3. Principles of chain shifting and mergers

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

3.1. General principles of chain shifting

(1) In chain shifts,

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

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

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

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

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

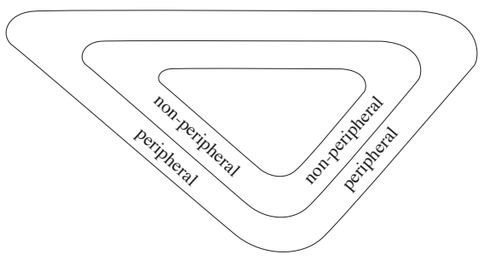

Figure 3.1. Peripheral and non-peripheral tracks in English phonological space

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

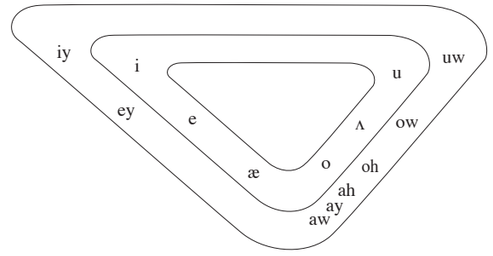

Figure 3.2. Location of initial position vowels in acoustically defined space

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

(2) In chain shifts,

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

Figure 3.3 illustrates the typical direction of movement in chain shifts. The movements shown here approximate the development of the Northern Cities Shift (Chapters 11, 14), in which the upgliding vowels retain their initial peripheral location.

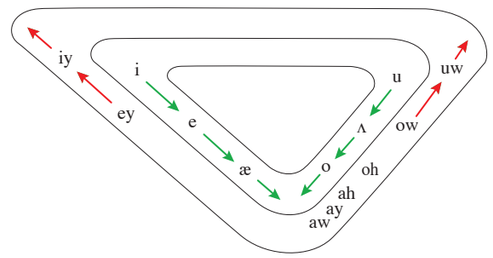

Figure 3.3. Directions of movement in chain shifts along peripheral and non-peripheral tracks

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

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

In this articulatory space, the fronting of /uw/ appears as a continuation of a raising process, since the high point of the tongue for /uw/ is considerably lower than the high point for [i].[2] The backing of /e/ and /i/, which will play a major role in Chapters 11, 14, and 15, now appears as a downward movement through the non-peripheral space of the center.

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

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

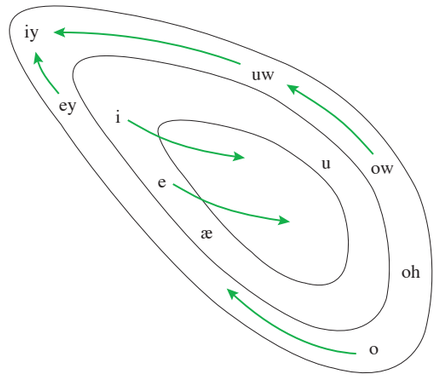

Figure 3.4. The articulatory space of North American English vowels, based on X-ray measurements of the highest point of the tongue. Based on Lindau 1978

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

3.3. Acoustic evidence for the Peripherality Hypothesis

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

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

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

Past discussions of the peripheral and non-peripheral tracks have been based upon the study of individual vowel systems, and the definitions of peripherality have been abstracted from displays of 300 to 500 vowels. The data assembled for ANAE has greatly enlarged the field of evidence, now consisting of measurements of 144,000 vowels. The application of this massive database to the empirical confirmation of the hypothesis depends upon the success of the normalization procedure which converts the 439 speakers to a common grid. This log mean normalization (Chapter 5) is generally effective in eliminating those acoustic differences that are the result of variation in vocal tract length, while preserving those social differences that are characteristic of the speech community (Nearey 1978; Hindle 1978; Labov 1994: Ch. 5; Adank 2003).

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

The front peripheral track

The front peripheral track is clearly outlined by two phonemes which are extended along the outer diagonal path leading from low front to high front. The red squares represent means for /æ/, which has in part or whole shifted to the peripheral track for various dialects, and undergone varying degrees of raising and fronting (Chapter 13). Separate means are calculated for /æ/ before nasal consonants and in all other environments. The upper set in Figure 3.5 consists largely of means for /æ/ before nasal consonants, which are generally further along the peripheral path. The two orange triangles labeled "NYC" and "MA" are the special subsets of tensed /æh/ in New York City and the Mid-Atlantic States, which are the result of a lexical split between lax and tense short-*a* characteristic of those dialects only (Chapter 17). Over half of the tokens in this category are before oral consonants, but they occupy the same position along the peripheral track as the pre-nasal allophones. The peripheral path is not therefore a property of nasal allophones, but it can be said that nasal allophones favor peripherality.

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

The front non-peripheral track

The front non-peripheral track is defined here by two vowels, following opposite distributions for the various dialects. The yellow diamonds are the means for /e/, which moves along the non-peripheral track, down and towards the center, in the course of the Northern Cities Shift (Chapter 14). The most advanced dialect in this respect is the Inland North, the lowest and most central mean symbol labeled

2 Chapter 8 of Labov 1994 condensed these two statements into the proposition that in chain shifts, *peripherality and openness dissimilate*.
3 The means for /aw/ before nasals are again calculated with separate values, and these are also shifted further along the peripheral path.

IN in Figure 3.5. Other yellow diamonds along this track have arrows pointing to the upper left; these are the mean symbols for /ey/. For the majority of dialects, the nucleus of /ey/ is in upper mid non-peripheral position. Only a few /ey/ tokens follow the downward non-peripheral path: these are the Southern dialects following the Southern Shift (see below). The lowest and most central symbol is that for the Inland South, the area where the Southern Shift is most complete; it is labeled IS in Figure 3.5. Behind this is the symbol for the other advanced Southern dialect, the Texas South (TS).

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

The back peripheral path

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

The back non-peripheral path

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

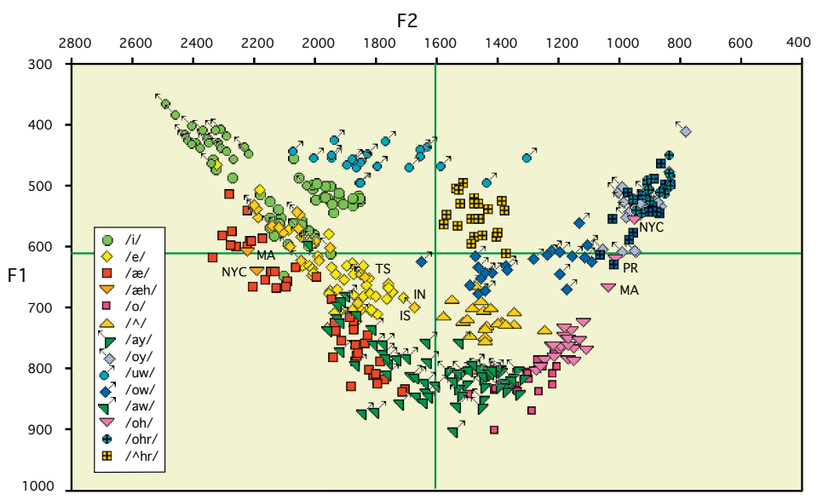

Figure 3.5. Peripheral and non-peripheral tracks in the mean file diagram of 14 vowels for the 22 dialects defined in Chapter 11

3.4. Movements across subsystems

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

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

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

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

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

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

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

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

current diphthong [aɪ] as a realization of /ay/.[6] A parallel development affected M.E. /u:/, which became /uw/ and then modern /aw/.

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

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

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

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

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

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

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

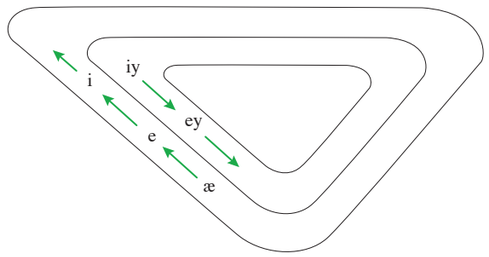

Figure 3.7. Movements along peripheral and non-peripheral tracks in the Southern Shift

are subject to Principle I and begin to rise, switching relative positions with their long counterparts as shown in the figure.

3.5. General principles of merger

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

Garde's Principle
Mergers are irreversible by linguistic means.

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

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

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

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

Figure 3.8. The Canadian Shift

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

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

of *cot*, *rock*, *stop* is then a member of the class that includes *saw*, *law*, *draw*, and is logically represented as /koht, rohk, stohp, soh, loh, droh/.

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