Chapter 1

Introduction

The Atlas of North American English (Labov et al. 2006), henceforth ANAE, represents the first comprehensive phonological study of the entire North American continent. It thus provides a detailed overview of the various dialect regions and the sound changes that are taking place in each one. ANAE, however, is a study of urban speech—the survey's methodology sampled two speakers from every Metropolitan Statistical Area with 50,000 or more inhabitants. Thus, while ANAE is able to precisely define the characterists of the dialect regions of North America, it is not able to describe how the areas at the dialect boundaries look, since these boundaries normally lie in less populated geographic regions between urban areas.[1] The aim of this dissertation is to address this lack of coverage by studying the dialect boundary areas around a city of theoretical interest: Erie, Pennsylvania.

Erie holds a unique place in the dialectology of North America, since it is the only city to appear to have switched from the North to the Midland throughout the course of the 20th century. The earliest dialectological records of the region (Kurath 1949, Kurath and McDavid 1961) show Erie to pattern together with the North with respect to nearly all

[1]Except for relatively rare cases such as Windsor, ON and Detroit, MI, where the presence of a sharp dialect boundary between two neighboring cities (Labov et al. 2006:217) is due to international border separating them.

lexical and phonological isoglosses. However, ANAE shows that the phonology of Erie is clearly no longer Northern, and shares two crucial phonological traits with the Midland: the merger of /o/ (as in *cot*) and /oh/ (as in *caught*) and a pattern of raising /æ/ before nasals (Labov et al. 2006:205).[2] This shift of allegiance from the North to the Midland is surprising, since the North is perhaps the most cohesive dialect region in North America—as evidenced by the high rate of homogeneity and consistency of its defining isoglosses (Labov et al. 2006:151)—and the boundary between the North and the Midland is one of the sharpest boundaries in North America.

The goals of this dissertation are both threefold: empirical, methodological, and theoretical. First, a corpus of speech samples collected from Erie and the surrounding boundary regions provides both real time and apparent time evidence for linguistic changes that occurred in and around Erie over the past 120 years. This empirical research supplements the ANAE by describing the speech of less populated areas that have never been studied before and by determining the exact locations of the dialect boundaries around Erie. In addition to the empirical aims ot this research, several methodological innovations were introduced to enable the automatic analysis of the large amount of acoustic data that was obtained through fieldwork around Erie. This application of methods commonly used in the field of automatic speech recognition to sociolinguistic research enables the analysis of a much larger amount of data in a much shorter time than would be possible with the traditional manual methods of analysis. Finally, I aim to address several theoretical questions in dialect geography through an analysis of the corpus. The following three sections provide more details about each of these three aims.

[2]For a description of the vowel symbols used in this dissertation, see Appendix A.

1.1 Empirical Aims

The most important empirical question that this dissertation addresses is the status of the vowels /o/ and /oh/. The fact that these two vowels are currently merger in Erie is the clearest diagnostic that Erie is no longer phonologically aligned with the North. The research conducted for this dissertation extends our knowledge about the merger in Erie in the dimensions of both time and space. The time depth of the evidence is increased by interviews with elderly Erie residents and archival data from speakers born before 1900. The geographical depth is extended by new data from several small towns between Erie and Buffalo. This data enables us to pinpoint the present location of the boundary between the merged and unmerged regions and to describe the current trajectory of the change.

On a larger scale, this research will contribute to our detailed knowledge of the progress of the merger of /o/ and /oh/ throughout North America. This change is quite likely the most widely studied phonological feature in American English, and detailed descriptions of its progress exist for many communities, including Eastern Pennsylvania (Herold 1990), the area around the border between Rhode Island and Massachusetts (Johnson 2007), Cooperstown, NY (Dinkin 2009), Charleston, SC (Baranowski 2006), West Virginia (Hazen 2005), Indianapolis, IN (Fogle 2006, 2008), Missouri (Majors 2005, Gordon 2006), Oklahoma (Bailey et al. 1993), Utah (DiPaolo 1992), and San Francisco, CA (Hinton et al. 1987, Moonwomon 1992, Hall-Lew 2009). As Labov (1994:316) states, the merger of /o/ and /oh/ is "the largest single phonological change taking place in American English." It is also the most important change from a structural standpoint, due to the large influence that the phonemic status of these two vowels has on the rest of the vowel system(Labov et al. 2006:119–151).

In addition to a documentation of the merger of /o/ and /oh/, this dissertation will also consider in detail two other aspects of the vowel system that sharply differentiate the North

and the Midland: the raising of /æ/ and the fronting of back upgliding vowels. In the North, the raising and fronting of /æ/ in all environments was the triggering event for the Northern Cities Shift (Labov et al. 2006:192–195), whereas Midland speakers generally exhibit no tensing and fronting in unfavored environments (before voiceless obstruents). As is the case with /o/ and /oh/ the degree and type of raising exhibited by /æ/ has wide-ranging effects on the rest of the vowel system. Speakers from Erie pattern consistently with other Midland speakers with regard to /æ/, in that they either exhibit raising only before nasals or have a continuous system (Labov et al. 2006:180). A comprehensive study of the status of /æ/ in the boundary regions around Erie will contribute to our knowledge of how the status of /æ/ and the merger of /o/ and /oh/ are linked (Labov 1991, Labov et al. 2006).

Whereas the analyses of /o/, /oh/, and /æ/ show that Erie's phonology is aligned with Midland patterns, the analysis of the back upgliding vowels /uw/, /ow/, and /aw/ show that Erie still shares some phonological characteristics with the North. The fronting of this system of vowels is a pronounced feature of the Midland, but is either restricted in scope or completely absent from the speech of Northern speakers. In Erie, fronting of /uw/, /ow/, and /aw/ is also quite limited. An analysis of these three vowels in Erie and the surrounding boundary regions thus provides a more complete picture of the dialectological status of the area.

Finally, the methodology adopted for this dissertation enables the analysis of all vowel tokens produced by a speaker. Thus, with a combination of word list and interview data, it is possible to obtain detailed information about a speaker's entire vowel system. Individual analyses will be presented for the first two formants each vowel in the form of natural break maps in an attempt to efficiently summarize the geographical patterns (or lack thereof) contained in the entire range of the empirical acoustic results.

1.2 Methodological Aims

This dissertation also contributes to the field by employing a methodology for data analysis that has not been used before in dialect geography. After the interviews were collected, they were all transcribed in their entirety. Then, forced alignment, a procedure commonly used in the field of automatic speech recognition, was used to automatically determine the locations of the word and phoneme boundaries throughout the course of the audio file. This information was then used to facilitate the automatic extraction vowel formants for all vowels contained in the transcription. This methodology thus enables a large corpus of speech data to receive a detailed phonetic analysis in a short period of time. In contrast, sociophonetic analyses of vowel formants have traditionally relied on manual extraction of F1 and F2 data for each vowel token. This means that a large-scale analysis, such as the ANAE, will take several years to complete. For this dissertation, however, approximately the same number of vowel tokens were analyzed (around 125,000) as were analyzed for the ANAE. The total time required for the automatic analysis, even when the system development and programming time is taken into account, was substantially less than the time required for manual analysis.

Furthermore, after the process of forced alignment has been applied to a corpus, any word or phoneme of interest can be extracted easily (for either automatic or acuostic analysis), since word-level and phoneme-level time stamps are available for the entire corpus. After a manual vowel anaylsis, however, the same amount of time and labor required for the initial analysis would be necessary if the researchers desired to study another acoustic feature, such as vowel duration. Using forced alignment for sociophonetic corpus analysis is thus a good investment for future research, as well.

Of course, the techniques of forced alignment and automatic vowel analysis do introduce some errors into the data, most of which could be avoided through a manual analysis.

To address this problem, a number of techniques for error reduction were employed for this dissertation, including an improved method of formant prediction. The fact that the acoustic analyses of vowels obtained through this methodology are consistent with prior manual analyses of speakers from the same locations demonstrates the validity of the automatic data extraction techniques.

A major aim of this dissertation is thus to introduce the methodology of forced alignment to the sociolinguistic community and advocate for its widespread adoption among researchers. If this were to happen, it would enable research projects to consider much larger pools of informants for the data collection stage of a project, since the analysis could be conducted quickly. Thus, findings based on social characteristics of a group of speakers would be more robust, since the number of speakers subject to analysis in each group would be much larger. Furthermore, if researchers were willing to share their data, the methodology of forced alignment would facilitate the replication of important findings and enable easy subsequent analyses of valuable corpora. As it currently is, however, if a researcher is interested in re-analyzing a corpus that has been analyzed already by a previous researcher, there is an extremely high barrier of entry. As an aid to publicizing the methodologies of forced alignment and automatic vowel analysis that were used for this dissertation, as well as facilitating their adoption by other researchers, all of the necessary software is available through the web site of the Phonetics Lab at the University of Pennsylvania.[3]

[3]The forced alignment software is available as part of the P2FA (Penn Phonetics Lab Forced Aligner) package, and the other software is available as part of P2TK (the Penn Phonetics ToolKit). Both sets of software are available at the following URL: *http://ling.upenn.edu/phonetics/*.

1.3 Theoretical Aims

1.3.1 What Causes the Diffusion of Linguistic Change across Dialect Boundaries?

One of the main theoretical questions facing dialect geographers is to explain the mechanism by which linguistic changes diffuse across dialect boundaries. The types of theories that have been put forth to explain the spread (or lack thereof) of a linguistic change from one dialect region to a neighboring one often make reference to the demographic situation that obtains in the two regions. For example, the Gravity Model (Trudgill 1974) proposed that the spread of sound change from one area to another is proportional to the population of the two areas, and inversely proportional to the square of their distances. In a similar approach, the Cascade Model (Labov 2003) proposed that changes spread from large cities to smaller ones, skipping over the sparsely populated areas in between. Both of these models are based on the idea that linguistic change is brought about through increased communication with speakers from another dialect region (Labov 1974). All of these types of explanations are ultimately based on the Principle of Density (Bloomfield 1933).

On the other hand, structural factors can also play a role in promoting or inhibiting the spread of a linguistic change across a dialect boundary. For example, the merger of /o/ and /oh/ would be expected to spread into all dialect regions in North America according to Herzog's Principle that "mergers expand at the expense of distinctions" (Labov 1994:313). However, other structural factors have inhibited its spread across certain boundaries, such as the fronting of /o/ as part of the Northern Cities Shift in the North. An example of a structural factor influencing the spread of a change is the correlated behavior of /ow/ and /ʌ/: the backing of /ʌ/ in the North appears to be influenced by the extreme back position of /ow/ in that region, whereas the fronting of /ʌ/ in the Midland and South appears to be influenced by the fronting of /ow/ (Labov et al. 2006:143).

The most important linguistic change to spread to Erie was the merger of /o/ and /oh/. Other studies that have examined areas of recent merger in depth have proposed explanations based on demographic shift to explain the merger, either through foreign immigration (Herold 1990) or through an influx of residents from a neighboring merged region (Johnson 2007). Using these earlier studies as a guide, this dissertation will attempt to determine the relative influence of social and structural factors on the spread of the merger of /o/ and /oh/ to Erie and its continuing diffusion to neighboring regions.

1.3.2 Are All Dialect Boundaries Alike?

In conducting fieldwork around Erie, Pennsylvania, I examined three disjoint dialect boundary regions consisting of two separate dialect contact situations:

1. Erie vs. the North: This boundary exists in the two geographically distinct regions between Erie and Buffalo to the northeast of Erie and between Erie and Cleveland to the west. On the Erie side of this boundary, /o/ and /oh/ are merged, and there is no evidence of the Northern Cities Shift. On the North side of the boundary, /o/ and /oh/ remain distinct, and the NCS is represented in varying degrees. Figure 1.1 shows how Erie is located outside of most of the 8 isoglosses for the North in ANAE. Furthermore, the two that do include Erie are tenuous there, at best.[4]

2. Erie vs. the Midland / Western Pennsylvania: This boundary exists between Erie and the Midland region centered around Pittsburgh to the south of it. On the Erie

[4]The barred blue isogloss showing the outer limits of the North is defined by the three characteristics that are thought to be necessary conditions for the Northern Cities Shift: a short-*a* system that is not split into tense and lax class, no fronting of /ow/, and the lack of a merger between /o/ and /oh/. While the first two characteristics clearly hold for the two Erie ANAE speakers, one speaker provides very slight evidence that the merger is not complete for her: two out of the five minimal pairs were judged close in production, although the rest were judged to be exactly the same. The other speaker is clearly merged across the board in production and perception. The second Northern isogloss that is shown to include Erie Figure 1.1 is the ED line, inside of which F2 of /e/ is less than 375 Hz higher than F2 of /o/. However, the ANAE speaker from Erie who has these two vowels the closest actually has them separated by 388 Hz. So, Erie should not actually have been included inside of the ED isogloss.

side of this boundary, /ow/ and /aw/ are not being fronted as they are in much of the Midland. Furthermore, near Pittsburgh, on the southern side of the boundary, the Pittsburgh Shift is apparent in many speakers who show monophthongization of /aw/.

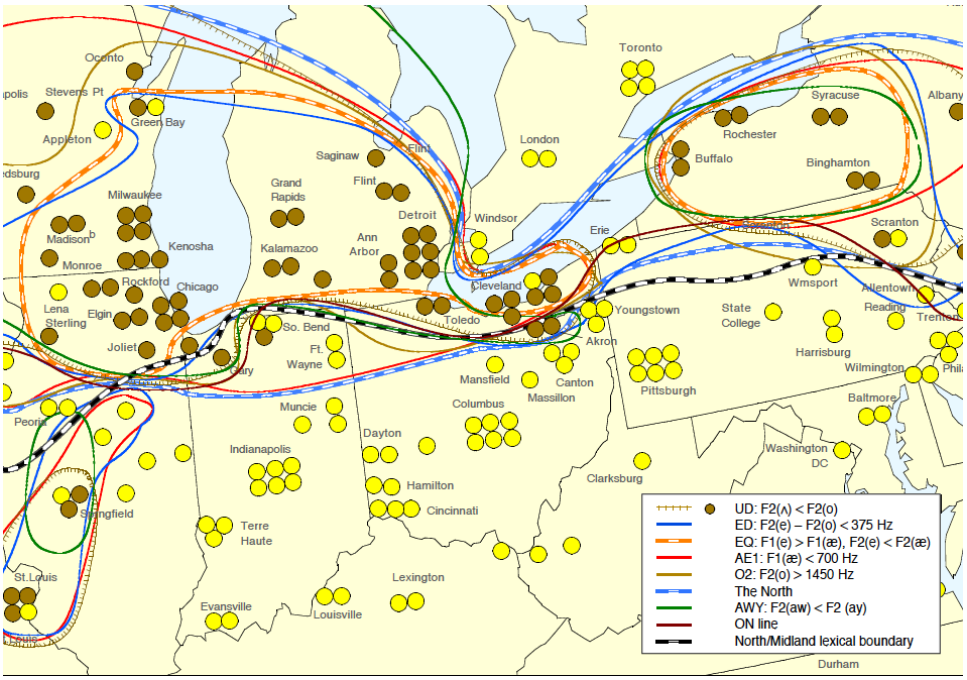

Figure 1.1: Erie and the surrounding region (Map 14.11 from ANAE)

One of the main goals of the fieldwork for this dissertation will be to determine the nature of these dialect boundaries in the areas of transition between the two regions. Several theoretical possibilities exist, based on the amount of overlap between the features of the two regions in the boundary area. For example, Chambers and Trudgill (1999:104) distinguish between *abrupt* and *gradual* transition areas. A slightly more refined taxonomy is presented by Dinkin (2009): *sharp*, *fading*, *overlapping*, and *null* boundaries. Research into the two boundary regions around Erie will determine what type of boundary exists in each area. It is hypothesized that the boundary between Erie and the North will be a sharper

boundary, since the merger of /o/ and /oh/ prevents the other stages of the Northern Cities Shift from taking place. ANAE has already shown that the boundary between the North and the Midland consists of a bundle of several closely related isoglosses, and that this is boundary is one of the sharpest in North America (p. 205). On the other hand, it is hypothesized that the boundary between Erie and the area to the south with strong fronting of /ow/ will be more gradual, since there are no structural barriers to the fronting of /ow/ in Erie.

1.3.3 What is the Relationship between Different Types of Isoglosses?

Chambers and Trudgill (1999) define six different types of isoglosses, based on the level of linguistic structure involved: *lexical*, *pronunciation*, *phonetic*, *phonemic*, *morphological*, and *syntactic*. Most studies that have attempted to define dialect regions to date have focused only on one or two of these types of isoglosses. For example, Carver (1987), Cassidy and Hall (1985–2002), and Kurath (1949) are all concerned with lexical isoglosses. On the other hand, (Kurath and McDavid 1961) examines only pronunciation and phonetic isoglosses. ANAE is the most wide-ranging single study to date: its main focus is on phonetic and phonemic isoglosses, but it also collected some data on lexical, pronunciation, and syntactic isoglosses.

There has not been any systematic research into how the different types of isoglosses pattern differently, especially around dialect boundary areas. ANAE has shown how phonetic and phonemic isoglosses bundle together along dialect boundaries in cases of large-scale sound shifts with many related components, such as the Northern Cities Shift and the Southern Shift. However, there has been less research into the correlation of isoglosses from levels of linguistic structure that are not related. One such case that has been investigated is the close correlation between the lexical boundary dividing the North and the Midland in Kurath (1949) and the phonological boundary separating the two regions in ANAE (Labov et al. 2006:205). ANAE showed that Erie was the only city to switch from

being on the Northern side of the lexical boundary to the Midland side of the phonological boundary. However, it is not known whether this shift in phonological status also coincided with a shift to Midland features in other levels of linguistic structure. Since many of the lexical items surveyed in (Kurath 1949) are now obsolete, I will investigate the relationship between the phonological isoglosses around Erie and a few syntactic isoglosses that are characteristic of the Midland areas with heavy original Scots-Irish settlement, specifically positive *anymore* and *need* + Past Participle.

1.4 Outline

This dissertation is organized as follows: Chapter 2 will first review the phonological and lexical evidence from earlier linguistic atlas projects that Erie's original linguistic patterns were Northern. Next, Chapters 3 and 4 will discuss the methodology used to obtain and analyze linguistic data for this dissertation. Chapter 3 presents details about how individual speakers were selected, and described the process of data collection (interview and transcription). Chapter 4 describe the technical details the forced alignment and vowel analysis procedures that were employed to automatically obtain vowel measurements. Chapter 5 presents natural break maps of the entire region under analysis for the F1 and F2 values for every vowel. The next two chapters contain detailed studies of a few crucial phonological features. Chapter 6 is a study of the merger of /o/ and /oh/ in the region, and Chapter 7 investigates the other vowels that differentiate the North and the Midland. Chapter 8 then presents data from lexical and morphosyntactic variables that differentiate the North and the Midland, and shows which side of the relevant boundaries Erie speakers fall on. Finally, Chapter 9 presents data relating to the settlement history of Erie in an attempt to shed light on the demographic causes of the observed linguistic patterns.