

## 9. North American mergers in progress

### 9.1. The low back merger

The vowel inventories of the dialects of North American English differ in many ways. Most of these differences concern the loss or maintenance of contrasts in restricted environments, before liquids or nasals. The major unconditioned merger is the loss of contrast between the short-*o* class of *got, rock, top*, etc., and long open-*o* in *law, talk, caught*, etc. Before presenting the geographic extent of the merger, it will be necessary to examine the history and composition of these two classes and introduce several other word classes involved in the merger.

The short-*o* class. The phoneme labeled /*o*/ in the subsystem of short vowels in the initial position of Chapter 2 is a broadly distributed set of common words. It descends historically from M.E. short **o** which is for the most part a continuation of O.E. short **o** (*hop, god, dog, pot, cock, on*), with only a few shortenings from O.E. **o:** (*soft*). Some M.E. **o** words are direct borrowings from French. In addition, a small set of words with original **a** was rounded after /*w*/ to merge variably with the short-*o* class: *watch, wallet, want, wander*, etc.<sup>1</sup> As the first two columns of Table 9.1 show, short-*o* is represented before all but two consonants, /*v*/ and /*zh*/ (Jespersen 1949: 90–91).<sup>2</sup>

The long open-*o* class. In contrast, the long open-*o* class has a highly skewed distribution that reflects the complex and irregular history of its composition. Present-day long open-*o* is primarily the result of monophthongization of **au** in *law, fault, talk, hawk, caught* (Jespersen 1949:311ff). This M.E. **au** was in turn derived from a wide variety of sources: O.E. **aw** (*thaw, straw, claw*); O.E. **ag** (*maw, saw, draw*); O.E. **ah**, broken to **eah** (*fought, taught*); O.F. **a + u** in the next syllable (*brown, pawn*), M.E. **av** (*hawk, laundry*); O.F. **au** (*applaud, fraud, because*); O.F. **am, an** (*lawn, spawn*). In addition, some long open-*o* is descended from O.E. **oht** (*thought, daughter, brought*). Despite this variety of historical origins, the environments in which **au** occurs are quite limited. As shown in the examples just given, and in the third column of Table 9.1, **au** occurs principally before /*t, d, k, z, n, l*/ and finally.

The column “*o* → *oh*” of Table 9.1 shows the set of short-open-*o* words that have shifted to /*oh*/ before voiceless fricatives and back nasals.<sup>3</sup> These are limited to specific phonetic contexts: voiceless fricatives and (back) nasals. Lexical variation is characteristic of this entire set, and is particularly marked in the case of short-*o* before /*g*/: Here *dog* is the most commonly found shifted to the /*oh*/ class, with extensive dialect variation in other words before /*g*/: *fog, log, hog, frog*, etc. The lengthening process occurred by lexical diffusion, so that uncommon words (like *Goth, toff*, or (*ping*)*pong*) were frequently unaffected. The process was also sensitive to prosodic constraints, so that polysyllables such as *hospital, toggle* and *soggy* remain in the lax class for most speakers.

Though the tensing of short /*o*/ is phonetically conditioned, the phonetic environments selected were limited by the phonological contrasts that already existed. It occurred primarily in those phonetic environments that were not represented in the /*oh*/ set. To the extent that the tensing of short /*o*/ was regularly conditioned by phonetic factors, it did not increase the degree of contrast between /*o*/ and /*oh*/: It did obscure the orthographic basis for the contrast. Moreover, the contrast between the majority of frequent forms that were tensed and the minority

of infrequent forms that were lax added to the lexical contrast that maintained /*o*/ and /*oh*/ as separate phonemes.

Table 9.1. Distribution of open-*o* classes in North American English by following segment. Words entered in each column are representative of common words; parenthesized forms are small or marginal word classes

	<i>o</i>	<i>o</i> → <i>oh</i>	<i>oh</i>
p	hop		
t	hot		caught
/č/	Scotch		(debauch)
k	lock		hawk
b	hob		(daub, bauble)
d	hod		(sawed)
ʃ	lodge		
g	log	dog	(auger, augment, augur, August)
f	(toff)	off	
s	hospital	loss	(sauce, exhaust, caustic)
/θ/	(Goth)	cloth	
/ʒ/	(Gosh)		
v			
z	positive		clause, hawser
/ð/	bother		
/ʒ/			(nausea, nauseous)
m	bomb		
n	don	(on)	haunt
ŋ	(Kong)	song	
l	doll		all
#			law

The highly skewed distribution of /*oh*/, a product of its historical formation, must be considered one of the factors in its unstable relation to /*o*/: The unpredictability of the /*oh*/ distribution after /*o*/ tensing is a second such factor.<sup>4</sup> As a result, the relation between /*o*/ and /*oh*/ has undergone a variety of changes:

1. Merger of /*o*/ with /*oh*/
2. Unrounding of /*o*/ to /*a*/ with subsequent increase of the qualitative difference between /*o*/ and /*oh*/ by
  - a. fronting of /*o*/ to low central position (the Inland North)
  - b. raising of /*oh*/ to mid or high back position (Mid-Atlantic States)
3. Development of a back upglide for /*oh*/ (the South).

<sup>1</sup> But not before velars, where /*æ*/ is retained (*whack, wagon, wax, waggle*, etc.).

<sup>2</sup> In British English, *of* retains a rounded vowel when fully stressed, but not in North American English.

<sup>3</sup> This occurred generally in southern England and became embedded in earlier RP, but it has now been generally reversed in RP. It is now principally a characteristic of North American English.

<sup>4</sup> It can also be pointed out that /*oh*/ is frequently ignored in phonics texts, partly as the result of the fact that there is no single spelling pattern that serves as a cue for readers



Chapter 11 discusses the regional differentiation of these three processes as the basis for a classification of North American dialects. This chapter is concerned with the geographic distribution and mechanism of the merger. It will also deal with the relation of /o/ and /oh/ to the /ah/ class in *father*, *ma*, *spa*, and the larger “foreign a” class.

Map 9.1 shows the distribution of the complete merger. The Telsur survey regularly elicited the contrast before /t/ in *hot* and *caught*, before /k/ in *sock* and *talk*, before /n/ in *Don* and *dawn*, and before /l/ in *dollar* and *caller*. The green symbols represent speakers for whom /o/ and /oh/ are identical before all these allophones in both production and perception; that is, the speaker judged them to be ‘the same’ and the analyst heard the productions as ‘the same’. The green isogloss outlines the areas of merger: Canada, the West, Eastern New England, and western Pennsylvania. The western Pennsylvania merger, now extending through West Virginia to Lexington, Kentucky, must be shown as a separate area from the Canadian merger on the other side of Lake Erie, since joining the two within a single isogloss would imply a continuity of speech across the water. In fact, where Canadian and American speech communities face each other on either end of Lake Erie, a Canadian merger is starkly opposed to an American distinction (Boberg 2000). By contrast, along the 49th parallel between the western halves of Canada and the United States, two large areas of merger are in direct contact, allowing them to be included within a single isogloss. The low back merger does not define any one dialect region but embraces several of the regions to be defined in Chapter 11, including roughly half of the geographic territory that the Atlas covers. The parameters of this isogloss are shown in Table 9.2. Homogeneity is only moderately high, since the change is still in progress, particularly in the West. The consistency parameter is much higher, indicating that the isogloss succeeds in containing a very large part of the merger, or conversely, that resistance to the merger is strongly motivated in the areas outside the isogloss (by factors to be discussed in Chapter 11).

Table 9.2. Isogloss parameters for the low back merger

	Total merged	Total within isogloss	Merged within isogloss	Merged outside isogloss	Homogeneity	Consistency	Leakage
/o/ ~ /oh/	169	235	145	24	0.62	0.86	0.09
__nasals only	68		24	44			

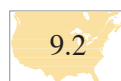
The low back merger is favored in syllables closed by nasal consonants.<sup>5</sup> On Map 9.1, red circles represent the speakers for whom the merger takes place before nasals only. It is clear that the merger is more advanced before nasals than in any other environment. At the same time, there is no evidence of a different geographic pattern for the merger before nasals: the red circles outside of the green isogloss are scattered throughout the South and the Midland. The 24 additional points within the isogloss make the merged region appear more homogeneous, but the 44 points outside of the isogloss are not concentrated in any way.

Age differentials within the Telsur sample permit a study of change in apparent time. The Telsur ratings of minimal pair tests are 0 for ‘the same’, 1 for ‘close’ and 2 for ‘different’. Adding values for production and perception yields a scale from 0 to 4 where 0 indicates no distinction at all (‘the same’ in both production and perception) and 4 indicates a complete distinction (‘different’ in both production and perception). Table 9.3 shows a sizeable age coefficient for the continent as a whole of 0.43. For each 25 years of age, the merger can be expected to advance .43 units on the four-point scale. Naturally, this movement in apparent

time is not uniform throughout the continent. Rather, it reflects the status of the merger in each region as complete, in progress, or absent. The rest of Table 9.3 shows the advance of the merger in nine dialect regions of North America (as defined in Chapter 11). The regions are listed in the ascending order of the regression constant, so that the areas with the most complete merger are listed first, and succeeding listings correspond to increasing resistance to the merger. Four regions show significant age coefficients, all in the direction of increasing merger (younger speakers have lower values). Two of these areas, Eastern New England and the West, are within the low back merger isogloss. The merger appears still to be progressing towards completion in both regions. Two, the South and the Midland, are outside the isogloss, where the shift towards merger may represent a change from ‘different’ to ‘close’.

Table 9.3. Age coefficients for the low back merger by region. Contrast scale is defined by 0 for complete merger and 4 for complete distinction.

	Constant	Age * 25 yrs	Prob.
All regions	1.35	0.43	.02
Western Pennsylvania	-0.28		
Eastern New England	-.07	0.63	.03
West	.21	0.30	.03
Canada	0.54		
Midland	1.38	0.33	.02
South	1.60	0.65	<.0001
North	1.90		
Inland North	3.31		
Mid-Atlantic	3.39		

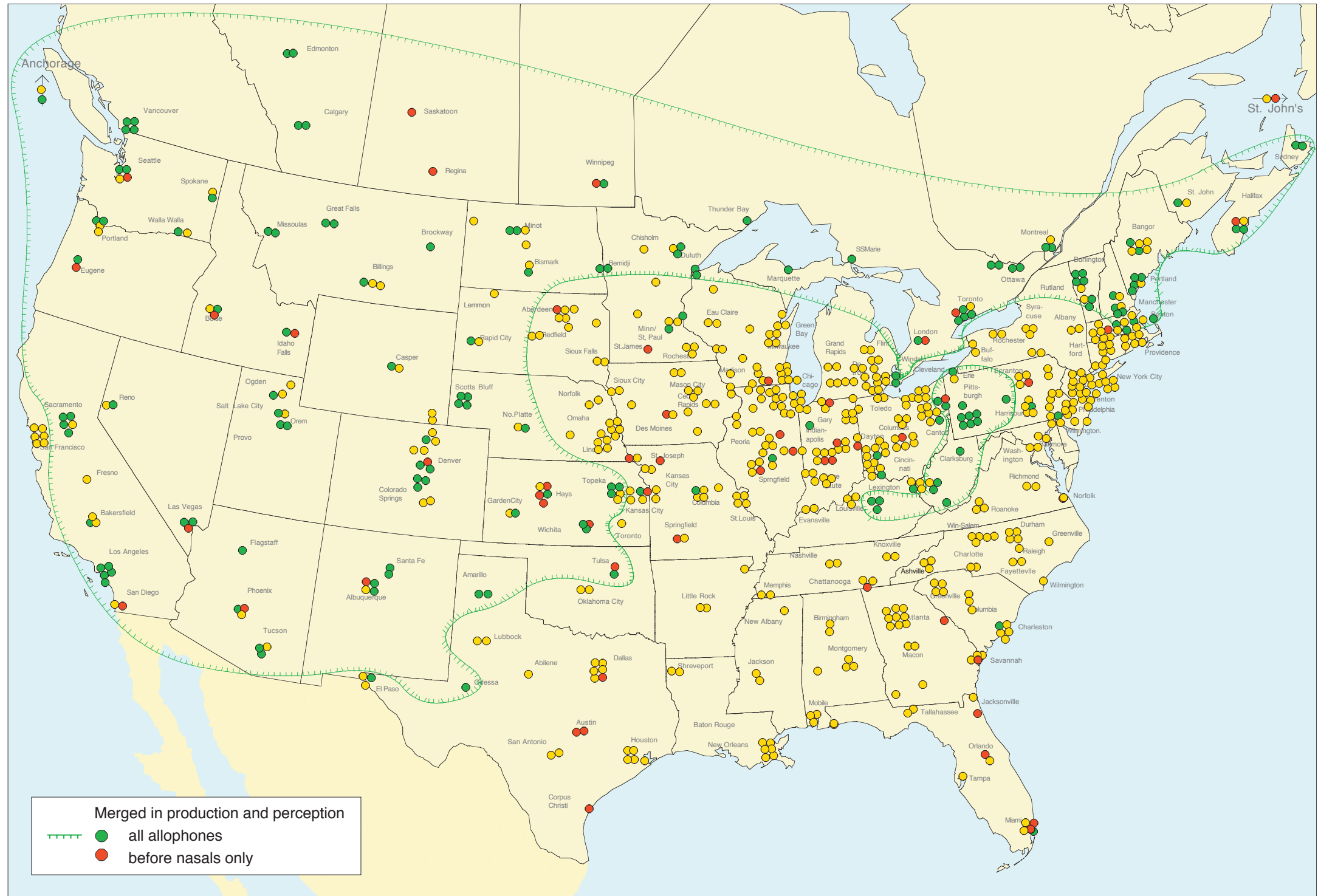


As Chapter 11 will show, the resistance of the North and the Mid-Atlantic areas to the merger is largely based on the presence of chain shifts that maintain the separation of /o/ and /oh/. Map 9.2 adds the designation of speakers for whom there is no trace of the low back merger: all /o/ vs. /oh/ words were judged to be distinct in both production and perception (blue circles). These speakers are concentrated in three areas, which are defined by the results of acoustic measurements drawn from Chapters 11 and 14:

1. The Inland North, including western New York, the area around the Great Lakes, and, less consistently, a narrow corridor running down from Chicago to St. Louis (Chapter 14). In this region, the separation of /o/ and /oh/ is maintained by the fronting of /o/. The blue circles are seen to be contained within the brown isogloss, which identifies the regions where the majority of speakers have fronted /o/ (greater than 1450 Hz).<sup>6</sup>
2. The Mid-Atlantic area, extending from Providence to New York City, Philadelphia, Wilmington, and Baltimore. In this area, defined by a purple isogloss, the low back merger is inhibited by the raising of /oh/ to mid and high back position (F1 < 700 Hz).
3. The South. In most of the South, /o/ and /oh/ both show the same low back rounded nucleus, but /oh/ is distinguished from /o/ by the presence of a back upglide. Frequently, the nucleus of /oh/ is fronted and unrounded, so that /oh/ effectively shifts to the back upgliding subsystem, becoming a new /aw/ back of the older Southern /aw/, which has fronted to /æw/ (see Chapter 18). The

<sup>5</sup> Essentially /n/, since /oh/ does not occur before labials and rarely before oral velars.

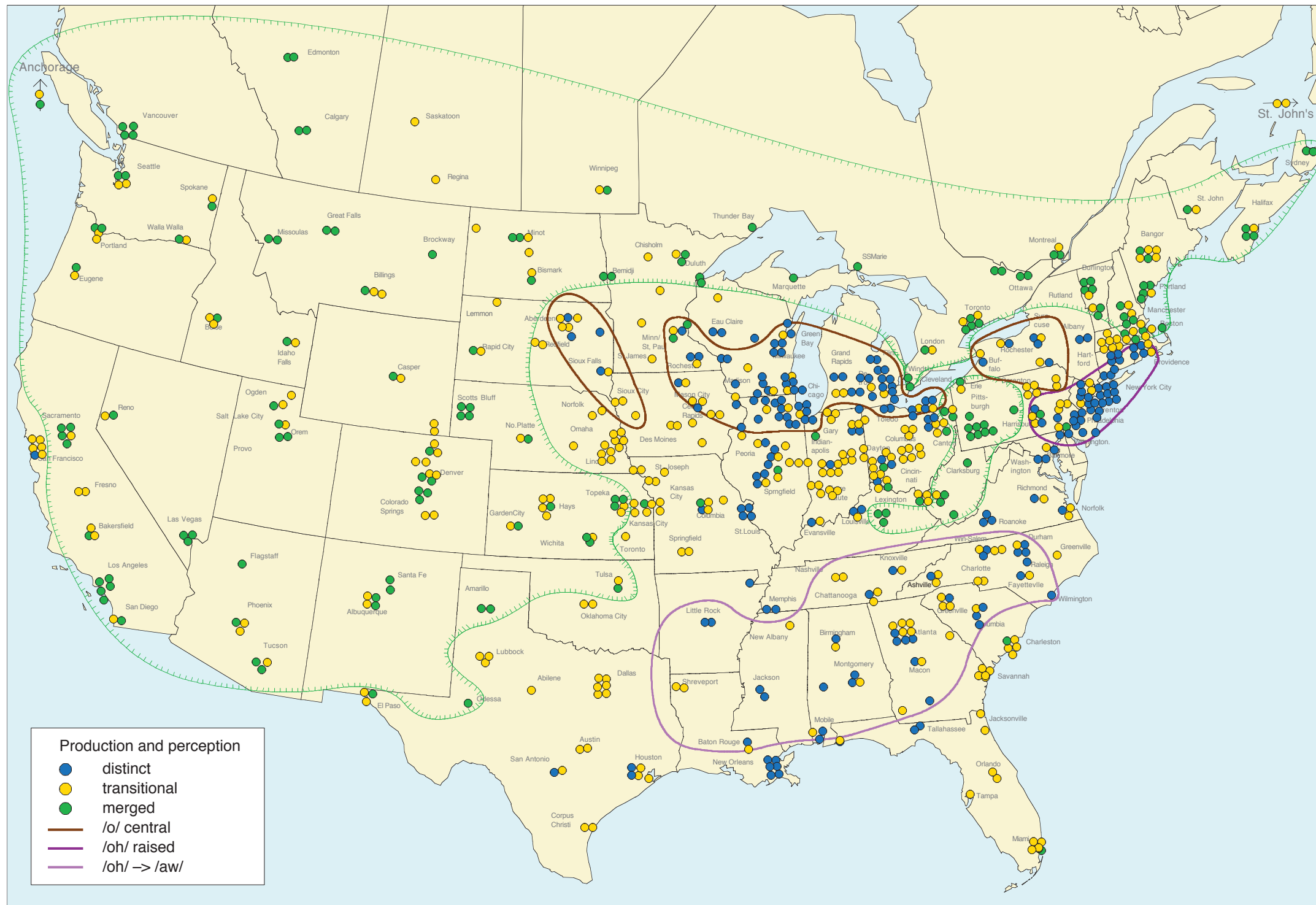
<sup>6</sup> The brown isogloss does not extend to the St. Louis corridor, since only two of the four St. Louis speakers satisfy this criterion, and none of the subjects is located in the corridor.



Map 9.1. The low back merger

The merger of /o/ and /oh/ in *cot* vs. *caught*, *Don* vs. *dawn*, *sock* vs. *talk*, is characteristic of a very large part of the geographic terrain of North America. The green symbol, showing a complete merger for all such pairs, is the dominant type in Canada, the West, Eastern New England, and western Pennsylvania. The

merger tends to occur first before nasal consonants, as in *Don* vs. *dawn*. The red symbols indicate Telsur speakers who have the merger only in that environment. However, the outer limit of merger before nasals is no different from the general isogloss, represented by the oriented green line.



Map 9.2. Resistance to the low back merger

This map focuses on the regions that show the most complete resistance to the low back merger. All three areas are of course outside of the oriented green line that outlines the region where the merger is dominant. The light brown isogloss shows the area of the Inland North where /o/ is strongly fronted and consequently remains distinct from /oh/. The purple isogloss identifies the strip along the Atlantic Coast from Providence down to Baltimore, where /o/ and /oh/ are kept distinct by the

opposite sound shift, the raising of /oh/. The magenta isogloss outlines that region of the South where the two sets of words are kept distinct by the back upglide on /oh/. This region is the most susceptible to the merger wherever the back upglide is beginning to disappear. All other areas outside of the green isogloss may be considered transitional. The Midland in particular is dominated by the yellow symbols that identify speakers for whom the pairs are 'close' in production and/or perception.

concentration of blue symbols in the South is not as great as in the other areas. Map 9.1 shows there is virtually no complete merger in the South, but there are a dozen red circles indicating merger before nasals. Feagin 1993 first observed a low back merger in Alabama with the loss of the back upglide among some younger speakers, and there is other evidence of sporadic merger in the South.

### Progress of the low back merger by region

The geographic boundaries of the low back merger are not used to define the regional dialects of North American English, since they tend to expand beyond the boundaries first established by settlement history and beyond the limits of the systematic chain shifting that are used to define regional dialects in Chapter 11. Nevertheless, there is a high degree of differentiation by regional dialects, and while the status of the low back vowels is not sufficient on its own to identify uniquely any of the dialects established in Chapter 11, each of these dialects is unified with respect to the status of the low back merger.

We can compare the results of the minimal pair tests across the regions established in Chapter 11 on the basis of acoustic measurement. In Figure 9.1 the vertical axis represents the overall response to the five minimal pairs contrasting /o/ and /oh/, where *same* means 'same' for all allophones, *different* means 'different' for all allophones, and *transitional* stands for any other pattern of response. The regions are ordered by frequency of 'same' responses (dark blue line), ranging from 0 percent for New York City on the left to 87 percent for Canada on the right. For the three dialects on the left (NYC, Inland North, and Mid-Atlantic) there is almost no trace of the merger. For the middle dialects (South, Midland, North outside of the Inland North, and Eastern New England) the frequency of *same* response ranges from 16 to 50 percent. For the three dialects on the right (West, western Pennsylvania, and Canada) the merger strongly predominates.

The yellow line indicating the percent of *different* responses is naturally the converse of the dark blue line, but is somewhat more categorical. The three dialects which most strongly maintain the distinction are more clearly separated from the others, and on the right, Eastern New England joins the merged dialects in showing 0 percent *different* responses.

The percent of *transitional* responses peaks sharply in the Midland, as the orange symbols of Map 9.2 indicate.

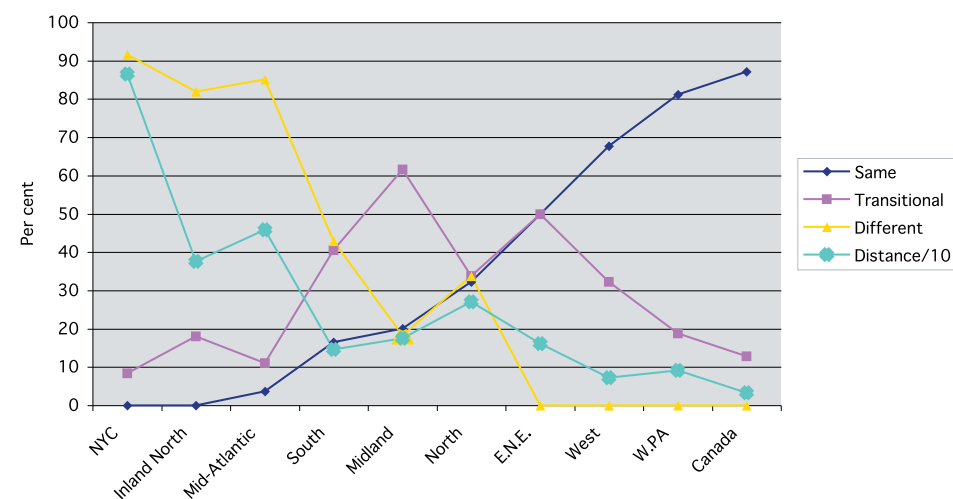


Figure 9.1. Perception of /o ~ oh/ minimal pairs by region compared to acoustic distance

The light blue line registers the Cartesian distance in Hertz between the means of /o/ and /oh/ on the F1/F2 plane, with the additional modification that if /o/ is higher or backer than /oh/, the value is set to 0. This distance ranges from 865 to 0; divided by 10, it can be superimposed on the percent values of Figure 9.1. New York City shows the highest value, a consequence of the extreme raising of /oh/, but all three unmerged regions show a substantially greater distance between /o/ and /oh/ than the other regions. The three regions on the right are the only ones for which the distance value is less than 10.

Figure 9.2 shows the corresponding values for production. The distance figures remain the same, while the percentages now indicate the analyst's judgment of the speaker's pronunciation of the minimal pairs. The results are almost identical. This indicates that the speaker's judgments are not heavily affected by any tendency towards correction of a stigmatized form or exaggeration of a prestige norm.<sup>7</sup> Like other mergers, the fusion of /o/ and /oh/ takes place below the level of social awareness and is normally not the focus of sociolinguistic evaluation.

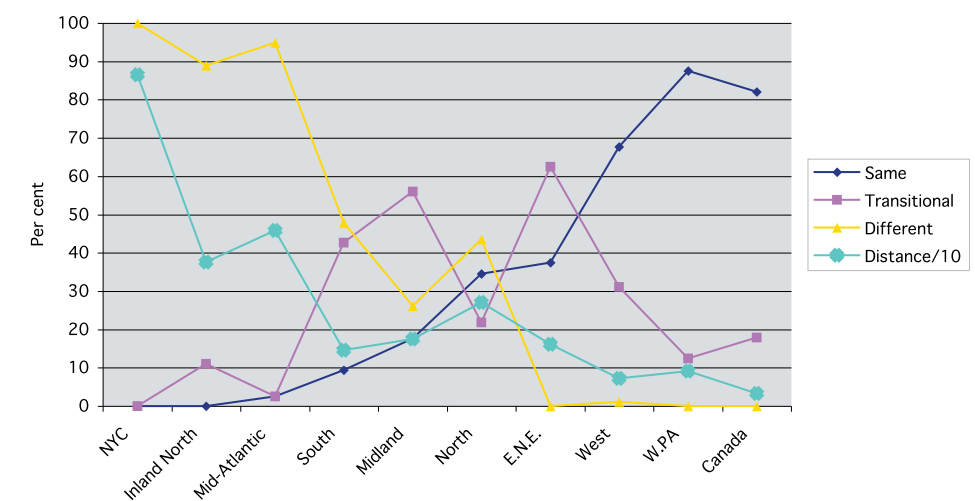


Figure 9.2. Production of /o ~ oh/ minimal pairs by region compared to acoustic distance

The study of sound changes in progress show that the relations of production and perception are not in general symmetrical. In the majority of cases, the change occurs earlier in perception than in production (Di Paolo 1988; Di Paolo and Faber 1990; Herold 1990). Map 9.3 identifies all asymmetrical cases. The red symbols identify speakers for whom the low back merger is more advanced in perception than production ('same' in perception and 'close' in production, 'close' in perception and 'different' in production, or 'same' in perception and 'different' in production). The blue symbols identify speakers with the reverse asymmetry, where production runs ahead of perception. On the whole, the Telsur data conform to expectations: there are a total of 109 subjects for whom the merger is more advanced in perception and only 51 where the reverse is true.

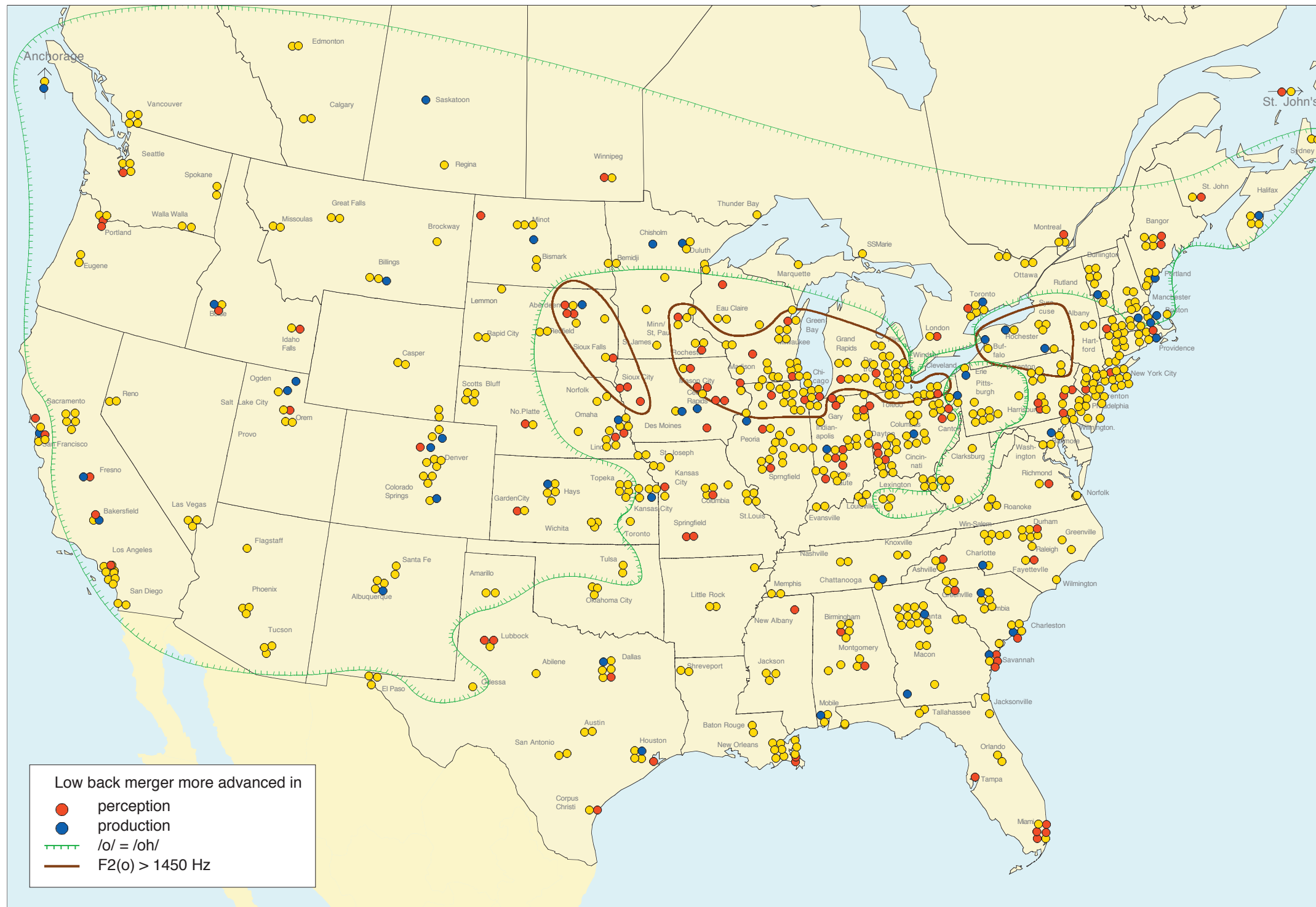
Table 9.4 shows that the situation is radically different for speakers within the area of low back merger and those in areas where the distinction is predominant. Inside the low back merger area, there is no difference; one type is as likely as the other. Outside of that area, the ratio is 3:1 in favor of perception.

This difference between the two areas may be interpreted as confirmation of the mechanism of merger suggested by Herold (1990): that the loss of phonemic

<sup>7</sup> Occasional differences between spontaneous speech production and minimal pairs do occur. Compare the case of Bill Peters in Duncannon, Pennsylvania, whose speech showed a clear distinction but minimal pairs indicated merger in both production and perception (LYS: 235).



9.3



Map 9.3. The relative advance of production and perception in the low back merger

In general, mergers tend to occur in perception earlier than in production. The red symbols designate speakers for whom the low back merger is more advanced in their judgments on ‘same’ or ‘different’ than in their actual production of the minimal pairs. There are also blue symbols indicating the opposite situation, about

half as many as the red symbols. The brown isogloss identifies those areas of the Inland North where /o/ is strongly fronted. The two westward portions show more red than blue symbols; the opposite tendency is found in New York State.

contrast actually represents a gain of information rather than a loss of information. Herold proposed that the merger spreads when speakers of the unmerged, two-phoneme dialect find that the distinction they produce and expect to hear is not reliable when communicating with speakers of the merged, one-phoneme dialect. In response, they stop relying on the difference in sound for the interpretation of meaning, relying instead on context for disambiguation, like merged speakers. Because this strategy reduces misunderstandings, it can be argued that the diffusion of the merger can be seen as a gain of information rather than a loss. Herold's analysis was supported by a study of natural misunderstandings in oral communication, where 23 out of 24 recorded misunderstandings involving confusion of the vowels /o/ and /oh/ were on the part of two-phoneme rather than one-phoneme speakers (Labov 1994: 325).

Table 9.4. Distribution of asymmetrical low back merger reports within and outside the low back merger area

	Total subjects	Perception > production	Production > perception
All subjects	741	105	51
Inside low back merger isogloss	208	20	23
Outside low back merger isogloss	528	85	28

The asymmetrical speakers of Map 9.3 are a subset of the larger group of 'transitional' speakers for whom /o/ and /oh/ are neither completely merged nor completely distinct. Map 9.2 displays these 'transitional' speakers with yellow symbols. They are heavily concentrated in certain areas: San Francisco, where, unlike the rest of California, the merger is not yet complete; Texas, where there have been regular reports of the merger in progress (Bailey 1991); the metropolis of Atlanta and all the marginal areas of the South (Charleston, Florida); western Massachusetts; and eastern Pennsylvania, where Herold (1990) made a close study of the merger in steel and mining towns dominated by heavy East European immigration. But the largest area that is primarily transitional is found in the Midland area south of the North/Midland boundary (see Chapter 11). If we exclude the St. Louis corridor running down I-55 from Chicago to St. Louis, there is a solid belt of yellow symbols from the eastern edge of the western /o/ ~ /oh/ merger all the way to eastern Ohio and the western edge of the western Pennsylvania merger area. This is in sharp contrast to the areas of resistance to the merger: the North and the Mid-Atlantic regions.

The Telsur project examined two Midland cities in greater detail than was the norm for the study; these were Indianapolis and Columbus. Though only seven Indianapolis and six Columbus speakers are displayed on the maps in this chapter, a total of 14 from Indianapolis and 15 from Columbus were interviewed. Figure 9.3 shows the low back merger responses of Indianapolis and Columbus by age and sex, permitting a closer view of the transition. In Indianapolis, the only speakers with a clear distinction are two members of the oldest group (over 40), and the only one with a total merger is a teenage girl. Indianapolis shows a relatively rapid transition across these narrow age ranges.<sup>8</sup> A similar pattern of rapid merger over three generations of speakers was found by Boberg and Strassel (1995) to be operating in Cincinnati.

The Columbus subjects cover a wider age range but show a more uniform situation: all speakers are transitional. Only one produced a clear difference in one mode, and she was the oldest of the group. Ten of the 15 subjects were judged to have pronounced all allophones as 'close' and they themselves judged them to be 'close'. The other four were mixed. As in Indianapolis, no clear sex differences emerge. Table 9.5 breaks down the data into responses for the four allophones.

The most advanced allophone is clearly before nasals, where 8 of the 21 responses indicated complete merger; the most conservative is plainly before velar /k/, where 50 percent were completely distinct.

The relation of perception to production in these transitional cities matches the conclusions drawn from Map 9.3. The responses in which perception shows a greater tendency to merger than production outweigh the reverse situation by a ratio of almost 4 to 1 (38 to 10).

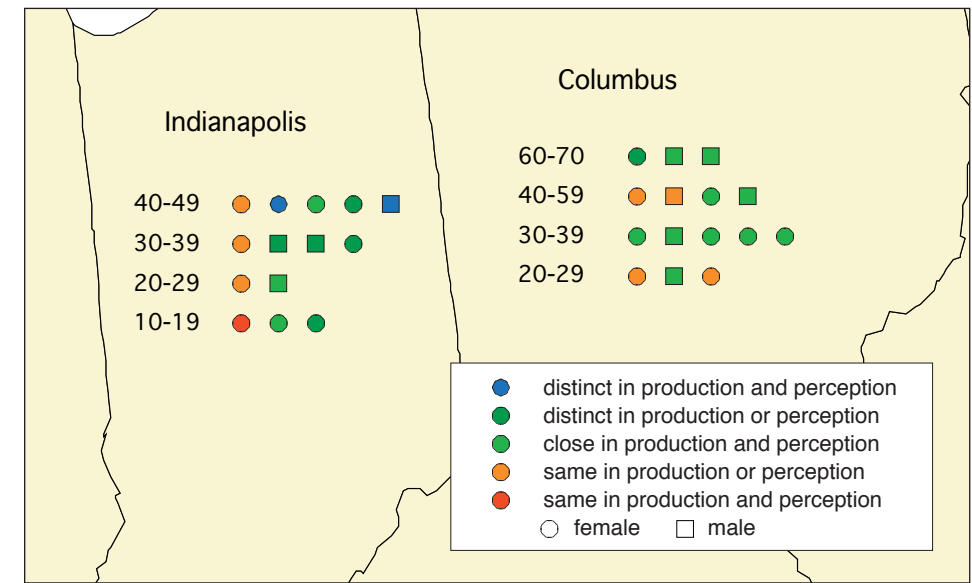
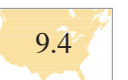


Figure 9.3. The low back merger in Indianapolis and Columbus

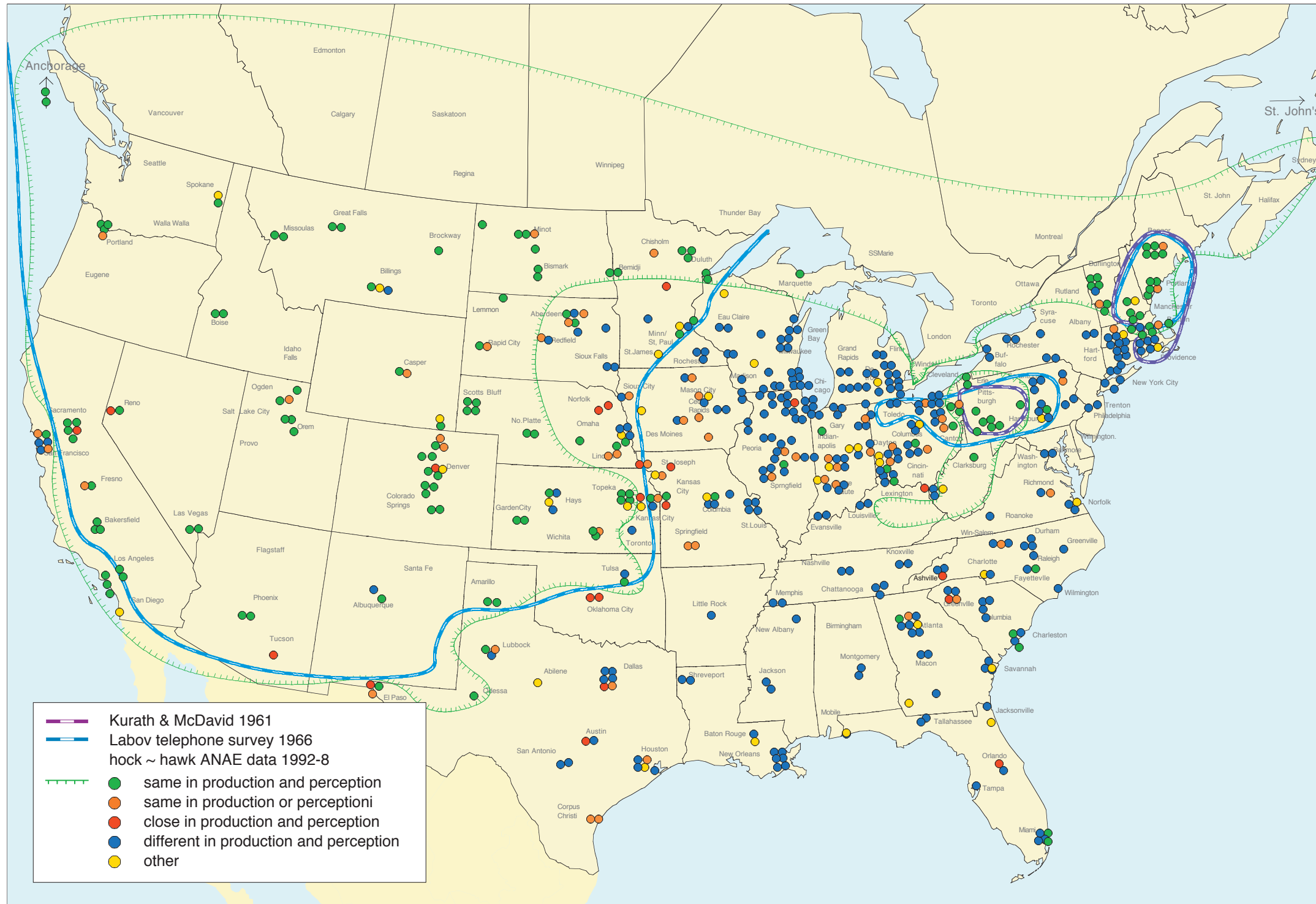
Table 9.5. Distribution of minimal pair responses for allophones of /o/ and /oh/ in Indianapolis and Columbus

Production	Perception	on_ohn	ot_oht	ok_ohk	ol_ohl	Total	Per > Prod	Prod > Per
same	same	8	4	3	3	18		
same	close	1	2	4	4	11	11	
close	same	0	0	1	0	1		1
same	different	3	5	2	5	15	15	
different	same	1	3	1	0	5		5
close	close	0	4	1	1	6		
close	different	4	1	1	0	6	12	
different	close	0	1	0	3	4		4
different	different	4	6	13	5	28		
Total		21	26	26	21	94	38	10

There are two earlier maps available for the geographic distribution of the low back merger. LANE and LAMSAS give some information on the state of the merger in the 1930s and 1940s for the eastern United States. Since there is no direct evidence on minimal pairs or speakers' judgments, we must infer the pres-



<sup>8</sup> Phillips 2004 reports a student project comparing the two Telsur speakers from Terre Haute with thirty speakers from Terre Haute. The overall view is that of a transitional state, with younger women (18–24) showing more 'same' judgments than older speakers (47–53), and younger women showing more tendency to merger than younger men.



Map 9.4. The development of the low back merger from the 1930s to the end of the twentieth century

This map compares three isoglosses. The earliest record of the merger is shown by the purple isogloss, outlining the area of merger in the Linguistic Atlas of the Atlantic States in the 1930s and 1940s. The broken blue isogloss is the record of a survey of long distance telephone operators carried out by Labov in 1966. The coloring of the symbols registers responses to the minimal pair *hock* vs. *hawk* in the ANAE data of the 1990s, and the oriented green isogloss is the same as

in Maps 9.1 to 9.3. The Eastern New England LANE data extends further south than the other isoglosses, but this turns out to be an error of the fieldworker. The clearest geographic movement is found in western Pennsylvania, where both the 1966 and 1990s data indicate both eastward and westward expansion, in addition to the excursion into the Appalachians. However, the Midwestern boundary of the merger does not seem to have shifted eastward.





ence or absence of merger by comparing phonetic data from maps that feature words belonging to the relevant classes. In regions where maps of the pronunciation of /o/ words show the same vowel quality as maps of the pronunciation of /oh/ words, we assume that the merger is present. In PEAS, Map 15 shows the pronunciation of the /o/ in *oxen*, while Maps 23 and 24 show the pronunciation of the /oh/ in *law* and *salt*, respectively. A merger can be inferred in those communities where a low back rounded vowel [ɒ] is recorded in *law* and *salt*, and either a low back or a lower mid back vowel [ɔ] is shown for *oxen*. The areas showing such a merger are indicated by the purple broken isogloss on Map 9.4, in Eastern New England and western Pennsylvania.

The first national map of any feature of American pronunciation was the by-product of a telephone survey of place names conducted by Labov in 1966. At that time, long distance telephone operators were much more locally situated than at present. The basic paradigm was to ask for the number for a name pronounced as [hæri hak], using a low central vowel for the surname. *Hawk* is a more common surname than *Hock*, and in the areas where merger was dominant, the operators would unhesitatingly search for *Harry Hawk*. The name was usually not found. The investigator then asked the operator if she had looked for *Harry* [H-A-W-K]. In the one-phoneme area, the answer was normally ‘yes’; in the two-phoneme area, the normal response was ‘no’. The investigator then said that he would have to look up the name in a business directory and asked the operator how she would say H-O-C-K and H-A-W-K. In the one-phoneme area, the operator would often say with surprise, “They’re the same!”<sup>9</sup> From this evidence, the distribution of the merger was charted.

The light blue broken isogloss on Map 9.4 shows the outer limits of clear merger in the 1966 telephone survey. Since the main data for the 1966 survey were derived from the contrast of *Hock* and *Hawk*, the symbols representing Telsur data on Map 9.4 show only the degree of contrast before /k/, primarily derived from the contrast of *sock* and *talk*.<sup>10</sup> The oriented green isogloss is the same as that in Maps 9.1 to 9.3, but the colors of the symbols are based on the merger before /k/, which was shown above to be particularly resistant to merger.

Since neither of the previous studies included Canada, no Canadian data are shown.

In Map 9.4, the three major areas of merger group together (green, orange, red symbols), and the areas of resistance to the merger group together (dark blue symbols); there is general agreement among the isoglosses from all three studies. The purple broken isogloss from PEAS is confined to western Pennsylvania, whereas the light blue broken isogloss from the 1966 study, one or two generations later, covers considerably more territory, including central Pennsylvania to the east and northeastern Ohio to the west. The most recent data from Telsur show the further expansion of this area of merger southward into West Virginia and parts of eastern Kentucky but do not show as much eastward and westward expansion as the 1966 data.<sup>11</sup>

In Eastern New England, the earliest LAMSAS and LANE data extend the area of merger into southeastern New England, and in particular show merger for the city of Providence. This does not match either the 1966 data for Providence or the ANAE data, which show a consistent and clear distinction of /o/ and /oh/ for all six Providence speakers.<sup>12</sup> It is now clear that LANE and LAMSAS were wrong in attributing the low back merger to Providence (Moulton 1968; McDavid 1983), and that the contrast between Providence and Boston in this respect is stable. Indeed, the syllabus given in Kurath and McDavid for the educated Providence speaker shows a lower mid back vowel [ɔ] for *law*, *water*, and *dog*, and a low back vowel [ɒ] for *frost* and *log*.<sup>13</sup> The Telsur data suggest that the contrast is even stronger than this; the typical realization of /o/ in Providence is with a mid-central vowel, clearly distinct from mid-back /oh/.

The boundary between the western merger and the North and Midland does not show the eastward expansion that one would expect from the general principle that mergers expand at the expense of distinctions (Labov 1994: 313). On the contrary, in the Upper Midwest, the merger appears to have receded in the interval between the 1966 and the Telsur studies. In the 1966 survey, the merger extended through all of South Dakota, most of Minnesota and all of Nebraska. The ANAE data do not show the merger as far eastward. Southern Minnesota, eastern South Dakota, and much of eastern Nebraska are not included in the merged area. The data on the merger before /k/ show only one point that might have been included in the merged area, in south central Nebraska. In South Dakota, there are a few transitional cities, but a solid block of five completely unmerged cities could not by any means be included in the territory of the merger.

Although the low back merger does not show a vigorous geographic expansion, it is expanding across the age range, with younger speakers in certain regions showing higher rates of merger than older speakers. The apparent time statistics of Table 9.3 indicate that this is true in the traditional areas of merger – Eastern New England, the West, and the Midland – and also in the South. Only in Canada is the merger well enough established to show no correlation with age. The mechanism of change appears to be quite different in the areas where the merger is closer to completion – Eastern New England and the West – than in those where it is a more active process – the Midland and South. The Midland speakers show a gradual transition across age levels with an increasing number of ‘close’ productions and judgments among younger speakers judgments of ‘the same’ among the youngest (Chapter 19).

The apparent inconsistency between the progress of the merger in apparent time and the absence of vigorous spatial expansion may be explained by the strength of the structural factors that inhibit the spread of the merger to the Inland North and the Mid-Atlantic States: fronting of /o/ in the former case and raising of /oh/ in the latter. These factors appear to support a stable resistance to the merger. Chapter 11 begins the definition of North American dialects with these considerations.

## 9.2. Conditioned mergers

Throughout the history of English, considerable fluctuation has been noted between the short vowels *i* and *e*, not only before nasals, but also before oral consonants, particularly *s* (Montgomery and Eble 2004). One of the most widely recognized features of Southern speech is the merger of /i/ and /e/ before anterior nasal consonants /m/ and /n/. Brown (1990) has studied the history of the merger in Tennessee in some detail (see also Guy and Ross 1992). Brown’s study of the writing of civil war veterans, combined with data from LAGS and LAMSAS, shows that the merger was at a very low level during the first 60 years of the nineteenth century, but then rose steeply to 90 percent in the middle of the twentieth century. Montgomery and Eble (2004) present further evidence from late nineteenth-century North Carolina documents, a corpus of letters from planta-

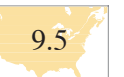
9 In that case, the investigator would say, “Where I come from, they are different” pronouncing them [hæk] and [hɔk].

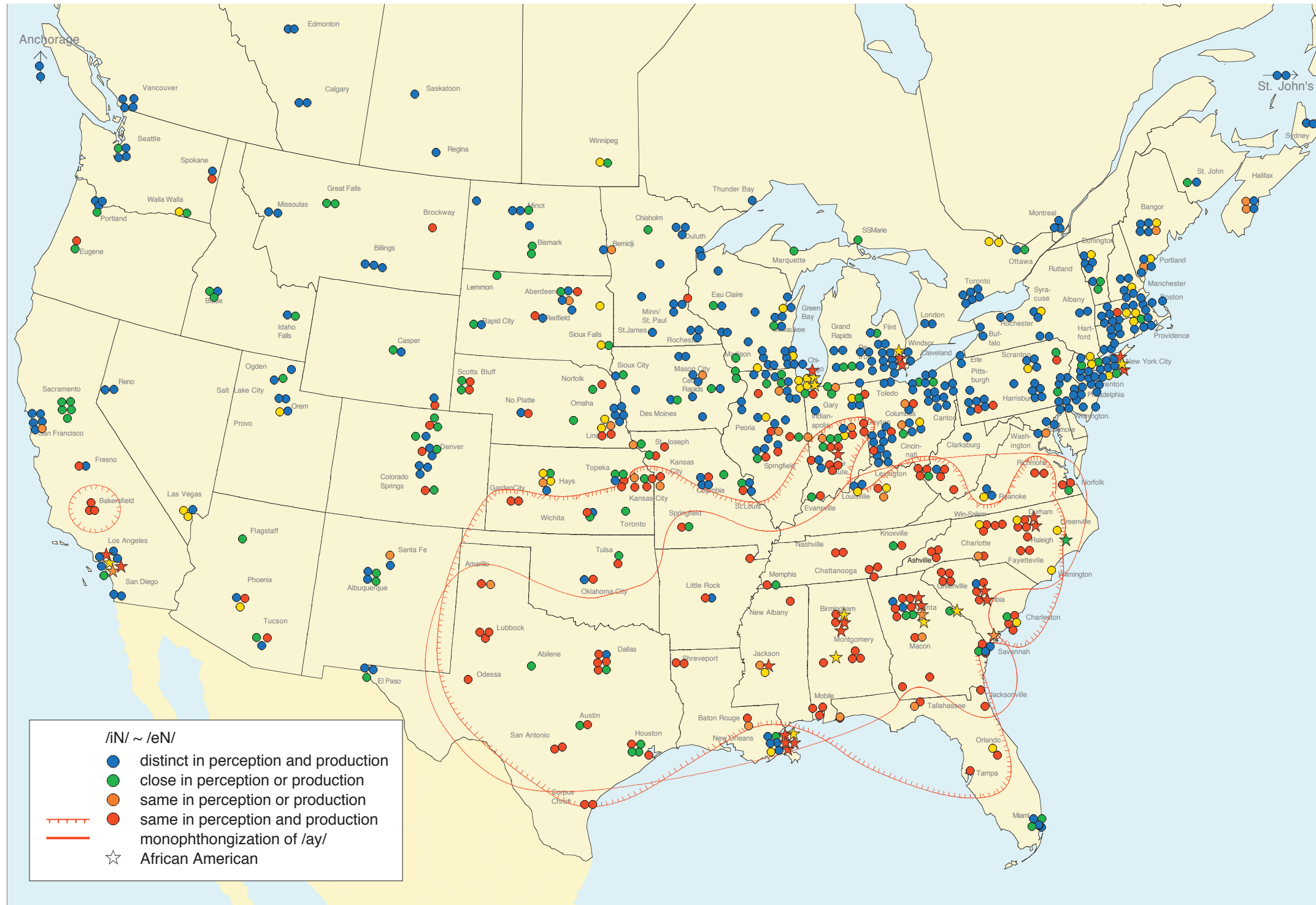
10 Data on *sock* and *talk* were not collected for some cities, so no symbols appear in certain areas.

11 The consistent merger in West Virginia is to some extent reinforced by the fact that data were not gathered on the most conservative environment, before /k/, in many cities of that region.

12 The 1966 survey had only one Providence speaker, but the ANAE data include four speakers who are different in both production and perception for all allophones and two speakers who show several ‘close’ judgments.

13 The only evidence for overlap is then the use of [ɒ] in *daughter*, and the variant [ɔ] for *frost*.





Map 9.5. The merger of /i/ and /e/ before nasals

The oriented red isogloss outlines the region where /i/ and /e/ have merged before nasal consonants in *pin* vs. *pen*, *him* vs. *hem*, etc. This well-known feature of Southern phonology is clearly expanding into the larger Southeastern region, passing beyond the solid red isogloss that defines the South by the deletion of the glide of /ay/. The expansion of this merger is particularly marked in Oklaho-

ma, Kansas, Missouri, and southern Indiana. The city of Bakersfield in Southern California is marked by three speakers who show this merger. The scattering of instances of the merger in several Northern cities is the result of the inclusion of African-American subjects in the sample population.

tion overseers and letters to the Freedmen’s Bureau in the 1860s from African-Americans. They find that even though the merger has expanded rapidly in recent times, it has a longer history than was previously believed. They further suggest that African-Americans have led in its development. Bailey (2004) argues for the rapid development of most features of Southern English in the second half of the nineteenth century and the beginning of the twentieth.

Map 9.5 shows the modern distribution of the merger in production and perception. The legend and symbols in Map 9.4, and the following maps in this chapter, are to be interpreted as follows:

	Production	Perception
Distinct in perception and production (blue)	different	different
Close in production or perception (green)	different	close
	close	different
Same in perception or production (orange)	close	close
	same	close or different
Same in production and perception (red)	close or different	same
	same	same

The largest part of the continent shows blue symbols – speakers who are solidly distinct in perception and production – though there are a certain number of green symbols in almost every region, indicating that the speaker perceived the pairs of words as close or pronounced them in a manner the phonetician heard as close. On the other hand, there is a high concentration of red symbols showing complete merger in the South and comparatively few orange circles for those with a merger in one mode but not the other. Table 9.6 gives the distribution of judgments for all speakers for whom we have firm data. It shows once again that the total number of cases where the merger was more advanced in production than perception is greatly in excess of the reverse, at 90 vs. 43.

Table 9.6. Distribution of pronunciation and judgments of the contrast of /i/ and /e/ before nasals

Perception	Production	N
different	different	369
different	close	35
close	different	40
different	same	2
close	close	38
same	different	20
same	close	30
close	same	6
same	same	183

The red-oriented isogloss in Map 9.5 defines the area of /in ~ en/ merger and compares it to the spatial distribution of glide deletion of /ay/ before obstruents, the definition of the South used in Chapter 11. Strong concentrations of merged speakers appear in parts of Kansas and in southern Indiana (The ‘Hoosier apex’), though the intervening areas are mixed. Within the South, the two largest cities, Atlanta and Dallas, are predominantly merged. On the other hand, New Orleans has not yet submitted to this merger, except for four African-American speakers, located at the right-hand side of the cluster of New Orleans speakers (Chapter 22). Montgomery and Eble’s (2004) suggestion that African-Americans have played an initiating role in the merger is consistent with Map 9.5. Not only in New Orleans, but in other Southern cities like Birmingham, Atlanta, Durham, and

Columbia, African-Americans are more consistently merged than other speakers. In the North, most of the isolated instances of the merger are African-American speakers, as can be seen in New York, Detroit, Chicago.

A notable cluster of three merged speakers appears in the southern California city of Bakersfield, possibly reflecting the migration to California’s Central Valley of agricultural workers from merged areas of the South during the Depression. We also observe a cluster of merged speakers in Colorado, extending northward to Scotts Bluff, Nebraska. In none of these cities is the merger more than 50 percent, so no isogloss is drawn.

The solid red isogloss indicates the region of glide deletion before obstruents which defines the South (Map 11.3), which is also the outer envelope of other Southern vowel shifts (Maps 11.4 and 11.5). It is evident that the merger of /i/ and /e/ before nasals has expanded beyond this Southern boundary.

Table 9.7 shows that the degree of homogeneity in this ongoing merger is still limited, at the same level as the unconditioned low back merger in Table 9.2. Consistency is at the same moderate level, given the many areas with a scattering of merger in the Midland and the North.

Table 9.7. Isogloss parameters for the low back merger

	Total merged	Total within isogloss	Merged within isogloss	Merged outside isogloss	Homo-geneity	Consis-tency	Leakage
/i/ ~ /e/ __.[+nasal]	179	182	119	60	0.65	0.66	0.23

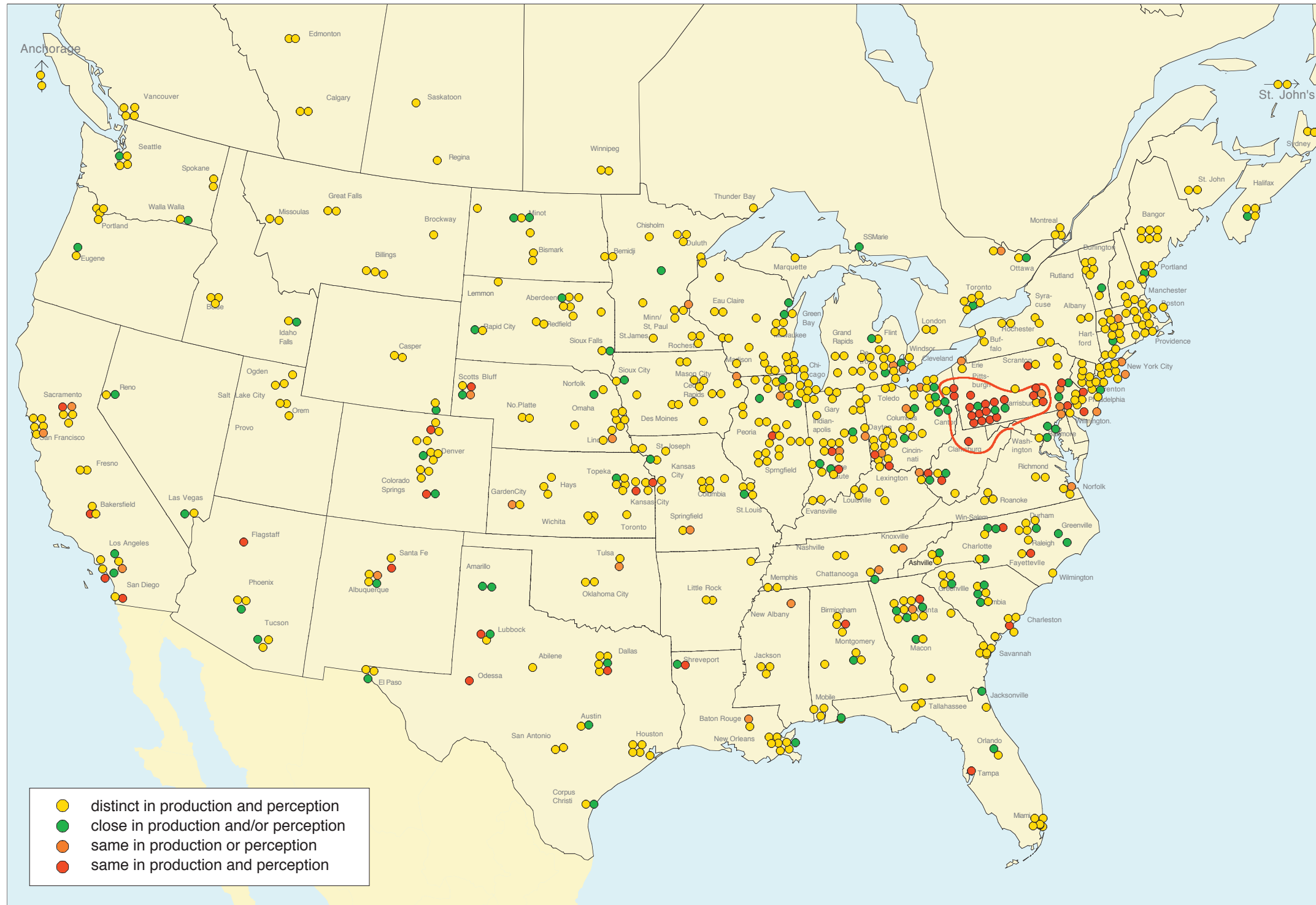
The merger displays a strong expansion in apparent time. Table 9.8 shows an age coefficient much larger than that for the low back merger: speakers 25 years younger than the mean would be shifted 1.5 units towards zero on the four-point scale. Education is correlated inversely with the merger: the higher the education, the higher the index of contrast. It also appears that the merger is favored by men: all other things being equal, women are shifted two units upward on the 4-point scale of contrast.

Table 9.8. Regression coefficients for the merger of /i/ and /e/ before /n/. Contrast scale is defined by 0 for complete merger and 4 for complete distinction.

	Coefficient	Probability
Age * 25 yrs	1.48	.006
Education (years completed)	0.45	.001
Female gender	1.97	.009

The Telsur survey examined a number of mergers before /l/ which have been reported as ongoing processes in North American English. Labov, Yaeger, and Steiner (1972) found the merger of the high tense and lax vowels before /l/ in Albuquerque and Salt Lake City. Di Paolo (1988) and Di Paolo and Faber (1990) did extensive studies of these mergers in the Salt Lake City community. Bailey (1997) and Bailey et al. (1991) traced the progress of both mergers in Texas and Oklahoma. These mergers have been examined with particular attention to the asymmetry of perception and production. LYS found that for some Albuquerque speakers, the merger of /ul/ and /uwl/ was a near-merger, with consistent differences in the F2 dimension that were not easily categorized or labeled by members of the speech community. Di Paolo and Faber (1990) reported the consistent advance of perception over production, using an experimental technique in which subjects identified the nucleus of *fool* or *full* with /uw/ or /u/ not before /l/.





Map 9.6. Merger of /u/ and /uw/ before /l/

ANAE gathered systematic data on the ongoing merger of vowels before /l/. One of the most widely reported such mergers affects the distinction of *full* vs. *fool*, *pull* vs. *pool*. It is found consistently in only one region, western Pennsylvania, the area surrounding the city of Pittsburgh. However, it is found in many indi-

viduals scattered throughout the Midland and the West. It has been studied as an ongoing process in Salt Lake City, where the ANAE respondents did not happen to show it. This merger consistently favors the lax pronunciation: *fool* is pronounced like *full* rather than the other way around.

Map 9.6 shows the geographic distribution of the /ul/ ~ /uwl/ merger. Only one area of geographic concentration is found that permits the construction of an isogloss, the western Pennsylvania region centered on Pittsburgh. In other areas of the Midland, the Southwest, and the South, there is a scattering of the red symbols that indicate total merger, but nowhere are they consistent enough to justify an enclosing isogloss. We can, however, distinguish these regions of variable merger from Canada, the Pacific Northwest, and New England, which are dominated by the yellow circles that designate an unmodified and consistent distinction. To emphasize the uniformity of the western Pennsylvania region, all 14 of the Pittsburgh subjects are displayed in Map 9.6 instead of the usual selection of seven. Sixteen of the 24 speakers in the larger western Pennsylvania area show a complete merger. Eleven of the 14 Pittsburgh speakers show the complete merger; the other three are ‘close’. This is not a recent phenomenon; of the three oldest speakers in their sixties, two show a complete merger.

The predominance of the /ul ~ uwl/ merger in western Pennsylvania is probably connected with the high rate of vocalization of final /l/ in this area.<sup>14</sup> The vocalic glide that represents a former lateral is intimately involved with the nucleus and restricts the range of contrast available in that nucleus.

The Telsur survey elicits two minimal pairs to test the status of the distinction of /i/ and /iy/ before /l/: *hill ~ heel* and *pill ~ peel*. The total number of speakers who show this merger is about the same as it is for the merger of *full* and *fool*, etc., but the geographic distribution is quite different. As with /ul/ ~ /uwl/, there is a scattering of merged speakers in the West,<sup>15</sup> but the largest and most homogeneous group of merged speakers is found not in western Pennsylvania but in the South, as shown in Map 9.7. There is virtually no trace of the merger in western Pennsylvania, or in the Pacific Northwest, Canada, the Inland North, the Mid-Atlantic region, or New England. Within the South, the /il/ ~ /iy/ merger is an inland phenomenon; the Gulf and Atlantic coastal areas of the South are largely unaffected. Like the Southern Shift (Maps 11.3–11.6),<sup>16</sup> the merger has two main centers; one in the Appalachian Mountain region and one in Texas. Its geographic coincidence with the Southern Shift is only approximate, however; in the Inland South, it extends well beyond the core territory of the Southern Shift.

Map 9.7 shows that the area of /il/ ~ /iy/ merger extends east than the Inland South, to include all of North Carolina, and further west to Louisiana and Mississippi. In Texas, the city of Dallas is not included in the merger isogloss, since only one of the six Telsur subjects there shows a total merger.

**Comparison of mergers before /l/**

The two cases just considered are structurally parallel, reflecting an ongoing loss of the tense/lax distinction of the high front and high back phonemes before /l/. Table 9.9 shows an extraordinary similarity in the distributions of these two processes. The extent of the mergers and their distribution across the minimal pair subtypes are virtually identical. The *r*-correlation between the two distributions is 0.9995. The rates of change in apparent time are the same. Both show a significant correlation with education: the greater the number of years of schooling finished, the greater the chances that the speaker will make a distinction. Nevertheless the geographic distribution of these two mergers is entirely disjunct.

The acoustic analysis of vowels before /l/ contributes to an understanding of the difference between these two mergers. Figure 9.4 shows the relevant vowels before /l/ for a characteristic Pittsburgh speaker, Henry K., 61.

In the front vowels, one can observe a clear differentiation of /iy/ and /il/. Two /iy/ tokens are in high front position, higher and fronter than the general /iyC/ mean, while the short /il/ vowels are lower and backer than the general /i/

Table 9.9. Distribution of /il/ ~ /iy/ and /ul/ ~ /uwl/ contrasts. Contrast scale is defined as 0 for complete merger and 4 for complete distinction. Regression coefficients: \* *p* < .05, \*\* *p* < .001, \*\*\* *p* < .001.

Perception	Production	/il/ ~ /iy/	/ul/ ~ /uwl/
different	different	538	531
close	different	21	39
different	close	15	24
close	close	24	31
same	close	13	20
close	same	3	3
same	same	52	54
same	different	9	14
different	same	1	3
Age coefficient		1.05**	1.12**
Education coefficient		0.44***	0.27*

mean. However, there are three tokens of *steel* that are much lower and backer than the rest. These may help to explain the general stereotype of Pittsburgh speech as rhyming *still mill* for “Steel mill”. However, the difference between the /il ~ iy/ situation and /ul ~ uwl/ is evident when we examine the high back corner of Figure 9.4. The complete merger of *pool* and *pull*, *fool* and *full* in the upper back region is evident in the measurements of the tokens taken from the minimal pair tests as well as the tokens from spontaneous speech. The /ow/ class before /l/ (in *Polish*, *cold*) is merged with /uwl/ and /ul/. Finally in low back position, one can observe the clear merger of /ohl/ and /ol/, in line with the data of Map 9.1.

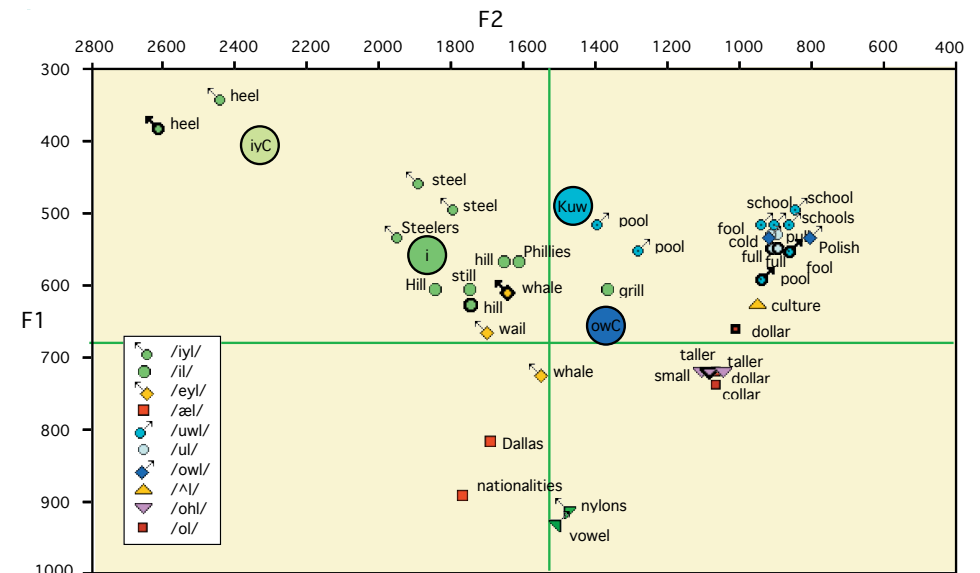
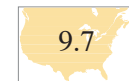
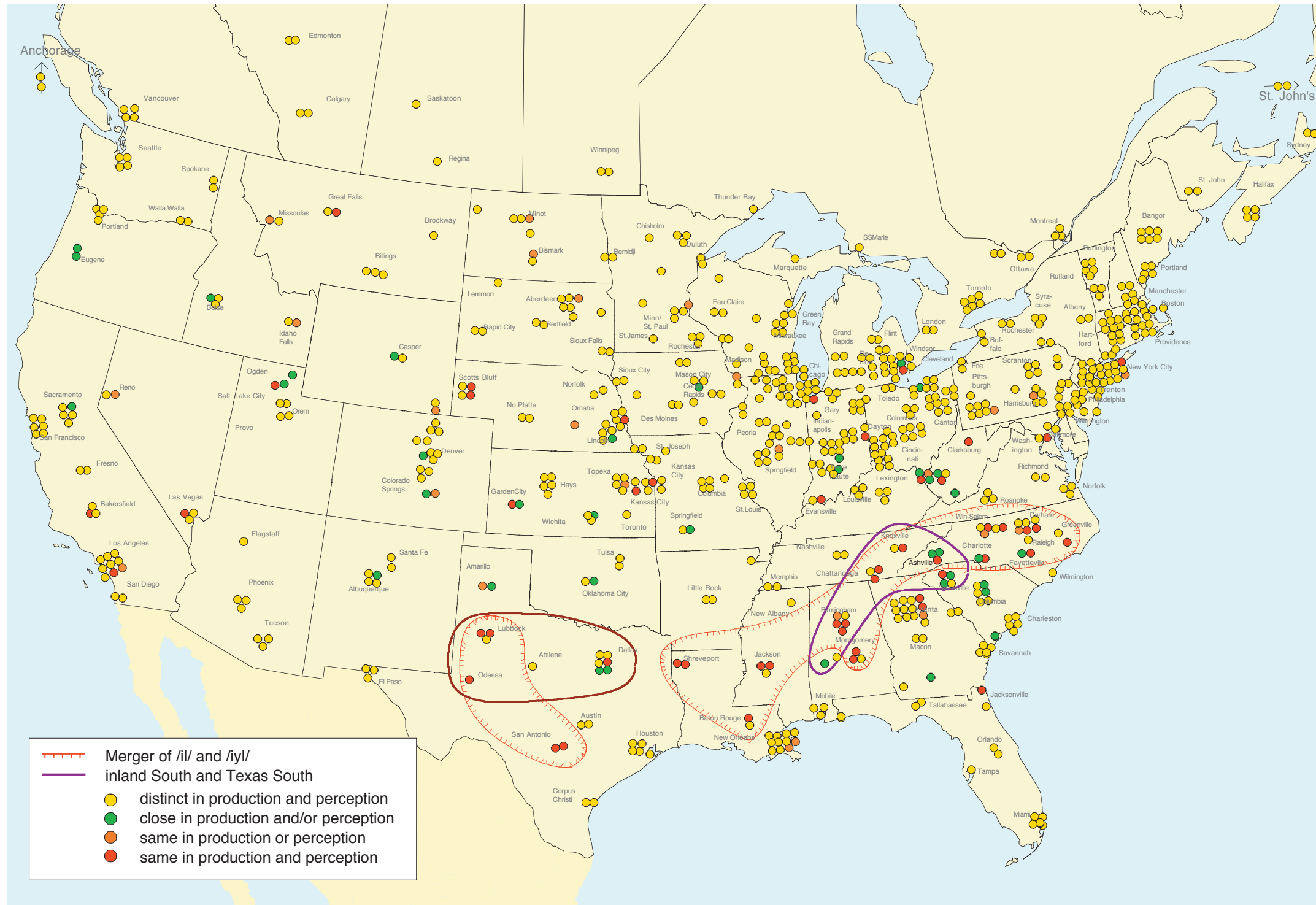


Figure 9.4. Vowels before /l/ in the system of Henry K., 61, Pittsburgh PA, TS 544. Bold symbols indicate minimal pair elicitation.

14 For data on the vocalization of /l/ in Pennsylvania see Ash (1982).  
 15 Some evidence of the merger appears in northern Utah, but again, the Telsur interviews fail to capture evidence for the merger in Salt Lake City. This must be considered an accident of sampling, in the light of other evidence cited for the merger in this area. Near-mergers of this type show a great deal of individual variation.  
 16 The feature of the Southern Shift that is most relevant to this merger is the third stage, in which short /i/ shifts to peripheral high front position, while the nucleus of /iy/ moves from that position to a lower high or upper mid nonperipheral position. This feature is more characteristic of the Inland South than the Texas South.



Map 9.7. Merger of /i/ and /iy/ before /l/

This map shows the areas that most frequently show the merger of the high front lax and tense vowels in *fill* vs. *feel*. The red oriented isogloss shows a very different geographic pattern from Map 9.6. The merger extends across the interior of the South, including the Inland South (purple isogloss) where the Southern Shift

of front upgliding vowels is most strongly advanced. It is also found in Texas, overlapping the second region where the Southern Shift is strongest. Originally, this merger favored the vowel of *feel*, but merger with the lax vowel /i/ of *fill* is now more characteristic of younger speakers.

The contrast between the high front and high back vowels before /l/ is displayed in Table 9.10, which summarizes the minimal pair responses of all 14 Pittsburgh subjects. For /ul ~ uwl/, 11 of the 14 were ‘the same’ in perception and production, but no one showed this response to /il ~ iyl/. Eleven of the 14 judged /il ~ iyl/ to be ‘different’ in perception and production, but no one showed this response to /ul ~ uwl/. We can conclude that the stereotype of merger of /il ~ iyl/ is based only on a close approximation of some forms, and does not represent the underlying norms of the dialect in Pittsburgh.

Table 9.10. Minimal pair judgments for 14 Pittsburgh subjects. 2 = ‘different’; 1 = ‘close’ 0 = ‘same’. The first digit represents the speaker’s judgment; the second represents the analyst’s judgment of the speaker’s production.

TS#	Name	Age	Gender	ul ~ uwl	il ~ iyl	el ~ eyl	ul ~ owl
355	Gwen S	66	F	21	22	22	
356	Cecilia S	62	F	00	22	22	
544	Henry K	61	M	00	22		
741	Effie K	44	F	00	22	22	22
732	Kacie R	39	F	00	12	12	02
738	Jordan K	38	M	00	22	22	00
737	Derek K	36	M	11	22	22	12
545	Ken K	35	M	00	22		
733	Talia R	35	F	00	22	22	22
739	Cara K	35	F	00	22	22	00
740	Nerissa K	33	F	12	01	10	11
742	Melody L	30	F	00	22	22	00
735	Scarlet C	28	F	00	22	22	01
744	Isabel P	35	F	00	01	12	01

In Figure 9.5, a speaker from Chattanooga, Tennessee illustrates the very different distribution of the front vowels before /l/ in the Inland South. The second stage of the Southern Shift (Chapters 11, 18) has reversed the relative positions for the means of /e/ and /ey/, but the third stage (the parallel reversal of /i/ and /iy/) has applied only to the extent of bringing the two nuclei together. The merger of *hill* and *heel*, *pill* and *peel* is evident in both minimal pairs and spontaneous speech. The high back vowels before /l/ remain in high back position, as expected, while the mean symbol for the allophones of /uw/ after non-coronals is fully centralized. The merger of /uw/ and /ul/ seems evident, but it cannot be entirely accidental that three of the four tokens of /uw/ are higher than the main group of /ul/ words. Horace P. judged *fool* and *full*, *pool* and *pull* to be ‘the same’, but the analyst listening to him judged his productions to be only ‘close’.

We also observe a close approximation of /el/ and /eyl/ in this system. Again, the speaker heard them as ‘the same’, but the analyst judged them to be distinct but ‘close’.

One might think that Figure 9.5 also shows a similar merger of /oh/ and /o/ before /l/, but this is not the case. Every one of the /ohl/ symbols is marked with a back upglide, the major Southern mechanism for resisting the low back merger (Maps 11.2, 18.8).

Another speaker from the Inland South shows even more clearly the different status of the high front and high back vowels before /l/. Figure 9.6 displays vowels before /l/ for a 61-year-old woman from Birmingham. Here the third stage of the Southern Shift has applied more clearly to reverse the relative positions of the main allophones of /i/ and /iy/ as well as those of /e/ and /ey/. The high front

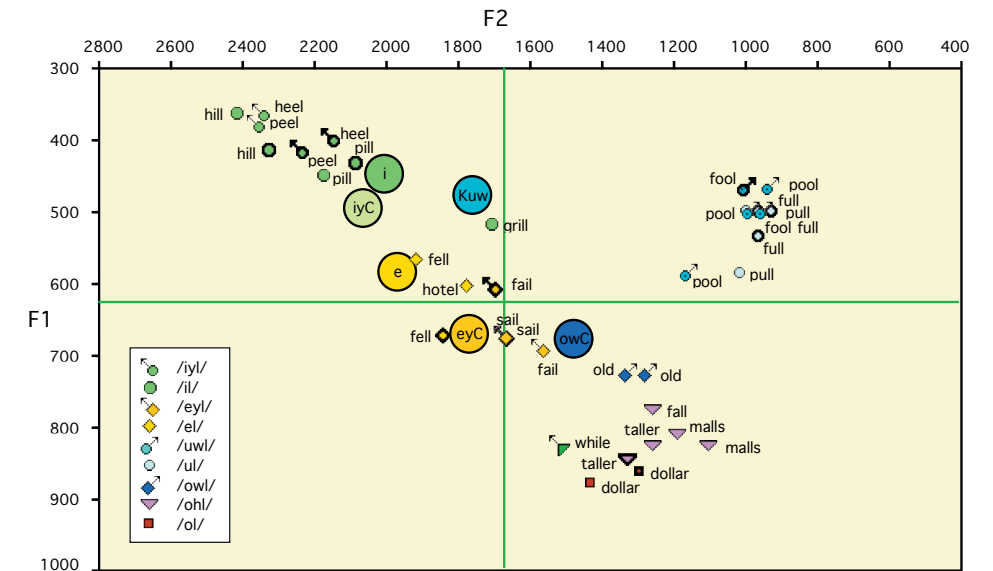


Figure 9.5. Vowels before /l/ in the system of Horace P., 43, Chattanooga TN, TS 609. Bold symbols indicate minimal pair elicitation.

vowels /iy/ and /i/ are clearly merged before /l/, again in high front position. In contrast, the back vowels before /l/ show no tendency at all to merge. One feature that distinguishes the South from all other regions is the fronting of back vowels before /l/. In Figure 9.6, /uw/ before /l/ is strongly fronted, in *school* as well as *pool* and *fool*, going considerably beyond the means for the vowels not before /l/. On the other hand, the short /u/ before /l/ has not fronted and remains completely distinct from /uw/. In contrast to the situation in western Pennsylvania, there is no trace of a merger of /uw/ and /ul/.

We can also note that the reversal of the relative positions of /e/ and /ey/ also applies to /el/ and /eyl/, so that the vowels of *fell* and *fail* are clearly differ-

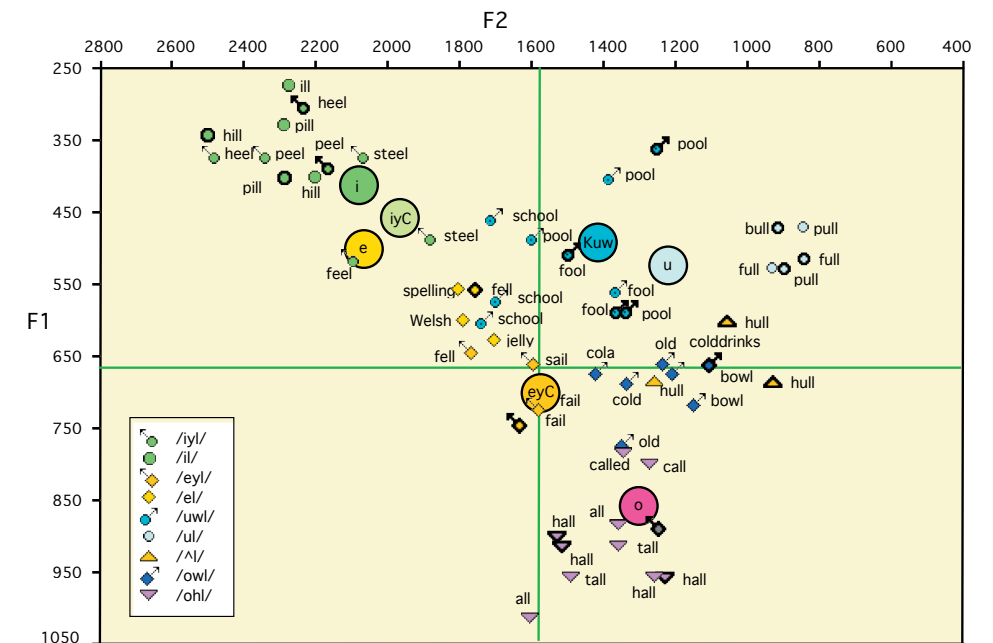


Figure 9.6. Vowels before /l/ in the system of Belle M., 61, Birmingham AL, TS 340. Bold symbols indicate minimal pair elicitation.

entiated. The merger of /iI/ and /iyI/ may be not a necessary consequence of the Southern Shift, but a separate and distinct event.

The tokens of /ohI/ in *all*, *hall*, *tall*, etc. are lower and fronter than those of /oI/, almost in central position. This is a clear indication of the unrounding that accompanies the development of the back upglide, which is found in all of these words.

The final vowel diagram in this series shows vowels before /I/ for a speaker from the Texas section of the discontinuous isogloss of Map 9.7. Sheldon M. is represented by the upper right circle in the three tokens for Lubbock, Texas. He shows a merger of /iI/ and /iyI/ but not in the high front peripheral position of the speakers from Chattanooga and Birmingham. The third stage of the Southern Shift has not applied to reverse the positions of /iyI/ and /iI/, and the merger takes place in the lax position characteristic of /iI/. This is the pattern that Bailey (1997) reports for the merger in Texas. In the coding of responses to questions inserted into the Texas poll, the merger is identified by the occurrence of a lax vowel in *steel*.

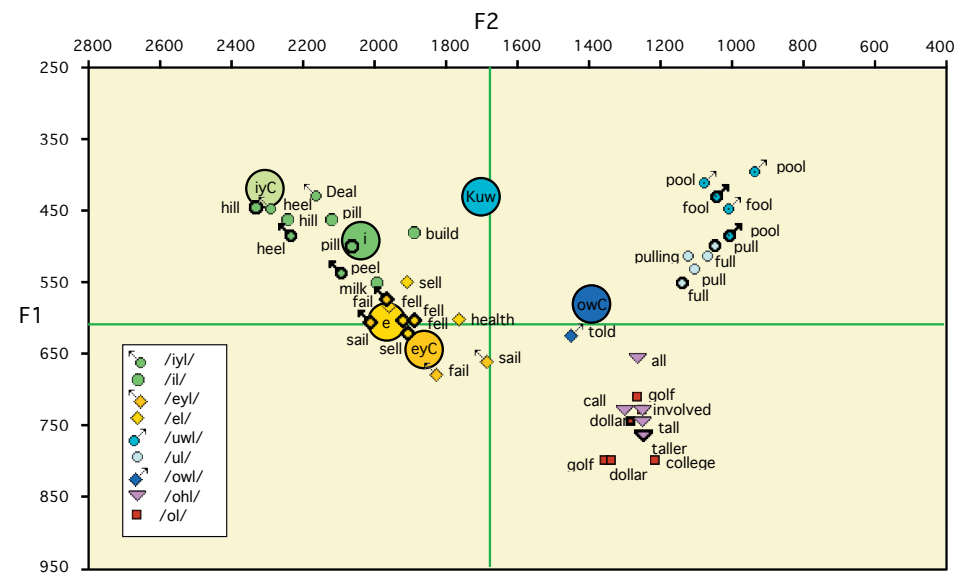


Figure 9.7. Vowels before /I/ of Sheldon M., 31, Lubbock TS 542

The second stage of the Southern Shift, the reversal of the relative positions of /eyI/ and /eI/, can be observed in Figure 9.7. The corresponding vowels before /I/ are not reversed, but are plainly merged.

Among the back vowels of Figure 9.7, there is no trace of fronting of the tokens before /I/. The distributions of /uwI/ and /ulI/ are close but non-overlapping. In the Telsur minimal pair test, Sheldon M. rated the contrast of *pool* and *pull* as 'close', and the analyst listening to his pronunciation agreed.

In low back position, considerable overlap of /oI/ and /ohI/ is observed, but it can also be noted that the highest tokens are in the /ohI/ class and the lowest in the /oI/ class. The upper right circle for Lubbock on Map 9.2 is orange, indicating a transitional state. It is in fact a near-merger. In response to each of the four minimal pairs, Sheldon M. said that it was 'the same' and the analyst judged his pronunciations as 'close'. There is no back upglide associated with /ohI/.

### Other mergers before /I/

In several of the vowel charts just given, one can observe a tendency for the merger of /eI/ and /eyI/ before /I/ in *fell* and *fail*, *sell* and *sail*. In general, this merger is closely associated with the merger of /iI/ and /iyI/. There are 49 cases of merger of /iI/ and /iyI/, and of these, 27, just over half, showed the /eI/ ~ /eyI/ merger also. There are only seven cases of speakers with an /eI/ ~ /eyI/ merger who do not have the /iI/ ~ /iyI/ merger.

In the course of the study, Telsur found evidence for a number of other mergers of back vowels before /I/ codas. Figure 9.4 shows a merger of /owI/ with /uwI/ and /ulI/. Minimal pairs for these contrasts were introduced in the course of the study but not consistently over the whole Telsur sample. In order of frequency of 'same' responses, these items were:

- the merger of /ulI/ and /owI/ as in *bull* and *bowI*;
- the merger of /ʌI/ and /ohI/ as in *hull* and *hall*;
- the merger of /ulI/ and /ʌI/ as in the rhyming pair *bull* and *hull*;
- the merger of /ʌI/ and /owI/ as in *hull* and *hole*.

The first three of these at least deserve further study.