Chapter 7

Other Phonological Features

7.1 Introduction

The most important phonological feature of Erie from a dialectological standpoint is the merger of /o/ and /oh/. The previous chapter described the status of this merger in the region, and showed that Erie speakers are categorically Midland with respect to this feature. This chapter will consider the other phonological features that display regional and age-based differences for the speakers in my corpus.

First, Section 7.2 will consider the system of back upgliding vowels, which are shown in the ANAE to have clearly distinct distributions in the North and the Midland. Next, Section 7.3 will consider the structurally related changes of the Northern Cities Shift and how they relate to the spread of the merger of /o/ and /oh/ discussed in the previous chapter. Finally, Section 7.4 will present results for two other phonological variables that provide apparent time evidence for change among the speakers in my corpus.

7.2 Back Upgliding Vowels

This section examines the system of back upgliding vowels: /uw/, /ow/, and /aw/. These three vowels are undergoing fronting in many dialects of North American English; however, the progress of the change in F2 and the effect of segmental environment depends both on the region and the specific vowel (see Labov et al. (2006:152–168) for a complete description of how the behavior of the back upgliding vowels varies by region). In general, the fronting of /uw/ after coronals is most widespread,[1] and the fronting of /aw/ is most advanced.[2]

The division between the North and the Midland is quite strong with respect to the behavior of the back upgliding vowels. The difference is especially strong for /ow/, where the Midland has the strongest and most consistent fronting, and the North has very little. The fronting of /uw/ after non-coronals is also much more advanced in the Midland than in the North. This section will show that the speakers from Erie, in general, display Northern patterns in the back upgliding system. This systematic behavior is in marked contrast to the categorical Midland behavior of the Erie speakers with regard to the merger of /o/ and /oh/ shown in Chapter 6.

7.2.1 /uw/

The ANAE shows that the degree of /uw/ fronting depends heavily on the identity of the syllable onset. Specifically, /uw/ after coronal onsets is fronted (with an F2 mean value greater than the F2 midline of 1550 Hz) for nearly all speakers in North America, while fronting after non-coronal onsets is not as extreme, and limited to certain dialect regions.

[1]Only two dialects do not have strong fronting of /uw/ after coronals: in the North there is moderate fronting, and only in Eastern New England is /uw/ still a back vowel after coronals.

[2]"Advanced" is used here in the sense that the fronting of /aw/ has reached its maximum value and is receding. Only three regions show a significant age effect for /aw/ (Mid-Atlantic, South, and North), and these effects are all positive, i.e., the apparent time distribution shows that younger speakers have less fronting than older speakers in these regions.

When discussing this allophonic variation, tokens of /uw/ occurring after coronal onsets will be referred to with the notation /Tuw/, and tokens occurring after non-coronals with /Kuw/. In addition, a following /l/ has a uniform backing effect in the North and the Midland (only some Southern speakers also have fronting of /uw/ before /l/), so tokens before /l/ will not be discussed in this section.

Figure 12.2 in the ANAE shows that the mean F2 value of /Tuw/ for all speakers in North America is 1811 Hz, and Figure 12.3 shows that the mean F2 value of /Kuw/ is 1433 Hz. Additionally, Table 12.1 displays the results of a linear regression analysis for F2 of /uw/, and by far the strongest segmental effect is the presence of a coronal onset.

These general findings are reproduced for the speakers in my corpus as a whole. The mean F2 value of /Tuw/ is 1758 Hz (N = 2,032), and the mean F2 value of /Kuw/ is 1265 Hz (N = 639). The relative positions of the two allophones in my corpus are thus similar to the ANAE data. However, the absolute mean values are slightly lower, reflecting the fact that the region included in my corpus does not include speakers with the most extreme fronting of /uw/.

A linear regression analysis for F2 of /uw/ was conducted to determine the effects of the segmental environment on /uw/ fronting. This analysis takes into consideration the following features:[3]

- **Preceding segment**: oral labial, nasal labial, oral apical, nasal apical, palatal, velar, liquid
- **Following segment manner of articulation**: stop, affricate, fricative, nasal
- **Following segment place of articulation**: labial, labiodental, interdental, apical, palatal, velar

[3]These features represent the codes defined by the Plotnik program for the preceding and following segmental environments. Codes for the tokens in the environments that were excluded based on the criteria in Section 3.8 are not included in the regression analyses in this chapter.

Feature	Coefficient	Probability
Intercept	1228	< 0.0001
Preceding oral apical	539	< 0.0001
Preceding nasal apical	447	< 0.0001
Preceding palatal	497	< 0.0001
Preceding liquid	503	< 0.0001
Following interdental	-298	< 0.05
Following apical	-82	< 0.05

Table 7.1: Linear regression coefficients for F2 of /uw/ for all environmental features significant at α = 0.05 (N = 2,671)

- **Following segment voicing**: voiceless, voiced
- **Following sequences**: one following syllable, two following syllables, complex coda, complex coda and one following syllable, complex coda and two following syllables

The results of the regression analysis are shown in Table 7.1. The four significant onset codes are all from coronal consonants, and they all show a strong fronting effect of about 500 Hz. This is similar to the 480 Hz coefficient shown for coronal onsets in Table 12.1 in the ANAE. In a departure from the ANAE results, no other onset consonants have a significant effect on the fronting of /uw/ (Table 12.1 shows significant effects for velar, obstruent+liquid, labial, and nasal onsets for the ANAE data). The effects of the following segment on /uw/ also differ somewhat from the observations in the ANAE. Table 7.1 shows a strong backing effect when /uw/ is followed by an interdental (in practice, this simply means the phoneme /θ/ since the phoneme sequence /uð/ does not occur in my corpus). This specific effect was not observed in the ANAE; however, they do note that following fricatives have a significant backing effect of -137 Hz. In addition, Table 7.1 shows a negative coefficient for following apicals, whereas the analysis for the ANAE data shows a positive coefficient for following coronals. However, the effects are not large in either study: -82 Hz and 70 Hz, respectively.

As an example of the main allophonic effect of coronal onsets on the fronting of /uw/, Figure 7.1 shows all tokens of /uw/ for Rachel A., from Ripley, NY, with separate symbols for tokens of /Kuw/ and /Tuw/.[4] Her mean F2 value of /Kuw/ is quite far back at 1108 Hz. Her fronting of /Tuw/ is not as extreme as it is for some speakers, but at 1685 Hz it is well in front of the mid line. There is a fair amount of overlap between the two classes, mostly caused by several fronted tokens of /Kuw/. There are very few non-fronted tokens of /Tuw/.

The ANAE shows that the Midland and the North clearly behave differently with respect to the fronting of /uw/. The mean values of /uw/ by region in Table 12.2 in the ANAE show the two regions occupying opposite ends of the continuum: the Midland has the largest amount of /uw/ fronting, with a mean F2 value of 1713 Hz, whereas the North has the backest /uw/, with a mean F2 of 1359 Hz. However, based on the more detailed regional results from the ANAE, no differentiation among the speakers in my corpus would be expected for the /Tuw/ allophone. While it is true that the Midland and the North are divided in their behavior with respect to /Tuw/, the division does not cut across the entire region (see ANAE Map 12.1 for the basis for the following discussion). Specifically, many Midland and Northern speakers behave similarly and follow the general pattern in North America of moderate fronting of /Tuw/ (defined as having an F2 mean value between 1550 Hz and 2000 Hz). Areas with extreme fronting are sometimes found in the Midland (for example, in the cities of Indianapolis and Kansas City); however, this isogloss excludes most of the Midland. Most importantly for this study, none of the Pittsburgh speakers are contained within it—the mean value for F2 of /uw/ in Table 12.2 in the ANAE shows a value of 1529 Hz for Western Pennsylvania. On the other hand, the North does contain

[4]The vowel means for /iyC/ and /o/ are also displayed as reference points for her vowel system

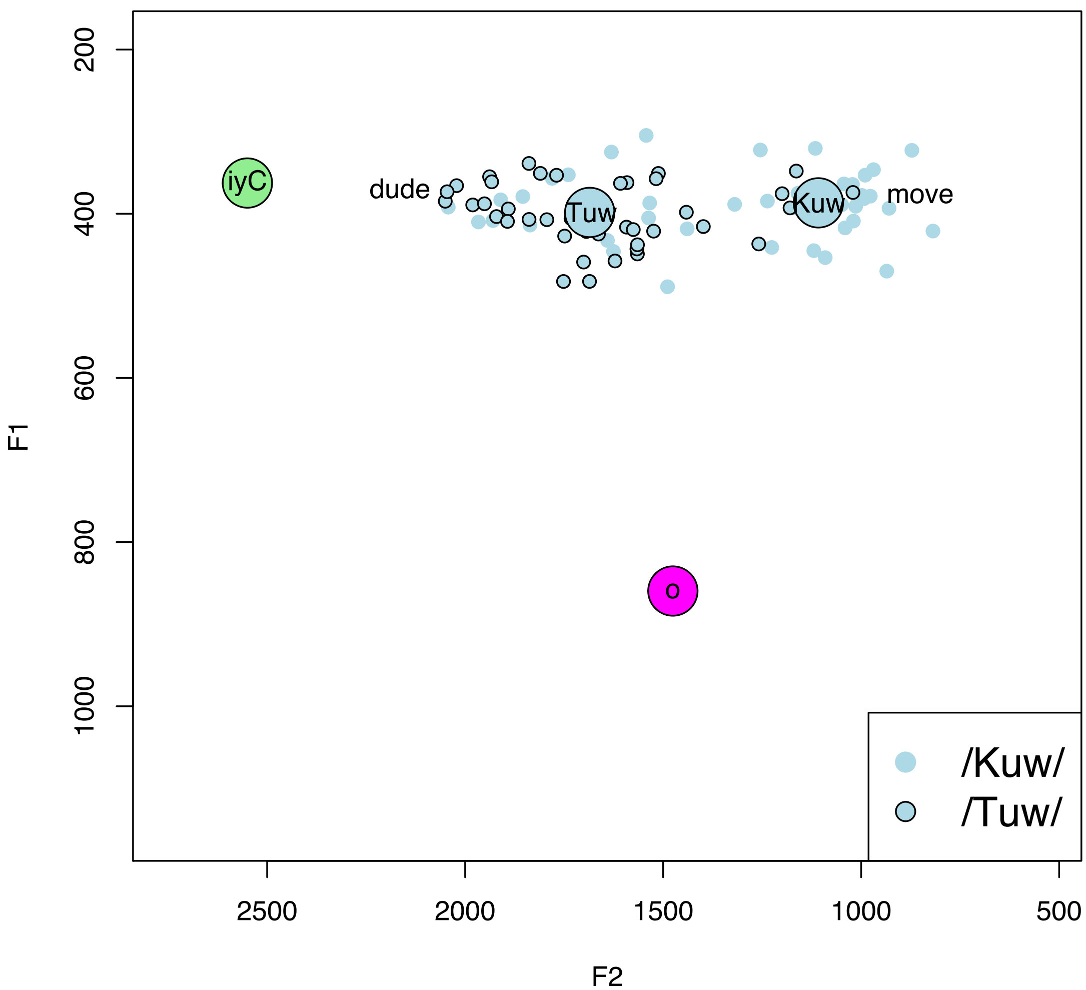

Figure 7.1: /Kuw/ and /Tuw/ for Rachel A., born 1951 in Ripley,
Mean(/Kuw/) = (387, 1108), N=20; Mean(/Tuw/) = (398, 1685), N=45

a large number of speakers with non-fronted /Tuw/; however, most of them are located in the western part of the region in Wisconsin and Minnesota. The results for the Northern speakers in the cities closest to Erie also mostly show the general pattern of moderate fronting of /Tuw/.

Figure 7.2 confirms this expectation for the speakers in my corpus. Nearly all of them have moderate fronting of /Tuw/ with an F2 value between 1550 and 2000 Hz. The speakers that have a mean value for /Tuw/ less than 1550 Hz are not mostly located in the North; neither are the speakers with a mean value for /Tuw/ greater than 2000 Hz mostly located in the Midland. Indeed, no clear regional pattern for these two groups of speakers with more extreme behavior of /Tuw/ is apparent.

The results for /Kuw/ from the ANAE, however, suggest a different regional pattern for the speakers in my corpus. ANAE Map 12.2 shows that the differentation between the Midland and the North with respect to /Kuw/ is much stronger than for /Tuw/. The entire Northern region is contained within the isogloss showing back values of /Kuw/, whereas most Midland speakers have either moderate or strong fronting of /Kuw/.[5]

Figure 7.3 shows the geographic distribution of speakers from my corpus with respect to the fronting of /Kuw/.[6] In this case, a clear regional pattern is observable: most of the speakers from Western Pennsylvania south of Erie County have moderate to strong fronting of /Kuw/, whereas most of the speakers from Erie County and New York show no fronting. The city of Erie clearly patterns together with the North with respect to this variable, and

[5]The isogloss for back values of /Kuw/, defined as speakers having a mean F2 of /Kuw/ less than 1200 Hz, cuts through the region between Pittsburgh and Erie. However, it is not clear why Erie was included inside this isogloss. Neither of the two Erie speakers match the selection criterion for this isogloss, and Erie is not entirely surrounded by communities inside the isogloss (due to the fact that Pittsburgh is also not included in it). So, according to the ANAE's isogloss construction procedure (Labov et al. 2006:42), they should be outside this isogloss.

[6]The displayed values of the feature are slightly different from those in the ANAE. The F2 threshold for the highest range of /Kuw/ fronting was set at 1450 Hz, 100 Hz lower than the 1550 Hz threshold displayed in Map 12.2 in the ANAE. This adjustment was necessary to produce a clear contrast between the Northern and Midland speakers, since few Midland speakers in my corpus have fronting of /Kuw/ greater than 1550 Hz.

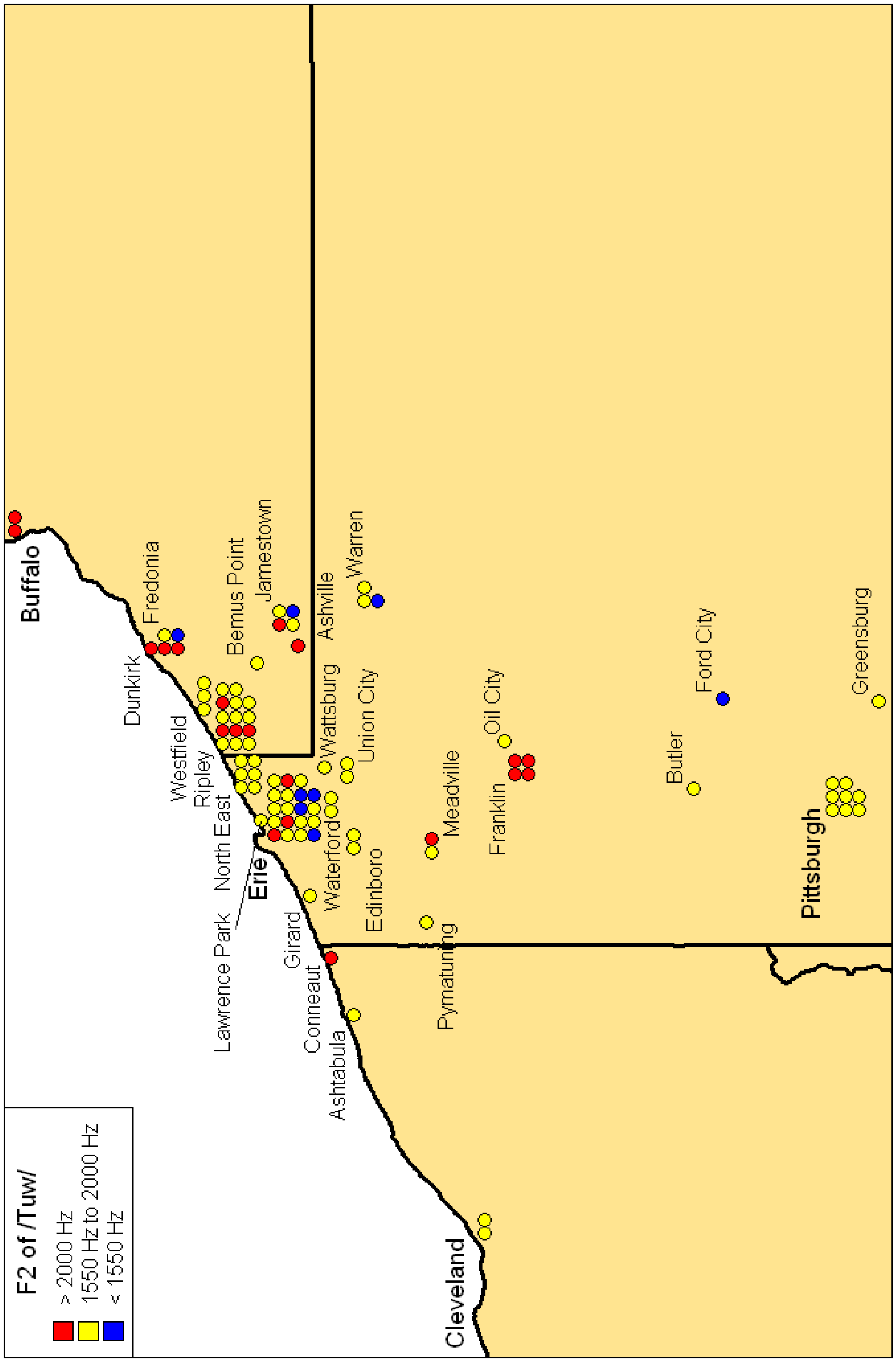

Figure 7.2: F2 of /Tuw/ (/uw/ after coronals)

Feature	Coefficient	Probability
Intercept	1148	< 0.0001
Preceding oral labial	-92	< 0.0001
Preceding nasal labial	-62	< 0.01
Preceding oral apical	123	< 0.0001
Preceding nasal apical	187	< 0.0001
Preceding palatal	124	< 0.0001
Preceding velar	41	< 0.01
Preceding liquid	-44	< 0.01
Following labial	-105	< 0.0001
Following interdental	-78	< 0.01
Following apical	22	< 0.05
Following velar	98	< 0.0001
Following fricative	-101	< 0.01
One following syllable	-25	< 0.05

Table 7.2: Linear regression coefficients for F2 of /ow/ for all environmental features significant at α = 0.05 (N = 6,341)

not with Pittsburgh and the Midland. This is in contrast to the Northern behavior of /o/ and /oh/ in Erie described in Chapter 6.

7.2.2 /ow/

The mid vowel /ow/ is fronting in parallel with /uw/ for many speakers in North America; however, the fronting of /ow/ is, in general, not as extreme as /uw/, and most fronted tokens are not much further front than the mid line of 1550 Hz. As an overview for the allophonic conditioning on the fronting of /ow/, Table 7.2 shows the segmental environment features that have statistically significant coefficients.

The results in Table 7.2 are quite similar to a similar analysis for the ANAE data using a similar number of tokens (see Table 12.3 in the ANAE). Both regression analyses show that /ow/ fronting is increased with coronal and velar onsets but inhibited by labial onsets.

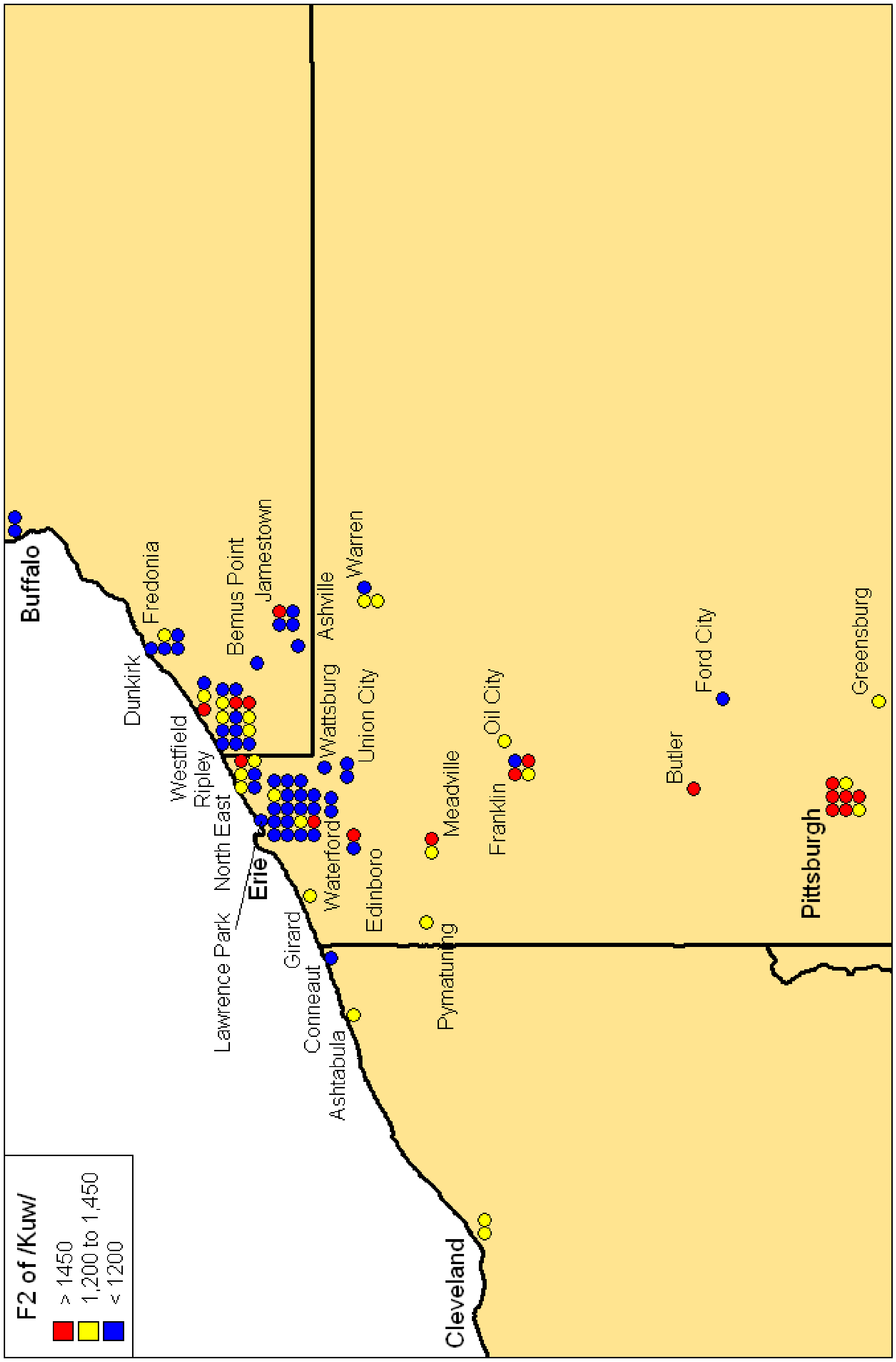

Figure 7.3: F2 of /Kuw/ (/uw/ after non-coronals)

Furthermore, both analyses show that fronting of /ow/ is inhibited by a following labial, a following fricative, or the presence of a following syllable. The analysis of my data set additionally shows a negative coefficient for preceding liquids and following interdentals as well as a positive coefficient for following velars and apicals where no statistically significant effect was found in the ANAE. On the other hand, the regression on my corpus did not find statistically significant effects for two environments that were significant in the ANAE analysis: word-final position and following nasal. Again, tokens before /l/ were excluded for this analysis (along with all other tokens matching the exclusion criteria listed in Section 3.8). A regression analysis including all tokens confirms the ANAE's finding that a following /l/ has by far the strongest effect on the position of /ow/, with a coefficient of -286 ($p < 0.0001$).

The division observed in the ANAE between the North and the Midland is even stronger with respect to the fronting of /ow/ than the fronting of /uw/. For this vowel, the Midland and the South behave quite similarly, and an isogloss based on the F2 value of /ow/ sharply divides the eastern part of North America into two regions. In the North, very few speakers have mean F2 values of /ow/ greater than 1300 Hz, whereas in the Midland and the South, very few speakers have values less than 1300 Hz. Again, Table 12.4 in the ANAE shows that the North has the lowest F2 mean value for /ow/ from among all the dialect regions, at 1127 Hz. In contrast to /uw/, however, where the speakers from Western Pennsylvania showed much less fronting than the rest of the Midland, speakers from these two regions have similar mean values for /ow/, and both are well over the 1300 Hz value separating the North and the Midland. In fact, the fronting of /ow/ is more advanced in Western Pennsylvania than in the rest of the Midland: the mean F2 of /ow/ in Western Pennsylvania is 1422 Hz, whereas it is 1367 Hz for speakers from the rest of the Midland.

As an example of a Pittsburgh speaker with strong fronting of /ow/, Figure 7.4 displays all tokens of /ow/ for Cecilia S., a speaker from the ANAE (TS 356). In this figure, all tokens of /ow/ before /l/ are marked with a black outline; these tokens are nearly all very back. On the other hand, most of the other tokens not before /l/ are fronted.[7]

As an example of a Northern speaker with a very back /ow/, Figure 7.5 shows all /ow/ tokens for Bill R. from Buffalo. In this plot, there is no separation between tokens before /l/ and tokens not before /l/: almost all tokens of /ow/ are very back. The non-fronted mean of /ow/ for Bill R. is aligned with his mean F2 value for /Kuw/, which is also quite far back (despite his strong fronting of /Tuw/).

Figure 7.6 shows the relative fronting of /ow/ for all of the speakers from my corpus. The red and orange symbols represent speakers with fronted /ow/ (defined as having a mean F2 value of /ow/ higher than 1300 Hz), whereas the symbols in three shades of blue represent speakers with non-fronted /ow/ (with a mean F2 value lower than 1300 Hz). The general pattern in Figure 7.6 is quite similar to the pattern observed for the fronting of /Kuw/ in Figure 7.3: speakers in Western Pennsylvania in the counties south of Erie mostly have fronted /ow/, whereas speakers from Erie County and Chautauqua County, NY, have non-fronted /ow/. Again, Erie's linguistic behavior with respect to this variable is clearly Northern.

The fact that the isoglosses for /ow/ and /Kuw/ are so similar suggests that the behaviors of /ow/ and /Kuw/ are structurally linked. That is, if a speaker has fronted /ow/, then he is very likely to also have fronted /Kuw/, and vice versa. A correlation test between the mean F2 values for /ow/ and /Kuw/ across all 90 speakers in the corpus provides further evidence for this: the correlation coefficient for the means of these two vowels is 0.64 ($p < 0.0001$). On the other hand, the behaviors of /ow/ and /Tuw/ are not linked at all: their correlation coefficient is 0.03 (*n.s.*).

[7]Cecilia S.'s mean F2 value of /ow/ is higher here at 1536 Hz than the value of 1457 calculated from the manual ANAE measurements. This discrepancy is due to the presence of several formant measurement errors (the tokens of /ow/ in Figure 7.4 with an F1 close to 800 Hz). However, the pattern wherein many tokens of /ow/ are fronted to around 1550 Hz, but most tokens remain non-fronted before /l/ is still apparent, despite the measurement errors.

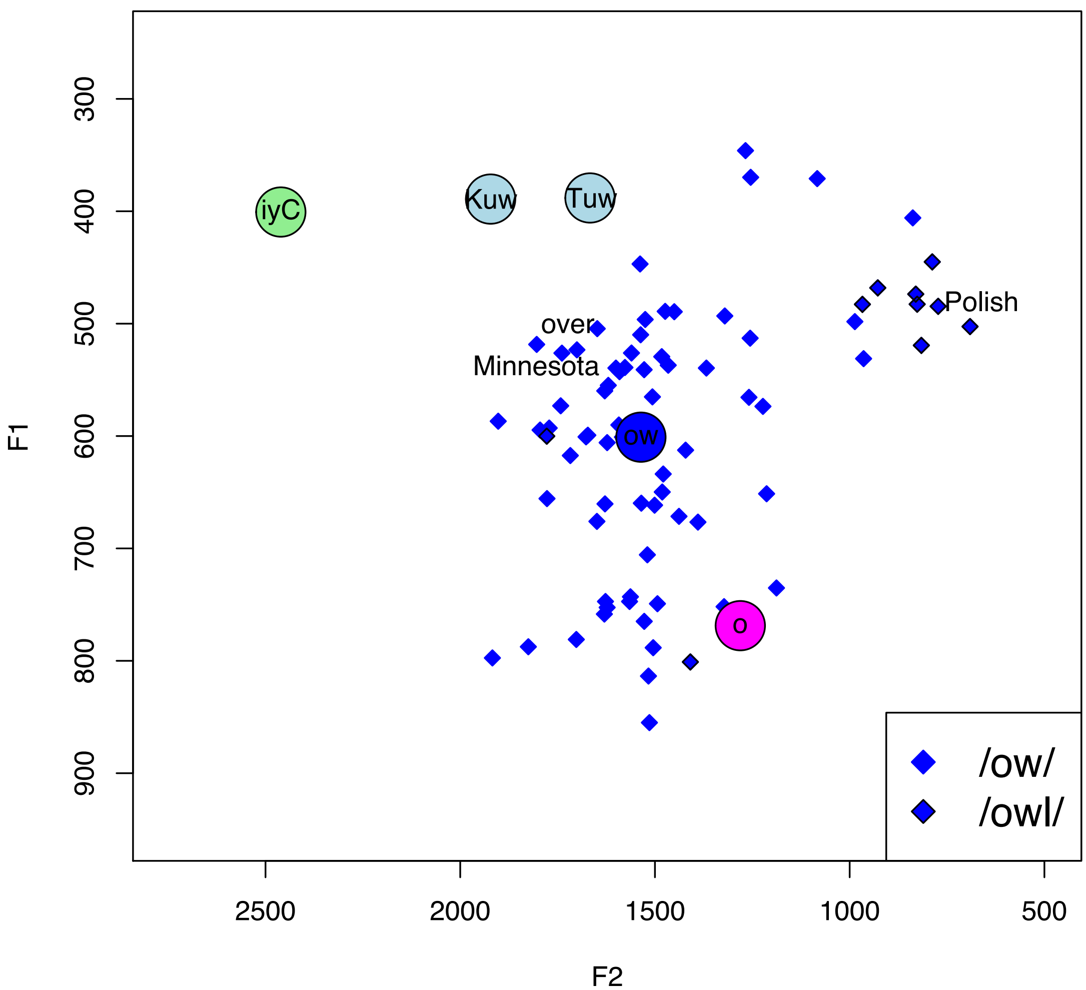

Figure 7.4: /ow/ for Cecilia S., born 1933 in Pittsburgh
Mean(/ow/) = (601, 1536), N=63

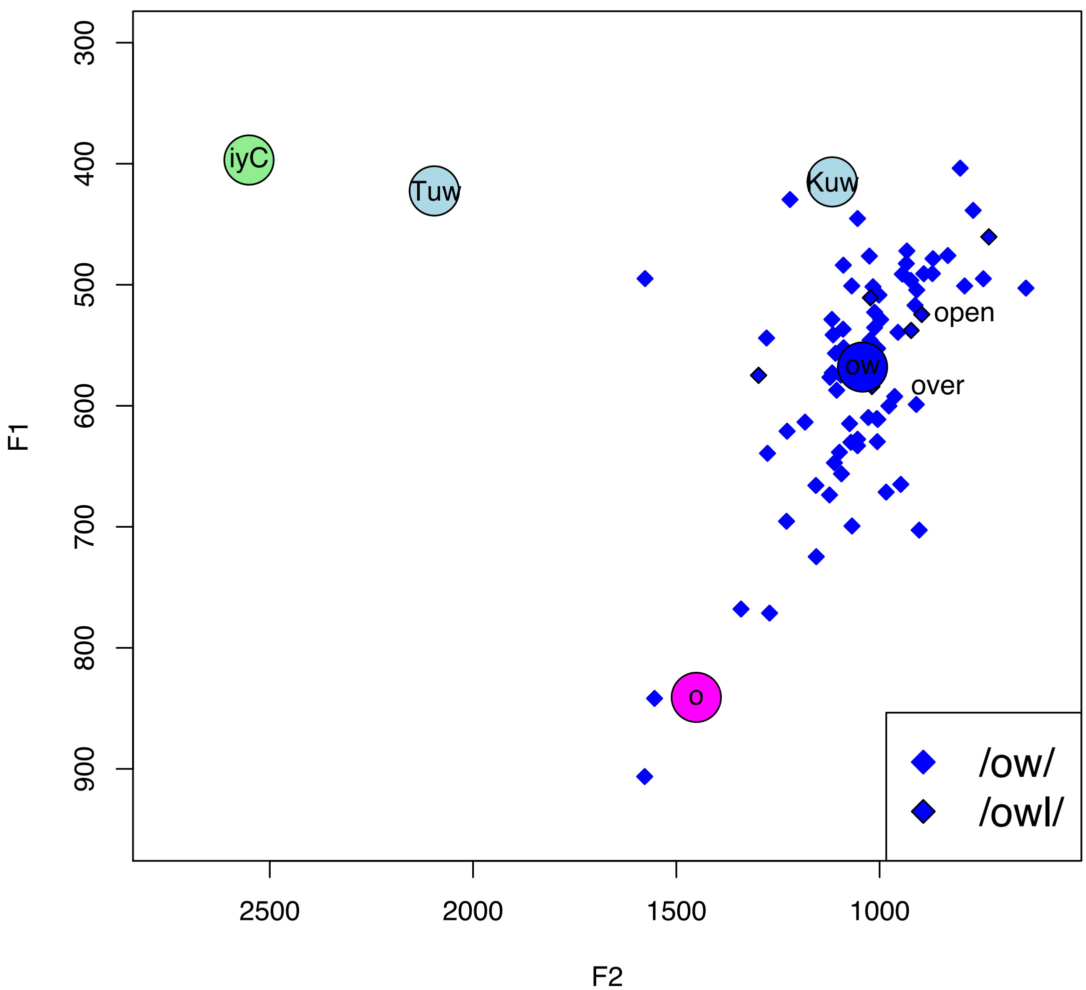

Figure 7.5: /ow/ for Bill R., born 1927 in Buffalo
Mean(/ow/) = (568, 1041), N=65

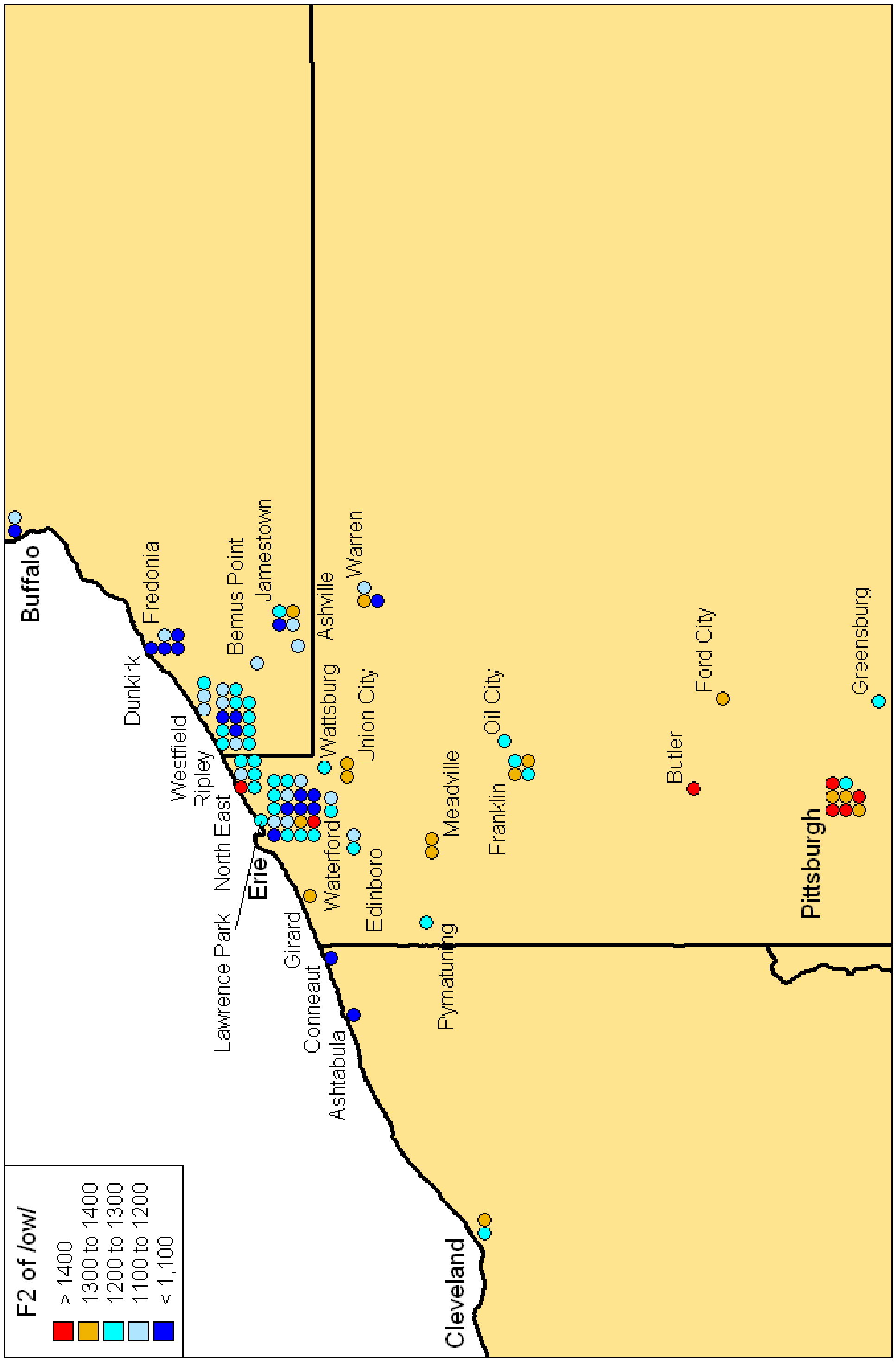

Figure 7.6: F2 of /ow/

7.2.3 /aw/

The lowest member of the system of back upgliding vowels, /aw/, is also fronted in much of the Midland and the South. For many of these speakers, the nucleus of /aw/ is consistently front of center, and is closer to [æw]. The general regional pattern is the same as it is for /Kuw/ and /ow/: Northern speakers mostly show conservative treatment of /aw/ with mean values less than 1550 Hz; Midland and Southern speakers show moderate to strong fronting. However, the strongest areas of fronting (where the mean F2 values of /aw/ are consistently over 1800 Hz) are found in the Mid-Atlantic region and the South. The Midland region around Western Pennsylvania is mixed with respect to this variable. The isogloss for the region with fronted /aw/ in Map 12.4 in the ANAE actually passes to the south of Pittsburgh. Thus, Pittsburgh and Erie are both included in the same isogloss as the North for /aw/. However, the speakers in both Pittsburgh and Erie are split 50-50 for this isogloss: three out of the six speakers from Pittsburgh have a mean F2 of /aw/ less than 1550 Hz, as does one out of the two speakers from Erie.

Figure 7.7 displays the values for this quantitative isogloss for /aw/ for the speakers in my corpus. As is the case for the ANAE data from the region, the speakers are mixed and no clear regional pattern is apparent. Roughly one-third (31 / 90) of the speakers from the corpus have a mean F2 value for /aw/ greater than 1550 Hz, and two-thirds (59 / 90) have a non-fronted /aw/.

The ANAE also defines a qualitative measure, the AWY criterion, for the fronting of /aw/ based on its position relative to the mean of /ayV/. Again, the Northern speakers, in general, show conservative behavior with a mean F2 value of /aw/ less than the mean of /ayV/. The Midland and Southern speakers, on the other hand, almost categorically show a mean value of /aw/ greater than the F2 mean of /ayV/. This structural isogloss shows higher consistency than the quantitative isogloss based on the value of 1550 Hz, and the ANAE authors use this fact to argue that the AWY line is better at dividing the fronted and

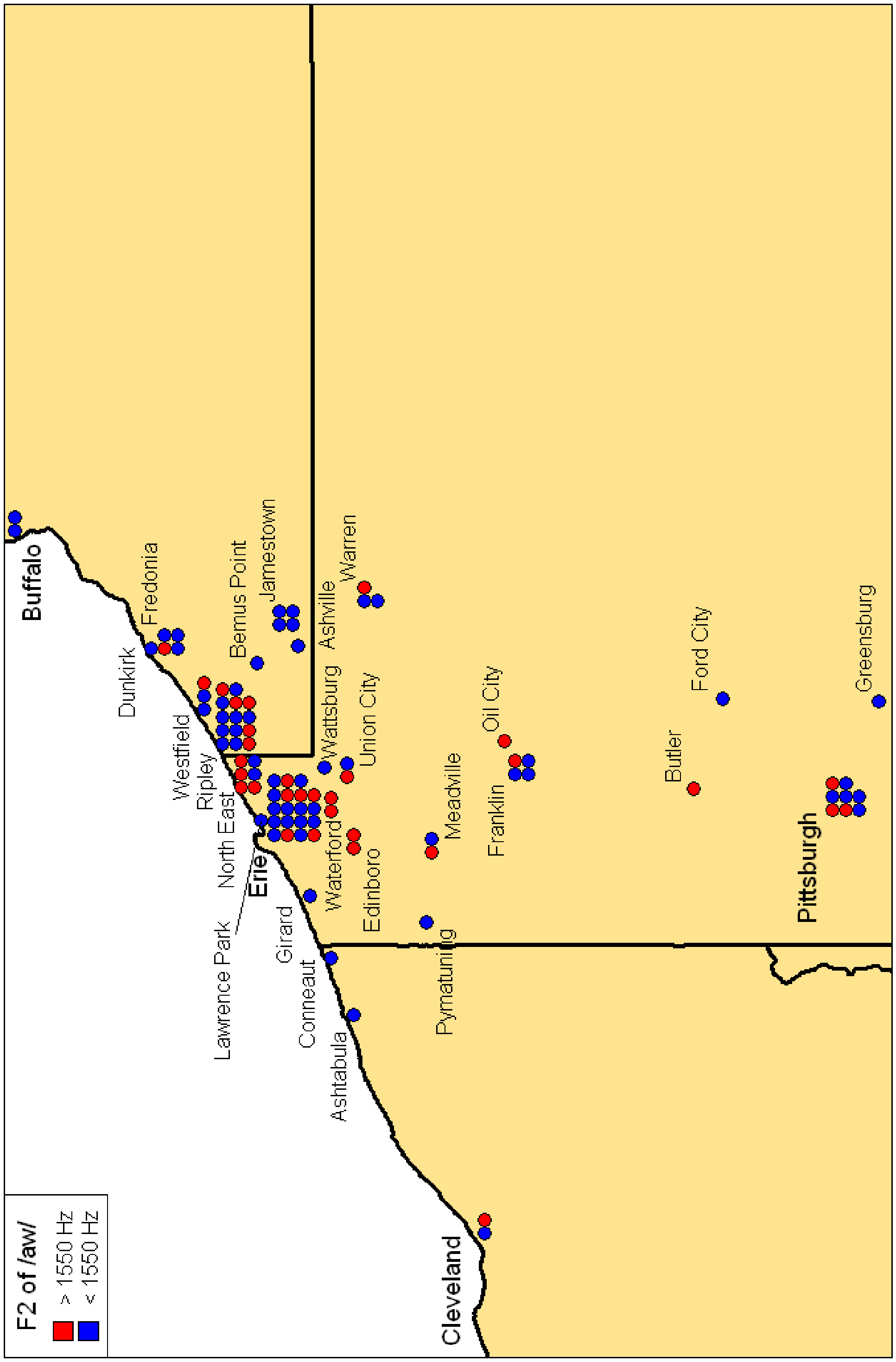

Figure 7.7: F2 of /aw/

non-fronted regions into two distinct groups Labov et al. (2006:160).

For the purposes of this study, a comparison of these two measures of the fronting of /aw/ is interesting, since they show different patterns in Pittsburgh and Erie for the ANAE speakers. As discussed above, the speakers in Erie and Pittsburgh were split evenly for the quantitative measure of /aw/ $>$ 1550 Hz, and were included inside the Northern isogloss in ANAE Map 12.4. Conversely, ANAE Map 12.5 shows that the six Pittsburgh speakers and the two Erie speakers categorically have a mean F2 value of /aw/ greater than the value of /ayV/. The structural isogloss for the non-fronted North thus does not include either of these two cities in western Pennsylvania. This area where /aw/ is more front than /ayV/ also stretches up from the Midland in northwestern Ohio to include Cleveland; thus, there is a discontinuity in the Northern isogloss for the AWY criterion stretching from Toledo to Buffalo.

Figure 7.8, however, shows that the speakers from my corpus are more mixed in this qualitative isogloss than the ANAE speakers from western Pennsylvania. Approximately one-fourth of them (23 / 85)[8] show a fronted value of /aw/ in comparison to /ayV/, whereas three-fourths (62 / 85) show non-fronted /aw/.

Thus, it appears that the fronting of /aw/ is not as closely tied to the fronting of /ow/ and /Kuw/ as the latter two are to each other. Correlation tests do show significant correlation coefficients between /aw/ and each of the other two back upgliding vowels. However, their values are much smaller than the value for the correlation between /ow/ and /Kuw/: the correlation between the F2 of /aw/ and the F2 of /ow/ is 0.26 ($p < 0.05$), and it is 0.27 ($p < 0.05$) for /aw/ and /Kuw/.

There is also no clear regional differentiation based on the fronting of /aw/ before /n/, an environment that generally favors stronger fronting, and might thus distinguish the

[8]Five speakers are not included in this count or in Figure 7.8 because they did not produce any tokens of /ayV/. These speakers were only recorded reading the word list, and they read an earlier version of the list that did not include the tokens such as *high*, *rider*, and *hide* that are listed in the word list in Appendix C.

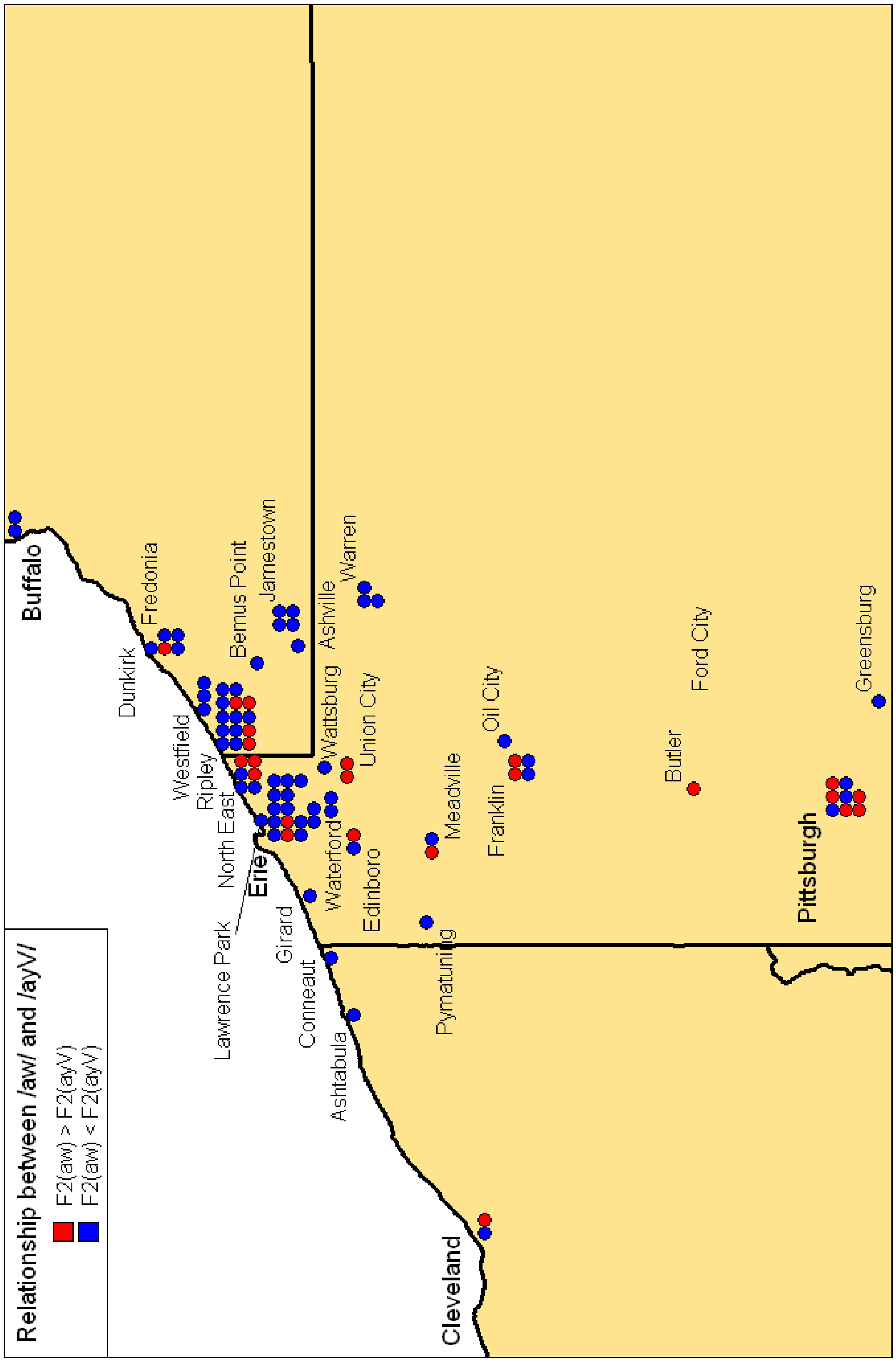

Figure 7.8: Relationship between /aw/ and /ayV/

Midland and Northern speakers better. Only six speakers in the corpus have a mean F2 value of /aw/ before nasals greater than 1800 Hz: they are scattered throughout the entire region, and are located in Oil City, Edinboro, Erie, North East, Ripley, and Cleveland. The remaining speakers do not show any regional pattern.

7.3 NCS vowels

Chapter 6 showed that the merger of /o/ and /oh/ spread to Erie around the turn of the 20th century. Subsequently, it continued to spread northward, and became a feature of the town of Ripley, NY in the latter half of the 20th century. On the surface, this slow spread of the merger to these areas is unsurprising. It coincides with the increasing spread of the merger throughout many areas of North America, and can be seen as an instantiation of Garde's Principle (by which mergers expand at the expense of distinctions). However, when considered in the specific context of where the merger has spread to, its advance through Erie County, PA and into Chautauqua County, NY is actually quite remarkable. This is because the North, with the fronting of /o/, represents one of the three regions of stable resistance to the spread of the merger of /o/ and /oh/ in North America.[9] The fact that /o/ is fronted in the North means that the distance between /o/ and /oh/ is generally quite large. This large margin of security brings about the Northern resistance to the spread of the merger.

This section will consider the the two main components of the Northern Cities Shift: the generalized raising of /æ/ and the fronting of /o/. Specifically, the progress of the NCS in Chautauqua County will be examined together with the spread of the merger of /o/ and /oh/ to Ripley in an attempt to understand why the merger was able to spread into this area of the North.

[9] The other two are the Mid-Atlantic region with raised /oh/ and the South with back upgliding /oh/.

7.3.1 /æ/

The fronting and raising of /æ/ in restricted phonological environments is quite common in North American English. For example, nearly all dialects have fronting and raising before nasal codas (Canada, especially Montreal, is the main exception to this trend (Boberg 2005)). Areas with a continuous system of fronting and raising before /æ/ often have tokens before /d/ and /g/ in an intermediate position between tokens before nasals and tokens before voiceless obstruents. An even more complex system is observed in Philadelphia and New York, where tensing occurs in a wide variety of phonological environments, in addition to being lexically specified for some words and sensitive to morphological constraints (see Labov (1994:429–431) for details of these systems). However, the generalized fronting and raising of /æ/ in all phonological environments is unique to the North. It was the triggering event for the Northern Cities shift, and is the structural precondition that enables the fronting of /o/ in the North. In other dialects where /æ/ is only raised in certain environments, some tokens of /æ/ still remain in low front position and inhibit the movement of /o/ in that direction.

A quantitative measure based on the degree of raising of /æ/ is one of the five criteria that define the North in the ANAE. This isogloss is called the AE1 line, and is defined to include speakers whose F1 mean value of /æ/ (excluding tokens before nasals) is less than 700 Hz. Map 14.4 in the ANAE shows that the largest concentration of speakers matching the AE1 criterion is in the North and the St. Louis corridor. Again, there is a discontinuity in the isogloss at Erie, since neither of the two ANAE speakers from Erie are selected by the AE1 criterion. The homogeneity and consistency values for this isogloss are less than they are for the other defining isoglosses of the North: there are many speakers outside the North with F1 mean values of /æ/ less than 700 Hz (especially in the South), as well as several speakers in the North who do not match this criterion.

Figure 7.9 shows the results for the AE1 criterion for the speakers in my corpus. The highest concentration of speakers with F1 of /æ/ less than 700 Hz is seen in Chautauqua County, NY, especially when the towns of Ripley and Westfield are excluded. There are also several speakers from Pennsylvania that match the AE1 criterion: 12 out of a total of 56. However, all of the speakers from Pennsylvania with an F1 of /æ/ less than 700 Hz are advanced in age. In fact, most of them come from archival sources: the red symbols in Figure 7.9 from Warren, Meadville, and Union City, as well as one of the three from North East are from the DARE recordings; the other two from North East are the speakers from the SWV archive. All of the other speakers from Pennsylvania who match the AE1 criterion (in Pittsburgh, Franklin, Wattsburg, Edinoboro, and Erie) are older than 60.

Figure 7.10 shows the relationship between the raising of /æ/ among the speakers from Pennsylvania and age. The dashed line represents the AE1 criterion, and the figure shows that all speakers with values below the line are older than 60.[10] In addition, many of the other elderly speakers have F1 values for /æ/ close to the 700 Hz line. A linear regression for the F1 value of /æ/ predicted by age shows a significant coefficient of -1.55 ($p < 0.0001$). This means that the regression model subtracts 39 Hz from the F1 value of /æ/ for every 25 years of age, i.e., the raising of /æ/ is decreasing in apparent time.

However, when the same analysis is conducted for the 30 speakers from New York (this group includes the 28 speakers from towns in Chautauqua County and two from the city of Buffalo), a different picture emerges. For these speakers, there is no significant effect based on age. In general, the speakers from New York show more raising of /æ/: there are only 6 speakers from New York with a mean F1 value greater than 750 Hz (compared to a total of 29 speakers from Pennsylvania).

The findings from the ANAE also show a recession in apparent time for the raising of /æ/, both in the North and elsewhere; however, the age coefficient is much larger for the

[10]Since several of the speakers shown in Figure 7.9 are drawn from archival sources, the *x*-axis represents their projected current age, calculated by subtracting their year of birth from 2009.

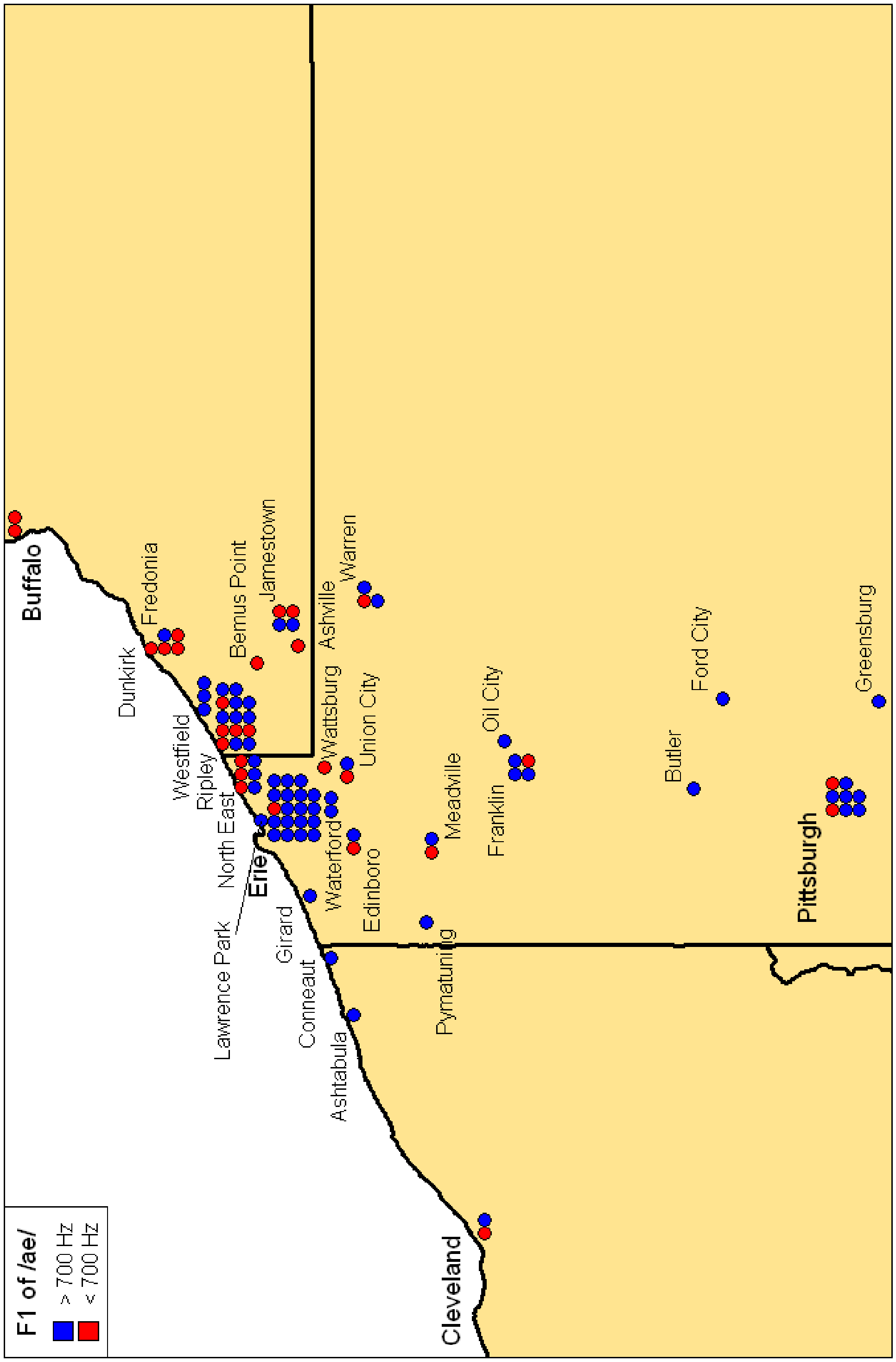

Figure 7.9: Raising of /æ/

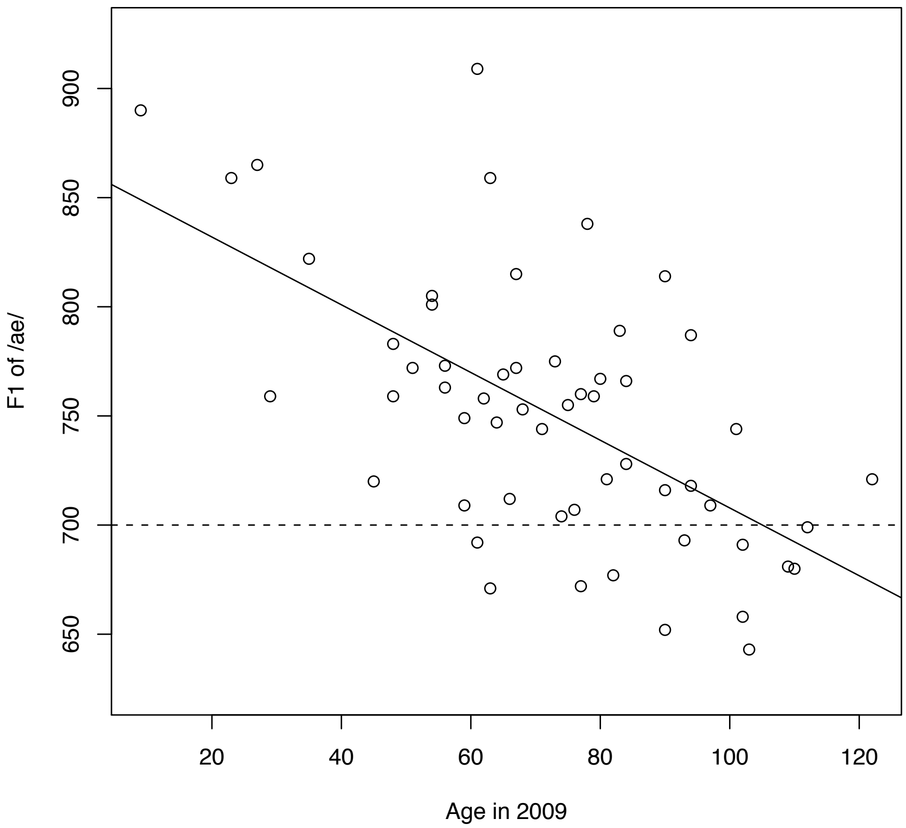

Figure 7.10: F1 of /æ/ by age for 56 speakers from Pennsylvania; Regression coefficient for age is -1.55 ($p < 0.0001$), $r^2 = 0.37$; dashed line shows AE1 criterion (F1 of /æ/ < 700 Hz)

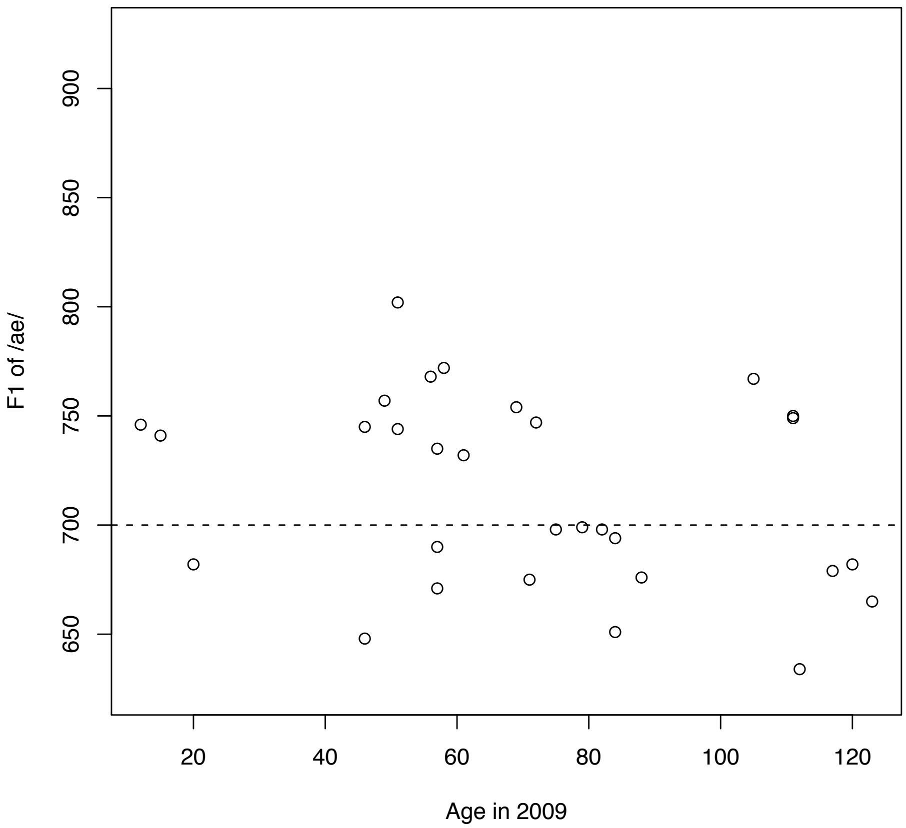

Figure 7.11: F1 of /æ/ by age for 30 speakers from New York; Regression coefficient for age is not significant at $\alpha = 0.05$; dashed line shows AE1 criterion (F1 of /æ/ < 700 Hz)

speakers from the North (Labov et al. 2006:195). Compared with this result, it is intriguing that the Northern speakers from Chautauqua County and Buffalo in my corpus do not also show a significant age effect on the F1 of /æ/. This is likely because the speakers from Chautauqua County do not have /æ/ raised nearly as much as the most advanced speakers in the Inland North. For the speakers from Chautauqua County who do match the AE1 criterion, Figure 7.11 shows that nearly all of them are clustered in the range between 650 and 700 Hz. This is in contrast to the ANAE, where the most advanced Northern speakers have a mean F1 of /æ/ less than 500 Hz (see Map 14.3). Chautauqua County can thus be considered to be on the fringes of the NCS area.

On the other hand, the age coefficient showing the lowering of /æ/ in apparent time for the speakers from Pennsylvania is much larger than the related coefficient calculated for all non-Northern speakers in the ANAE. In the case of the speakers from my corpus, this effect reflects a shift away from membership in the North. The fact that several elderly and archival speakers from the area of Pennsylvania around Erie have a raised /æ/ shows that they patterned with the other Northern speakers of their generation and had the structural precondition for the NCS. However, the fact that /æ/ is not raised for all speakers from Pennsylvania under age of 60 in my corpus shows that this precondition has disappeared. Stage 2, the fronting of /o/ is now blocked for these speakers, as will be demonstrated in the following section.

7.3.2 /o/

The second defining criterion for the North provided by the ANAE is based on the fronting of /o/, Stage Two of the NCS. It is called the O2 line, and is defined to select speakers whose mean F2 value of /o/ is greater than 1450 Hz. The isogloss based on the O2 criterion has a very high consistency in the ANAE: almost no speakers outside of the North are selected by it (see Map 14.5).

Figure 7.12 displays the results for the O2 criterion for the speakers in my corpus. The distribution of speakers is similar to the one shown in Figure 7.9 for the AE1 line, with even fewer speakers from Pennsylvania matching the O2 criterion. As was the case for the AE1 criterion, all of the Pennsylvania speakers who are aligned with the North in the fronting of /o/ are either elderly or drawn from archival sources.[11] This evidence suggests that the fronting of /o/ used to be more widespread in Erie County, but was in the process of receding around the turn of the 20th century.

The status of the speakers from Ripley, NY with regard to the O2 criterion is informative in understanding the spread of the merger of /o/ and /oh/ to that town. Figure 7.12 shows that four speakers from Ripley have an F2 mean value of /o/ greater than 1450 Hz. One of these is an archival speaker from DARE, Jill C. (born in 1889). The other three are Stan R. (born 1948), Rachel A. (born 1951), and Daphne R. (born 1958). These three speakers make up half of the list of six speakers in my corpus who maintain a clear distinction between /o/ and /oh/, judged on the basis of the minimal pair test results (see Table 6.12 in Chapter 6). Thus, based on this evidence alone, it would appear that satisfying the O2 criterion is a sufficient condition (but not a necessary) one for a speaker to maintain the distinction between /o/ and /oh/. However, the evidence from the two speakers in Jamestown who do not match the O2 criterion, but nevertheless maintain a clear distinction between /o/ and /oh/, shows that the actual relationship between a speaker's mean F2 value of /o/ and their status with regard to the merger is more complex than this.

Figure 7.13 plots the relationship between a speaker's mean F2 value of /o/ and their status for the minimal pair test of *Don* vs. *dawn*. In this figure, the production and perception scores are summed together to provide a single score on a scale of 0 to 4 for each speaker. On this scale, 0 represents a complete merger and 4 represents a complete distinc-

[11]The Pennsylvania speakers with a mean F2 greater than 1450 Hz from Warren, Union City, and North East are from archival sources and are no longer alive. The two other speakers from Erie and Wattsburg were born in 1916 and 1927, respectively.

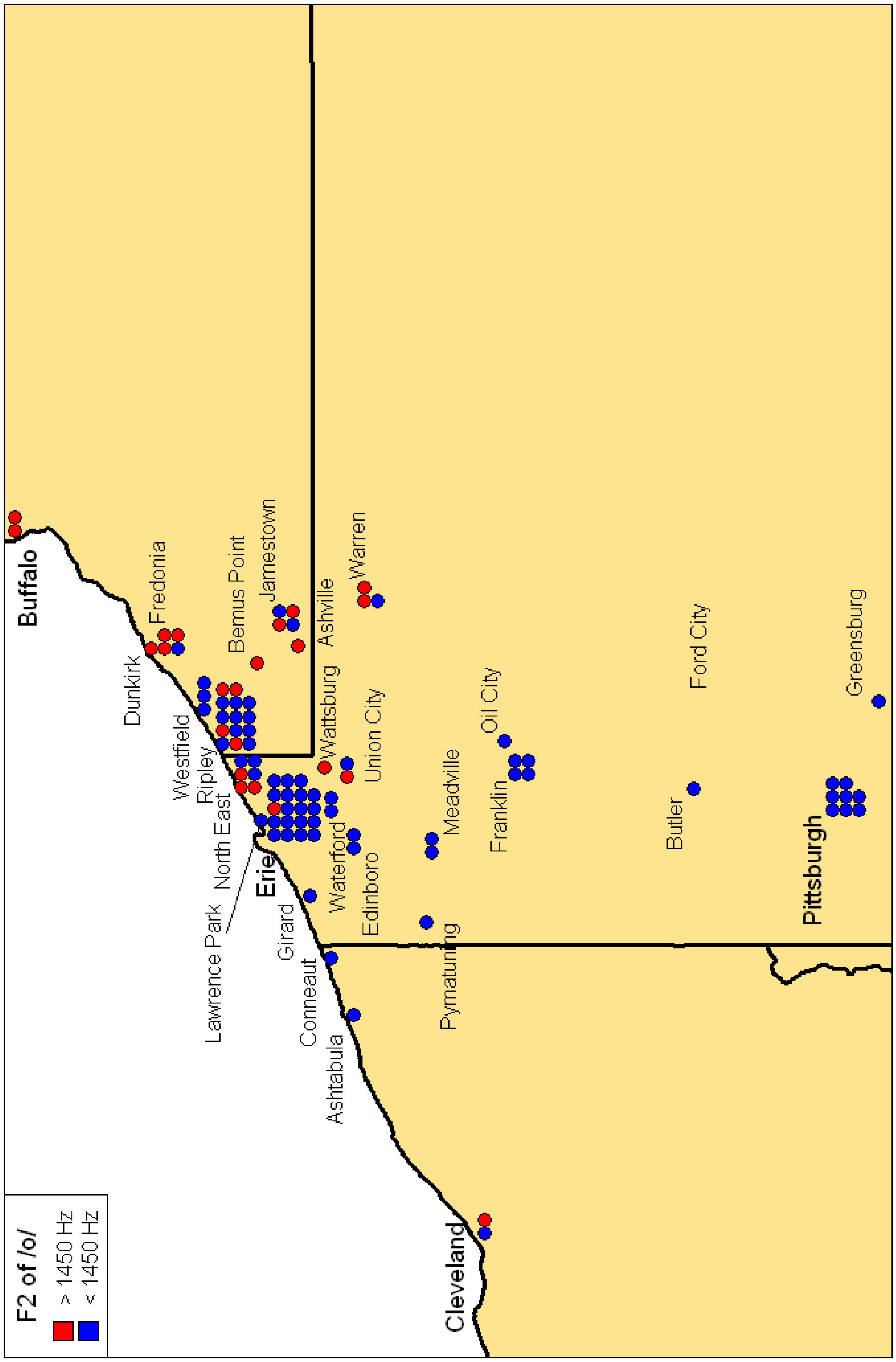

Figure 7.12: The fronting of /o/

tion.[12] The general trend shown in the figure is that speakers with higher F2 mean values for /o/ are more likely to maintain the distinction between /o/ and /oh/, and, conversely, speakers with lower values are more likely to have the merger. A linear regression model predicting the status of the minimal pair test by a speaker's mean F2 value of /o/ shows an increase of 0.96 points on the 5-point scale for every 100 Hz ($p < 0.0001$, $r^2 = 0.41$).[13]

A more precise relationship can be seen by examining the O2 criterion, drawn as a dotted vertical line in Figure 7.13. This line shows that only a single merged speaker has an F2 mean value of /o/ greater than 1450 Hz (Robert E. from Erie, born 1916); however, his mean F2 value is only slightly over the O2 line at 1456 Hz. On the other hand, the figure shows that there are several speakers with a complete distinction between *Don* and *dawn* who have a mean F2 value less than 1450 Hz. Thus, the correct characterization of the relationship between these two features appears to be that if a speaker has the merger of /o/ and /oh/, then their mean F2 value of /o/ will be less than 1450 Hz. That is, the merger of /o/ and /oh/ is a sufficient condition for a speaker not satisfying the O2 criterion.

In addition, Figure 7.14 shows the results for a third measure of the NCS from the ANAE, the ED criterion. This is a quantitative measure of the relationship between the mean values of /e/ and /o/, and is satisfied when their difference is less than 375 Hz. Again, the map based on the ED criterion (Map 14.7 in the ANAE) shows a very high consistency for this feature in the North—very few speakers outside of the North satisfy it. Figure 7.14 shows that only eight speakers in my corpus satisfy the ED criterion. One of them is an archival speaker from Warren, PA, another is one of the three unmerged Ripley speakers who satisfy the O2 criterion, and the remaining six are from other towns in Chautauqua County. The fact that only one out of 14 speakers from Ripley satsified the ED criterion

[12]For the production and perception halves of each minimal pair test, a response of "same" is given the value 0, "close" is given the value 1, and "different" is given the value 2.

[13]Note, however, that almost all speakers in the corpus are either categorically merged or unmerged for this minimal pair. Only two speakers have intermediate values between 0 and 4. This is in contrast to the Midland speakers from the ANAE, who mostly show intermediate values.

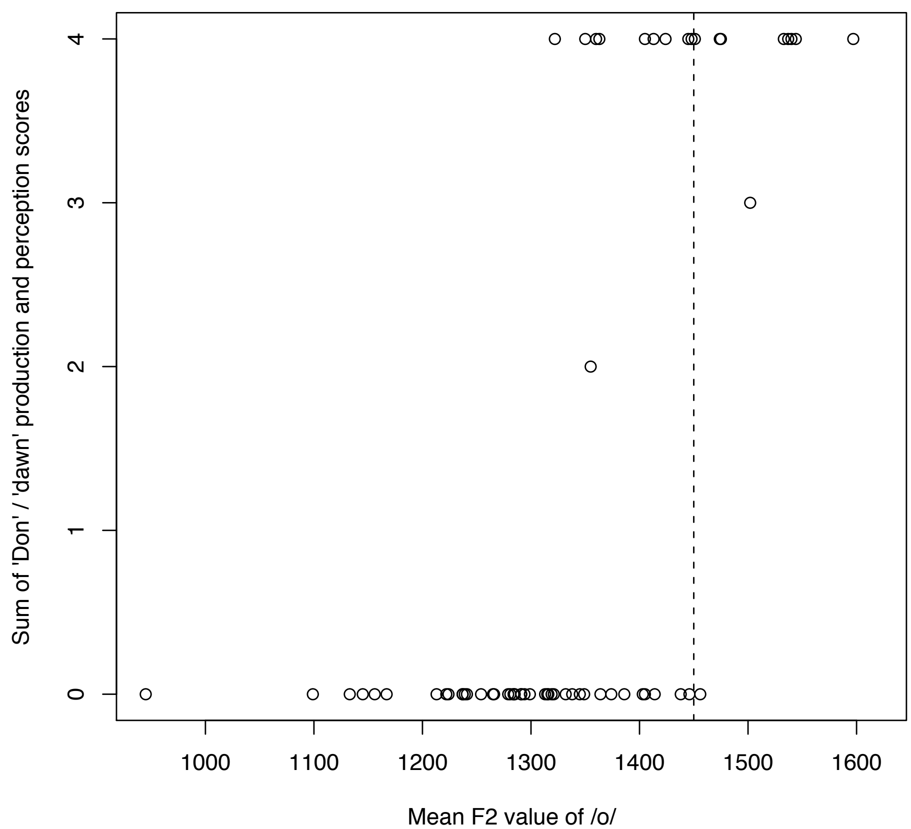

Figure 7.13: The relationship between a speaker's mean F2 value of /o/ and the merger of /o/ and /oh/ in *Don* vs. *dawn*;
dotted line shows the O2 criterion (F2 of /o/ $>$ 1450 Hz)

shows that the NCS is not active at all in that town.

Finally, the anomalous status of the three speakers from the town of Westfield must be discussed. All three of these speakers maintain a clear distinction between /o/ and /oh/ in the minimal pairs tests (see Figures 6.15 – 6.18 in Chapter 6). However, none of them are selected for any of the three criteria of the NCS discussed in this chapter: they all have a mean F1 value of /æ/ greater than 700 Hz, a mean F2 value of /o/ less than 1450, and a difference between the F2 means of /e/ and /o/ greater than 375 Hz. Figures 7.9, 7.12, and 7.14 show that these three speakers from Westfield are grouped together with most of the speakers from Ripley and Pennsylvania for these three criteria, and not with the speakers from the other towns in Chautauqua County, NY.

Thus, it appears that the NCS is also currently not a feature of the speech of Westfield. Figure 7.15 displays a plot of all tokens of /æ/, /o/, and /oh/ for Amy C., one of the three speakers from Westfield. There is little overlap between the distributions of /o/ and /oh/—her acoustic data thus matches her experimental results from the minimal pair tests. However, her mean F2 value of /o/, 1350 Hz, is 100 Hz below the O2 criterion.

The other two unmerged speakers from Westfield who do not match any of the NCS criteria were born in 1940 and 1960. All three of them thus represent the speech patterns of two to three generations ago. It is possible that these three speakers indicate that the Northern structural factors preventing the spread of the low-back merger were absent from Westfield approximately 60 years ago (as they were in Ripley), and that the merger of /o/ and /oh/ could be in the process of speading to Westfield as well. Unfortunately, my corpus does not contain any younger speakers from Westfield, so this hypothesis can not be tested with the data at hand. However, Westfield is the next town over on the shore of Lake Erie past Ripley, and is only 8 miles away from Ripley. Thus, its proximity to the merged area and its lack of NCS features would make it quite likely that the merger will spread there, too.

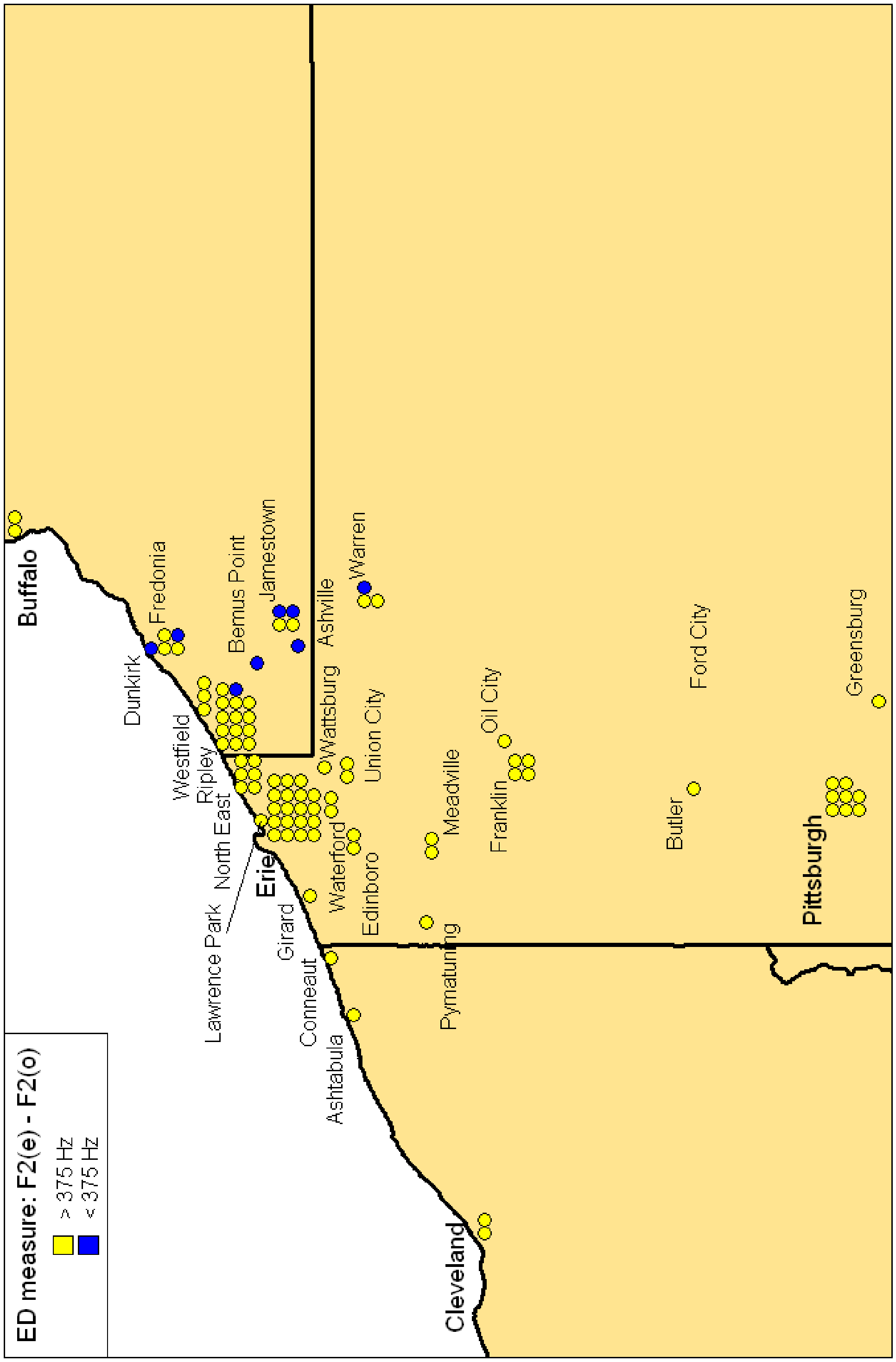

Figure 7.14: The relative position of /e/ and /o/ in the F2 domain

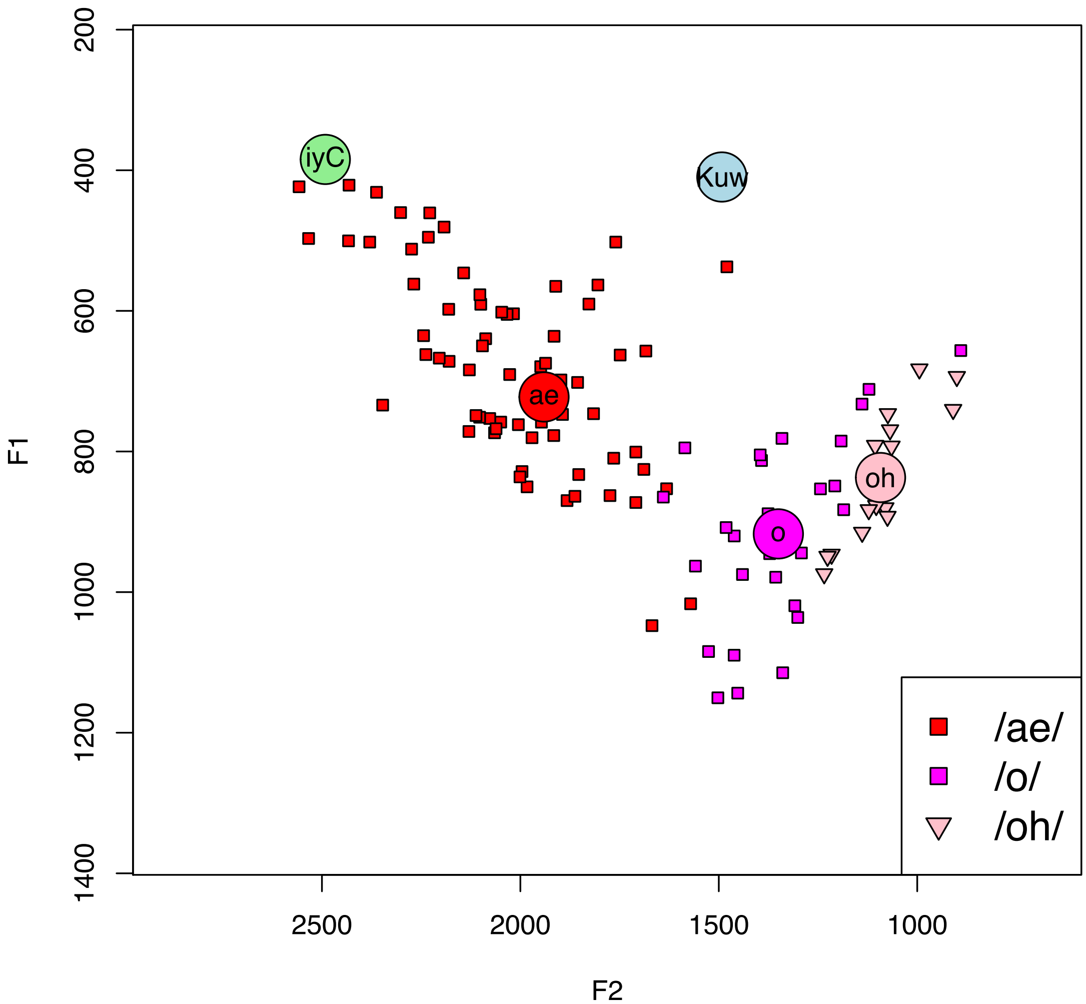

Figure 7.15: /æ/, /o/, and /oh/ from Amy C., born 1937 in Westfield;
Mean(/o/) = (917, 1350), N=26; Mean(/oh/) = (837, 1092), N=14; Dist(/o/, /oh/) = 270

7.4 Other changes in progress

Finally, this section will consider two other phonological changes that can be observed in my corpus. These changes, however, do not show regional differntiation, but rather a distribution based on age. Both involve the disappearance of phonemic distinctions that were originally more widespread, specifically the distinction between /hw/ ‘which’ and /w/ ‘witch’ and the distinction between /uhr/ ‘poor’ and /ohr/ ‘pour’.[14]

Both of these pairs display an apparent time distribution among the speakers in my corpus: in both cases, the older speakers are more likely to maintain a distinction, while the younger speakers are more likely to have them merged. These two pairs are the only minimal pairs that show an apparent time distribution among the 17 minimal pairs studied. They are the only two for which correlation tests between the minimal pair scores and the speaker’s age only produce significant results. The correlation coefficients are 0.62 ($p < 0.0001$) for *poor* vs. *pour* and 0.43 ($p < 0.05$) for *which* vs. *witch*. The positive correlation here means that as age increases, the production value for the minimal pair test also goes up (as described above, a value of 2 represents a distinction in production; 1 means that the two pairs were close, but slightly different; 0 means represents a merger).

Map 8.1 in the ANAE shows the distribution for the merger of /hw/ and /w/ across all of North America. The only region where the distinction is consistently maintained is the South. Among the speakers in my corpus, seven maintain the distinction in production for the pair *which* vs. *witch*, and most of them are advanced in age. The range of ages for these seven speakers spans from 57 to 78, with an average age for the group of 68. It is quite likely that all traces of this distinction will have disappeared within the next one or two generations.

The data for the distinction between /uhr/ and /ohr/ is quite sparse in the ANAE, and

[14] All speakers in my corpus have the merger of /ohr/ as in ‘hoarse’ and /ɔhr/ as in ‘horse’. The vowel resulting from this merger will be represented by the symbol /ohr/.

there is thus no map for it. However, the merger of these two vowels is discussed in the ANAE in connection with the Back Chain Shift before /r/. This chain shift is initiated by the merger of /ohr/ ‘four’ and /ɔhr/ ‘for’. This then enables the raising of /ahr/ to a mid-back position, and causes the subsequent raising of /ohr/ ∼ /ɔhr/. The final stage of this chain shift is then the merger of /ohr/ ∼ /ɔhr/ with /uhr/.

This chain shift is widespread in the Mid-Atlantic region, and is also found in other areas. However, it is not the cause of the merger of *poor* and *pour* among the speakers in the region around Erie. For these speakers, the merged phoneme is a mid-back vowel, similar to the vowel from the original /ohr/ class, not the high back vowel that would be the outcome of the Back Chain Shift before /r/. Thus, it is more likely that the speakers in my corpus instead provide evidence for a merger by transfer in which individual lexical items from the /uhr/ class are moving into the /ohr/ class. This lexical variation is widespread in North American English, and it often affects the more frequent words such as *sure* and *poor* first (Labov et al. 2006:273). Unfortunately, there are only a few tokens of other, less common, words with /uhr/ in my data set, so it is not possible to test this hypothesis to see whether the less frequent words are less likely to merge with the /ohr/ class.

Figure 7.16 displays the results for *poor* vs. *pour* geographically. While no regional pattern emerges from this figure, the apparent time distribution is visible: the unmerged speakers cluster towards the upper-left portion of the symbols for each location. Since the symbols are arranged in decreasing order by age, this distribution matches the result from the correlation test showing that the distinction is receding in apparent time.

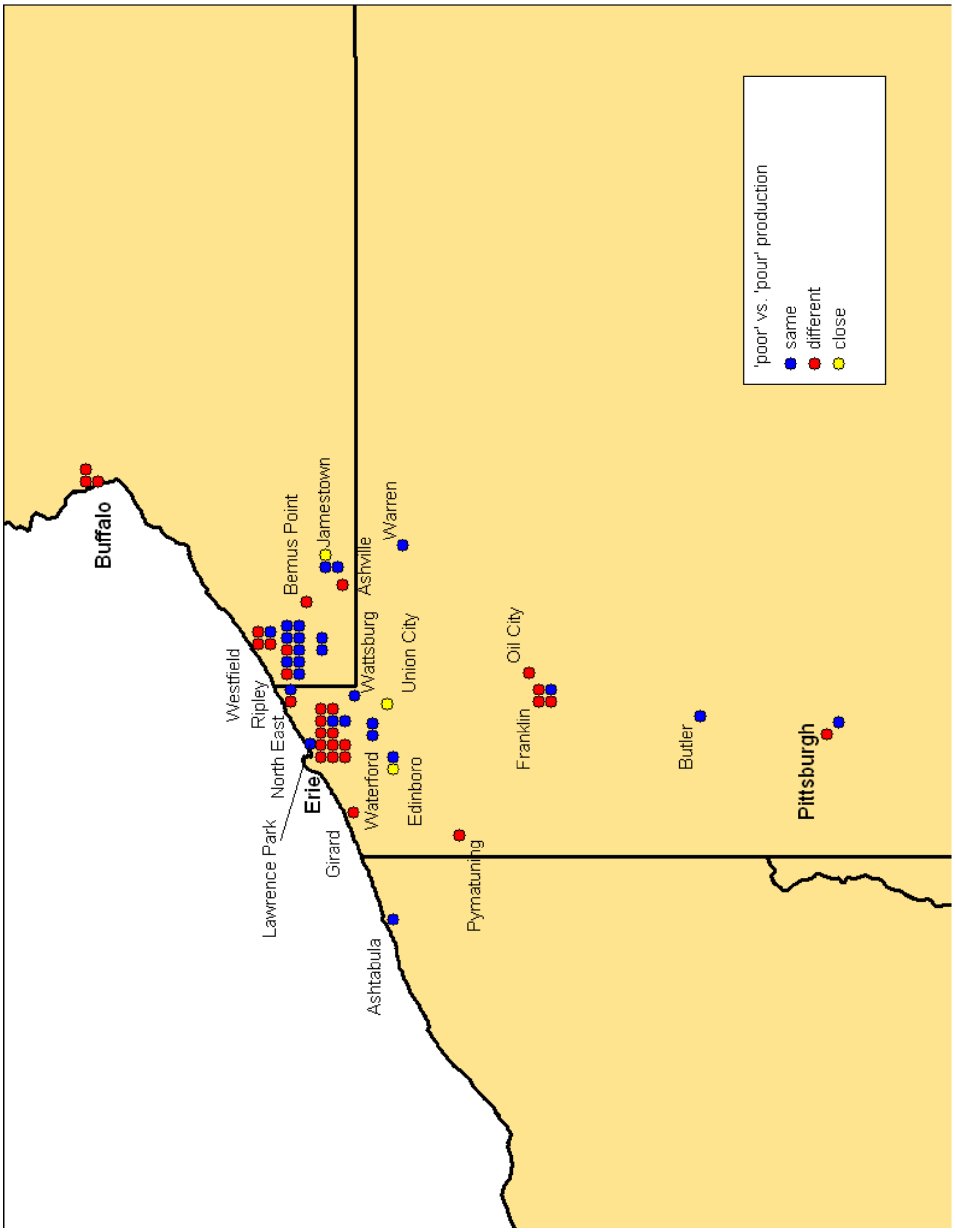

Figure 7.16: Minimal pair results for *poor* vs. *pour*: production data