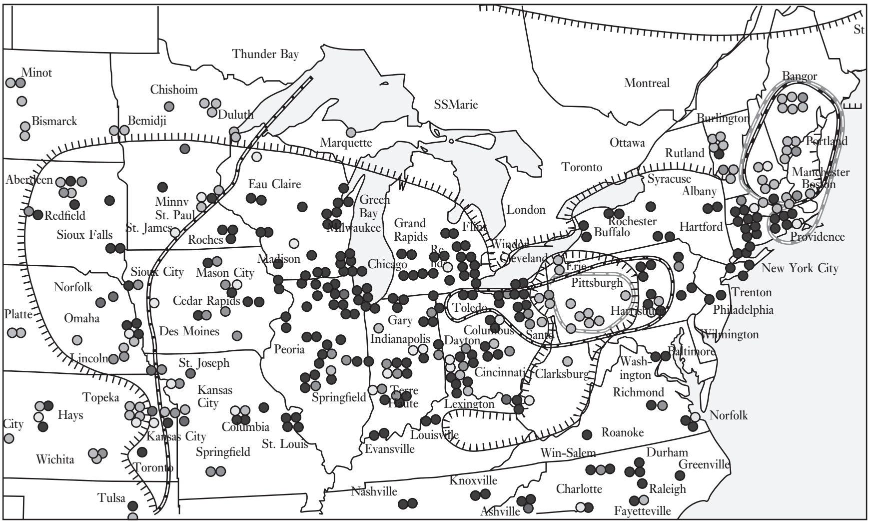

Figure 6.12 Comparison of low back merger in PEAS of the 1950s, Labov telephone survey of 1968, and ANAE of the 1990s

gender in any region and no effect of education or city size outside of the South (see Table 6.2). The South, however, is a different story. It shows a powerful positive age coefficient (consistent with Figure 6.11), indicating that younger speakers are the most likely to merge. As in the case of the *pin/pen* merger, we observe that the bigger the city, the lower the value: the merger is an urban phenomenon. It is also associated with lower educational levels. These figures reflect the same retreat from salient Southern phonology in the big cities that we find for the Southern Shift and for the fronting of /uw/ before /l/ (ANAE, Chapter 18). In this case, the salient feature is the back upglide with /oh/. When it is abandoned, merger must follow, since the locations of /o/ and /oh/ are otherwise almost identical in F1/F2 position.

Our major concern here is with the stability or instability of the boundaries between the merged and the unmerged areas. Figure 6.12 is based on ANAE, Map 9.4, which superimposes the PEAS boundaries, the ANAE boundaries, and a study of the contrast of *hock* and *hawk* in the speech of long-distance telephone operators that I carried out in 1968 (OH68).[13]

Figure 6.12 shows that the merger was confined to Eastern New England in PEAS and OH68, but expanded to Western New England in the ANAE data of the 1990s. Furthermore, the merger had expanded to the east and to the west in Western Pennsylvania in OH68, and in ANAE it expanded further, to West Virginia. Irons (2007) reports further merger in Eastern Kentucky. The South generally shows a tendency to merger through the loss of the back upglide, as noted above (Feagin 1993). In the North Central states, one can observe a spread of the merger from Canada southward. However, there is one area on Figure 6.11 where the expected real-time pattern is reversed. If the merger is expanding from the West, the Western 1990s boundary for the low back merger should be located to the east of the 1960s boundary; but, on the contrary, it is located well to the west. There is a sizeable territory in Minnesota, South Dakota and Nebraska where the OH68 line is to the east of the ANAE boundary, and it appears that the low back merger has receded from the 1960s to the 1990s.

Is this reversal of the expected positions of the isoglosses an indication that the merger is being reversed in this area? If this is the case, we should find a reversal in apparent time, as in St Louis and Charleston. Table 6.3 shows the mean minimal pair ratings for the thirt-six Telsur subjects in the region where the OH68 isogloss lies to the east of the ANAE isogloss. As in Baranowski's data in Figure 6.7, consistent "different" ratings are assigned a value of 2, consistent "close" ratings, a value of 1, and consistent "same" ratings, a value of 0. Separate averages are given for perception (the speaker's judgment of "same" and "different") and production (the analyst's judgment of the speaker's productions). The thirty-six speakers are divided into three age groups. No significant difference appears between the 51–75 and 41–50 groups. However, the youngest age group, 18–30, has a lower mean value. T-tests show a probability of this difference being due to chance of .08 for perception and .01 for production. We can conclude, then, that the OH68 survey of telephone operators – whose local status was not as clearly defined as that of the Telsur subjects – did not succeed in locating the actual geographic boundary at the time. The merger appears to be moving forward in this border area, as in others.

The low back merger was the focus of five papers presented at the 2008 NWAV meeting in Philadelphia, and in all the cases discussed there were indications of

Table 6.3 Mean ratings on minimal pair test in area of Figure 6.12, where the OH68 isogloss is east of the ANAE isogloss

Age	Perception	Production
51–75	.84	1.16
31–49	.92	1.25
18–30	.61	.59**

merger expansion.[14] In Indianapolis, the characteristic "close" transitional stage of the Midland was found to be progressing further, towards merger by approximation (Fogle 2008). In Miami, a similar transitional stage displayed further progress towards complete merger among younger speakers (Doernberger and Cerny 2008). In Erie, Pennsylvania, Evanini (2009) finds that the shift to Midland alignment under Pittsburgh influence is accompanied by a fronted form of the merger, not present in PEAS but distinct phonetically from the merged phoneme of Pittsburgh.

The most substantial new study of the low back merger is that of Johnson (2010), who traced the boundary between the merged area of Southeastern Massachusetts and the area of distinction centered on Rhode Island, shown in Figure 6.13. Johnson first found an extraordinary stability of the boundary across generations, which raised some questions about the generality of Herzog's corollary.[15] However, when Johnson carried out deeper studies of family patterns in several cities, he found a sudden shift towards merger in the youngest generation of pre-adolescent children. Figure 6.14 shows such a pattern for the town of Seekonk (for location, see Figure 6.13), where there is considerable variation among adults. One can observe

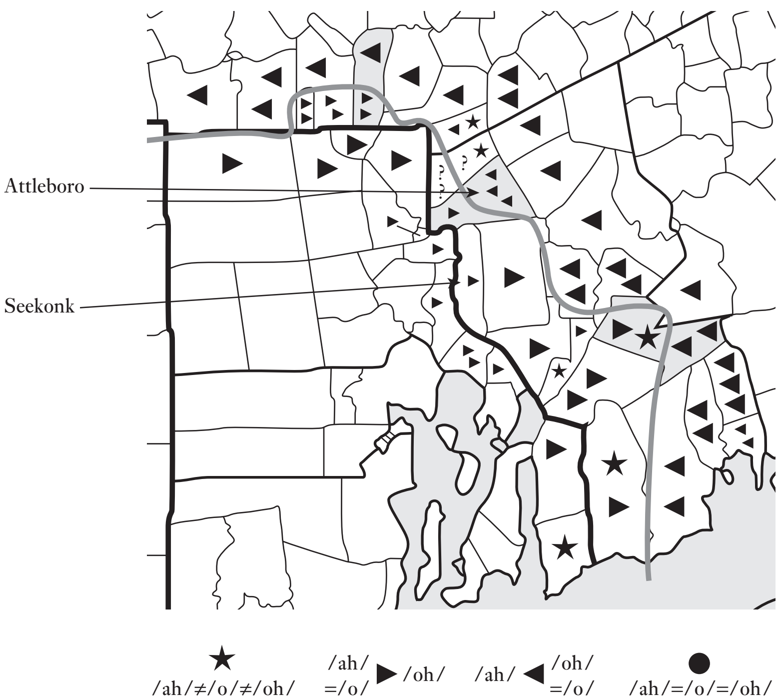

Figure 6.13 Boundary of low back merger in Southeastern New England (Johnson 2010, Figure 4.3). Reprinted by permission of the Publications of the American Dialect Society

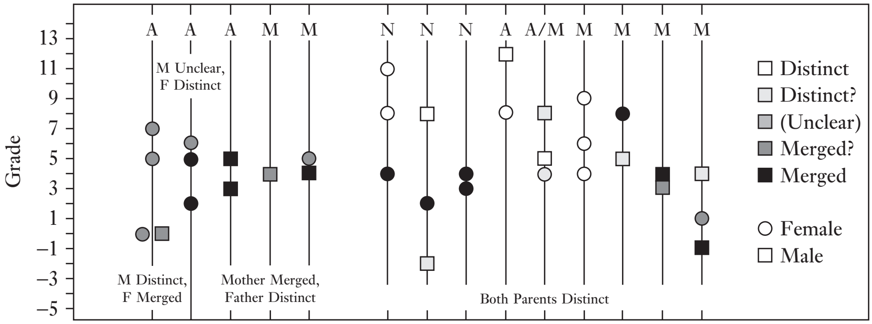

Figure 6.14 Development of the low back merger across generations in Seekonk (Johnson 2010, Fig. 6.5). N = North Seekonk; A = Central Seekonk; M = South Seekonk. Reprinted by permission of the Publications of the American Dialect Society

a shift to merged status for children in the elementary school grades, independent of gender or the parents' use of /o/ and /oh/. The town of Attleboro, just north of Seekonk, shows a similar shift. Though Johnson's regression analyses indicate some influence of the parental system on the eventual outcome, Figure 6.14 shows that the expansion of the low back merger is a community phenomenon that reaches children as they emerge from their initial family-centered language learning into the domain of peer-group influence.

These major shifts are taking place along the linguistic boundary and provide further support for Herzog's corollary. Although the boundary was stable for several generations, the changes now in progress are in the direction of the low back merger. Johnson also considers the possibility that some of the momentum towards merger is a general phenomenon, independent of geography; he finds some shift among speakers well within the state of Rhode Island. However, at community level none of these has as yet progressed as far as the movement towards merger displayed in Figure 6.14. Johnson gives considerable attention to the hypothesis that the impetus for change came from the movement of families from the merged Greater Boston area into the Seekonk-Attleboro area. His overall assessment is that there is only limited support for this idea. His Table 5.7 shows that the percentage of merged parents is much greater in South Attleboro than in Sekonk, yet the strongest impulse towards merger is found in the latter city. Furthermore, the percentage of inmigrant merged parents shows no increase among the younger children.

6.3.4 *Reassessment of Garde's principle*

The two counterexamples of St Louis and Charleston require a reassessment of the force of Garde's principle and, along with it, of Herzog's corollary. If we think of the boundary around the Charleston merger of /ihr/ and /ehr/, or around the one defining the St Louis merger of /ahr/ and /ɔhr/, it is clear that these isoglosses did not expand; instead they contracted to zero. How do these exceptions differ from the normal expansion of mergers?

The general pattern of North American English phonology is that regional dialects are becoming more diverse, but dialects associated with individual cities of moderate size are giving way to the regional dialect. The two cases of merger reversal that we have found here are associated with such a regional transformation of a city dialect. The reversal of the *card/cord* merger is part and parcel of the general replacement of the traditional St Louis dialect by an approximation to the Northern Cities Shift of the Inland North (see Chapter 15). Similarly, the reversal of the *fear/fair* merger is an integral component of the replacement of the traditional Charleston dialect by the regional Southeastern pattern (Baranowski 2007).[16]

The larger body of expanding mergers reviewed here is independent of any particular dialect. The contrasts of *which/witch*, *four/for* and *dew/do* were generally found throughout the North and the South, not associated with the phonology of an individual city. The *pin/pen* merger was associated with the Southern region as a whole, not with any particular city, and it has since expanded beyond the South. Although the mergers of *fill/feel* and *full/fool* showed some regional concentration in the ANAE maps, they have been reliably reported from many different regions. In fact the tendency for mergers to expand beyond regional boundaries is the basis for the ANAE policy (Ch. 11) of not using merger isoglosses to define North American English dialects.

The exceptions to Garde's principle can therefore be characterized as mergers that are associated and identified with a dialect in the process of replacement. This is not to underestimate the difficulty of separating a merged word class into two components, once their historical identity has been lost. The exploration of driving forces in Chapter 9 will attempt to deal with this problem.

There remains the problem of accounting for the fact that some urban dialects survive and others perish. The most prominent dialect associated with a single city is that of New York City. Despite the fact that the locally born white population who use this dialect has dropped to less than 50 percent of the city's total, there is little evidence of the dialect's decline or replacement. The dialect of the NYC Telsur subjects preserves its traditional features, as these were reported since the end of the nineteenth century.[17] The Philadelphia dialect, for which we have more detailed historical records, shows a similar stability in its basic structure: the short-*a* split, the back chain shift before /r/, the merger of /ohr/ and /uhr/, the near-merger of *ferry* and *furry*, the merger of *pal*, *pail* and *Powell*, the merger of *crown* and *crayon*. One of the sound changes traced in the 1970s – the raising and fronting of /aw/ – has begun to recede (PLC, Vol. 2; Conn 2005), but others have advanced further – the raising and fronting of (eyC), the backing and centralization of (ay0). The dialect of Boston has been strongly associated as a central focus of the Eastern New England region and there is no indication of its being replaced by some other regional pattern.[18]

Table 6.4 Metropolitan statistical areas and city population for seven cities

	City Size	MSA
New York	8,643,437	7,380,906
Philadelphia	1,585,577	4,952,929
Boston	574,283	3,263,060
St Louis	396,685	2,548,238
Pittsburgh	369,879	2,379,411
Cincinnati	364,040	1,597,352
Charleston	80,414	495,143

Population size appears to be a decisive factor in determining the survival of an urban dialect. Table 6.4 lists the 1990 populations of the seven cities discussed here and their associated Metropolitan Statistical Areas (MSAs). It appears that dialects of cities with populations of over half a million are stable, while those with smaller populations are not. The amount and type of "dialectal attrition" of these smaller cities varies from one case to another. The entire configuration of the Charleston dialect has been radically altered in recent decades (Baranowski 2007). Boberg and Strassel (2000) report that the specific short-*a* pattern of Cincinnati has been reversed in favor of the general Midland nasal pattern. St Louis has lost the most distinctive feature of its phonology, the merger of /ohr/ and /ɔhr/, and has imported most of the elements of the Northern Cities Shift from Chicago (Labov 2007). Among all these mid-sized cities, Pittsburgh shows the strongest tendency to maintain its local dialect. Its dominant stereotype, the monophthongization of /aw/, shows some attrition for those born after 1950 (Johnstone et al. 2002), but Pittsburgh also shows a new chain shift, specific to its phonology (Ch. 5 of this volume). As Johnstone et al. (2002) suggest, the high degree of local linguistic consciousness in Pittsburgh may be a supporting factor.

Though the major regional dialects continue to diverge, the general trend is towards the absorption of the smaller city dialects into their surrounding regional patterns. In this respect, the North American trend is similar to that described for many Western European dialects (Thelander 1980). The two cases of merger reversal that we have encountered here are a part of the mechanism of regional absorption.[19]

Three mechanisms have been identified for merger: phonetic approximation, lexical exchange, and sudden implosion of two categories into one (Trudgill and Foxcroft 1978, Herold 1990, 1997). The reverse process of splitting would seem to require lexical reorganization, and, so far, the lexical irregularities from St Louis and Charleston provide some evidence for a word-by-word relearning of the distinction. It is not likely that an entire generation of adults can do this. The limited amount of lexical variation in these cases suggests early contact with young speakers of the two-phoneme system by native speakers of the one-phoneme system. The critical number of inmigrant children for such a reversal is probably greater than the proportion needed to motivate the expansion of the low back merger (Yang 2009).

6.4 Principles Governing Chain Shifts

The development of governing principles of phonological change has taken its most substantial form in the domain of chain shifting, that is, in a series of changes that are causally linked in ways that preserve the number of distinctions (Martinet 1955; LYS; PLC, Vol. 1, Ch. 5). In this sense, chain shifts are the complement of the mergers discussed in section 6.3, which by definition reduce the number of distinctions. Yet many complex series of changes involve both mergers and chain shifts; as we will see, it is common for mergers to initiate, or follow from, chain shifts. Chapter 5 raised the question of how we distinguish chain shifts from parallel or generalized movement, and concluded that the causal character of chain shifts is most apparent when the changes involved are qualitatively different.

Given the recognition of a chain shift (1) with A as the *entering* element and with B as the *leaving* element,

(1) A → B →

the temporal sequence is an essential issue. In a *drag chain*, B moves first; in a *push chain*, A moves first. If A and B moved simultaneously, this would be evidence of a generalized sound change – not of a chain shift in the sense of Chapter 5.

The existence of drag chains is generally accepted, but push chains remain a matter of controversy. In the view of sound change as an alteration in a set of binary rules (Halle 1962), a push chain is not possible: it would be equivalent to a merger. One possible governing principle for chain shifting would be that all chain shifts are drag shifts, which correspond to Martinet's concept of filling a hole in the pattern. Thus Martinet (1952) explains the Western Romance lenition of intervocalic stops as a push chain:

(2) /pp tt kk/ → /ptk/ → /bdg/ → /βδγ/

(but see reservations in Cravens 2000 and 2002: 69 ff., where it is argued that voicing preceded degemination). In Volume 1, the Swedish Pattern 3 chain shift (Benediktsson 1970) was cited as evidence of a push chain – one initiated by the lengthening of short /a/ and the consequent backing and raising of /a:/ (see also Hock 1986: 157).

The issue as to whether push chains exist – and whether they are reasonably frequent – is an important one for our conception of the nature of sound change. Push chains presuppose that sound change takes place in a continuous phonological space in which margins of security may be diminished or expanded. The discussion of chain shifting principles to follow depends on the answer to this question, and it is therefore most relevant to ask what evidence has accumulated over the past decade and a half.

It is widely held that the Great Vowel Shift was a drag shift initiated by the diphthongization of the high vowels (Martinet 1955). But equal numbers of scholars agree with the argument of Luick (1903) in favor of a push chain, pointing out that the diphthongization of /u:/ did not occur when (in the North of England) /o/ was fronted rather than raised. In her article "The first push," Lutz (2004) finds evidence for an even earlier raising of /æ:/ and /ɔ:/ as initiating changes.

Some of the most productive work on sound change in progress has focused on the development of the New Zealand front vowel shift (3) (Woods 2000, Lau 2003, Gordon et al. 2004, Trudgill 2004, Langstrof 2006):

(3) /i/ → /ɨ/
↑
/e/
↑
/æ/

The Origins of New Zealand English (ONZE) project of Gordon et al. (2004) took advantage of recordings of early settlers made in 1948 by the New Zealand Broadcasting Service. It was established that the backing of /i/ to mid central position was a relatively late change. Studies of the earliest period (Woods 2000) and the middle period of the development of New Zealand English (Langstrof 2006) led to the conclusion that the shift was a push chain, in which the raising of /e/ preceded the backing of /i/. Langstrof further argued that the raising of /æ/ was the earliest stage in the process.

The generally accepted ordering of the Northern Cities Shift, as displayed in Figures 1.4 and 5.15, involves drag chain effects in stages 1–3, initiated by the general raising of /æ/. However, the ordering of stages 4 and 5 indicates that /e/ pushes backward towards /ʌ/ before /ʌ/ shifts further to the back. Chapter 6 of Volume 1 presented some evidence for a push chain on the basis of a limited number of speakers. The ANAE data set includes sixty-two speakers from the Inland North, where the NCS is active, with ages ranging from 14 to 78. Figure 6.15 shows the mean difference between the second formants of /e/ and /ʌ/ for four age levels within this group. If a drag shift were involved, the difference would increase from the beginning and close up at the end. But the figure shows the opposite tendency: the mean difference falls steadily from the oldest to the youngest group, which shows the smallest gap between the two vowels.[20] This is strong evidence of a push chain operating within the larger mechanism of the NCS.

The growing body of evidence for push chains supports the view that chain shifts, like mergers, operate within a phonological space of continuous dimensions. The F1/F2 diagrams which are generally used to display the progress of these mechanisms do not of course fully characterize the dimensions of this space. As we will see, duration is a prominent feature in the opposition and contrast of vowel

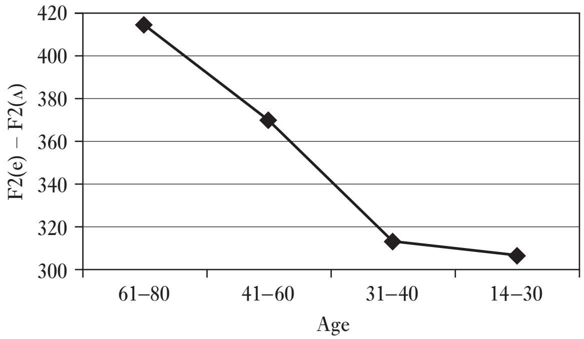

Figure 6.15 Mean differences of second formants of /e/ and /ʌ/ by age for 63 Telsur speakers in the Inland North

phonemes, along with rounding and dynamic directions of the trajectories that define the various vowel subsystems.

Given the possibility of both drag chains and push chains, a number of questions can be raised concerning the mechanism and nature of the causal link. The general theory that has been proposed here is that the shift of one vowel in response to the shift of another is a mechanical result of the language learning process (see PLC, Vol. 1, Ch. 20). Given the normal distribution of phonemes, with characteristic margins of security, outliers falling within the main distribution of a neighboring phoneme will not be recognized as consistently as other productions, and so will have less effect on the language learner's calculation of the mean. Figure 6.16a displays the situation. In Stage I, with normal margins of security, an outlying realization of phoneme B in the midst of phoneme A will have a finite tendency to be misunderstood as A, and to that extent will contribute less than others to the language learner's pool of tokens recognized as B. The resultant calculation will yield a target mean of, say, 1560 Hz. This is the normal conservative effect of neighbors on outliers, which contributes to the stability of a phonemic system. In Stage II of Figure 6.16a, phoneme A has shifted away, leaving a considerable gap. As a result, the same outlier is more likely to be recognized as a token of B and so will contribute to a shifted mean target of perhaps 1570 Hz. Stage III is the output of the language learner, who will aim at a target mean of 1570 Hz, with or without an outlier, and so will shift the main distribution to center on 1570 Hz.

Figure 6.16b is the corresponding mechanism of a push chain. Stage I represents the same stable beginning, with a single outlier of B in the A distribution. Stage II, however, is quite different from Stage II of the drag chain. The decreased margin of security between A and B leads to considerable overlap. Here some tokens of A are subject to decreased recognizability, namely those marked with circular outlines. As a result, the language learners of Stage II calculate a target mean somewhat higher than the actual mean of Stage I, say 1810 Hz in place of 1770.

The end result of successive repetitions of Stage II is seen in Stage III: a restoration of the normal margin of security, with a mean F2 of A 200 Hz greater than the mean F2 of B.

It should be apparent that the mechanism of a push chain is more complex than the mechanism of a drag chain in Figure 6.16a. But in this machinery there is no immediate answer as to why the circled tokens of A were recognized less frequently, but not so the adjacent tokens of B. If the overlap of A and B produced symmetrical results in terms of recognizability, we would see a symmetrical recoiling of the means of A and B to restore the situation found in Stage I. The preceding discussion

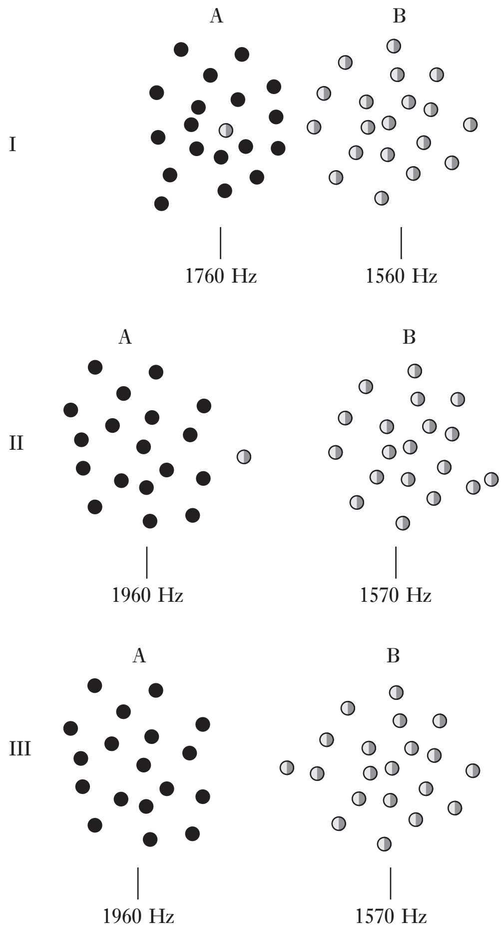

Figure 6.16a Model of a drag chain showing the result of a shift away of a neighboring phoneme, which leaves a hole in the pattern

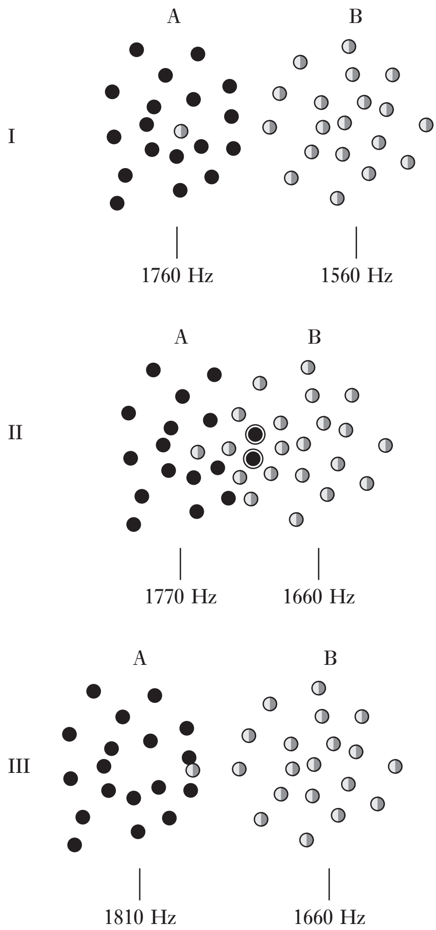

Figure 6.16b Model of a push chain showing the result of a shift towards a neighboring phoneme, which results in an increased number of overlapping tokens

of the NCS indicates that this did not happen. An explanation for the continued asymmetry suggests that, in a push chain, the advanced tokens of B are marked as being more expected than the conservative tokens of A. This suggests a process of social marking that will be considered in greater detail in Chapter 9 on "driving forces."

In any case, the relative complexity of a push chain compared to a drag chain leads us to expect that drag chains would be more frequent in the historical record, and this seems to be the case.

6.5 Principles Governing Chain Shifting within Subsystems

The general principles of chain shifting were first put forward in 1972, in LYS, as the result of a general survey of chain shifts available in the historical record.

[1] In chain shifts,

a long vowels rise;
b short vowels fall;
c back vowels move to the front.

Principle [1b] was divided into two cases: simple short vowels and the short nuclei of upgliding diphthongs. The classification of English vowels into "long" and "short" is not only based on their historical development, but on their phonotactic distribution, which persists unchanged in all modern-day dialects. As first discussed in Chapter 1, English short vowels cannot occur in stressed word-final position, no matter what sound changes affect their physical realization. To describe sound changes now in progress, it proved useful to adopt the tense/lax feature, which predicts the behavior of current vowels more closely than the short/long distinction. In the course of the Southern Shift (Figure 1.5), short front vowels become tense and the nuclei of long vowels become lax. These then follow the principles of chain shifting in [2]:

[2] In chain shifts,

a tense nuclei rise;
b lax nuclei fall;
c back nuclei move to the front.

Although [2] is a useful reformulation, there is no generally agreed upon method or physical measurement that will decide whether any given vowel is tense or lax. It is well known that tense phonemes are opposed to lax partners on several physical dimensions. Tensing is accompanied by an increase in duration, by the development of inglides, and by the distribution of energy over time. The underlying assumption is that the production of tense vowels involves more muscular energy than that of lax vowels, but measures of muscular activity are not readily available for the detailed study of change in progress.[21] A more precise and practical measure is peripherality, defined as proximity to the outer envelope of distribution in two-formant space. For English and other modern West Germanic languages, one can define a phonological space with peripheral and nonperipheral tracks in both front and back areas of the vowel distribution. For these systems, we derive the principles in [3]:

[3] In chain shifts,

a tense nuclei rise along a peripheral track;
b lax nuclei fall along a nonperipheral track.[22]

In Volume 1, this formulation was further developed in relation to articulatory position, where the front–back dimension coincides with the closed–open dimension, and a third principle is not required. Since the present volume will be concerned with the results of acoustic measurement on a large scale, the approach to the front–back movements will take a different direction.

The application of the concept of peripherality is particularly helpful in tracing changes in English diphthongs. In the historical record, tense and lax nuclei of diphthongs are not easily distinguished; but, in studies of changes in progress, acoustic measurements lead to a clear differentiation of diphthongal nuclei in terms of their distance from the outer limit of phonological space.

6.5.1 A redefinition of peripherality

Chapter 6 of Volume 1 developed the principles of chain shifting in a format most suitable for the acoustic exploration of sound change in progress, using the framework reproduced here as Figure 6.17a. Here peripherality is defined in terms of extreme values of F2. This was then extended to a framework in which extreme values of F1 were included as well, yielding the concentric framework of Figure 6.17b.

The question remains as to how much evidence there is for either of these definitions of peripherality as a constraint on chain shift movements. The individual vowel systems cited in LYS and in PLC, Volume 1 do not provide enough data to yield a decisive answer. Sufficient evidence is now available from the large data set of vowel measurements provided by ANAE. This comprises an acoustic analysis of 130,000 vowels from the systems of 439 speakers, aged 12 to 85, representing all the cities with a population of 50,000 and over in English-speaking North

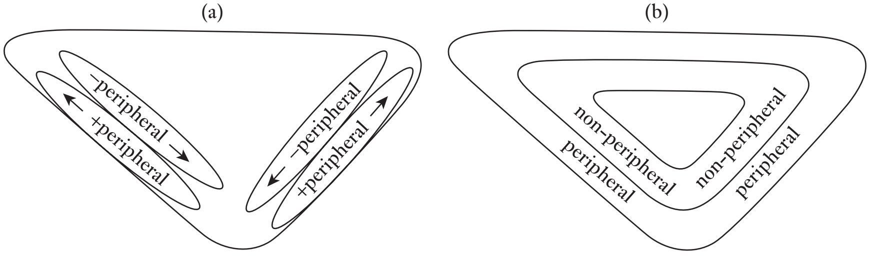

Figure 6.17 Two frameworks for a definition of peripherality in Volume 1; Figure 6.17a F2 only; Figure 6.17b F2 and F1

America. The individual systems are normalized with the log mean algorithm of Nearey (1977), which has proved successful in eliminating the differential effects of vocal tract length (ANAE, Ch. 6, pp. 39–40). Rather than attempt to plot the 130,000 tokens, or the mean values of each vowel for each speaker, Figure 6.18 plots the mean values of each vowel for the twenty-one dialects defined in Chapter 11 of ANAE.[23]

In Figure 6.18, an inner boundary separating peripheral and nonperipheral vowels is superimposed on the vowel distribution. The high and mid lax vowels are contained within the nonperipheral area. The means for /i/ (open circles) are clustered tightly in the upper left of the nonperipheral domain. The short /e/ means (open diamonds) are spread out on a path from upper mid to lower mid, all contained within the nonperipheral boundary. In the back portion of the nonperipheral area are located the means of their back counterparts, /u/ (solid circles) and /ʌ/ (solid upward triangles). The distinction between extreme and less extreme F1 values also serves to separate peripheral /uw/ from nonperipheral /u/ and peripheral /iy/ from nonperipheral /i/. The /uw/ symbols (solid circles with arrows pointing to the upper right) are spread out along the entire front–back dimension.[24]

On the other hand, the short or lax vowels /æ/ and /o/ are not distinguished by F1 values from /ah/, /oh/ or the nuclei of /ay/ and /aw/. All low vowels form

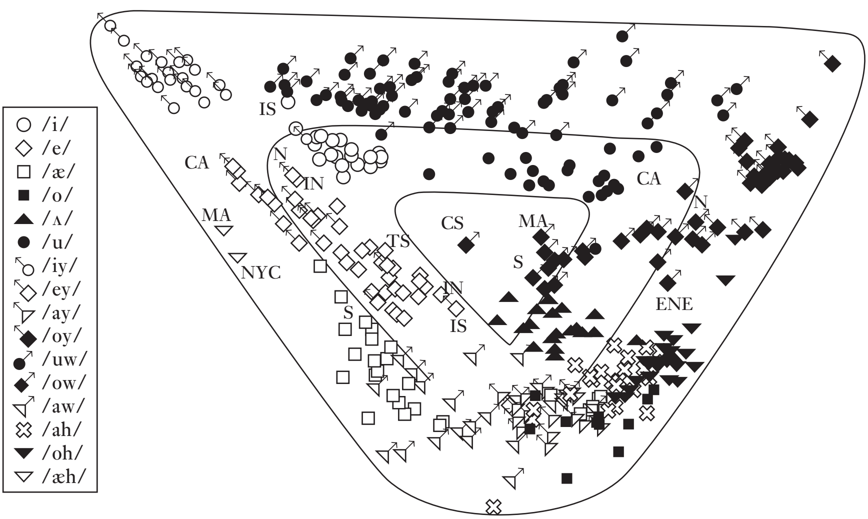

Figure 6.18 Peripheral and nonperipheral areas of the vowel system, redefined on ANAE data. Normalized vowel means of twenty-one ANAE dialects (N = 439) with nonperipheral tracks indicated. CA = Canada, CS = Charleston, ENE = Eastern New England, IN = Inland North, IS = Inland South, MA = Mid-Atlantic, N = North, S = South, TS = Texas South

an undifferentiated cluster on the F1 dimension and are separated only by F2. On the left, one can see an upward extension of /æ/ means along the peripheral path. Two extreme values of tense /æh/ (open downward triangles) represent the Mid-Atlantic (MA) and New York City (NYC) tense phonemes. The highest /æ/ (open squares) is labeled IN for Inland North: this is the generalized raising of /æ/ that defines the Northern Cities Shift. On the back portion of the peripheral track, one can observe the means for the three dialects that have tensed and raised /oh/ (solid downward triangles) and the tight cluster of /oy/ means (solid diamonds with forward arrow).

The utility of the peripheral/nonperipheral distinction is most evident in the word classes that cross the boundary. The symbols representing /ey/ (open diamonds with arrows to upper left) follow an elongated pattern from upper mid to lower mid, some on the peripheral track and others on the nonperipheral. The /ey/ means for Canada (CA) are the highest, and clearly peripheral. The /ey/ means for the North (N) and Inland North (IN) are almost as high, but are nonperipheral. The concept of nonperipherality has the greatest explanatory value in tracking the development of the Southern Shift (Vol. 1, Ch. 6; ANAE, Chs 11, 18). Once engaged in the Southern Shift, the Southern lax nucleus descends on the non-peripheral track. The /ey/ symbol marked "IS," the Inland South, is the leader in the development of the Southern Shift, and its position is very close to that of the backed and lowered /e/ marked "IN" (Inland North), descending by the same principle in the Northern Cities Shift. Following slightly behind, on the nonperipheral track, is "TS" for "Texas South."

The other facet of the Southern Shift is the tensing of the short vowels, which is again most extreme in the Inland South. The mean value of /i/ for the Inland South is indicated by the empty circle labeled "IS," located higher than any others and well across the boundary into the peripheral area.

Another vowel class that crosses the peripheral/nonperipheral boundary in Figure 6.18 is /ow/ (solid diamonds with arrows to the upper right). In the back peripheral track one can observe the means for the North (N) and Eastern New England (ENE), along with a group of other conservative dialects (see ANAE, Ch. 12). As /ow/ undergoes the process of fronting, the nuclei shift to the nonperipheral area and move steadily across to a central (Mid-Atlantic, South) and even front nonperipheral position (Charleston). Thus the fronting of /ow/ crosses the peripheral/nonperipheral boundary and is independent of principles [2] and [3]. This fronting of /ow/ is independent of any chain shifts, being essentially a parallel response to the fronting of /uw/.

In Figure 6.18 peripherality appears as a property of high and mid vowels, but not of low vowels. In the course of sound change, low vowels may rise to lower mid position and acquire peripherality, or they may fall to low position and lose this property. Another way to look at this process is to follow the lead of Stampe (1972) and Donegan (1978) in seeing peripherality as a means of increasing vowel color and distinctiveness, or, in their terms, of increasing chromaticity (see PLC, Vol. 1, Ch. 6). On the other hand, the loss of peripherality entailed by a fall to low position leads to an increase in sonority.

6.5.2 The role of duration in low vowels

The differentiation of tense and lax vowels in low position is not dependent on F1 values or degrees of opening, but appears to involve other features, primarily duration. Labov and Baranowski (2006) studied the extensive overlap in low front position of short /e/ and /o/ in the Inland North. This overlap is the result of the response of both vowels to the gap in the pattern produced by the general raising of /æ/. Though there were many tokens occupying the same F1/F2 space, /e/ was significantly differentiated from /o/ by a mean difference in duration of 50 msec. Controlled experiments showed that 50 msec was a difference in duration sufficient to produce a radical change in recognition rates, longer values favoring /o/ and shorter values triggering a perceptive switch to /e/.

In the preceding chapter it was suggested that the NCS was initiated by a tensing of /æ/ and /o/, which was represented in Figure 5.15 as a shift from the [–peripheral] to the [+peripheral] track. This section has shown that peripherality does not distinguish low vowels, so that tensing of low vowels is most likely realized as an increase in duration.

Duration plays an even greater role in differentiating vowels in low position in Pittsburgh, where monophthongized /aw/ overlaps the F1/F2 space of /ʌ/. There is a sizable F1 difference between Pittsburgh /aw/ and Pittsburgh /ʌ/, but the durational differences are even greater. The mean duration of monophthongal /aw/ is 208 msec, whereas the mean duration of /ʌ/ is only 98 msec: this is a difference of six standard deviations, with no overlap between the shortest /aw/ and the longest /ʌ/.

The role of peripherality in the development of unidirectional changes in progress is a particular realization, in North American English, of the more general opposition of long and short vowels first presented in Chapter 5 of Volume 1. The essential point is that these governing principles of chain shifts operate only within subsystems and are triggered only when membership in a subsystem undergoes change.

6.5.3 The limitations of F2 perception and the instability of the peripheral/nonperipheral distinction

One of the most striking facts about the notation of dialectology is the disparity between the dimension of height and the dimension of fronting and backing. Many dialect atlases register as many as sixteen distinctions of height, using five or six alphabetic units like [i, ɪ, e, ɛ, æ] or [i, é, e, è, á, a], along with diacritics that indicate one level higher or one level lower. Whether or not one can achieve reliable agreement on sixteen distinctions, this corresponds roughly to the F1 range of 300 to 1000 Hz, or a discrimination of a little less than 50 Hz. On the other hand, dialect atlases and monographs rarely make more than three distinctions of fronting and backing, which correspond to an F2 range from 2800 to 600 Hz – a discrimination no less than 700 Hz. The rare use of fronting and backing diacritics yields no more than seven notational units, or a discrimination of differences of 300 Hz.

The use of logarithmic or Bark scales for fronting and backing reduces, but does not eliminate, this disparity between the two dimensions. Studies of just noticeable differences between isolated formants (Flanagan 1955) show F2 limens not much greater than F1 limens, but in connected speech the perceptibility of F2 differences is much less than for F1. The great majority of near-mergers, where people produce a difference they cannot recognize, concerns vowels that are differentiated only along F2 (Vol. 1, Ch. 12). This is characteristic of the near-merger of *source* and *sauce* in NYC (LYS), *fool* and *full* in Albuquerque (LYS) and Salt Lake City (Di Paolo 1988), and *ferry* and *furry* in Philadelphia (Labov et al. 1991). Chapter 13 of Volume 1 reviewed a number of paradoxical reports from the history of English and other languages, which could be resolved through the general observation that, whenever two phonemes are separated by an F2 distinction of less than 200 Hz, they will be perceived as "the same," but they may maintain separate histories in the speech community. Thus eighteenth-century *loin* and *line* were reported by contemporaneous observers to be "the same," but followed distinct paths in the centuries that followed.

Location on the peripheral or nonperipheral tracks will therefore distinguish the history and trajectories of vowels, but it is not a physical difference sufficient in itself to maintain a stable phonemic distinction.

6.5.4 Changes of subsystem in North American English

Chapter 9 of Volume 1 presented some general principles governing the shift of a vowel from one subsystem to another. The chapters to follow will trace the step-by-step progress of a number of English chain shifts, all initiated by a change of subsystem. It may be helpful to review the range of such changes and to consider whether they are unidirectional or bidirectional.

There are many different types of vocalic subsystems in the languages of the world, of which English has only a partial sampling. English has no nasal system, no creaky register, no glottal or ejective vowels, no tonal subsystems. The four subsystems that North American English does have are displayed in Figure 1.1, which is incorporated here in Figure 6.19. This is of course a phonemic display, located at a more abstract level of structure than the acoustic phonetic display of Figure 6.18. Each subsystem is organized into orthogonal discrete feature levels: [±high], [±low], [±front]. As pointed out in Chapter 9 of Volume 1, each subsystem assembles those units that are most subject to confusion in everyday speech. The

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

Figure 6.19 Subsystems of North American English, with the Canadian Shift superposed

principles and mechanism of chain shifting developed in this chapter apply primarily within the V, Vy, Vw or Vh subsystem. In Figure 6.18, most of the Vy, Vw and Vh subsystems are located on the peripheral track, since the nuclei of their components are all peripheral. Although the nuclei of /ay/ are largely coincident with those of /ah/, it is not in danger of confusion with /ah/ as long as the front glide /y/ remains. However, some tokens of /ay/ will be confused with /ey/ and others with /oy/, even when these units are not engaged in change in progress.

The inglide which distinguishes Vh from V is not in fact as distinctive as the /y/ glide that marks Vy or the /w/ glide that marks Vw. This is the basis for the instability that was documented in the last chapter: in North American English, inglides alternate freely with short vowels. Thus the oppositions *bomb/balm*, *Tommy/balmy*, *have/halve* tend to collapse unless they are further reinforced.

The Canadian Shift, which was displayed in Figures 5.3 and 5.4, is superimposed upon the abstract vowel system of Figure 6.19. The merger of /o/ and /oh/ is shown by a unidirectional arrow from the V to the Vh subsystem. Thus the phoneme /oh/ has not become a member of the V subsystem, which occurs only in checked position, but rather the /o/ class has become an integral part of the /oh/ class, which has representatives in word-final (free) position (*law*, *flaw*). This development is integral to the consequential response in the V subsystem, which is now missing a low back member. In response, /æ/ shifts backward, following the mechanical operation of the drag chain discussed above. Consequently /e/ moves back and downward. In the various reports of the Canadian Shift (Clarke et al. 1995, De Decker and Mackenzie 2000, Boberg 2005, Hollett 2006, Hagiwara 2006, Roeder and Jarmasz 2009; see ANAE Ch. 15), there is considerable variation as to whether backing of lowering predominates.

It is interesting to note that all of the current changes of subsystem in North American English involve movement to the Vh subsystem:

a Southern monophthongization of /ay/: /ay/ → /ah/;
b Pittsburgh monophthongization of /aw/: /aw/ → /ah/;
c the low back merger in Canada, the West, Western Pennsylvania, and Eastern New England: /o/ → /oh/;
d Inland North general raising of /æ/: /æ/ → /æh/.[25]

These changes are all unidirectional, in the sense that no reverse sound change has been observed. There are no observations of unconditioned development of upglides from low monophthongs.[26]

So far the discussion has concerned unconditioned changes. For conditioned subsystems, such as vowels before /r/, it is even clearer that misunderstandings will be concentrated within the subsystem. The confusion of *far* and *for*, or *for* and *four*, is much more likely to occur than a mishearing of *four* for *phone*. Vowels before /r/ form a separate subsystem, as in Figure 6.1, because the phonetic influence of /r/ on the vowel is such that it is no longer obvious which vowel in the Vhr subsystem matches with which vowel in other subsystems – in other words, whether the vowel in *four* corresponds to the vowel in *flow* or to the vowel in *flaw*.

The back chain shift before /r/ is active in many areas of North America (ANAE, Chs 18, 19):

/ahr/ → /ohr/ → /uhr/
(*bar* → *bore* → *boor*)

It appears to be triggered by the merger of /ohr/ and /uhr/ rather than by an element leaving the Vhr subsystem.

With the vocalization of /r/, the Vhr system merges with the Vh system, with profound structural consequences (Labov 1966). Although the tide is now running in the other direction as far as /r/ is concerned, the ongoing vocalization of /l/ is currently active in many regions. It is producing new structural effects, namely a vocalic contrast in the Vw system of *go* [gɛo] versus *goal* [go:] in Pittsburgh, or the homonymy of *pal*, *pail* and *Powell* in Philadelphia, as reported in the last chapter.

6.6 How Well Do Governing Principles Govern?

We can judge the value of the principles developed so far in two distinct ways. On the one hand, we judge them by the proportion of the data they account for. ANAE provides data on twelve mergers in North American English, as shown in (4):[27]

(4)

Unconditioned	*Conditioned*			
	___ *l*	___ *rC/#*	___ *rV*	___ *m/n*
o ~ oh	i ~ iy	ih ~ eh	ey ~ e	i ~ e
hw ~ w	u ~ uw	oh ~ ɔh	e ~ æ	
iw ~ uw		ah ~ ɔh		
o ~ ah		uh ~ oh		

Two of these mergers have shown evidence of reversibility, which would seem to be a sizeable percentage of the total (two out of twelve). Another way of looking at the matter is to consider the massive geographic evidence for the expansion of mergers, which affects in one way or another all of the 326 cities studied by ANAE. In two communities we find a distinction expanding; in all we find at least some cases of mergers expanding.

When we consider the consistency of the principles of chain shifting, the evidence is even more favorable. In the original formulation of LYS, there appeared to be several counterexamples to the lowering of short vowels (for instance /e/ in New Zealand) and to the fronting of back vowels (for instance /e/ in the Northern Cities Shift). The formulation of [3] predicts that /e/ will fall along a nonperipheral track, and Figure 6.18 shows that this is what has happened to the mean position of /e/ in the Inland North: the diamond labeled "IN" has evidently lowered along the nonperipheral track.[28] From Langstrof's study of the raising of /e/ in the New Zealand chain shift (2006), we now know that this short vowel showed an increase in duration, indicating a shift to the tense class as it moved up along the peripheral track. As far as principle [3a] is concerned, there have never been counterexamples advanced to show tense vowels lowering in chain shifts.

A second way of evaluating general principles is the extent to which they can be accounted for by, and fit in with, our understanding of other principles of linguistic behavior. The unidirectionality of mergers scores high in this respect, since it is indissolubly linked to the arbitrary character of the linguistic sign and to everything we know about language learning ability. Chain shifting principles are another matter. Efforts to explain the principles in [3] are largely discursive and argumentative,[29] but do not yet connect with what we know of the mechanics of vowel production.

We may also ask of any general constraint whether it relates to the continued renewal and progress of change across generations. It is one thing to say that a merger tends to expand rather than contract, but it is quite another to say that it will do so. We have seen in this chapter that some boundaries of the low back merger have been stable for generations, while others are eroding rapidly. As a result of the tendency for mergers to expand, we abstain from using merger isoglosses to define regional boundaries. But there is nothing in this tendency that actually drives the merger.

It is even less likely that we can locate the driving force behind chain shifting in the general principles under [3]. Once a subsystem is disturbed through the loss or gain of a member, we can argue that the well-established tendency towards maximizing the distance among members of a subsystem will drive the chain shift along its destined path. But once again we must cite the opinion of Meillet (1921) that no universal principle can account for the fluctuating and sporadic course of sound change.

We will return to the problem of driving forces in Chapters 9 and 10. But before this we must examine more carefully the paths that lead to divergence. Given a triggering event and our understanding of the direction in which its consequences can flow, the crucial question remains: how do neighboring dialects take up different directions, and so become more and more different from each other?