The Sociophonetic and Acoustic Vowel Dynamics of Michigan's Upper Peninsula English

Wil A. Rankinen

Submitted to the faculty of the University Graduate School

in partial fulfillment of the requirements for the degree

Doctor of Philosophy

in the Department of Linguistics

Indiana University

August 2014

ProQuest LLC.
789 East Eisenhower Parkway
P.O. Box 1346
Ann Arbor, MI 48106 - 1346

Accepted by the Graduate Faculty, Indiana University, in partial fulfillment of the requirements for the degree of Doctor of Philosophy

Doctoral Committee:

Kenneth de Jong, Professor of Linguistics (chair)
Indiana University, Bloomington, Indiana

Stuart Davis, Professor of Linguistics
Indiana University, Bloomington, Indiana

Julie Auger, Professor of Linguistics
Indiana University, Bloomington, Indiana

Dennis Preston, Professor of Linguistics (outside member)
Oklahoma State University, Stillwater, Oklahoma

Pia Päivö, Professor of Linguistics (CEUS minor member)
University of Copenhagen, Denmark

August 15$^{\text{th}}$, 2014

This dissertation is dedicated to Michael and Jill Rankinen;
two parents that gave the world to their sons and inspired them to do more.
We do what we do because of you.

Acknowledgements

To Dr. Kenneth De Jong, my chair, advisor, colleague and friend, thank you for being my pillar of support throughout the entire process and guiding me through the many challenges I encountered. Dr. Dennis Preston, thank you for inspiring me to become a linguist early in my career and continually being there to advise and support me in my growth and the development of the thesis. Thanks must be given to Dr. Julie Auger, Dr. Stuart Davis, and Dr. Pia P*ä*ivö, all of whom contributed to the development of the thesis in its present form. Aaron Albin (ABD), as a colleague and dear friend, thank you for your expertise and guidance in the co-development of the procedural methods of formant extraction used in the thesis. To my loving wife and son, Leah Rankinen and Eli Sheridan, your patience, support and love was felt every step of the way. To my parents, I would not be where I am today without the sacrifices that you have made, the upbringing you have provided and the support you have given. Thanks must also be given to others that have offered their support at various stages of the research: Dr. Clancy Clements, Dr. Kristopher Ebarb, Dr. Susan E. Wagner, Dr. Karthik Durvasula and yet others that remain unnamed. Finally, the research would not have been possible without the kindness and willingness of those that voluntarily shared their time and experiences with me during the summers of 2007 and 2008 in Michigan's Marquette County.

Wil A. Rankinen

The Sociophonetic and Acoustic Vowel Dynamics of Michigan's Upper Peninsula English

The present sociophonetic study examines the English variety in Michigan's Upper Peninsula (UP) based upon a 130-speaker sample from Marquette County. The linguistic variables of interest include seven monophthongs and four diphthongs: 1) FRONT LAX (i.e., /ɪ, ɛ, æ/), 2) LOW BACK (i.e., /ɑ, ɔ/), and 3) HIGH BACK vowels (i.e., /ʊ, u/) and 4) SHORT (i.e., /ej, ow/) and 5) LONG DIPHTHONGs (i.e., /ɑj, ɑw/). The sample is stratified by the predictor variables of HERITAGE-LOCATION, BILINGUALISM, AGE, SEX and CLASS. The aim of the thesis is two fold: 1) to determine the extent of potential substrate effects on a 71-speaker older-aged bilingual and monolingual subset of these UP English speakers focusing on the predictor variables of HERITAGE-LOCATION and BILINGUALISM, and 2) to determine the extent of potential exogenous influences on an 85-speaker subset of UP English monolingual speakers by focusing on the predictor variables of HERITAGE-LOCATION, AGE, SEX and CLASS. All data were extracted from a reading passage task collected during a sociolinguistic interview and measured instrumentally. The findings of this apparent-time data reveal the presence of lingering effects from substrate sources and developing effects from exogenous sources based upon American and Canadian models of diffusion. The linguistic changes-in-progress from above, led by MIDDLE-class females, are taking shape in the speech of UP residents of whom are propagating linguistic phenomena typically associated with varieties of Canadian English (i.e., low-back merger, Canadian shift, and Canadian raising); however, the findings also report resistance of such norms by WORKING-class females. Finally, the data also reveal substrate effects demonstrating cases of dialect leveling and maintenance. As a result, the speech spoken in Michigan's Upper Peninsula can presently be described as a unique variety of English comprised of lingering substrate effects as well as exogenous effects modeled from both American and Canadian English linguistic norms.

Kenneth de Jong, Professor of Linguistics (chair)

Indiana University, Bloomington, Indiana

Stuart Davis, Professor of Linguistics

Indiana University, Bloomington, Indiana

Julie Auger, Professor of Linguistics

Indiana University, Bloomington, Indiana

Dennis Preston, Professor of Linguistics (outside member)

Oklahoma State University, Stillwater, Oklahoma

Pia P*ä*ivö, Professor of Linguistics (CEUS minor member)

University of Copenhagen, Denmark

Table of Contents

Tables

Figures

CHAPTER 1

INTRODUCTION

The Upper Midwest, post-European settlement and occupation, is a region characterized with a rich and diverse history, which includes communities with vibrant cultures centered around both urban-rural and rural lifestyles and varying cultural practices. However diverse, the areas within this region uniquely share similar geological forces shaping the topographical formation of its geography, economic sources of industrial development shaping its infrastructure and means of commerce, and historical patterns of migration and settlement shaping its communal practices and local identities. With the seminal work of Labov et al.'s *The Atlas of North American English* (ANAE), the areas within the Upper Midwest (i.e. known also as the North Central region) have recently been shown to also share many phonological linguistic variables, and as a geolinguistic region, it notably differs from other neighboring regions (Labov et al. 2006, 141):

> "The Central region ranges from Montana to Michigan along the U.S.-Canadian border, including the communities of Billings, Bismark, Minot, Fargo, Duluth, and Marquette. It does not participate actively in the sound changes in progress ... [that define the neighboring regions] ... It is distinguished from the North by the presence of [the low back merger]. It is distinguished from Canada by the absence of the Canadian Shift. It is distinguished from Canada and the West by a very limited fronting of /uw/ after non-coronals..."

A geolinguistic region is a geographical area within which the speech community or communities exhibits a preference for a definable set of linguistic variants (e.g., phonological, syntactic) and characterizes the linguistic speech patterns of residents living in this geographical area. Since the Upper Midwest is characterized as having a "mixed-bag" of phonological and phonetic variables that typify the speech of those communities within this region, it can be characterized as a geolinguistic region juxtaposed between the neighboring regional varieties of the North and Canadian English. Labov et al. (2006)'s use of the term "residual region" indicates two underlying assumptions, both of which refer to the potential impact that these neighboring American English varieties may have on this region. This region may be under 1) potential competing pressures of neighboring regional varieties (i.e., regions with a defined set of linguistic variables) and 2) a potential change-in-progress toward the adoption of a preferred set of phonological variables.[1] Since these assumptions go beyond the scope of the seminal work of Labov et al. (2006), the authors offer them with the expectation that future empirical support would be required; that is, they sought to stimulate future investigations that are not only area-focused in design but also examine the internal linguistic and social constraints operating and affecting sociolinguistic language change at the more local level (Konopka and Pierrehumbert 2014).

The present sociophonetic and phonological study is an acoustic investigation of vowels and the sociolinguistic variation that exists in the speech of rural Upper Midwest immigrant-American communities located in Marquette County in Michigan's Upper Peninsula (UP). This thesis investigates eleven linguistic variables of which seven are phonologically regarded as monophthongs (i.e., /ɪ/, /ɛ/, /æ/, /ɑ/, /ɔ/, /ʊ/, /u/) and the other four as diphthongs (i.e., /ej/, /ow/, /ɑj/, /ɑw/); in this the-

[1]Of course, Labov et al. (2006) report no change-in-progress in the case of the Canadian shift; however, the claim made is questionable since it was based on data obtained from very few speakers.

sis, these linguistic variables will be grouped into five sets: FRONT LAX (i.e., /ɪ, ɛ, æ/), LOW BACK (i.e., /ɑ, ɔ/) and HIGH BACK (i.e., /ʊ, u/) vowels and SHORT (i.e., /ej, ow/) and LONG DIPHTHONGs (i.e., /ɑj, ɑw/). Each set of linguistic variables will be examined in relation to the five predictor variables of HERITAGE-LOCATION, BILINGUALISM, AGE, SEX and CLASS. The sociolinguistic factors of HERITAGE-LOCATION and BILINGUALISM are included to examine the potential substrate influences of ethnic-heritage and ethnic-language usage in shaping the American English language variety in Michigan's UP (Labov 2008).[2] Additionally, the speech communities in this region also find themselves in a unique position for the potential adoption of new local norms from two opposing and neighboring regional English varieties (e.g., Canadian English as reported in Boberg (2008) and American English; the latter is characterized either by the post-Northern Cities Vowel Shift (NCVS) in the Inland North as reported in Labov et al. (2006) or by the pre-NCVS in Michigan as reported in Peterson and Barney (1952)). The factors of AGE, SEX and CLASS are sociolinguistic variables that are used in the apparent-time construct of the thesis to determine if changes-in-progress are taking shape in this speech community, and if so, to reveal the types of change (i.e., change from above or below) and the sociolingustic trends of such changes (Labov 2001).

1.1 Research Questions

This thesis has two main research questions:

1. What is the extent of potential substrate influences on the linguistic variables in question with specific reference to the predictor variables of HERITAGE-

[2]Labov states when using the term "substrate", sociolinguists are typically "...speaking of a community effect - that is, a change in the language that is the result of a very large number of bilingual speakers transferring some part of the L2 effect to large numbers of their descendants..." (2008, 316).

LOCATION and BILINGUALISM? This question can be broken into three subsequent parts: 1) how have the phonological and phonetic characteristics of the five sets of English vowel qualities and their overall constellation and individual distribution in the vowel space been affected in the speech of UP speakers in regards to ethnic ancestry and exposure to immigrant-heritage communities throughout Marquette County, 2) what linguistic differences or similarities exist for these linguistic variables when comparing UP bilingual speakers and UP monolingual English speakers, and 3) how do these BILINGUALISM groups differ as a factor of HERITAGE-LOCATION.

2. With regards to potential exogenous influences on UP vowels, to what extent are the social groups according to the predictor variables of HERITAGE-LOCATION, AGE, SEX and CLASS differing from one another in the use of variants typically associated with regional varieties? For example, is the distribution of the /æ/ in the speech of UP speakers showing similar patterns typically associated with either the significant raising of [æ] characterized by the NCVS or the lowering and retraction of [æ] characterized by the Canadian shift? This research question is not restricted to a single linguistic variable but to all considered in this thesis, and as such, this question essentially seeks to understand if, for certain groups of linguistic variables, particular social groups are: 1) converging toward the regional or substrate variants (e.g., a change-in-progress led by comparing age groups in an apparent-time construct), 2) diverging away from substrate variants (e.g., due to social pressures), or 3) remaining stable with relatively equal use of potential variants.

1.2 Potential Outcomes

In regards to the first research question, there are several possible outcomes. As this study examines two Finnish-heritage groups and one Italian-heritage group (i.e., further split by locale),[3] as well as, two bilingual groups and one monolingual group (i.e., further split by language-dominance),[4] the investigation seeks to tease apart the predictor variables of HERITAGE-LOCATION and BILINGUALISM to see if substrate influences exist and to what degree they are present in the English variety spoken by UP speakers across the Marquette County. The potential outcomes of this first research question are spelled out below:

1. When comparing subject groups for HERITAGE-LOCATION and BILINGUALISM, most linguistic variables, if not all of them, might show little to no statistical difference or correlation between linguistic and predictor variables. This outcome may be indicative of the potential fact that, while perhaps a lingering substrate influence might have been present at one time, such an influence is no longer present in the English spoken by either monolingual or bilingual speakers for this particular speech community. Additionally, the lack of linguistic differences for HERITAGE-LOCATION would indicate that such communities are much more internally focused than what previous research suggests (Rankinen 2013b; Remlinger 2006; Simon 2005). Such an outcome in the data would validate the claim that the once heterogeneous communities seem to have become more homoge-

[3]The HERITAGE-LOCATION variable is split into three levels because, while the Finns are located throughout the county in both rural and urban areas, the Italians are largely found in only the more urbanized, eastern areas of the county; see Chapter 3 for a thorough discussion of this predictor variable.

[4]The BILINGUALISM variable is split into three levels and restricted to older-aged speakers, since in this community, there are older-aged UP residents with limited to no knowledge of their heritage language, while the older-aged bilinguals in the community can be further divided in terms of when English was acquired as either their dominant language spoken in the home during early childhood or learned only after entering grade school; see Chapter 3 for a thorough discussion of this predictor variable.

neous, having integrated amongst themselves enough to homogenize even their phonological vowel system; a type of linguistic phenomenon typically shown to be largely below the speaker's awareness (Konopka and Pierrehumbert 2014).

2. When comparing subject groups for HERITAGE-LOCATION and BILINGUALISM, several linguistic variables might show statistical differences or correlations between linguistic and predictor variables, which may indicate a lingering, rather than strong, substrate influence. This outcome may be indicative of the fact that there still exists a certain amount of second language effects, from an immigrant-heritage language, on the English variety spoken in Michigan's UP. Such an outcome in the data would validate the claim that HERITAGE-LOCATION within this speech community is: a) a valid and salient predictor category and b) is potentially losing ground to dialect leveling pressures (i.e., the replacement of substrate linguistic variables for more local norms shared by the larger speech community).

3. When comparing subject groups for HERITAGE-LOCATION and BILINGUALISM, several sets of linguistic variables might show statistical differences or correlations between linguistic and predictor variables, which indicate a strong substrate influence. This outcome may be indicative of the fact that there currently exists a strong amount of second language effects on the English variety spoken in Michigan's UP. Such an outcome in the data would validate the claim then that HERITAGE-LOCATION within this speech community is a) a valid and strongly salient predictor variable and b) is not likely succumbing to pressures resulting in dialect leveling.

Regarding the second research question posed by this thesis, there are some other possible outcomes as well. This study examines to see if the UP speakers as a speech community, as characterized by the four predictor variables (i.e., excluding BILIN-

GUALISM), are aligning with particular sets of linguistic variables associated with one neighboring regional English variety or another. The investigation seeks to test if exogenous influences exist and to what degree they are present in the English variety spoken by UP speakers. The following potential outcomes are detailed below:

1. When comparing subject groups for HERITAGE-LOCATION, AGE, SEX and CLASS, there might not be any linguistic variables that show statistical differences or correlations between the linguistic and predictor variables, which may indicate the stability of the set of linguistic variables. Furthermore, this outcome would suggest this speech community is relatively close-knit and homogenous, and thus, may indicate a tendency toward being more resistant to potential exogenous pressures.

2. When comparing subject groups for HERITAGE-LOCATION, AGE, SEX and CLASS, there might only be a few linguistic variables that show statistical differences or correlations between the linguistic and predictor variables. This outcome may indicate a preference toward the use or disuse of canonically salient regional variant(s) of particular variable(s). This might be indicative of a beginning stage for a change-in-progress, where the use of new non-local norms in the community is correlated with the factor of AGE (e.g. the raising of /æ/, fronting of /ɑ/ and lowering of /ɔ/ among only the YOUNGER-aged speakers). In such cases of change, the sociolinguistic trend of the change may be indicated by the predictor variables of SEX and CLASS; in accordance with the general principles of linguistic change supported by previous sociolinguistic research, women and socioeconomic groups located in the middle of the social hierarchy of a speech community have been shown to lead the use of the innovative variants (Labov 2001). While some groups may exhibit a preference for exogenous models of diffusion at the beginning stages of a change-in-progress, there may be varying

degrees of resistance to such exogenous influences by particular groups within the community due to various orientations toward local norms.

3. When comparing subject groups for HERITAGE-LOCATION, AGE, SEX and CLASS, there might be many linguistic variables showing statistical differences or correlations between the linguistic and predictor variables. This would be indicative of a strong preference toward the use or disuse of the variants of a particular set of variables associated with a canonically salient regional variety (e.g., the Canadian shift, low-back merger, /u/ fronting, and Canadian raising). If predictor variables of the HERITAGE-LOCATION and AGE reveal differential effects, this may indicate linguistic changes-in-progress or the propagation of innovative variants by particular groups based upon ethnic-heritage or locale. Furthermore, the predictor variables of SEX and CLASS will like indicate which of the social groups are the most extreme users of the innovative linguistic forms and help reveal the nature of the linguistic change-in-progress.

1.3 Outline of Thesis

Including the present chapter, this thesis is organized into eight chapters. The next chapter, Chapter 2, examines the background of various fields of literature pertaining to the socio-cultural development of the communities in Michigan's Marquette County, and in Michigan's UP more generally, and the linguistic literature pertaining to English varieties within and neighboring the Upper Midwest. Chapters 3 and 4 report on the methods and procedures used in the thesis. Chapter 5 presents the first analysis of thesis investigating the predictor variables of HERITAGE-LOCATION and BILINGUALISM in regards to the five sets of linguistic variables of interest. Chapter 6 presents the second analysis of these sets of linguistic variables restricted to the predictor variables of HERITAGE-LOCATION, AGE, SEX and CLASS. Chapter 7 presents

the discussion of the findings reported in Chapters 5 and 6. The final chapter, Chapter 8, concludes with a discussion of the contributions and limitations of the present research, the continuation of this research and potential threads of future research.

CHAPTER 2

SOCIO-CULTURAL AND LINGUISTIC BACKGROUND

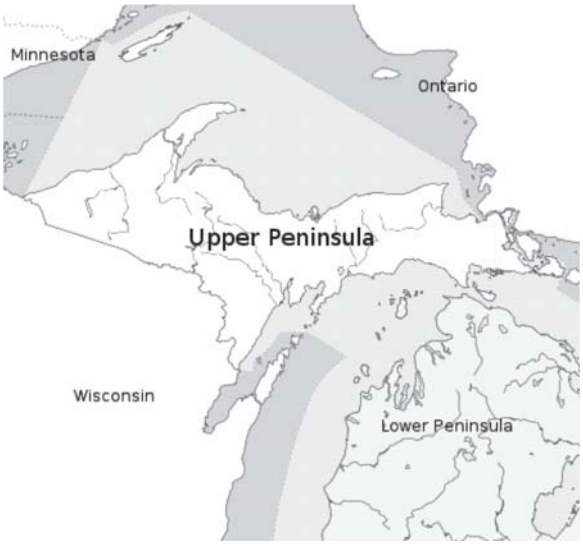
The Upper Peninsula (UP) of Michigan sits in a uniquely remote region of the United States, juxtaposed between Wisconsin and three of the Great Lakes. It has a fascinating history of economic and population growth and decline over the past hundred and seventy years (1840s-2010s). As it is with many other mining and lumber communities across the United States, the rise of this region's economy and population was due to the discovery of valuable natural resources (e.g., iron ore, copper) and the industrialization of the mining and lumber sectors. The subsequent decline of the economy, largely due to the depletion of these natural resources, and cultural factors affecting succeeding generations (e.g., out-migration due to unemployment, use of English over heritage languages, inter-marriage of ethnic heritage groups), has ultimately had a dramatic effect on the development of the speech communities found within the peninsula. The speech communities within the UP are under-documented; however, this region's unique socio-historical and -cultural situation has garnered some attention from several sociologists, historians and several linguists in the past five decades. In this section, I will provide brief expositions on the following: a) Michigan's UP history regarding the formation and development of its economy, culture and communities, and b) previous linguistic research in the UP English variety and neighboring regional varieties.

2.1 Michigan's Upper Peninsula as a Region

2.1.1 Geological Position and Landscape

The distinctive profile of Michigan's northern peninsula is a result of major glacial shifts and processes that carved the geological landscape of the Great Lakes. Figure 2.1 displays Michigan's UP in its adjacent geographical setting. Michigan's northernmost state border is shared with Wisconsin. Michigan's UP juts out eastward and is surrounded by three of the Great Lakes: Lake Superior to the north, Lake Michigan to the south and Lake Huron to the west. At the northeastern tip of the peninsula, the St. Mary's River connects Lake Superior and Lake Huron. Similarly, the five-mile wide waterway connecting Lake Huron and Lake Michigan is known as the Mackinac Strait.

Figure 2.1: Michigan's Upper Peninsula

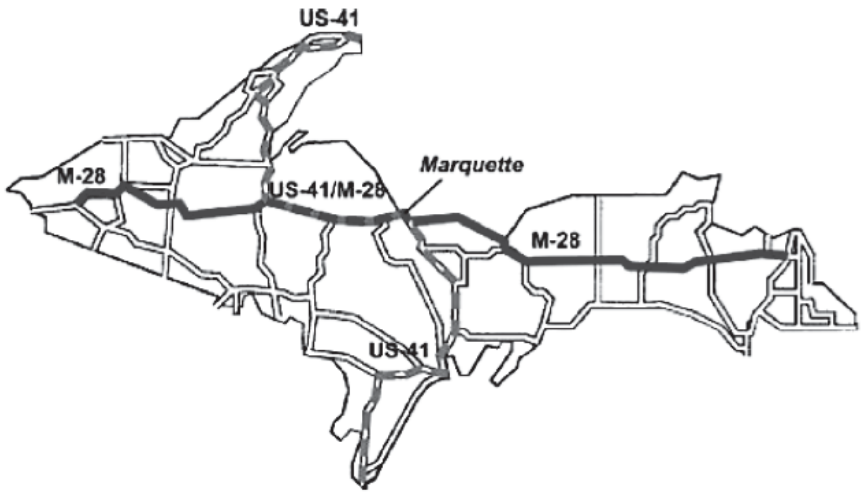


Prior to the 1950s and 1960s, the only way to gain access to Michigan's UP from the east was by waterway, railway or air from Lower Michigan or Ontario, Canada. As a result, most railway and roadway traffic utilized Wisconsin-bound routes. Nevertheless, shipping lanes through the St. Mary's River or Mackinac Strait waterways have been largely utilized by domestic and international shipping traffic in the transportation of natural resources and manufactured goods to or from Duluth, Copper Harbor or Marquette; a railroad bridge was built in 1880 to span the St. Mary's River as a land-transportational route between the northern peninsula and Ontario, Canada

(MDOT 2014a). In addition to shipping lanes and railways, ferries were utilized as a way to transport passengers and automobiles from either Lower Michigan or Ontario Canada to Michigan's UP (or vice versa). While waterways and railways are still utilized today, the Mackinac Bridge built in 1957 and the International Bridge built in 1962 replaced the need for ferries and opened major thoroughfares for both domestic and commercialized traffic (MDOT 2014b).

2.1.2 Development of the Highway System

Figure 2.2: US41/M28 Highway Corridor
in Michigan's Marquette County



The town of Marquette is not only the largest urban center in the county (i.e., approximately 26,000), it is the largest urban center in the entire northern peninsula of Michigan (US Census Bureau 2000).[1] Local residents of Marquette County, living outside of the city limits of Marquette, may travel forty-five miles or more (i.e., one-way) to go shopping at the local mall (e.g., Westwood Mall) or department stores (e.g., Wal-mart, Shopko), dine at local restaurants (e.g., Casa Calabria), or hang out in the many parks and recreational sights along Lake Superior's shoreline (e.g., ore

[1]Sault St. Marie, Escanaba and Iron Mountain are the only other urban centers within the UP that break the 10,000 mark for total population (US Census Bureau 2000).

docks, parks). Many Marquette County residents, who work in Marquette, actually live in other areas of the county in such towns as Negaunee or Ishpeming and in the more rural townships as Ely, Humboldt, Michigamme and Republic. The majority of these commuting locals take the US-41/M-28 Highway, which in fact, is a vital traffic corridor from western to eastern Marquette County (i.e., from Michigamme to Marquette). Figure 2.2 shows that the two highways, US-41 and M-28, span the entire northern peninsula from the northern to the southern tip and from the western to the eastern tip.

Figure 2.3: Michigan's Marquette County,
Townships and US-41/M-28 Corridor

In Figure 2.3, the merging of US-41 and M-28 in Marquette County is regarded as the US-41/M-28 highway corridor. This corridor is a major route for both local and non-local traffic to and from the prominent social centers in the county (i.e.,

Marquette, Ishpeming and Negaunee). According to the the US-41/M-28 Comprehensive Corridor and Assessment Management Plan, "...the US-41/M-28 corridor is much more than a local lifeline. It serves as a major east/west route across not only the Upper Peninsula, but the northern United States [...and ...] provides a southern route around Lake Superior for Canadian and American trucking firms ..." (Marquette County Planning Commission 2010). Not only is this highway of great importance to local residents and local businesses along the corridor, it is utilized by non-local and regional traffic as well.

In the first half of the twentieth century, this highway corridor underwent several significant realignments which ultimately affected the surrounding communities. In the 1930s, M-28 and US-41 were distinct until these two main roads were rerouted to merge with one another; M-28 was previously merged with M-15 between Negaunee and Marquette, while US-41 was previously merged with M-35 (Michigan State Highway Department 1927). Furthermore, other smaller realignments such as the routing of US41/M-28 north of Ishpeming and Negaunee, bypassing the downtown sectors of these towns in the late 1930s, had significant repercussions to not only the flow of traffic but community development as well (Marquette County Planning Commission 2010). Over the last sixty years, many residential areas and business sectors have relocated along this vital corridor. This realignment of the Marquette County highway system has observably shifted the community structure from being internally oriented and dependent on small urban centers (e.g., Ishpeming, Negaunee) to one that is much more widely oriented and mobile (e.g., Marquette, Iron Mountain, Green Bay).

2.1.3 Socio-cultural Relevance of Immigration and Acculturation

The Upper Midwest, specifically northern Minnesota, Wisconsin and Michigan, has historically been influenced by diverse immigration patterns. Michigan's UP is by no means an exception. Immigrants from European and Scandinavian countries began settling in this northern peninsula around the mid-19th century, gradually tapering off during the next hundred years. Multi-ethnic immigrant communities began cropping up around mines and lumber camps after the discovery of valuable natural resources such as copper and iron ore. Immigration has greatly affected the formation of UP culture and history.

Ethnicity is an important concept, which is distinct from traditional social categories of age, sex and socioeconomic status, and will be an important factor to consider throughout this thesis. This term here will refer strictly to the ancestral heritage of speakers and may be referred to as ethnic-heritage (i.e., shortened to just 'heritage" and discussed in greater detail in Chapter 3); more than a strict definition, Isajiwa (1985) points out the importance of operationalizing this extralinguistic variable in order to better understand and index ethnolinguistic behavior. Furthermore, when referring to ethnic-heritage, this term remains distinct from — albeit related to — the much more documented extralinguistic category of race which is often addressed during the discussion of African-American English (Labov 1966) and Latino-American English (Eckert 2008). Racial categories often denote social, cultural and ancestral ties of a group of speakers and have been shown to be a more sociolinguistically salient predictor variable, in comparison to ethnic-heritage, for documenting language variation and change (Labov 2008, 317; Boberg 2004, 540). Nevertheless, subtle ethnolinguistic differences have been shown to exist among Irish, Jewish and Italian Canadian communities in Montreal (Boberg 2004) and in Amer-

ican communities located in Boston (Laferriere 1979), among Germans, Polish and Italians immigrants in Buffalo (Carlock and Wolck 1981), and among speakers with Italian and Jewish ancestry in New York City (Labov 2001); in contrast, of course, there has been many other studies that have shown little to no trace of these differences (Haugen 1969; Purnell et al. 2005). An ethnolect is regarded as a unique, native variety of a language (e.g., English), which is spoken by the successive generations of immigrants and these speakers tend to acquire English at an early age even when the immigrant-heritage language is spoken in the home; moreover, the English variety "...often preserves unique features that distinguish them from the speech of the wider community ...(Boberg 2004, 539). This thesis offers a unique opportunity to build upon the prior ethnolect literature that has examined Italian ancestry by contrasting a comparable group of Italian-heritage UP speakers with a less common studied ethnolect — one spoken by Finnish-Americans — in the Upper Midwest.

The Finnish-immigrant population has had the strongest influence on UP society, as well as many other areas of the Upper Midwest. Although late in immigrating to the region, a vast number of Finns settled in the peninsula in two waves from the 1880s to the 1920s (Kero 1969, 2014). In Marquette County, the Finnish were the largest immigrant group in the towns of Marquette, Negaunee, Ishpeming, and other neighboring towns of Palmer, Republic, and Michigamme. These immigrants formed communities on the outskirts of the rural mining towns; Palmer, a small town located south of the larger town of Negaunee, is an example of such a community that was comprised mostly of residents claiming Finnish-heritage at approximately 90 percent by the late 1960s (Holmio 2001). The Finns maintained public use of their language, which, in addition to the size of the community, aided in the maintenance of the Finnish language. The fact that the Finns owned businesses, held Finnish church services, and ran Finnish newspapers up until the mid-20th century exhibits the prevailing use of the Finnish language. (For a more thorough discussion of Finnish-

American immigration history and impact on the community in Michigan's Upper Peninsula, please see Rankinen 2014).

Similar to the Finns, Italian immigrants began to make an appearance in the UP during the 1880s and 1890s (Rudnicki 1987). By the turn of the century, the Italian immigrant population was one of the largest ethnic groups in the iron mining towns of Ishpeming and Negaunee. Many Italians began businesses in these developing towns and formed large immigrant-heritage communities — often second in population size only to the Finns (Sturgul 1987). Though a much smaller immigrant-American group than the Finns, the Italian-American community is an excellent comparative group to that of the Finnish-American community in the Marquette County. Even today, both heritage-communities have actively participated in acknowledging their cultural identity. The Italian and Finnish heritage pride is clearly and vibrantly celebrated annually during the UP Finn Festival and Italian Festival.

The highest percentage of Finnish-Americans are geographically located primarily in the western half of Michigan's Upper Peninsula as described by Rankinen (2014) using 2009-2013 US Bureau Census' data. Italian-Americans, in contrast, tended to settle in the more central regions of the peninsula, which includes the counties of Dickinson, Delta and Marquette. Most importantly, Marquette County reports significant populations of those claiming either Finnish- or Italian-heritage as their first, and potentially their most salient, ethnic-heritage. Focusing on Marquette County, many of the residents claiming Italian ancestry are located primarily in the city limits and townships of Ishpeming and Negaunee, while those claiming Finnish ancestry are more dispersed throughout the county and located in the much more rural townships of Champion, Republic and Michigamme (US Census Bureau 2000). Table 2.1 below reports on US census data of total populations and first ancestry reported (i.e., based on the 2005-2009 estimates).[2]

[2]The 2005-2009 estimates were included in this table because 1) all subjects were interviewed

Table 2.1: US Census Bureau statistics of total population by UP county (i.e., based on 2005-2009 Census estimates) and Ethnic-heritage (i.e., those claiming Finnish (FA) and Italian (IA) as their first ethnic-heritage)

Counties in Michigan's UP	Total Population (TP) & Percentages [for each UP county]	TP & Percentages of Finnish Ancestry [for each UP county]	Percentages of Finnish Ancestry [relative to UP's TP of FA]	TP & Percentages of Italian Ancestry [for each UP county]	Percentages of Italian Ancestry [relative to UP's TP of IA]
Houghton	35,214 (1.4%)	11,062 (31.4%)	30.1%	1,555 (4.%)	9.8%
Marquette	65,298 (21.1%)	11,014 (16.9%)	29.9%	4,374 (6.7%)	27.4%
Gogebic	16,193 (5.2%)	2,523 (15.6%)	6.9%	1,304 (8.1%)	8.2%
Delta	37,413 (12.1%)	2,033 (5.4%)	5.5%	941 (2.5%)	5.9%
Ontonagon	6,907 (2.2%)	1,737 (25.1%)	4.7%	141 (2.0%)	0.9%
Baraga	8,650 (2.8%)	1,713 (19.8%)	4.7%	160 (1.8%)	1.0%
Dickinson	27,003 (8.7%)	1,461 (5.4%)	4.0%	3,136 (11.6%)	19.7%
Iron	11,923 (3.9%)	1,188 (10.0%)	3.2%	1,261 (10.6%)	7.9%
Chippewa	38,700 (12.5%)	1,097 (2.8%)	3.0%	1,672 (4.3%)	10.5%
Alger	9,512 (3.1%)	1,036 (10.9%)	2.8%	220 (2.3%)	1.4%
Keweenaw	2,224 (0.7%)	943 (42.4%)	2.6%	69 (3.1%)	0.4%
Menominee	24,230 (7.8%)	378 (1.6%)	1.0%	590 (2.4%)	3.7%
Luce	6,645 (2.1%)	247 (3.7%)	0.7%	128 (1.9%)	0.8%
Mackinac	10,871 (3.5%)	241 (2.2%)	0.7%	206 (1.9%)	1.3%
Schoolcraft	8,413 (2.7%)	120 (1.4%)	0.3%	184 (2.2%)	1.2%
Total	309,196	36,793		15,941	

The counties in the far left column in Table 2.1 are in a descending order according to the highest total population and percentages of Finnish ancestry relative to each county's total population. Of Marquette County's total population (i.e., approximately 65,300 residents), 16.9% report Finnish as their first ethnic-heritage (i.e., 11,014 residents), while 6.7% report Italian (i.e., 1,555 residents). Combining all of the counties ethnic-heritage populations for the two groups, an estimate of 36,800 residents claim Finnish ancestry as their first ethnic-heritage of which 29.9% of them reside within Marquette County; in contrast, 27.4% claiming Italian as their

during the summers of 2007 and 2008, and therefore, it potentially reflects more accurately the sampled population at the time of data collection, and 2) the 2005-2008 estimates provides comparable results with the 2009-2013 estimates reported in Rankinen (2014).

first ethnic-heritage reside in the Marquette County. While there are more residents claiming Finnish-heritage in Marquette County, the two ethnic-heritage groups are comparable relative to the total populations of each ethnic-heritage group for the entire northern peninsula. While there are other European and non-European ancestral groups that exist in Marquette County (e.g., German, Swedish, French Canadian, etc.), Finnish and Italian as ethnic-heritage groups are not only instantiated by their population size - but also, as ethnic-heritage groups, they are among the few that still vibrantly celebrate their ancestry at local festivals which legitimizes their sense of identity within and among the local communities (Rankinen 2014; Remlinger 2006).

In addition to population size, the language that is used in the home is also an important topic to consider with regards to Michigan's Marquette County. According to the 2009-2013 statistics reported in Rankinen (2014, 10), "... Of the 88.3% claiming to be native-born residents of the county, the US Census reports only 2.4% of the residents claim to speak another language in the home (i.e., other than English) and only 1.1% of those residents claim to speak a language other than either an Indo-European or an Asian and Pacific Island language; based on that small percentage of potential Finnish [and Italian] bilinguals, 0.54% are estimated to be 65 years or older, 0.40% are estimated to be between 65 and 18 years old, and only 0.13% are estimated to be between 17 and 5 years old" (US Census Bureau 2000). This is supported by the 2005-2009 US Census estimates that approximately 94.7% of Marquette County's population are monolingual English speakers. Although the Finnish and Italian languages are still retained among a minority of the first and second-generation speakers in these communities, Michigan's UP should be regarded today as being a predominately monolingual English speaking community. However, this is not to say that the present-day monolingual English speakers have escaped the influence of their cultural or linguistic ethnic-heritage. In fact, the UP community is claimed to be distinct in their cultural-identity and language from other neighboring regional communi-

ties such as Canada and Lower Michigan. While Marquette County, and the Upper Peninsula more generally, may not be unique in being a monolingual-oriented speech community - it is however an excellent location to examine the potential lingering substrate influences of two distinctly different ethnic-heritage groups on an American variety of English spoken by both bilingual and monolingual speakers.

2.2 Previous Linguistic Research in the Region

2.2.1 American English in Michigan's Upper Peninsula

Recent linguistic qualitative research has focused primarily on ethnographic concerns (e.g., enregisterment, local identity, and regional and local perceptions (Remlinger 2006, 2007, 2009; Simon 2005). Similarly, the quantitative linguistic research examining this northern peninsula has been limited to only a handful of studies. Those studies containing UP subjects have referred to them as either a rural community on the marginal limits of the study or as a contrastive group; as a result of not focusing on the linguistic characterization of the English language variety spoken in Michigan's UP, such studies have held subject pools of relatively small sample size and none of them have examined the internal diffusion of a linguistic variable by investigating the speech patterns of groups of speakers and comparing those patterns across social categories (Labov et al. 2006; Rakerd and Plichta 2010). There are three exceptions to this claim: 1) an earlier dialectal research study conducted by Steward A. Kingsbury and Zacharias Thundyil for the North Central atlas in the Linguistic Altas Project (1945-1975), 2) an earlier dialect survey focusing on Finnish-heritage influence on English conducted by Anita Adamson, and 3) a more recent sociophonetic study that investigates the potential substrate and neighboring regional influences on the vowel system of sixty-nine Michigan UP Finnish-Americans (Rankinen 2014).

While the North Central atlas in the Linguistic Atlas Project (1945-1975) originally did not include speakers from Michigan's Upper Peninsula, contributions from Stewart A. Kingsbury, Zacharias Thundyil, and Joseph Peterson mark the earliest linguistic investigation in the region (Allen and Underwood 1977, 179). This preliminary dialectical work, initially presented by Peterson and Thundyil in 1971 at Michigan's Linguistic Society conference, reported on a wide-range of survey data that included phonological, lexical and grammatical items; the survey sought to obtain residents from each of the fifteen counties located in the peninsula (1971).

Peterson and Thundyil were not alone at making a debut of UP dialect research in 1971. Anita Adamson, at the same Michigan Linguistic Society annual conference that year, also presented on UP dialect survey data that she collected for a graduate term paper. Unlike the wide-scope project done by Peterson and Thundyil, Adamson's survey focused specifically on the speech of UP Finnish-heritage speakers from the local dialect area in and around the town of Marquette, Michigan (1971). Three generational groups (i.e., Finnish immigrants who migrated in the 1930s and 1940s, first-generation UP residents whose parents were immigrants, and second-generation UP residents whose grandparents were immigrants) were compared with a control group (i.e., non-Finnish-heritage residents from Marquette with a diverse range of occupational, social and economic categories) (1971, 6). Based on phonemic transcription of single-word pronunciation of lexical items, Adamson concluded that the second generation Finnish-heritage speakers pattern more similarly to the Finnish immigrants than to those of the first generation. This claim is weakened, however, due to the small number of subjects claiming to be immigrants in her study. While the results and conclusions may be questioned, this study serves as the first attempt toward examining generational effects of Finnish-heritage in the speech among Michigan's UP speakers, as well as, the first linguistic study to investigate the speech specific to Michigan's Marquette County.

Results from my previous sociophonetic vowel system study (Rankinen 2014), which examined sixty-nine Finnish-heritage UP English speakers from Michigan's Marquette County, suggests that there is a change-in-progress toward a set of linguistic variables associated or shared with that of Canadian English speakers; this shift is most pronounced in the vowels of younger-aged speakers compared to that of the older- or middle-aged speakers. More specifically, the lowering and retraction of the front lax vowels in conjunction with the presence of the low-back merger stands as apparent-time evidence to support that the Canadian shift is being adopted by the younger monolingual, and not the older bilingual, UP speakers.[3]

2.2.2 Substrate Systems in the Upper Midwest

The two substrate systems of interest are Finnish and Italian, both of which are distinct from one another in terms of phonological inventory and system configuration. The Finnish vowel system includes eight short and long vowel phonemes (i.e., /i/, /y/, /e/, /ø/, /æ/, /ɑ/, /o/, /u/), which forms a trapezoidal configuration (Wiik 1965); limited dialect variation exists for Finnish vowels (Suomi et al. 2008). In contrast, the Italian system is conservatively characterized as having seven vowel phonemes (i.e., /i/, /e/, /ɛ/, /ɑ/, /ɔ/, /o/, /u/) and form a triangular configuration (Bertinetto and Loporcaro 2005); however, there can be as many as eight and as low as five vowel qualities, particularly among southern Italian dialects (Flege et al. 1999, 2976). The triangular configuration of the Italian vowel system is structurally distinct compared to the trapezoidal configuration of the Finnish and English systems (Flege et al. 1999, 1580; Escudero et al. 2014, 2978).

[3]The middle-aged monolinguals' front lax vowels (e.g., the /ɪ/, /ɛ/ and /æ/ vowels) are in-between the older- and younger-aged counterparts.

2.2.3 American English in the Upper Midwest

The vowel system characteristics in the American English speech communities located in the western parts of the Upper Midwest also need to be addressed due to this area's proximity with Michigan's UP, which together, comprise of the larger "transitional region" as defined by Labov et al. (2006). As such, it is generally regarded as having the *low-back merger* and slight */uw/-fronting* but not the *Canadian shift*. In addition to these sets of linguistic variables that indicate a variety, recent sociophonetic work in the region report evidence of a monophthongized /ow/ variant preferred among more rural communities in the Minnesota and Wisconsin areas (Allen 1973; Nguyen 2011; Rose 2006). However, the use of the monophthongized /ow/ variant is often stigmatized and disfavored by those preferring the use of the standard diphthongal variant (Nguyen 2011); further research is required to confirm such a claim and to provide a more comprehensive account of this variable in general (e.g., larger sample size of both urban and rural speech communities).

2.2.4 American English in the Lower Midwest

The geolinguistic region known as the "Inland North" is typically characterized by the internal acoustic relationships between the vowels participating in the Northern Cities Vowel Shift (NCVS) (Gordon 2000b; Konopka and Pierrehumbert 2014; Labov et al. 2006). The presence of EQ, ED and UD criteria in the vowel system of a speaker, as characterized by Labov, is defined as being a fully shifted NCVS system: 1) the EQ criteria stipulates that the relative position of the /æ/ and the /ɛ/ must reverse so that /æ/ is both higher and fronter than the /ɛ/ vowel; 2) the ED criteria stipulates that the /ʌ/ is further back than the /ɑ/ vowel; 3) the UD criteria stipulates that the /ɛ/ and the /æ/ vowels must be <375Hz in the F2 dimension from one another

(Labov et al. 2006, 200-204). The Inland North, as defined by the full adoption of the NCVS, is a region that spans from Bufflalo, New York to Milwaukee, Wisconsin. The propagation of the set of linguistic variables associated with the NCVS tend to diffuse from one urban center to another, after which they have the potential to disperse to more rural regions (Labov 2011, 139).

Since the /ɑ/ and the /ɔ/ vowels are participating in the NCVS (i.e., fronting relative to their canonical acoustic positions), they do remain phonologically distinct from one another in the Inland North. Furthermore, the /ow/ vowel is characterized as a typical short diphthong, and there is limited */uw/-fronting* (i.e., <1500 Hz in F2 value when following a coronal consonant and <1200 Hz when following a non-coronal); this is reported in the speech of speakers located in the western part of the Inland North and the North Central regions (Labov et al. 2006, 154-155). The presence of /aw/-fronting (i.e., <1550 Hz) and the centralization of /aj/ (i.e., when followed by a voiceless consonant) are also reported to be present in the region; the latter one exists in areas such as Detroit and New York (Eckert 1996; Keyser 1963; Labov et al. 2006).

Currently, the NCVS is not likely an influencing factor on the speech of UP English speakers as reported by Rakerd and Plichta (2010). In their study, they compared the vowel spaces of one speaker from Michigan's UP and one speaker from Michigan's Lower Peninsula (LP). Based on this perceptual study, the two speakers were recognized as having observably different systems. The relative position of the LP speaker's vowels were distinct from the UP speaker. The /æ/ vowel was in a low position for the UP speaker, while the /æ/ and /ɛ/ vowels for the LP speaker have switched positions (i.e., Labov et al's "EQ" factor stating that /æ/ is both more front and higher than the /ɛ/ vowel). The cot-caught merger existed in the vowel space of the UP speaker. In contrast, this low-back vowel merger was not present in the LP

speaker vowel space (i.e., as is characteristic of systems participating in the NCVS). Note also that the LP speaker's /ɛ/ and /ɑ/ vowels were relatively close in their F2 space, which is a general characteristic that is not shared with the UP speaker; this is the "ED" criterion for the NCVS, which states that the /ɛ/ vowel is less than 375Hz further front than the /ɑ/ vowel (Labov et al. 2006). At the present time of Rakerd and Plichta (2010)'s study, the NCVS is shown not to be a factor on Michigan's UP vowel system; however, future studies in the next few decades should revisit the development of the NCVS in this region.

While the influencing effects of the post-NCVS system may not have had a chance yet to reach the northern peninsula, a pre-NCVS Michigan system reported in Peterson and Barney (1952) is shown to have been a dominant system in Lower Michigan until the inception of this post-NCVS system and may have had an impact on the speech spoken in Upper Michigan. This older Michigan system is plotted in Figures 2.4 and 2.5.[4]

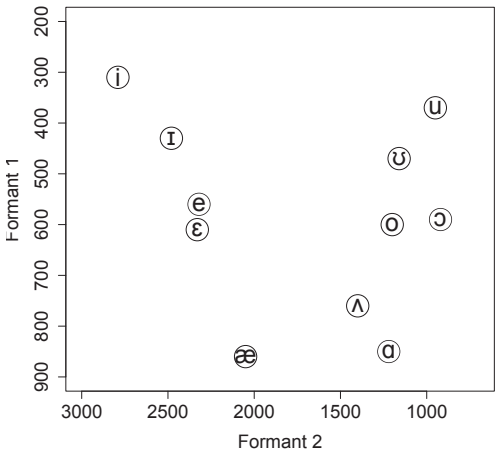


Figure 2.4:
Pre-NCVS Michigan (females)
(Peterson and Barney 1952; Stevens 2000)

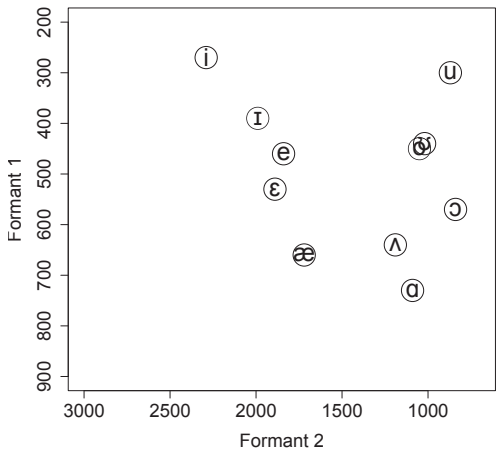


Figure 2.5:
Pre-NCVS Michigan (males)
(Peterson and Barney 1952; Stevens 2000)

[4]This pre-NCVS Michigan English system is based on the averages of 61 speakers' F1 and F2 for 28 females and 33 males (Peterson and Barney 1952); the /e/ and /o/ data, supplemented by Stevens (2000), comes from two females and two males; both datasets are plotted using unnormalized values.

As shown in the figures above, these general plots display the raw acoustic vowel data of the Lower Michigan female and male speakers. Furthermore, these figures show several key characteristics of sets of linguistic variables associated with this system: 1) a clear phonetic distinction between the phonemes /ɑ/ an /ɔ/, 2) relatively low low vowels at approximately 600-900Hz, and 3) relatively high high vowels at approximately 250-350Hz.

2.2.5 Canadian English in Ontario and Elsewhere in Canada

Canadian English, as a possible exogenous factor on Michigan UP English, is the last neighboring regional variety to take into consideration. As a possible exogenous factor, the author will restrict his focus to examine vowel system characteristics reported on the neighboring Canadian English variety spoken by speech communities in Ontario, Canada. Ontario Canadian English (OCE) is strongly characterized by the lowering and retraction of the front lax /ɪ/, /ɛ/, and /æ/ vowels, the low-back merger of the /ɑ/ and /ɔ/ vowels, /u/ fronting, and the centralization of the nuclei of /aj/ and /aw/ (i.e., before voiceless obstruents) (Boberg 2008; Labov et al. 2006; Roeder and Jarmasz 2009, 2010, 138). Boberg (2008)'s work on regional Canadian English reports that the Canadian shift and /uw/ fronting are both changes-in-progress, with the former primarily restricted to Canada and the latter affecting North America more generally (Boberg 2008, 149).

The Canadian shift, first reported by Esling and Warkentyne (1993), is often associated with the presence of the low-back merger as first described in Clarke et al. (1995). While there is disagreement as to the specific path of the lowering and/or retraction of the front lax vowels, most researchers agree that the shifting of these vowels is driven by the merging of the /ɑ/ and /ɔ/ vowels in the lower back quadrant of the acoustic vowel space as diagramed in Figure 2.6 above (Roeder and Jarmasz

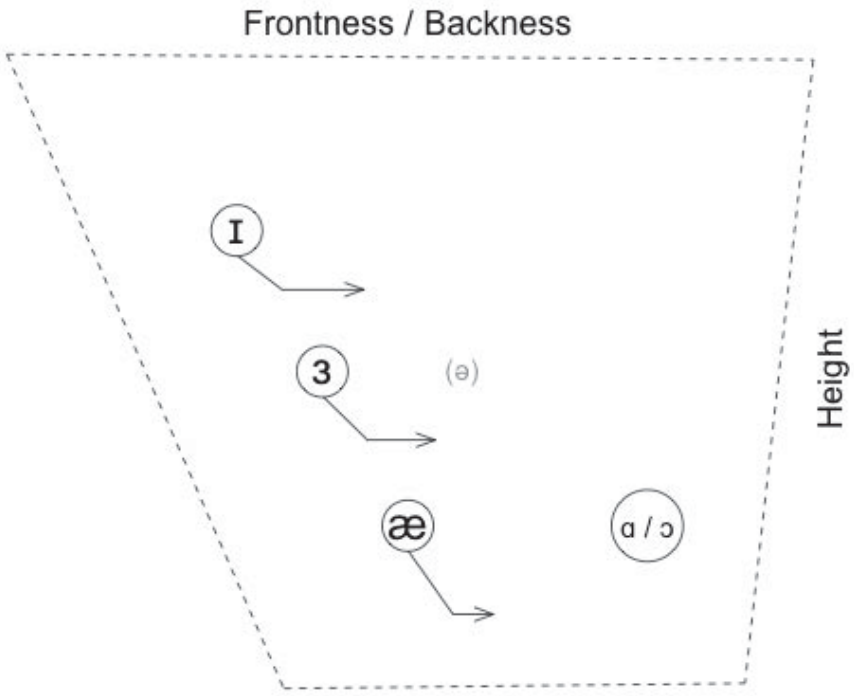


Figure 2.6:
Schematic of the Canadian Shift and
the Low-Back Merger
(Based upon a similar one developed
by Roeder and Jarmasz (2009))

2009). This shift is shown to be occurring in much smaller and more rural speech communities of OCE (De Decker and Mackenzie 2000). In other areas of Canada (e.g., in such urban centers as Winnipeg and Montreal), the Canadian shift and the low-back merger are also both shown to be present (Boberg 2005; Hagiwara 2006; Labov et al. 2006).

The phenomenon, first coined as "Canadian raising" (Chambers 1973, 113), involves the onset or nucleus of the long diphthongs /aw/ and /aj/ of which are phonetically realized higher in the acoustic vowel space when followed by voiceless obstruents; however, when followed by voiced obstruents, non-raising occurs (Chambers 1989, 2006; Thomas 1991; Vance 1987).[5] The inquiry to the origins of this phenomenon in Ontario, reported by Thomas (1991, 162), suggests that the origin of Canadian raising "... must be pushed back as far as 1880, two generations before previously cited evidence indicated ..."; this claim stands in contrast to an alternative hypothesis proposed by Trudgill (1986) that the raised nuclei of /aw/ and /aj/ occurs largely on account of dialect mixing — a hypothesis that is currently empirically unsupported (Chambers 1989, 85). Regardless of their origins, the raising of the /aw/ and /aj/ nuclei have been documented to occur independent of one another (Chambers 1989, 77). The labeling of these phenomena as "Canadian" is also misleading since the raised nuclei of /aw/ and /aj/ have been shown to be present in speech of many American English varieties (Dailey-O'Cain 1997; Vance 1987); however, Chambers (2006, 110) points out that "... northern U.S. /ai/-raising is much more general ... [showing that] Saginaw raising apparently occurs when tonic /ai/ is followed by a weak syllable regardless of the voicing of consonants" as demonstrated in the work of (Milroy 1996, 215). In addition, the /aw/ is shown to not only raise before voiceless obstruents in more recent documentation of the phenomenon but to front as well (i.e.,

[5]Martin Joos (1942) was the first to note the raised and non-raised variants of the /ay/ diphthong. As for the raised variant of the /aw/ diphthong, Chambers (2006, 106-107) accredits Ahrend (1934, 136) and Ayearst (1939, 231-232) for the earliest record of the phenomenon.

known as "/aw/-fronting") (Easson 1997, 61; Rosenfelder 2005; Chambers 2006, 117); this tends to be led by females and seems to be slowing down as a change-in-progress in Canadian English more generally (Chambers 2006, 115). The low-back merger, the Canadian shift, the Canadian raising and /aw/-fronting are all distinctive linguistic phenomenon that characterize the English variety referred to in this thesis as Ontario Canadian English.

In the next chapter, we will turn to the description and implementation of the thesis' methods and procedures.

CHAPTER 3

METHODS

3.1 The Sets of Linguistic Variables

This thesis examines five sets of linguistic variables, comprised of seven monophthongal variables and four diphthongal variables. The first set of linguistic variables (FRONT LAX vowels), participating in the Canadian shift or the California shift, involves the three front lax /ɪ/, /ɛ/ and /æ/ vowels as in *bit*, *bet* and *bat*. The second set of linguistic variables (LOW BACK vowels), typically regarded as the low-back merger, involves the two low back /ɑ/ and /ɔ/ vowels as in *cot* and *caught*. The third set of linguistic variables (HIGH BACK vowels) involves the high back /ʊ/ and /u/ vowels as in *put* and *boot*. The fourth set of linguistic variables (SHORT DIPHTHONG vowels) involves the /ej/ and /ow/ vowels as in *bait* and *boat*. The fifth set of linguistic variables (LONG DIPHTHONG vowels) involves the /ɑj/and /ɑw/vowels *bite* and *bout*. The subsequent sub-sections are organized by the sets of linguistic variables as shown in Table 3.1, where potential variants of each linguistic variable (i.e., analyzed separately) for each set of linguistic variables are described in detail.

Table 3.1: Linguistic variables and potential variants organized by set of linguistic variables

Sets of Linguistic Variables	**LV**	**Potential Variants**
FRONT LAX	/ɪ/	[ɪ] ∼ [ɪ̟] ∼ [ɪ̠]
	/ɛ/	[ɛ] ∼ [ɛ̟] ∼ [ɛ̠]
	/æ/	[æ] ∼ [æ̟] ∼ [æ̠] (Canadian shift)
		[æ] ∼ [æ˕] ∼ [æ˔] ∼ [ɛ] (NCVS shift)
LOW BACK	/ɑ/	[ɑ] ∼ [ɑ / ɔ] ∼ [ɑ̞] ∼ [æ]
	/ɔ/	[ɔ] ∼ [ɑ / ɔ] ∼ [ɔ̝]
HIGH BACK	/ʊ/	[ʊ] ∼ [ʊ / u]
	/u/	[u] ∼ [ʊ / u] ∼ [u˕]
SHORT DIPHTHONGS	/ej/	[ej] ∼ [e̞j] ∼ [e]
	/ow/	[ow] ∼ [o̞w] ∼ [o]
LONG DIPHTHONGS	/ɑj/	[ɑjT] ∼ [ʌjT] ∼ [ɑ̟jT] ∼[ɐjT]
		[ɑjC] ∼ [ʌjC] ∼ [ɑ̟jC] ∼[ɐjC]
	/ɑwT/	[ɑwT] ∼ [ʌwT] ∼ [ɑ̟wT] ∼[ɐwT]

3.1.1 The Front Lax /ɪ/, /ɛ/, /æ/ Vowels

The /ɪ/, /ɛ/ and /æ/ vowels are all considered to be front and lax in terms of phonological description. However, their relative position in the overall acoustic phonetic vowel space is typically determined relative to their height and backness compared to the front tense vowels and back vowels. While the potential number of variants for each of these three variables may be numerous, the likely variants of each variable is relatively small as indicated in Table 3.2.

Table 3.2: Linguistic variables and potential variants of the front lax set of LV

Set of Linguistic Variables	**LV**	**Potential Variants**
FRONT LAX	/ɪ/	[ɪ] ∼ [ɪ̟] ∼ [ɪ̠]
	/ɛ/	[ɛ] ∼ [ɛ̟] ∼ [ɛ̠]
	/æ/	[æ] ∼ [æ̟] ∼ [æ̠] (Canadian shift)
		[æ] ∼ [æ˕] ∼ [æ˔] ∼ [ɛ] (NCVS shift)

The relative raising of the [æ] vowel past the height of the [ɛ] vowel is a potential variant of the /æ/ vowel, which would be indicative of a Northern Cities Vowel Shift (NCVS) influence. Similarly, the lowering (and possible retraction) of the [æ] vowel past the relative height of the [ɔ] is another possible variant of the /æ/ variable, which would be indicative of an Ontario Canadian English (OCE) influence. The third possible variant of the /æ/ variable is to remain at the same relative height of the [ɔ] and relative backness compared to other neighboring vowels.

The relative lowering (and possible retraction) of the [ɪ] and [ɛ] vowels are potential variants of the /ɪ/ and /ɛ/ variables, respectively, which would be indicative of either a NCVS or a OCE influence; that is, being contingent on the preferred variant of the /æ/ variable. The other possible variants for these two variables is to remain at the same relative height of their back lax counterparts (i.e., [ʊ] and [ʌ]).

In terms of their phonetic environments, the /ɪ/, /ɛ/ and /æ/ phonemes are followed by obstruents (i.e., *picked* and *did* for /ɪ/; *said* and *get* for /ɛ/; and *have* and *hat* for /æ/);[1] the preceding phonetic environments of the phoneme and the syllable length of the token word were not controlled.

3.1.2 The Low Back /ɑ/ and /ɔ/ Vowels

The /ɑ/ and /ɔ/ variables are likely to have three variants as described in Table 3.3.

Table 3.3: Linguistic variables and potential variants of the low-back set of LV

Set of Linguistic Variables	**LV**	**Potential Variants**
LOW BACK	/ɑ/	[ɑ] ∼ [ɑ / ɔ] ∼ [a̟] ∼ [æ]
	/ɔ/	[ɔ] ∼ [ɑ / ɔ] ∼ [ɔ̟]

[1]For the full token word list from the reading passage, see Table 8.1 in the appendix for detail. In fact, the proceeding environment is controlled for all variables due to the nature of the reading passage.

The [ɑ] vowel can: a) retract relative to the vowel space (i.e., crowding the neighboring acoustic space of the [ɔ] vowel), b) advance relative to the vowel space (i.e., utilizing the low central or low front vowel space if available), or c) remain in the relative position of the low back vowel space. The [ɔ] vowel can: a) lower to the low-back vowel space (i.e., utilizing the empty acoustic space left by the [ɑ] vowel), b) lower relative to the vowel space (i.e., begin crowding the acoustic space already utilized by the [ɑ] vowel), or c) remain in the relative position distinct from the low back vowel space. The phonetic environments of [ɑ] and [ɔ] were restricted to being either followed by a consonant or located at syllable-final position (e.g., *Bob* for /ɑ/ and *saw* for /ɔ/; see Table 8.1 in the appendix for details).

3.1.3 The High Back /ʊ/ and /u/ Vowels

In Table 3.4 below, the /ʊ/ and the /u/ variables have three likely variants.

Table 3.4: Linguistic variables and potential variants of the high-back set of LV

Set of Linguistic Variables	**LV**	**Potential Variants**
HIGH BACK	/ʊ/	[ʊ] ∼ [ʊ / u] ∼ [u̟]
	/u/	[u] ∼ [ʊ / u] ∼ [u̟]

The [u] vowel can: a) advance relative to the vowel space (i.e., utilizing the empty high central area of the acoustic vowel space), b) slightly advance and/or lower to merge with its high back lax counterpart, or c) remain in the relative high back position distinct from its lax counterpart. The [ʊ] vowel can: a) advance relative to the vowel space (i.e., patterning with the advancement of the [u] variant), b) retract and/or raise relative to the vowel space (i.e., crowding the acoustic space already utilized by the [u] vowel and potentially merge with the [u] vowel) or c) remain in

the relative position distinct from its tense counterpart. Both linguistic variables are only followed by an obstruent or located at syllable-final position (e.g., *put* for /ʊ/ and *two* for /u/; see Table 8.1 in the appendix for details).

3.1.4 The Short Diphthongs /ej/ and /ow/ Vowels

The potential variants of the short diphthongs are displayed in Table 3.5.

Table 3.5: Linguistic variables and potential variants of the short diphthongal set of LV

Set of Linguistic Variables	**LV**	**Potential Variants**
SHORT DIPHTHONGS	/ej/	[ej] ∼ [e̞j] ∼ [e]
	/ow/	[ow] ∼ [o̞w] ∼ [o]

The nucleus of the [ej] vowel can: a) retract relative to the acoustic vowel space currently being utilized by the [ɪ] monophthong, b) retract relative to the acoustic vowel space to utilize the acoustic space left empty by the lowering (and possible retraction) of the [ɪ] vowel, or c) remain at the relative position distinct from its lax and monophthongized counterpart. The nucleus of the [ow] vowel can: a) advance relative to the acoustic vowel space (i.e., crowding the central acoustic space), b) retract relative to the acoustic vowel space (i.e., utilizing the back most region of the acoustic space), or c) remain in the relative position of backness compared to the /ɔ/ vowel and relative position of height compared to the /ɪ/ vowel. One additional variant for each of the short /ej/ and /ow/ diphthongs is that both can be phonetically realized as monophthongs (i.e., [e] and [o] as in [bet] for *bait* and [bot] for *boat*); if the nucleus of the vowel quality monophthongized as well as shifted, both variants would still likely maintain lengthening contrasts with the neighboring monophthongs (e.g., [ɪː] ∼ [ɪ] as in [bɪːt] and [bɪt] for *bait* and *bit* respectively). Both linguistic variables

are only followed by an obstruent or located at syllable-final position (e.g., *chased* for /ej/ and *go* for /ow/; see Table 8.1 in the appendix for details).

3.1.5 The Long Diphthongs /ɑɹ/and /ɑw/Vowels

The long /ɑj/and /ɑw/diphthongs are the last variables, and their respective variants, to consider for this section. It is important to note first that /aj/ and /aw/ are both constrained in their following phonetic environments in that they are only followed by an obstruent. Furthermore, /aw/ is only followed by a voiceless segment (e.g. *house*, *out*, *(a)bout*), while /aj/ is followed by both a voiced and voiceless obstruent (e.g., *slices*, *tried*); whenever /ɑj/ and /ɑw/ are followed by a voiceless obstruent, the phonetic realization will be presented with a "T", and whenever /ɑj/ is followed by a voiced obstruent, the phonetic realization will be represented with a "C" as displayed in Table 3.6 below.

Table 3.6: Linguistic variables and potential variants of the long diphthongal set of LV

Set of Linguistic Variables	**LV**	**Potential Variants**
LONG DIPHTHONGS	/ɑj/	[ɑjT] ~ [ʌjT] ~ [ɑ̟jT] ~[ɐjT]
		[ɑjC] ~ [ʌjC] ~ [ɑ̟jC] ~[ɐjC]
	/ɑw/	[ɑwT] ~ [ʌwT] ~ [ɑ̟wT] ~[ɐwT]

The nuclei of the [ɑjT] and [ɑjC] diphthongs can: a) raise relative to the acoustic vowel space and crowd the acoustic space already utilized by the /ʌ/ vowel, b) advance relative to the acoustic vowel space and utilize the low central acoustic space, c) raise to the height of the /ʌ/ and advance to the central vowel space, or d) remain in the relative position of the /ɑ/ monophthong. Similarly, the nucleus of the [ɑwT] diphthong can: a) raise relative to the acoustic vowel space and crowd the acoustic space already utilized by the /ʌ/ vowel, b) advance relative to the acoustic vowel

space and utilize the low central acoustic space, c) raise to the height of the /ʌ/ and advance to the central vowel space, or d) remain in the relative position of the /ɑ/ monophthong.[2]

3.2 The Speakers and Predictor Variables

This study includes a total of 130 participants, all of which are native to Michigan's Marquette County. Speech data obtained from each participant were collected during the summers of 2007 and 2008. While the bilingual subset of this corpus is split based on whether participants spoke their heritage language (i.e., Finnish or Italian) or English first during their early childhood, both bilinguals and monolinguals alike speak the American English variety spoken in the Upper Peninsula (UP) as their first, second or only language. Additionally, each participant must have had at least one grandparent who claimed full ancestry of either Finnish or Italian ethnic-heritage. In addition to being native to the region of study, all participants spent the majority of their lives in Michigan's UP; "majority" means that they spent no more than five years away from the peninsula. In the following subsections, a full description of the HERITAGE-LOCATION, BILINGUALISM, AGE, SEX and CLASS predictor variables will be provided.

The original corpus design was based on a stratified random sampling technique. The predictor variables that stratify this original corpus included HERITAGE, BILINGUALISM, AGE, SEX, CLASS. However, the present thesis will examine the predictor variable of HERITAGE (i.e., Finnish- or Italian-heritage) as it correlates with the predictor variable of LOCATION (i.e., the geolocation of participants based on residency).

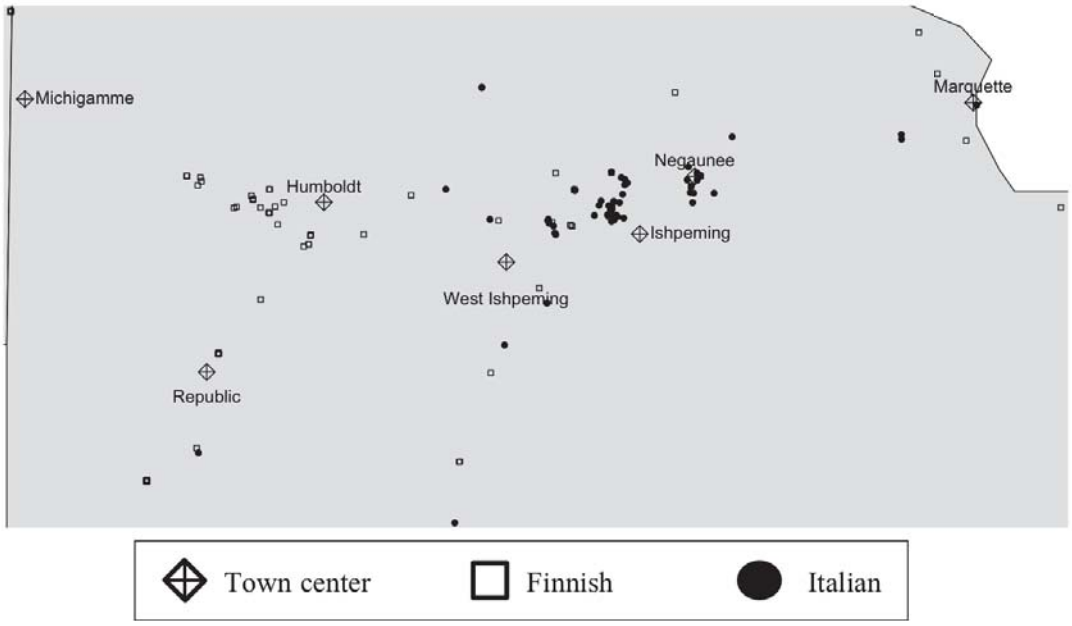
[2]While it is possible that these diphthongs could monophthongize, it is not likely due to their distinctive trajectory and durational patterns for marking lexical contrasts and a lack of any neighboring regional variety that has the monophthongization variants of these long diphthongs (i.e., American English in Pittsburgh or the U.S. South would be the closest regional varieties, but both are unlikely to have any influence on UP English).

As a result, Subsection 3.2.1 will first explain the combined predictor variable of HERITAGE-LOCATION and then subsections 3.2.2 and 3.2.3 will describe the sample speaker designs used in subsequent analyses of this thesis.

3.2.1 HERITAGE-LOCATION AS A PREDICTOR VARIABLE

In Figure 3.1 below, the unfilled squares and filled circles represent each of the 130 participants in Marquette County (MQT) according to their heritage and residency. The filled circles indicate participants who reported Italian-heritage ancestry, while the unfilled squares indicate participants who reported Finnish-heritage ancestry. The geographic location of each symbol is based on the latitudinal and longitudinal co-ordinates of a participant's address reported at the time of a field recording. The crossed diamond symbols represent the approximate location of the center of town. The mapping of participants' residency is used as a general approximation of location within Marquette County; it is understood that a participant may in fact live in or near one social center (e.g., Ishpeming) but commute to a neighboring town (i.e., Marquette) for employment, recreational or other purposes.

Figure 3.1: Participants' geolocation by heritage (MQT; n=130)

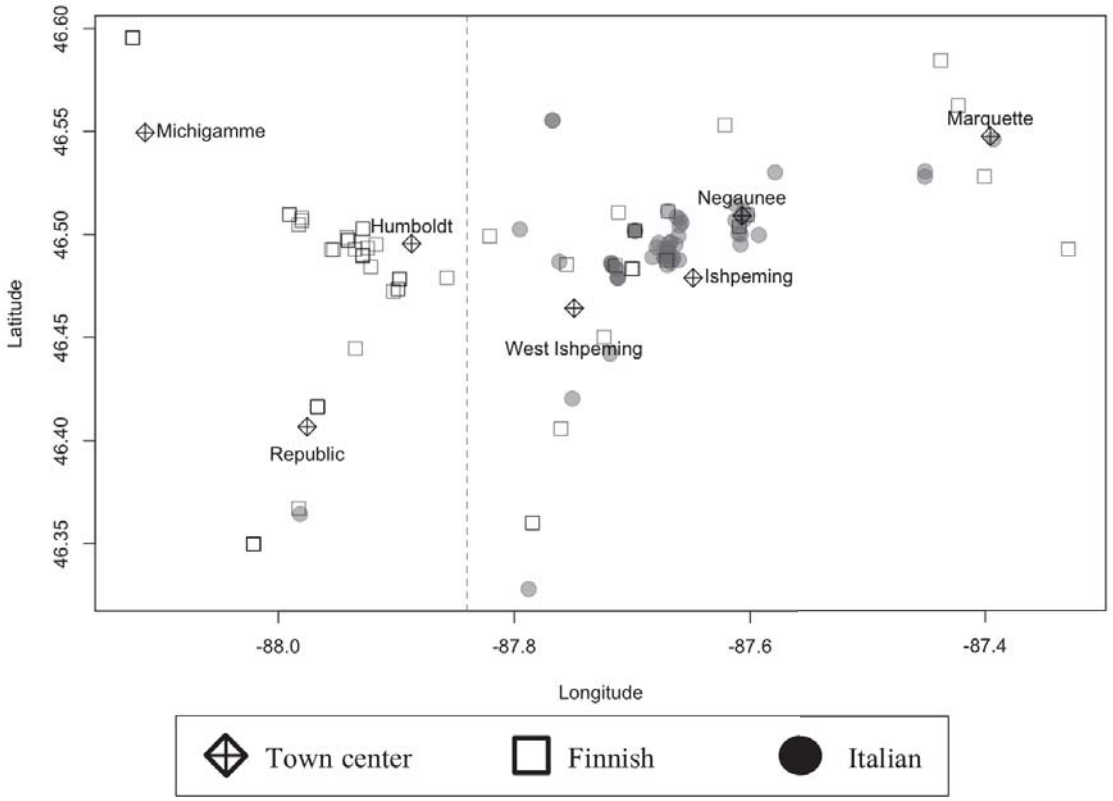


An immediate concern raised by Figure 3.1 is the asymmetrical patterning of participants heritage and residency. Those claiming Finnish heritage are dispersed across the county while those claiming Italian heritage are largely found in the eastern half of the county. In other words, there seems to be a limited number of participants' claiming Italian-heritage in the western half of Marquette County. Interestingly, however, this lack of Italians in western Marquette County is supported by population and ancestry data obtained by the US Census Bureau (2000), which indicates that the sample obtained for the thesis is representative of the population under study.

This west/east distinction, based on participants' heritage and location of residency, can be parameterized based both on geographic and social grounds. Recall back in Chapter 2, the US-41/M-28 highway corridor links the towns (e.g., Marquette) from the east-side of the county to townships on the westside of the county (e.g., Michigamme). While Marquette, Negaunee and Ishpeming are more appropriately referred to as towns, those social centers found west of the -87.84 longitudinal dimension are not "towns" per se but more like townships with small or indefinite

business sectors. This single geographical line, as displayed in Figure 3.2 below, can be argued to delineate Marquette County in half along the longitudinal dimension of participants' heritage and location of residency.

Figure 3.2: The longitudinal dimension and west/east threshold of participants' geolocation by heritage (MQT; n=130)



While the -87.84 threshold may seem arbitrary at first, it is actually based upon two parameters: 1) the gap that exists in the sample distribution of participants as a factor of heritage and location of residency and 2) a reduction of population density that exists along a two-mile straight-stretch of the US–41/M–28 highway; both parameters spans parallel along this longitudinal dimension and contribute to the west/east threshold. In other words, this threshold along the longitudinal dimension is justified based on both social and geographical parameters and is used to establish

a west-to-east dichotomy for the participant sample in this thesis.

Figure 3.3 below displays the participants' heritage along this longitudinal dimension as a density plot. The dashed vertical line represents the west-to-east threshold.

Figure 3.3: West– to east–siders by heritage groups (MQT; n=130)

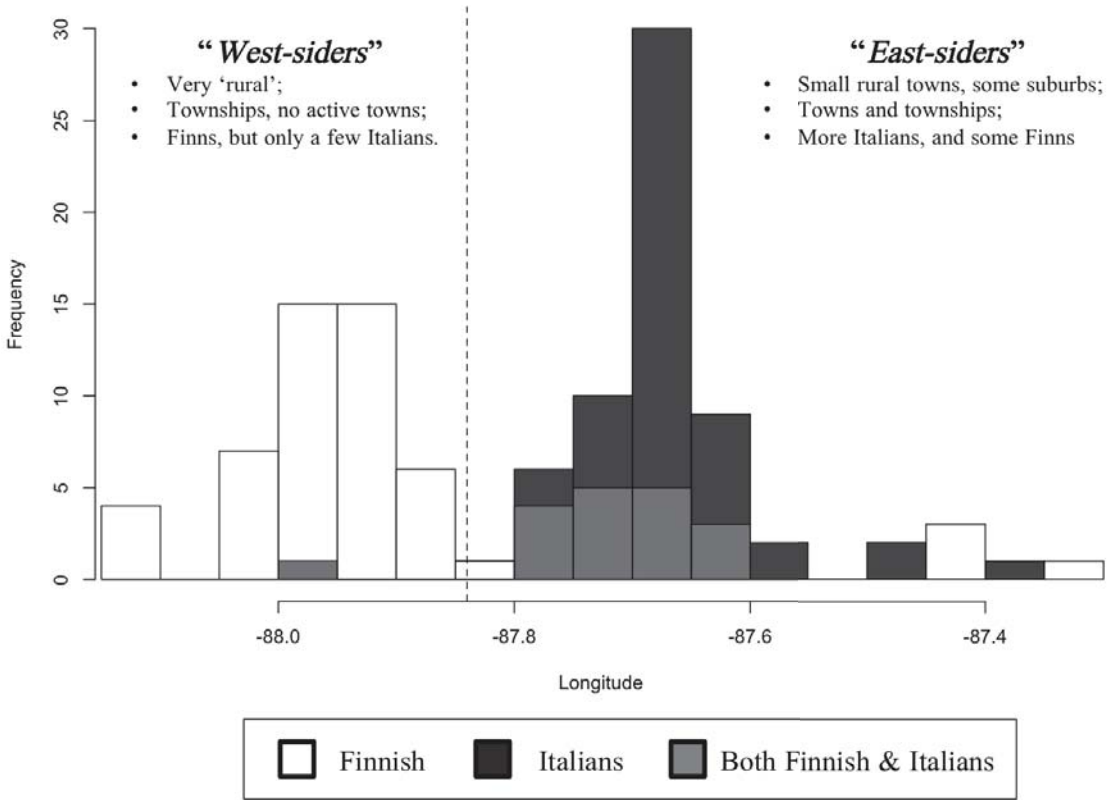


Figure 3.3 highlights the fact that the majority of the "west-siders' are characterized as being rurally based in townships and as having mostly Finnish-heritage residents and few Italian-heritage residents. In contrast, the "east-siders" are characterized as being both rurally and more suburban based in small towns and townships and as having more Italian-heritage residents and some Finnish-heritage residents.

Table 3.7 displays the number of sampled participants as stratified by this west-to-east dichotomy of location of residency and heritage.

Table 3.7: Sample demographics of heritage and location

		Location	
		West	East
Heritage	Finns	47	22
	Italians	1	60

This table displays the four potential levels of the HERITAGE-LOCATION predictor variable; however, only three have an adequate number of participants for quantitative analysis. As a result, HERITAGE-LOCATION has the following three levels as a predictor variable: WEST-side Finnish UP speakers (n=47), EAST-side Finnish UP speakers (n=22), and EAST-side Italian UP speakers (n=60). The single WEST-side Italian UP speaker will be excluded from further quantitative analysis but may still be used for qualitative observations in this thesis; as a result, the total number will remain at 130 participants.

3.2.2 HERITAGE-LOCATION AND BILINGUALISM

Table 3.8 reports the number of participants in each of the grouping according to the breakdown of HERITAGE-LOCATION and BILINGUALISM.

Table 3.8: Sample demographics of heritage-location and bilingualism

HL-levels	BILINGUALISM-levels			Total
	Heritage-bilinguals (G1)	English-bilinguals (G2)	English-monolinguals (G3)	
EAST-side Finns	7	2	2	11
EAST-side Italians	7	9	12	28
WEST-side Finns	8	11	13	32
Total	22	22	27	71

The predictor variable of HERITAGE-LOCATION is based on the ethnic-heritage and location of residence of participants included in the study as described in Subsection 3.2.1. In terms of the predictor variable of BILINGUALISM, there are three divisions: 1) bilingual speakers whose first language is their heritage language (i.e., Finnish or Italian), 2) bilingual speakers who are bilingual in both their heritage language and English from birth or at a very early age, and 3) monolingual speakers of English with little or no knowledge of their heritage language. Furthermore, all participants are categorized as being older-aged speakers (i.e., 59 years old or older); that is to say, there are no middle- or younger-aged bilinguals in the sample observed in this thesis.

3.2.3 HERITAGE-LOCATION, AGE, SEX AND CLASS

Table 3.9 reports the number of participants in each of the groupings according to the breakdown of HERITAGE-LOCATION, AGE, SEX and CLASS.

Table 3.9: Sample Demographics of Heritage-Location, Age, Sex, and Class

		HL	West-Finns			East-Finns			East-Italians		
SEX	CLASS	AGE	O	M	Y	O	M	Y	O	M	Y
Female	WORKING-class		3	2	2	0	1	1	3	5	1
	MIDDLE-class		5	2	2	1	3	1	4	7	4
Male	WORKING-class		3	2	2	0	1	1	2	4	3
	MIDDLE-class		2	1	1	1	1	2	3	4	4

Again, the predictor variable of HERITAGE-LOCATION is based on the ethnic-heritage and location of residence of participants included in the study as described in Subsection 3.2.1. In regards to the predictor variable of AGE, the three age levels include: older-aged (59 years and above), middle-aged (41-57 years), and younger-aged (19-38

years); age group divisions were based on two factors: a) retirement age of approximately 59-62 years old and b) natural divisions in the age distribution. Both predictor variables of SEX and CLASS have a binary distinction, where male or female serve as the category labels for the predictor variable of SEX and middle or working class for CLASS. Each participant presented themselves as either male or female, which determined the binary distinction of sex as a predictor variable. Furthermore, the participant's occupation and level of education, or their spouse or parents' occupation and level of education, were used to index the binary distinction of socioeconomic status as the predictor variable of CLASS. The level of education was found to be the most revealing for the index, since those that obtained a post-secondary education were regarded as MIDDLE-class and those that did not obtain a post-secondary education were regarded as WORKING-class.

CHAPTER 4

PROCEDURES

This chapter examines the specific procedures used in the collection, extraction, normalization and analysis of vowel data. Section 4.1 describes the speech stimuli; all data is obtained from a reading passage. The extraction and handling of data are critical stages of any sociophonetic study, and as such, the present chapter will give a thorough explanation of the models behind the formant extraction and the normalization procedures used in this thesis. Section 4.2 describes the formant extraction procedure used in this thesis, which is referred to as the PIVOT METHOD and is non-traditional in nature; to give validity to its use, this alternative formant extraction procedure undergoes a three pair-wise comparison with two additional traditional methods (i.e., MANUAL METHOD and FIXED METHOD for formant extraction). Section 4.3 describes the normalization procedure used, which follows a version of Labov's Atlas of North American English (ANAE) algorithm (i.e., uses a data internal GRAND MEAN and is speaker-, vowel- and formant-extrinsic in nature). Finally, Section 4.4 briefly describes the statistical tests used to determine correlations of the formant and durational measurements of vowels and the predictor variables under investigation (e.g., MANOVA, ANOVA, independent and dependent Student's t-Tests, CoV).

[0]The novel formant extraction procedure described in this chapter and used in the obtainment of vowel formant data presented in the thesis is a result of collaborative work between Aaron Albin and Wil Rankinen (Albin and Rankinen 2012; Rankinen 2013a).

4.1 Speech Stimuli

All data were collected from fieldwork recordings during the summers of 2007 and 2008. The present author is the sole fieldworker for all interviews. As a native to Michigan's Upper Peninsula (UP), the author had access to a variety of community networks in Michigan's Marquette County. The author knew the speakers personally for several of the interviews, however most often he was introduced as a "friend of a friend". The environment varied for each interview, though considerable effort was made to conduct the interview in a quiet and familiar setting, often at the speaker's home or cabin. Every opportunity was taken to try to find participants of various social networks and backgrounds in the community, while at the same time, continue to meet the stratified requirements of the study's judgement sampling design.

Each recording contains a sociolinguistic interview and the reading of a passage and a wordlist. The interview section consists of background questions and casual conversation. There are considerable stylistic differences from speaker to speaker; the shorter interviews lasted approximately fifteen minutes, while longer ones took as long as sixty minutes. The sociolinguistic interview typically takes on an interviewing style (i.e., elicitation/reply structure) but speakers did often go into extended monologues to describe a particular situation or personal experience (Labov et al. 2006; Milroy 1987). The reading passage and word list text, respective of each task, were both displayed on a Dell Latitude D430 laptop in large font using Microsoft's PowerPoint® software. The reason for this was twofold: 1) to maintain consistency across the interviews, and 2) to aid in speakers' convenience of reading the provided text sequentially and in manageable parts.

The *Bad Day for Ducks* reading passage, created by Dr. Dennis Preston and presented as Appendix A on page **??**, consists of four paragraphs with 110 tokens located

in canonically stressed positions throughout the passage;[1] this standard passage was created for and used in several studies of the Northern Cities Chain Shift in independent and NSF-sponsored work at Michigan State University (Bakos 2008; Evans 2001; Evans et al. 2000, 2006; Ito 1999; Jones 2003; Ocumpaugh 2010; Preston and Ito 1998; Preston 2003, 2007, 2010; Preston et al. 2007; Roeder 2006).[2] This passage was originally constructed to investigate vowels participating in the Northern Cities Vowel Shift (NCVS). Table 4.1, provided below, displays these vowel qualities and their corresponding token counts.

Table 4.1: The phonetic inventory of 13 American English vowels in the "A Bad Day for Ducks" passage.

IPA Vowel	Token Word	Token Count
/ i /	BEAT	2
/ ɪ /	BIT	9
/ ej /	BATE	4
/ ɛ /	BET	12
/ æ /	BAT	9
/ ɑ /	COT	21
/ ɔ /	BOUGHT	9
/ ʌ /	BUT	19
/ ow /	BOAT	4
/ ʊ /	PUT	8
/ u /	BOOT	3
/ ɑj /	BITE	2
/ ɑw /	BOUT	8
	Grand Total	110

There are nine monophthongal qualities (i.e., /i, ɪ, ɛ, æ, ɑ, ɔ, ʌ, ʊ, u/), and four diphthongal qualities (i.e., /ej, ow, ɑj, ɑw/).[3] In the reading passage, vowel qualities traditionally participating in the lower elements of the NCVS (i.e., [æ, ɑ, ɔ]) and the upper elements of the NCVS (i.e., [ɪ, ɛ, ʌ]) have higher token counts (e.g., nine tokens

[1]Here, the term "token" refers to lexical items in the passage which contains the stressed vowel of interest.

[2]See Appendix B, p. 68, of Betsy Evan's 2001 dissertation as an example study that used this reading passage.

[3]This passage does not include the /ɔj/ diphthong — likely due to its limited import toward examining the NCVS for which the passage was originally designed.

or above) than those that do not (Gordon 2000b, 53). As a consequence of using this passage, there are several vowel qualities that have low token counts (i.e., [i, u, ɑj] have two or three tokens).[4]

This thesis limits its focus to the reading passage data.[5] The reading passage contains various consonantal environments, all of which are in a stressed syllable position. The passage contains a total of 110 observed vowel tokens. The potential token count, therefore, is 14,520; a potential vowel token count of 110 in the reading passage multiplied by 130 passages.

All interviews were digitally recorded on a Macintosh Macbook OS X version 10.5.5 laptop using a MC51B Lavalier microphone and a USB-Pre digital device. The speech analysis software Praat, developed by Boersma (2001), was used to record all respondents (i.e., version 5.0 was used to record speakers, while version 5.1 and 5.2 were used to extract formant measurements; versions are free to download at: `http://www.fon.hum.uva.nl/praat/download_win.html`). All recordings were initially captured at 44.1 kHz and saved as individual WAV files for later data handling and eventual analysis.

4.2 Formant-Extraction of Vowel Trajectories

Vowel qualities are not static but transient and dynamic acoustic events. Phonologically, vowels are traditionally categorized as either being a monophthong or a diphthong in American English. The distinction between a monophthong and a diphthong resides in the trajectory pattern of the acoustic quality of the speech event.

[4] At the time of field recordings, the use of this passage could be justified since little was known about the participation of UP speakers in the NCVS.

[5] While the thesis restricts its focus to just the reading passage data, the wordlist contains a total of 111 observed vowel tokens and yields a potentially comparable 14,652 token count (i.e., in comparison to the 14,520 tokens in the reading passage).

Under the gestural model, the production of a vowel is inextricably linked to a target or targets and the gestural timing of sound sequences needed to reach a target and transition to the next (Browman and Goldstein 1985, 1990).[6] A monophthongal quality is characterized as a vowel with an acoustic trajectory toward a single target, while a diphthongal quality is characterized as a vowel with an acoustic trajectory toward two sequentially occurring targets.

4.2.1 Previous Extraction Procedures

For the phonetic analysis of vowels, there is an ongoing debate as to the best practice for efficiently extracting the linguistically important information as well as accurately capturing any socially or extralinguistically relevant information of a vowel quality (i.e., predictor variables). As noted by Neary and Assemann (1986), phoneticians need to distinguish between three types of auditory-acoustic relations:[7] 1) traditionally phonological monophthongs (e.g., /ɪ/, /ɛ/, /æ/), 2) traditionally phonological diphthongs (e.g., /ɑj/ and /ɑw/), and 3) environmentally conditioned phonetic diphthongs (e.g., [ɛg], [æg]). Socio-phoneticians need to address to additional auditory-acoustic relations: 4) socially conditioned phonetic monophthongs (e.g., [ɑ:] for /ɑw/ in Southern U.S. varieties) and 5) socially conditioned phonetic diphthongs.

Two main extraction models exist, based upon what information within the vowel's

[6]For example, the word [bæn] as in "*ban*" has three phonetic units. Each of the three sounds are phonetically realized relative to one another and must be dynamically produced in regards to differences in the articulatory timing of plan gestural movements. For each of the speech sounds, the gestural timing and sequencing of the articulators is actually comprised of a series of targets for each sound segment. Thus, gestural movements need to be planned concurrently as well as sequentially in order to produce a three sound-segment event. The transition from one segment to the other also requires that the gestures overlap (i.e., to transiently and dynamically co-exist, often referred to as the consonantal effect of a neighboring consonant at beginning or at ending of a particular vowel). Ultimately, the gestural timing of these sound segments, as well as the transitions from one to the other, is directly correlated with the acoustic properties embedded within the acoustic phonetic signal of the speech event.

[7]Auditory-acoustic relations (i.e., a termed used by (Nearey and Assmann 1986)) refers to the production-perception mapping of how the acoustic signal is produced and how it is perceived by the speaker/listener.

trajectory is regarded as being important. The first model conceptualizes vowels as non-dynamic and static entities; for monophthongal qualities, single-point measurements are taken at the center of a vowels' duration (e.g., see Peterson and Barney (1952)). The second model views a vowel as a dynamic but linear entity, where two- or multi-point measurements are taken at pre-established locations (i.e., fixed-positions) relative to the vowel's duration (e.g., see Browman and Goldstein (1990); Labov et al. (2006); Lindblom (1986)). The latter model has two standard approaches for extracting multiple points: a) the formant extraction measurements of a vowel are taken at pre-established points, relative to the vowel's duration (e.g., if three points are desired, then measurements are taken at the 33rd, 50th and 66th percentile relative to the duration of each vowel token) (Labov et al. 2006); b) first, pre-established "cut-offs" of a vowels's on- / offglides are established and removed (i.e., the rationale for this removal is that this portion of a vowel's quality contains undesired consonantal effects), then the formant extraction measurements of a vowel are taken at pre-established points similar to the first standard approach. For example, 20-percent at the beginning and 20-percent at the end of the vowel,[8] relative to its duration, would be removed and discarded, then the remaining duration of the vowel (i.e., approximately 60-percent) would be divided into a set number of points where either measurements are extracted there or bins of measurements are taken as averages of multiple measurement points (MacDonald et al. 2011).[9]

Critically, these approaches base the measurement values either on arbitrarily fixed points or averages for predetermined ranges of measurements. These approaches assume that two similar vowel tokens (i.e., those that are of the same quality and

[8]Technically speaking, identifying the first and last 20 percent of a vowel's duration is a kind of binning in and of itself; however, the important distinction is that this information is completely removed.

[9]Of course, there are other models that can be used for formant extraction as well; for example one that determines the point of measurement in a vowel's trajectory based upon the maximal F1 or point of inflection in F2 (Boberg 2004).

have phonetically similar conditioning environments as in “pit” and “bit”) and two dissimilar vowel tokens (i.e., those that are of different quality and have phonetically dissimilar conditioning environments as in “big” and “poke”) have inherently the same dynamic trajectory patterns, since all measurements using either approach for this standard extraction model superimposes either “fixed” points or “average measurement ranges” and are contingent only on the relative duration of each vowel token. These approaches assume that a vowel’s duration is independent from the formant measurements extracted from the vowel; in other words, it is assumed that a long or a short vowel is not affected or influenced by the trajectory of it’s quality. This assumption, however, does not account for cases such as undershoot, where the vowel target is missed because there is not enough duration to do so. The present section describes an alternative way to model vowels’ targets and proposes a novel formant extraction method — one that addresses said concerns and is used in the attainment of the acoustic vowel data for this thesis.

4.2.2 A Proposed Formant Extraction Method

This proposed formant extraction method is in accordance with the conceptualization of a vowel as being both a dynamic and linear entity. Furthermore, it assumes that vowel trajectories are acoustically dynamic entities because of the articulatory dynamics needed to reach a particular target; to produce an acoustic quality, this requires a series of co-occurring gestural movements. This proposed formant extraction method uses both manual and automated procedures to extract the measurements from each vowel quality, and more specifically, it can be broken into three stages and will be described in terms of this thesis.

The first stage of the procedure for this formant extraction method is to mark the beginning and ending of each vowel token. This part of the procedure is the

most time-intensive, since for this thesis each vowel throughout the passage for all participants needed to be manually marked in the acoustic phonetic software of Praat.

After all the boundaries of every vowel in a reading passage are marked for an individual participant, a set of Praat scripts are then used to extract the various pieces of information associated with the time points along a vowel's duration for all 110 vowel tokens in the passage. The second stage of the procedure involves the automated extraction of various pieces of information associated with each time point at every 1ms along each individual vowel's trajectory. A master text file is generated, where measurements at 1ms-intervals are sequentially stored for each vowel and saved for each speaker. For each millisecond of each vowel token, the timestamp, the frequency value of F1/F2/F3, and the bandwidth of F1/F2/F3 are saved.

Once data is collected, the final stage of the formant extraction process is applied. Stylization is the process of taking a large number of samples from the signal and reducing it down to a much smaller number of representative vectorized points in such a way that it still closely resembles the original raw signal. The automated application of stylization models are used to determine where along the vowel's trajectory is the best "fitted". Two separate stylization models must be applied to find the best fitted target(s) of each individual vowel trajectory: 1) a single-pivot stylization model is used to determine the target of a monophthongal quality, and 2) a dual-pivot stylization model is used to determine the target of a diphthongal quality. Thus, this procedure assumes that vowel qualities are of two types, monophthongs and diphthongs. These two vowel categories correspond to either one or two targets that are represented in the acoustic space of a vowel's trajectory of F1 and F2; the "expected" value (i.e., monophthong or diphthong), given the specific vowel of interest (e.g., [ow] as in "boat"), is used to determine this aspect of the model. The use of such stylization models for dynamic structures is not new, and in fact is based on one common method

for objectively identifying the elbow in F0 contours as documented in Pierrehumbert and Beckman (1988) and D'Imperio (2001).

To understand how each of these stylization models actually operate, the dynamic structure of a monophthong's trajectory and a diphthong's trajectory are examined. Figures 4.1 and 4.2 are examples of how the algorithm of each model would determine the best fitted pivot-point(s) of a monophthong and diphthong (i.e., for either a single target or a dual target event), based on each model's assumptions.

Figure 4.1:
Single-pivot stylization model
for a monophthong
(i.e., [ɛ] in "(e)lectric")

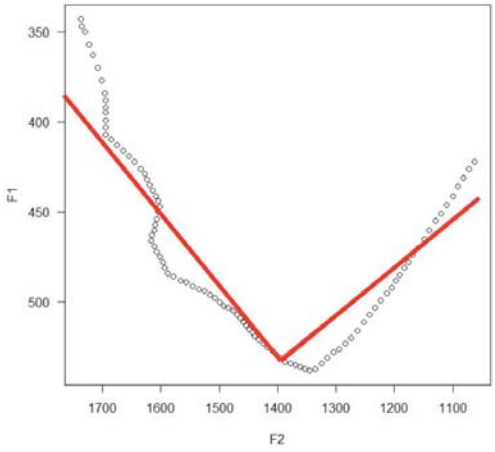
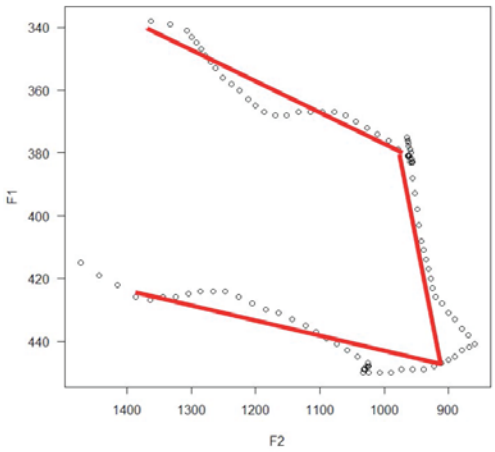


Figure 4.2:
Dual-pivot stylization model
for a diphthong
(i.e., [ow] in "so")



As an initial example, Figure 4.1 shows the actual trajectory of 100 measurement points of F1 and F2 plotted in the acoustic vowel space for the [ɛ] vowel quality in the token word "(e)lectric". The fitted straight-lines (i.e., indicated by the solid lines) that come together to form a "pivot" are determined by the underlying algorithm of the model for monophthongs, known as the SINGLE-PIVOT MODEL. This model assumes that the pivot (i.e., the turning point in the formant contour) is roughly equivalent to the speaker's formant target when producing the vowel. It assumes the pivot is located somewhere in the trajectory of the vowel (i.e., not tied to tokens

with N=100). For all points in the middle (in this example, the middle 98 of the 100 points), it runs linear regressions to determine a best-fitting line over the points to the left and to the right; both regressions are constrained such that they have to pass through the "pivot" point. Then, it calculates a goodness-of-fit. Specifically, the SINGLE-PIVOT MODEL's algorithm finds an absolute value of the divergence of the actually measured points from the fitted straight lines, separately for F1 and F2. Then, it calculates the median of these for F1 and the median for F2. Finally, it adds these together; this is repeated for each of the possible stylizations (i.e., the fitted straight line (s) to the contour of a dynamic entity, which, in this case, is a vowel. This calculation can be stated in the following formulaic expression:

$$median(|ActualF1 - StylizedF1|) + median(|ActualF2 - StylizedF2|)$$

The model for diphthongs, known as the DUAL-PIVOT MODEL, assumes two targets and is demonstrated in the second example provided above. Figure 4.2 displays the acoustic trajectory of the [ow] vowel in the token word "so". This model's algorithm does the exact same calculations except that it also draws a straight-line connecting the two pivots. Everything else, like the calculation of goodness-of-fit, works the same as previously described.

By comparing this goodness-of-fit metric for all points in the middle of the vowel's trajectory, in this case the 98 measurement points in Figure 4.1 and Figure 4.2, we can then find which one of those candidates' stylizations is the best fit for each vowel. More specifically, the pivot is chosen such that it minimizes the value yielded by the equation given above. Any stylization of phonetic data is an instantiation of an underlying linguistic model. In current models used in this thesis, there is one pivot for monophthongs and two pivots for diphthongs, plus two extra on the sides for

consonantal effects. The "better" model is one that has unused residual information, due to the stylization process, which is essentially just random noise; conversely, a "bad" model would be one that throws away linguistically-relevant information.

For either model, the goodness-of-fit metric determines which pivot point(s) is chosen, and that pivot-point is then used as the measurement(s) for sociophonetic analysis. If a stylization systematically diverges from the original trajectory of the vowel, this will yield enormous residuals over a large stretch of the contour and a large value for the goodness-of-fit; for the above equation, such a stylization would be disfavored and not be used to determine the pivots for the analysis.

Essentially, this proposed formant extraction method uses a more efficient (i.e., and perhaps more objective) means of determining a meaningful measurement(s) based on phonetic assumptions about the linguistic phenomenon in question.[10] This method uses all the data of a vowel quality's trajectory to determine the best-fitted measurement relative to each vowel token. While trying to be objective in nature, it remains a question as to the validity of the present method in terms of comparability with the more traditional methods of formant extraction. As a result, three pair-wise comparisons are provided in the following section, namely the formant measurements obtained using two traditional formant extraction procedures and this proposed procedure.[11]

[10] One always has to be careful about proclaiming "objectiveness", because while the algorithm is fully automatic, the assumptions in the underlying model are determined subjectively (e.g. the number of pivots to use for a given token, the details of the goodness-of-fit equation, etc.).

[11] It is important to note that one weakness of this proposed method is that an a priori classification of a vowel token's quality (i.e., a vowel token's status as either a monophthong or a diphthong) is required in order to determine which of the two pivot-based models is applied; at present, however, this weakness is shared with traditional formant extraction procedures as well.

4.2.3 Pair-wise Comparions of Formant Extraction Procedures

In this subsection, three vowel datasets are extracted from the same corpus and three vowel measurement datasets, all from the same reading passage task, are examined in three pair-wise comparisons; the critical difference between these datasets is the procedure used to extract the formant measurements. The three formant extraction procedures are: 1) a MANUAL METHOD, 2) a FIXED METHOD, and 3) the proposed PIVOT METHOD. Since the procedural extraction of formant measurements using the third method has already been discussed, the first two methods will be described in detail below.

The formant measurements obtained from the MANUAL METHOD are reported in Rankinen (2013b, 2014). Formant measurements are obtained at two temporal points relative to a vowel's duration (i.e., irrespective of the vowel being a monophthong or a diphthong). A vowel is first visually inspected via waveform and accompanying spectrographic representation to determine the beginning and ending of the vowel. Then, two points are manually selected at approximately the 33^{rd} and the 66^{th} percentile relative to the vowel's duration, and the formant measurements are then extracted at each point. While the selection of the two points is based on approximate "fixed" points relative to a vowel's duration, they may be manually adjusted to the right or left in order to obtain F1 or F2 bandwidths below 300Hz values; F1 and F2 bandwidths greater than 200Hz have been shown to increase perceptual distortions in actual communicative situations and may negatively affect the validity of production data (Klatt 1982, 1279; Thomas 2011, 47).

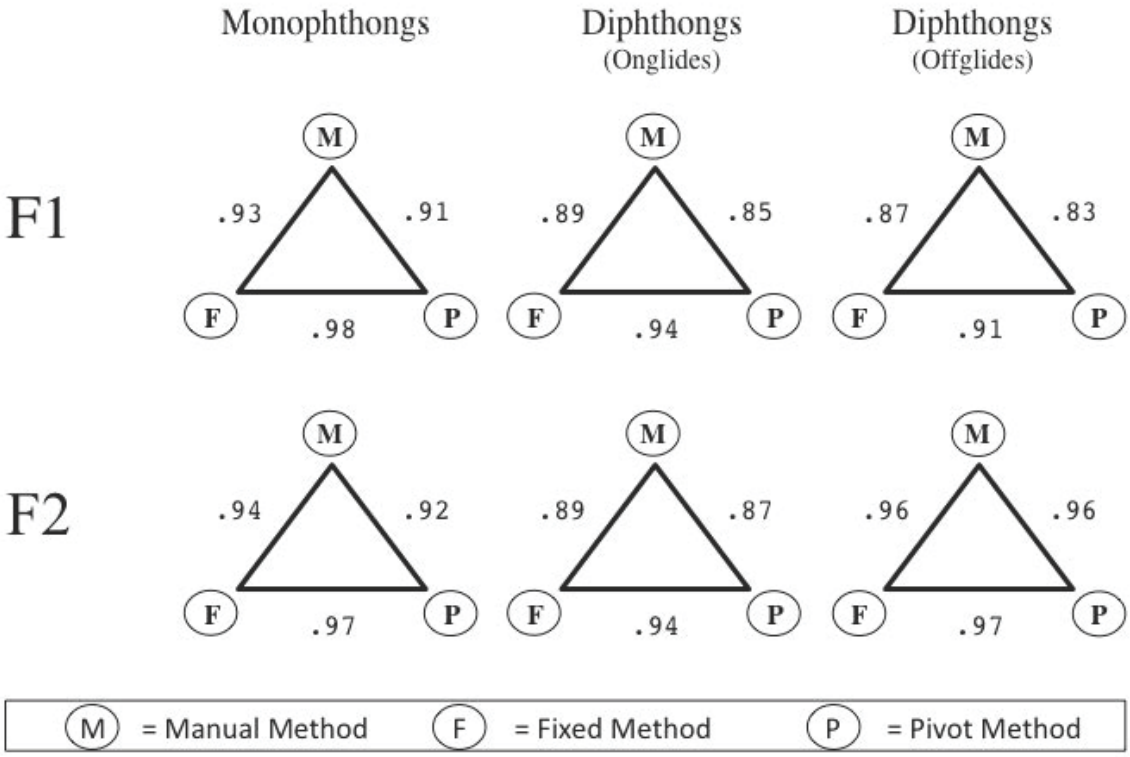
Both the FIXED METHOD and the PIVOT METHOD originate from the same dataset of raw measurements. While the PIVOT METHOD uses stylization models to select

the best "fitted" one or two pivot points, this FIXED METHOD obtains its formant measurements based on absolute "fixed" points at the 33rd and the 66th percentile relative to the vowel's duration with no manual adjustment.

For both the FIXED METHOD and the MANUAL METHOD, formant measurements are based on two temporal points relative to a vowel's duration. In order to compare the monophthong formant estimate of these two different procedures with the PIVOT METHOD, the first and second measurements of a monophthong are averaged together. This follows the assumption that monophthongs have a single target and yields a value that can be directly compared with that of the PIVOT METHOD. Formant measurements for diphthongs remain unaffected since all three formant extraction procedures select two temporal points of a diphthong (i.e., relative to its duration). Essentially, all three procedures are able to model vowels with one or two targets but differ in the criteria used to select the measurements representing those targets.

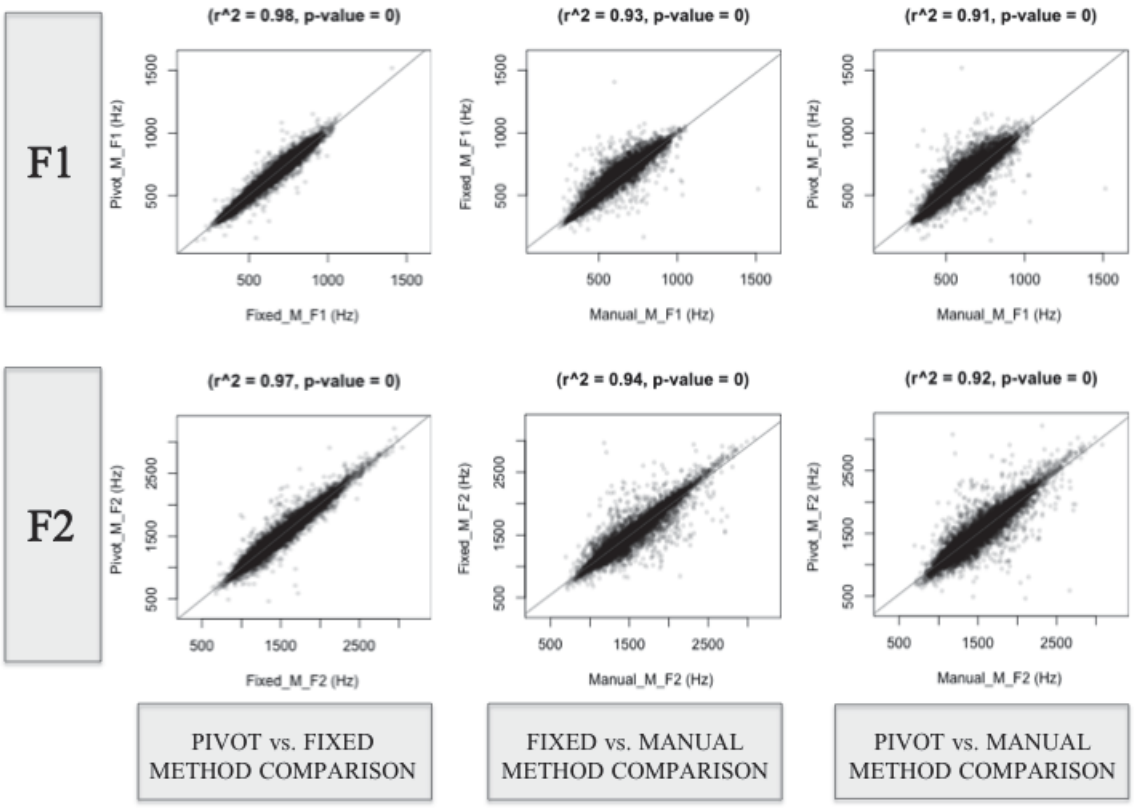
In Figure 4.3 below, the correlation coefficient values (i.e., using Pearson's product-moment correlation) are displayed for the eighteen pair-wise comparisons between the three procedures, two formants (i.e., F1 and F2), and three possible targets (i.e., the first and only target for a monophthong, the first of two targets for a diphthong, and the second of two targets for a diphthong). As reported in Figure 4.3, the correlation coefficients are very high (i.e., r^2 = .83 – .97, all p-values < .001), with between 83% and 97% of the variation being explained for every one of the eighteen pair-wise comparisons! As such, the three procedures' formant measurements can be stated as being highly correlated with one another.

Figure 4.3: The correlation coefficient values (r^2)
of pair-wise comparisons between the formant extraction methods



The remainder of this section examines this data in correlation plots of the eighteen pair-wise comparisons for: 1) the monophthongs, 2) nuclei of the diphthongs, and 3) offglides of the diphthongs. Figure 4.4 displays the three pair-wise comparisons for F1 and F2 measurements of monophthongs as correlation plots. The PIVOT METHOD and the FIXED METHOD are most correlated with one another, while the other two are less so. Nevertheless, all six pair-wise comparisons report high correlations (i.e., $r^2 \geq 0.91$, p-value $< .001$).

Figure 4.4: The pair-wise comparisons
for monophthongs' F1 and F2 measurements



Figures 4.5 and 4.6 display the correlation plots for the F1 and F2 measurements of the nuclei and offglides of diphthongs. All F1 and F2 measurements for either the temporal points measured at the nucleus or the offglide of the vowels are shown to have high correlations (i.e., $r^2 \geq .83$, p-value $< .001$).

Figure 4.5: The pair-wise comparisons
for diphthongs' F1 and F2 measurements for nuclei

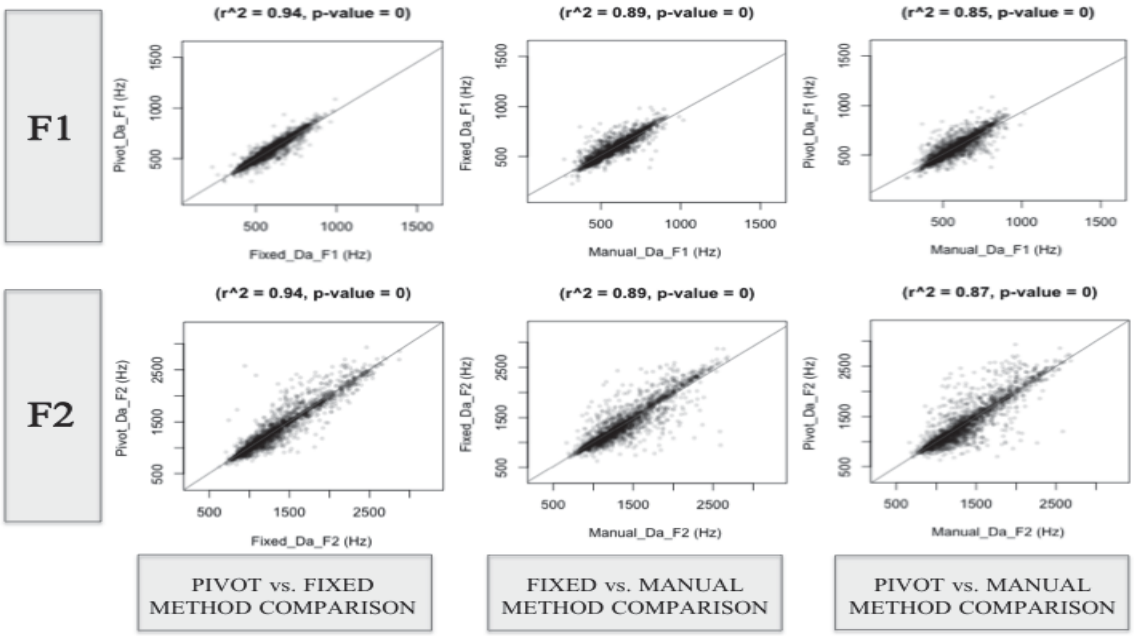
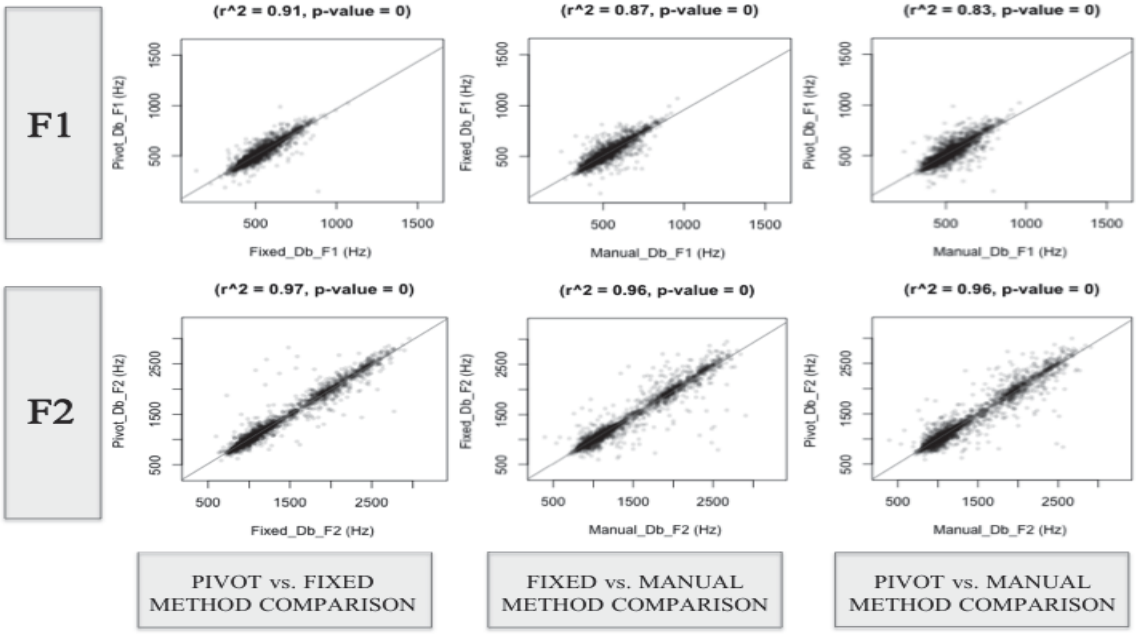


Figure 4.6: The pair-wise comparisons
for diphthongs' F1 and F2 measurements for offglides



In general, the three pair-wise comparisons of the formant measurements show high correlations (i.e., with correlation coefficients greater than .83). However, when the pair-wise comparisons are contrasted with one another we see that certain comparisons have higher correlations than others. The PIVOT METHOD and the MANUAL METHOD pair-wise comparison have the lowest correlations, while the PIVOT METHOD and the FIXED METHOD pair-wise comparison has the highest. In the latter case, the formant estimates show the strongest relationship with one another because they are mainly automated and are derived from the same raw dataset. In contrast, the MANUAL METHOD differs from the PIVOT METHOD in the same ways that the FIXED METHOD does but with two additional differences. First, the MANUAL METHOD manually selects formant measurements at the approximate 33^{rd} and 66^{th} percentile, however, there can be potential deviations made on account of inspection of the speech analyst. Second, a different set of formant tracking parameters may have been used when obtaining formant measurements for the MANUAL METHOD as opposed to the other two (e.g., for a given vowel, Praat might have been set to track four or six formants instead of five).

In summary, this section validates the use of this novel PIVOT METHOD. This formant extraction method applies stylization models to objectively determine the "best" fitted point(s), or pivot(s), along a vowel's trajectory (i.e., based on if the vowel is assumed to have a single or a dual target). When compared to more traditional formant extraction methods, the PIVOT METHOD's formant measurements are shown to be significantly correlated. Backed by this statistical support, this method will be used for all formant estimates presented in the remainder of the present thesis.

4.3 Speaker Normalization of Vowel Data

Normalization is performed in order to factor out known anatomical differences due to vocal-tract size effects, which impact the size and shape of the vowel space (Hillenbrand et al. 1995; Peterson and Barney 1952). All data for this thesis are normalized using a version of the algorithm used by the phonological Atlas of North American English (ANAE) (Labov et al. 2006, 39-40). This method's algorithm handles the data at three different levels:

1. SPEAKER-EXTRINSIC: all speakers' data are pooled together in the algorithm (i.e., as opposed to being individually applied speaker-by-speaker);

2. VOWEL-EXTRINSIC: all vowels' data are treated simultaneously in the algorithm (i.e., as opposed to looping through each vowel and applying the algorithm to each separately); and

3. FORMANT-EXTRINSIC: all data for all formants are combined in the algorithm (i.e., as opposed to isolating F1 data from F2 data).

Following Labov et al. (2006)'s algorithm, measurements are normalized using the `norm.labov()` function in the statistical and graphing language R (i.e. see the R-project website: `www.R-project.org`) (Boersma 2001). To serve as a metric for interpreting the formant values, a single grand mean was calculated for the particular set of speakers included in the dataset for this thesis and not from an externally derived grand mean (i.e., the Telsur G value as discussed by Thomas and Kendall (2007) at the NORM website: `http://ncslaap.lib.ncsu.edu/tools/norm/`). Additionally, this method computes a scaling factor for each individual speaker in order to modify each individual's vowel space to scale to Hertz-like values. This metric has been proven to be the best transformation for reducing anatomical variation while maintaining phonological and sociolinguistic variation (Adank et al. 2004; Clopper

et al. 2005).

Figure 4.7 and Figure 4.8 display the unnormalized and normalized data, respectively, for single-pivot point measurements for all monophthongs in the dataset used in this thesis, collapsed across all vowels (i.e., [i, ɪ, ɛ, æ, ɑ, ɔ, ʌ, ʊ, u]). On average, men (i.e., as represented by black crosses in Figures 4.7 and 4.8) have longer vocal-tracts than women (i.e., as represented by gray circles), which corresponds to a smaller acoustic vowel space for males and a larger acoustic vowel space for females in general. By comparing the unnormalized with the normalized data, the physiological differences due to vocal tract size effects are removed when the ANAE normalized procedure is applied.

Figure 4.7: Unnormalized monophthongs

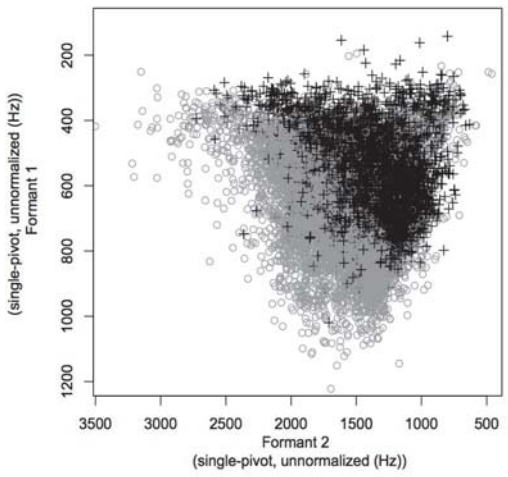
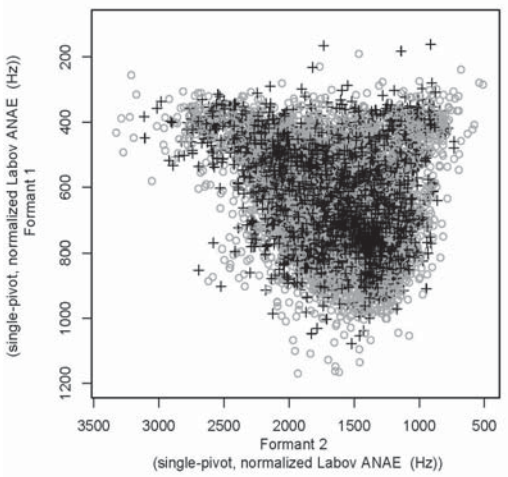


Figure 4.8: Normalized monophthongs



Figures 4.9 and 4.10 display similar information to the ones described above, except that these figures represent the unnormalized and normalized data for the measurements of the first and second dual-pivot points for all diphthongs. The left-most panel displays the unnormalized data, while the right-most panel represents the normalized data using the ANAE method as described above. Once again, the anatomical differences that exist in the left-panel were removed once the normalization method were applied (i.e., as shown in the right-panel).

Figure 4.9: Unnormalized and normalized diphthongal nucleus data

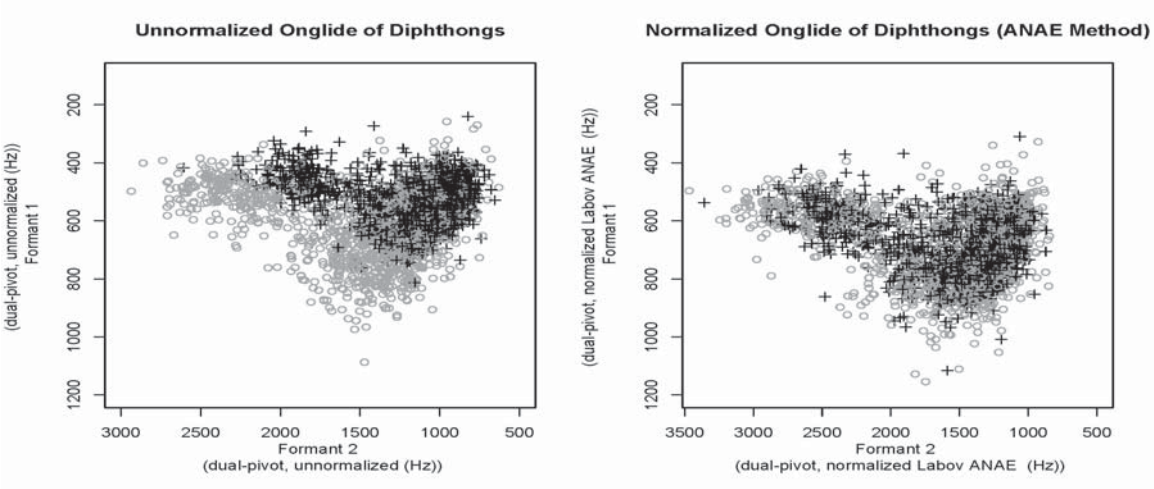
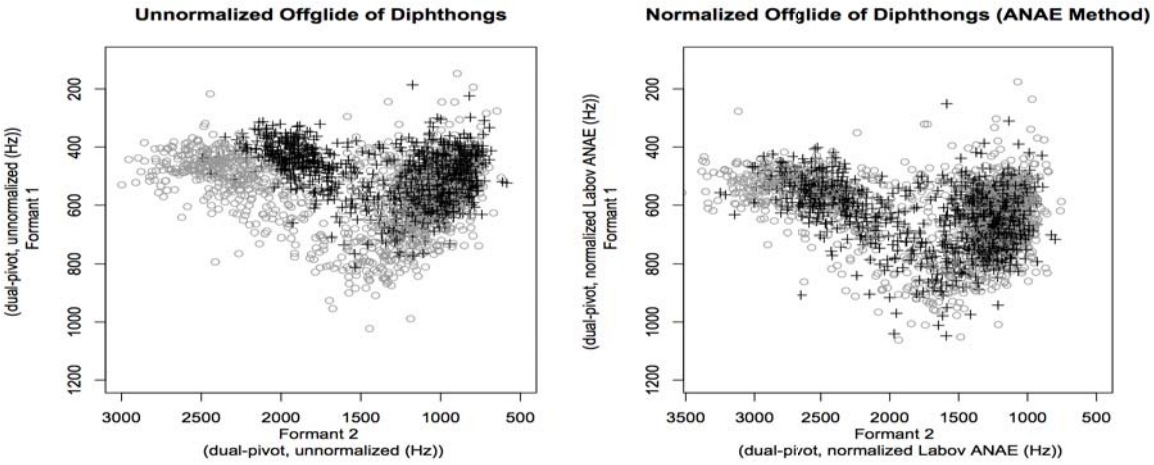


Figure 4.9 displays the normalized and unnormalized nucleus data (i.e., the first pivot of the DUAL-PIVOT MODEL). Finally, Figure 4.10 displays the normalized and unnormalized offglide data (i.e., the second pivot of the DUAL-PIVOT MODEL).

Figure 4.10: Unnormalized and normalized diphthongal offglide data



In all cases (i.e. Figures 4.7-4.10), this ANAE normalization method successfully factors out the anatomical differences (i.e. unnormalized data displayed in the left-most panels) so that only the phonological and sociolinguistic information remains for sociophonetic analysis (c.f., normalized data displayed in the right-most panels).

4.4 Statistical Analysis

Prior to and after normalization, individual speakers' vowel spaces are checked for outliers or possible data-entry errors. This dataset is then submitted to a series of statistical test procedures according to the particular questions posed in this thesis. Each of the linguistic variables considered is examined separately, unless otherwise stated. Five main statistical tests are frequently used throughout the subsequent chapters, and as a result, Table 4.2 provides a summary of those tests.

Since the main thrust of the thesis investigates the independent variables of HERITAGE-LOCATION, BILINGUALISM, AGE, SEX and CLASS for both monophthongs and diphthongs, multivariate analysis of variance (MANOVA) and univariate analysis of variance (ANOVA) will be used to determine if significant differences exist between the mean values of F1 and/or F2 and at least two independent variables for any given main effect or interaction of effects; besides F1 or F2, Euclidean distances (EDs) and duration may also be used as dependent variables for ANOVAs. A Student's t-Test is also used but typically only as a post-hoc analysis of a particular case where two means of a single dependent variable are compared; unpaired t-Tests will be used in cases where the two means are independent from one another (e.g., mean of two distinct vowel categories), while paired t-Tests will be used when the means are dependent (e.g., the mean of a vowel's nucleus compared to the mean of that same vowel's offglide).

Table 4.2: Statistical tests and use

Test	Outcome Variable	Operationalization of the Test
Multivariate Analysis of Variance (MANOVA)	Formants 1 (F1) and 2 (F2)	to determine if significant differences exist between the mean values for two dependent variables and two or more predictor variables
Univariate Analysis of Variance (ANOVA)	F1 or F2; EDs; duration	to determine if significant differences exist between the mean values for a particular dependent variable and two or more predictor variables
Student's t-Test (independent; unpaired)	means of F1 or F2	to determine if a significant difference exists between two mean values for a particular dependent variable and a single predictor variable (e.g., comparison of [ɑ] and [ɔ] for all UP speakers)
Student's t-Test (dependent; paired)	means of F1 or F2	to determine if a significant difference exists between two mean values for a particular dependent variable and a single predictor variable (e.g., the comparison of the nucleus and offglide of /ow/ being realized as either [ow] or [o] for all UP speakers)
Coefficient of Variation (CoV)	distribution of F1 and F2 points	to determine the ratio of the standard deviation of a set of measurements to the mean (i.e., a statistic that captures the range of production for a particular vowel category)

In certain cases, it may prove useful to go beyond the examination of a vowel's mean and investigate the dispersion of a vowel's token distribution; in such a case, coefficient of variation (CoV) will be used. As a statistical measure, the CoV is defined as being the ratio of the standard deviations to the means and shows the extent of variation (i.e., represented as a percentage) in relation to the mean of the population. CoVs will be used in cases where the differences in token distributions of a linguistic variable are correlated with the levels of an predictor variable (e.g., two of the HERITAGE-LOCATION groups may have similar token distributions of /ae/, while the third group's distribution might form a tighter cluster of tokens and in turn have a lower value for the variation coefficient).

The next two chapters present the results of two comparable yet distinctive anal-

yses based on a shared 130-speaker sample of a rural immigrant-American English speech community in Michigan's UP. The first analysis of Chapter 5 examines FRONT LAX, LOW BACK, HIGH BACK, and SHORT and LONG DIPHTHONGs to determine if they correlate with the extralinguistic factors of HERITAGE-LOCATION and BILINGUALISM for a 71-speaker sample of older-aged UP speakers. In Chapter 6, the second analysis examines these five sets of linguistic variables in the speech of an 85-speaker sample of monolingual English UP speakers stratified across HERITAGE-LOCATION, AGE, SEX and CLASS. Together these analyses seek to reveal the sociolinguistically relevant correlates of interspeaker variation that exists within this speech community.

CHAPTER 5

RESULTS I:

HERITAGE-LOCATION AND BILINGUALISM

This chapter examines F1, F2 and duration response variables for the five sets of FRONT LAX, LOW BACK, HIGH BACK, SHORT DIPHTHONG and LONG DIPHTHONG linguistic variables produced by seventy-one older-aged Upper Peninsula (UP) speakers. The analyses of this chapter takes into account the predictor variables of HERITAGE-LOCATION and BILINGUALISM.[1] As described in Chapter 3, these predictor variables are restricted to the older-aged speakers whom are grouped by the defined levels of HERITAGE-LOCATION (i.e., EAST-side Finns, EAST-side Italians or WEST-side Finns) and BILINGUALISM (i.e., Heritage-bilinguals, English-bilinguals or English-monolinguals). Therefore, only results from this 71-speaker subset of the larger corpus will be reported in this chapter.[2]

This chapter reports on four specific analyses of the data: 1) an analysis of the overall structure of the older-aged UP speakers' vowel system, 2) an analysis of HERITAGE-LOCATION as a main effect, 3) an analysis of BILINGUALISM as a main effect, and 4) an analysis of the HERITAGE-LOCATION and BILINGUALISM as an in-

[1]Multivariate analyses investigating the three-way interactions of SEX and CLASS with either HERITAGE-LOCATION or BILINGUALISM were performed but failed to report differences between groups for the linguistic variables considered; two-way interactions were also performed and did yield cases where significance differences existed but no interpretable patterns could be made. Furthermore, the structure of the sampled population and stratified corpus would not allow for a four-way comparison of HERITAGE-LOCATION, BILINGUALISM, SEX and CLASS. As a result, only the two predictor variables of HERITAGE-LOCATION and BILINGUALISM are considered in this chapter (i.e., as main effects and as a two-way interaction).

[2]The breakdown of the demographics for this subset is located in Table 3.8 on page 41.

teraction. Section 5.1 first investigates the individual placement of vowels within the structural configuration as a global system for these seventy-one older-aged speakers. This section prepares the reader for the next two sections by justifying a focused analysis of each main effect for the FRONT LAX, LOW BACK, SHORT DIPHTHONG and LONG DIPHTHONG sets of linguistic variables. Section 5.2 takes into account the predictor variable of HERITAGE-LOCATION when examining these linguistic variables, while Section 5.3 focuses on the predictor variable of BILINGUALISM. The final section, Section 5.4, examines the interaction of these two factors. This chapter ultimately seeks to uncover if substrate characteristics are present in the vowel spaces of these older-aged UP speakers, and if such characteristics are correlated with either HERITAGE-LOCATION or BILINGUALISM as main effects or as an interaction of these two predictor variables.

5.1 The Vowel System of Older-aged Speakers

The first analysis of this chapter investigates the individual vowel placement and overall configuration of the seventy-one older-aged bilingual and monolingual UP speakers' vowel spaces as a vowel system. The grand averages of the first and second formant values have been calculated for each of the nine monophthongs and four diphthongs, and each vowel is plotted in the acoustic vowel space as a global system in Figure 5.1.

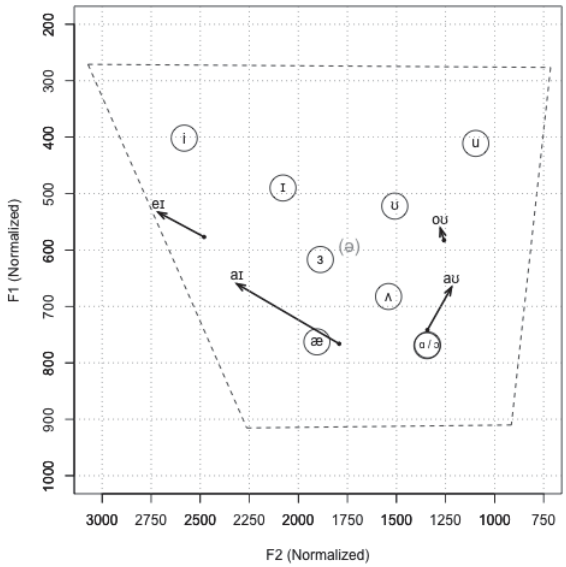


Figure 5.1: The grand F1 and F2 means of monophthongs and diphthongs for the older-aged speakers in Michigan's UP vowel corpus (n=71)

In this figure, there are two superimposed hypothetical reference markers: 1) the hypothetical boundaries and 2) the centralized midpoint (i.e., denoted with parenthesized schwa) of this global acoustic vowel space determined by the entire 130-speaker corpus.

- The dashed-lines forming a trapezoid in Figure 5.1 are derived from the hypothetical, peripheral corners of the shared vowel space by all 130 UP English speakers. The average standard deviations (SDs) for all vowels are first calculated (i.e., F1's global SD = 135.7Hz and F2's global SD = 430.7Hz). These values are then either added or subtracted to the F1 and F2 mean values of the most peripheral qualities of the acoustic vowel space to obtain the four-corners of this hypothetical trapezoid; for example, in order to obtain the top-right corner' coordinates of (763.1, 275.3), the lowest mean along the F2 dimension in the top right corner (i.e., based on the [u] quality's mean F2 = 1175.4Hz) is subtracted from the F2's global SD and the lowest mean along the F1 dimension in the top right corner (i.e., based on the [u] quality's F1 = 412.4Hz) is

subtracted from the F1's global SD. The hypothetical four-corner trapezoid is primarily used as a visual reference in examining this 71-speaker system relative to the entire sampled population.[3]

- The x- and y-coordinates of the hypothetical midpoint (1741, 598) are derived from the corresponding mean values of the four corners' coordinates (i.e., displayed as the "hypothetical schwa", or (ə), in the figure). The use of the hypothetical midpoint allows for a comparison of vowel qualities in relation to one another within a single system as well as a comparison of vowel qualities between groups' systems, which if potential differences exist, they can be attributed to the sociolinguistic factors of interest; this comparison is not only possible, but ideal, since all data in the subsequent analyses are normalized (i.e., with the physiological differences removed), and therefore, the speakers' spaces share an acoustic vowel space defined by the 130-speaker sample.

It should also be noted that for monophthongs in the figure above, the placement of an IPA symbol within a circle represents that vowel's F1 and F2 mean values. For a diphthong, the start of the arrow represents the F1 and F2 means for its nucleus and the tip of the arrowhead represents the means for its offglide; the IPA symbol for a diphthong is slightly offset to the mean values of the offglide.

Using these reference markers as guides, there are several striking observations noted in Figure 5.1 above. First, the overlap between circles for the [ɑ] and [ɔ] vowels suggest the strong presence of a merger (i.e., F1's $t(998)$=-0.26, p>.05, $r = 0.008$; F2's $t(1193)$=-0.28, p>.05, r=0.008). Second, Figure 5.1 reveals that these older-aged UP speakers' [ow] has a very short trajectory, with little difference between the nucleus and the offglide along either the F1 dimension or the F2 dimension. The speakers'

[3]The 71-speaker subset in this chapter and the 85-speaker subset in Chapter 6 use this hypothetical trapezoid since both subsets are derived from the same sample population and share a normalized acoustic vowel space as described in the previous chapter (c.f., page 61).

nucleus of [ow] is approximately the same as the offglide (i.e., the F1 and F2's mean differences between the nucleus and the offglide is 21.2Hz and 18.5Hz respectively); the difference for F2 is not significant (i.e., $t(214)$=-1.71, p>0.05, $r = 0.12$), while the F1 does report a significant difference (i.e., $t(214)$=6.49, p<0.001, r=0.41). The third and fourth striking characteristics refer to the nucleus of the LONG DIPHTHONGs and their proximity with their neighboring monophthongs. The [ɑj] vowel is considerably forward in terms of this shared vowel space with an F2 mean of 1787Hz compared to the [æ] vowel's F2 mean of 1907Hz and the [ɑ/ɔ] vowels' F2 means of 1341Hz and 1343Hz respectively. In contrast the [ɑw] is higher rather than more forward in the vowel space, with an F1 mean of 742Hz compared to the [ʌ] vowel's F1 mean of 683Hz and the [ɑ/ɔ] vowels' shared F1 mean of 769Hz. Although Figure 5.1 provides four striking characteristics, this plot is limited in that it does not account for the token distribution of each vowel or the relationship of a vowel to another in the acoustic vowel space.

As an accompaniment to the previous figure, Figures 5.2 and 5.3 display the global distribution as well as the grand means of each monophthong and each diphthongs' nucleus and offglide.

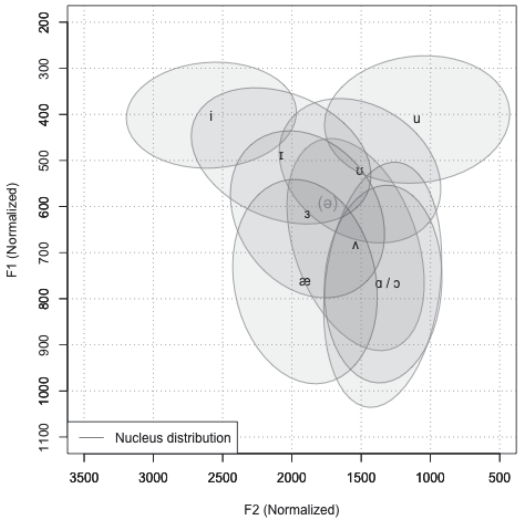


Figure 5.2: The global distribution of monophthongs' F1 and F2
(95% confidence-interval)

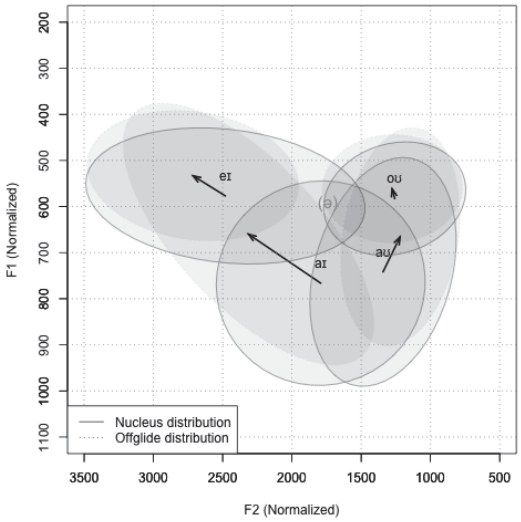


Figure 5.3: The global distribution of diphthongs' F1 and F2
(95% confidence-interval)

The ellipses in Figures 5.2 and 5.3 display the hypothetical distribution of each vowel based on a 95% confidence-interval of the F1 and F2 values assuming a normal distribution.[4] The monophthongs in Figure 5.2 show an a overlapping yet distinct set of regions within the vowel space taken up by individual qualities. The one exception to this claim is the merged [ɑ] and [ɔ] vowels as previously mentioned.

To examine the [ɑ] and [ɔ] qualities more closely, Figure 5.4 displays the hypothetical distributions and actual token distributions of these two vowels. The ellipses displayed in the figure represent the two hypothetical distributions of the [ɑ] and [ɔ] vowels based on a .95 confidence-interval of each token distribution. This figure confirms the significant overlap of the token distribution, which is also supported by the test statistic of $p>0.05$ implying that the two means are not significantly different from one another; additionally, the multivariate analysis of variance (MANOVA) reports a lack of significant difference between these low back vowels (i.e., MANOVA reports V=001, $F(2, 326)=0.2$, $p=.84$). Thus, the statistical evidence does not reject

[4] As a consequence, the increase of a vowel's SD is correlated with an increase in the size of its ellipsis.

the claim that the [ɔ] and the [ɑ] are merged within the general UP system. It will be interesting to see if the merger is maintained at subsequent levels of analysis for HERITAGE-LOCATION and BILINGUALISM in this chapter.

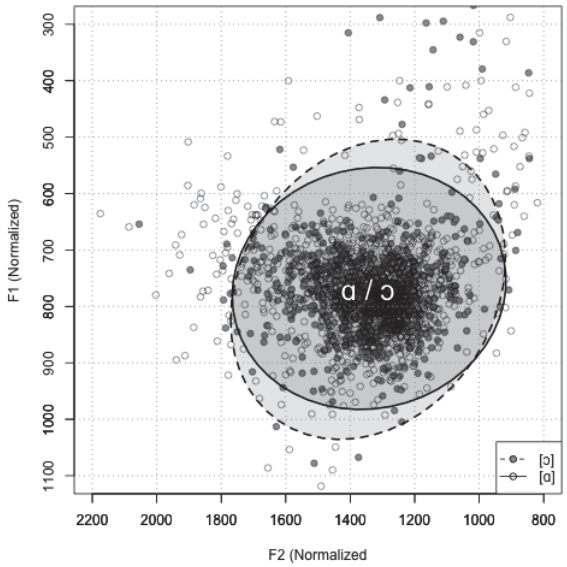


Figure 5.4: a
nd [ɔ] merger]The distribution density
of the [ɑ] and [ɔ] merger
(ellipses based on .95 confidence-interval)

Turning back to the diphthongs in Figure 5.3, the two types of ellipses (i.e., solid vs. dotted) represent the nucleus distribution and the offglide distribution of the SHORT DIPHTHONGs and LONG DIPHTHONGs. Each of the four diphthongs are patterning very differently in comparison to one another in that their respective nuclei are utilizing distinct regions of the vowel space. Even the nuclei of the [ɑw] and [ɑj] diphthongs are significantly different from one another in the F1 and F2 dimension (i.e., univariate analysis of variance (ANOVA) of F2 reports $F(2, 698)=401$, $p<.001$, while ANOVA of F1 reports $F(2, 6.83)$, $p<0.01$; MANOVA reports $V=0.367$, $F(2, 697)=202$, $p<0.001$).

In this thesis, the question remains as to if the following environments condition the raised and non-raised variants of the LONG DIPHTHONGs' nuclei, [ɑj] and [ɑw].

However, this question can only be partially answered, since the [ɑj] vowel is followed by both voiced and voiceless obstruents while the latter is only followed by voiceless obstruents in the reading passage dataset. As a result, first we will examine the nucleus of /ɑj/ to see if it is conditioned based on the following environment for the two tokens "tried" for [ɑjC] and "slices" [ɑjT].

Figure 5.5 displays the means and token distribution of the phonetical realization of the nucleus of /ɑj/ in a pre-voiced context (i.e., [ɑjC] as in the case of "tried") and a pre-voiceless context (i.e., [ɑjT] as in the case of "slices").[5] The pre-voiceless tokens of /ɑj/ are on average raised more than the pre-voiced ones. The pre-voiced and -voiceless environments of the /ɑj/ observationally and statistically are conditioning the raised and non-raised variants; a MANOVA reports statistical significance with a 66.2Hz difference along the F1 dimension (i.e., MANOVA reports V=0.167, F(2, 139)=13.9, p<0.001). A greater than 60Hz difference between the variants of /ɑj/ in pre-voiced and pre-voiceless contexts is shown to be a diagnostic for determining the presence of Canadian raising in the seminal work of Labov et al. (2006, 222).

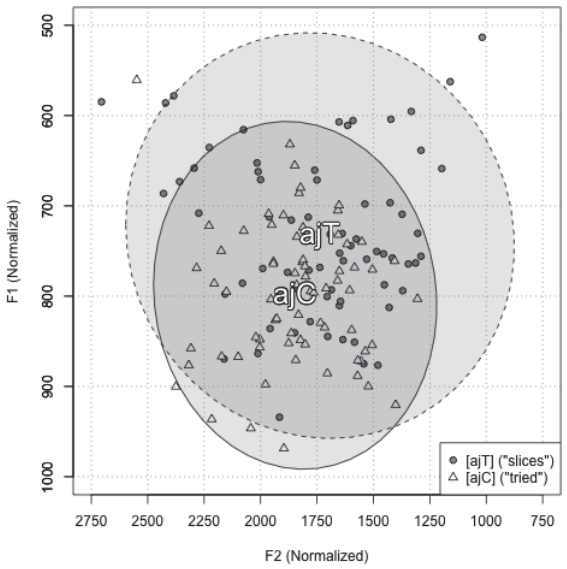


Figure 5.5: The distribution density of the [ɑjT] and [ɑjC] nuclei

If the nuclei of the two LONG DIPHTHONGs are distinctive from one another along the F2 and F1 dimension, are they also distinctive from neighboring vowel qualities (e.g., [æ], [ɑ/ɔ], [ʌ])? In order to answer this question, both the nuclei of the pre-voiceless /ɑj/ and /ɑw/ vowels will be examined in relation to their neighboring

[5]The ellipses are based on .95 confidence-interval.

monophthongs to approximate the nuclei's position in the low regions of the acoustic vowel space (e.g., advanced, raised, or both relative to the low-back merger). Since the nucleus of the /ɑj/ diphthong is divergent from /ɑw/ along the F2 dimension on average, it is reasonable to inquire if the [ɑjT] quality is statistically different from either the [æ] or [ɑ/ɔ] monophthongs which occupy the low front and back regions of the vowel space. Figures 5.6 and 5.7 display the token distribution for the nucleus of [ɑjT] in comparison to the low front vowel and the low back vowels respectively.

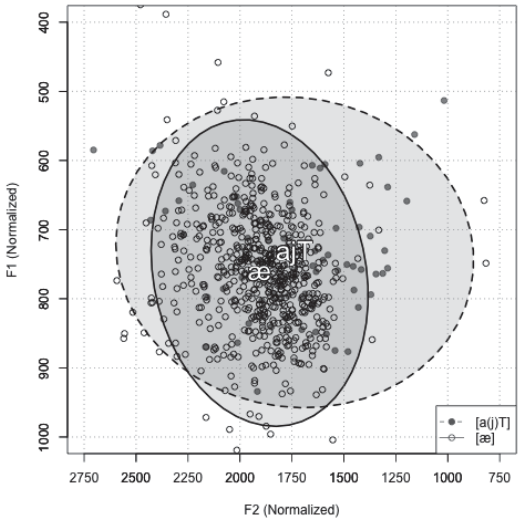


Figure 5.6: The nucleus of [ɑjT] compared to the [æ] vowel

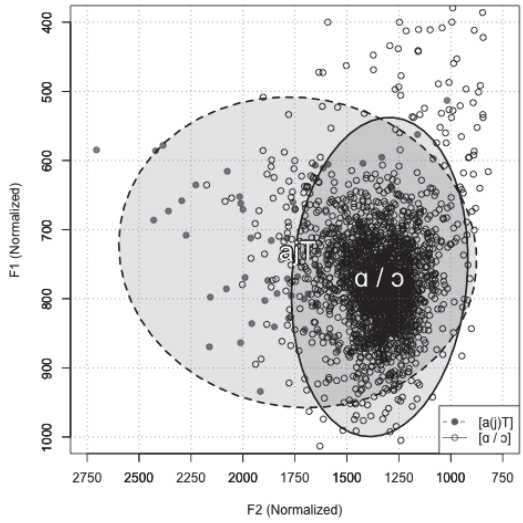


Figure 5.7: The nucleus of [ɑjT] compared to the [ɑ/ɔ] vowel

When comparing the F1 and F2 means of the nucleus of [ɑj] before voiceless obstruents with the [æ] vowel in a MANOVA, there is a significant difference between the two vowels (i.e., MANOVA reports V=0.034, $F(2, 714) = 23$, $p<0.001$); separate ANOVAs for each response variable reveals that the two vowels are significantly distinct along the F2 dimension, as well as the F1 dimension (i.e., ANOVA of F2 reports $F(1, 714) = 34.4$, $p<0.001$; ANOVA of F1 reports $F(1, 714) = 6.92$, $p<0.01$). The F1 and F2 mean comparison of the nucleus of [ɑj] and [ɑ/ɔ] merger also reports a significant difference according to a multivariate test statistic (i.e., MANOVA reports V=0.135, $F(4, 2211) = 80$, $p<0.001$). Similar to the previous comparison with the [æ] vowel, the subsequent univariate analyses between the nucleus of [ɑjT] diphthong and the low-

back merger reveal that the vowels are significantly distinct along the F2 dimension and the F1 dimension (i.e., ANOVA of F2 reports $F(2, 2211) = 160.3$, $p<0.001$; ANOVA of F1 reports $F(2, 2211) = 4.94$, $p<0.01$).

Since the nuclei of the /ɑj/ and the /ɑw/ are phonetically distinct along the F2 dimension, what is [ɑwT]'s relationship with the neighboring vowels in the low back quadrant of this global vowel space? With the focus on the nucleus of the [ɑwT] diphthong, Figures 5.8 and 5.9 display the token distribution of the nucleus of this diphthong with the token distribution of the [ɑ/ɔ] vowels and the [ʌ] vowel respectively.

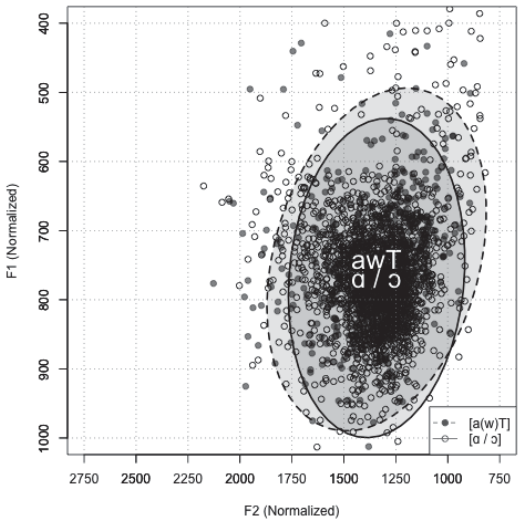


Figure 5.8: The nucleus of the [ɑwT] diphthong compared to the [ɑ/ɔ] vowel

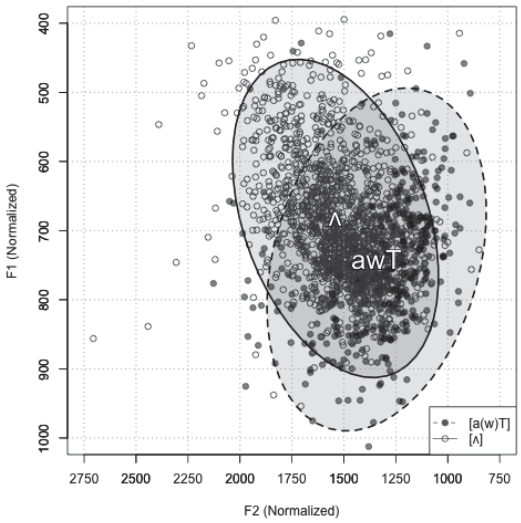


Figure 5.9: The nucleus of the [ɑwT] diphthong compared to the [ʌ] vowel

The multivariate analysis of variance for [ɑwT] before voiceless obstruents and the low-back merger reveals a significant difference (i.e., MANOVA report $V=0.013$, $F(4, 2710) = 9$, $p<0.01$); subsequent ANOVAs report significant differences between these qualities along the F1 dimension but not the F2 dimension (i.e., ANOVA of F1 reports $F(2, 2710) = 17.7$, $p<0.001$; ANOVA of F2 reports $F(2, 2710) = 0.074$, $p>0.05$). The nucleus of [ɑwT] and the [ʌ] vowel are also significantly distinctive from one another (i.e., MANOVA reports $V=0.19$, $F(2, 1925) = 229$, $p<0.001$); along both the F1 and

F2 dimensions, the nucleus of the diphthong is distinctive from the [ʌ] monophthong (i.e., ANOVA of F1 reports $F(1, 1925) = 152.7$, $p<0.001$; ANOVA of F2 reports $F(1, 1925) = 369.3$, $p<0.001$). These test statistics indicate that the nucleus of the [ɑwT] diphthong is raised in the older-aged UP speakers' system; that is, it is distinctive from both the [ɑ/ɔ] and [ʌ] vowels that are the low-back merger but below the [ʌ] monophthong. In general, the nucleus of the [ɑwT] diphthong can be described as being both raised above the low-back merger but not advanced in the acoustic vowel space, while the nucleus of the [ɑjT] diphthong is both advanced and raised relative to the merger.

When examining diphthongs, the response variables of Euclidean distance (ED) and duration should also be taken into account. Figure 5.10 displays the relationship of ED and duration for the diphthongal qualities of [ej, ow, ɑwT, ɑjT, ɑjC], with labels located at the centralized loci of the five ellipses. The ED is the distance from the nucleus (i.e., first-pivot point) to the offglide (i.e., second pivot-point) of a diphthong's trajectory, while a diphthong's duration begins at the vocalic onset and ends at the vocalic offset of the vowel.

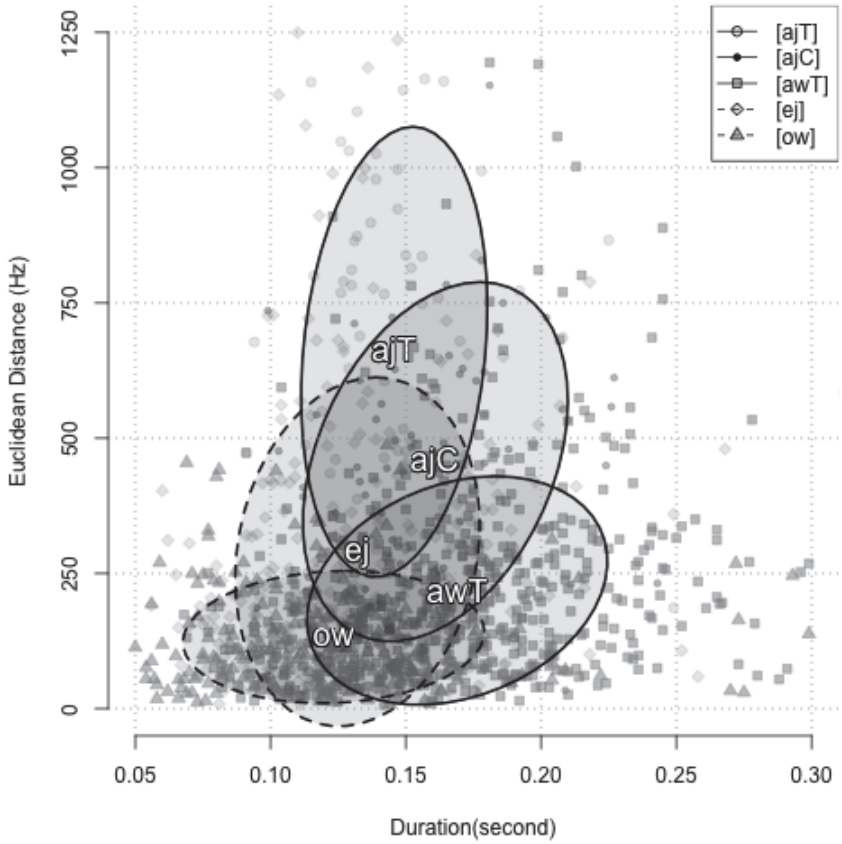


Figure 5.10: The relationship of euclidian distance and duration for diphthongs
(ellipses based on .5 confidence-interval)

In Figure 5.10 the [ɑjT] and [ɑjC] LONG DIPHTHONGs have the longest distance between the nucleus and offglide of any of the other diphthongs; the [ɑjT]'s mean is 659.5Hz while the [ɑjC]'s mean is 456.4Hz.[6] In contrast, the [ow] quality likens to a monophthong more than a diphthong due to the limited deviation in its trajectory pattern from nucleus to offglide with a ED of approximately 125Hz (i.e., median = 103.7Hz and mean = 132.5Hz).[7] The [ej] SHORT DIPHTHONG and the [ɑwT] LONG DIPHTHONG maintain EDs between their nucleus and offglide at approximately 175-300Hz (i.e., the [ɑwT]'s mean = 218Hz, while the [ej]'s mean = 289Hz); a univariate analysis of variance reports a significant difference between these vowel's EDs (i.e.,

[6]The [ej]'s, [ɑjC] and [ɑjT]'s offglides' hypothetical distributions, represented by dotted ellipses in Figure 5.3 on page 72 are considerably larger than the ellipses for the accompanying nuclei; this is due to the outliers for the offglides, which is apparent in Figure 5.10.

[7]The hypothetical distribution of the [ow]'s nucleus and offglide are also quite close to one another (as was displayed in Figure 5.3 on page 72).

ANOVA of ED reports F(3, 1207) = 120.5, p<0.001). If the EDs for /ɑj/ is excluded, the univariate analysis of variance for the nucleus of [ow], [ɑwT] and [ej] reveal that they are all statistically different from one another (i.e., ANOVA of ED reports F(2,1067) = 38.81, p<0.001).

In terms of total duration, as shown in Figure 5.10 as well, the SHORT DIPHTHONGs and LONG DIPHTHONGs are patterning very similarly with their respective counterparts. The duration means for [ej] and [ow] are ≈ 132ms and 123ms (i.e., ANOVA of duration reports F(1, 499)=5.28, p<0.05), and the duration means for [ɑjT], [ɑjC] and [ɑwT] are ≈ 156ms, 161ms and 169ms respectively (i.e., ANOVA of duration reports F(1, 708)=13.45, p<0.001). All diphthongs are distinctly different in terms of duration; however, the /ɑw/ and /ɑj/ diphthongs are clearly longer than the /ej/ and /ow/ diphthong which maintains the traditional long-short distinction. The duration measurements for these older-aged UP speakers' diphthongs follow the traditional distinction between SHORT DIPHTHONGs and LONG DIPHTHONGs, while the ED measurements do not. The short ED and the significant correlation between the SHORT DIPHTHONG /ow/ indicates its quality resembles a monophthong rather than a diphthong (i.e., this suggest that "boat" might be pronounced more like [bot], instead of [boʊt], by an older-aged UP speaker in this speech community).

This section reveals that the global system of these older-aged UP speakers has several salient characteristics: 1) the presence of a low-back merger, 2) the monophthongized [ow] vowel 3) fronting of the /ɑj/ nucleus (but not the /ɑw/ nucleus), and 4) raising of both the [ɑjT] and the [ɑwT] nuclei above the low-back merger. Now that an overall description of the older-aged UP speakers' system has been provided, the remainder of this chapter will focus on the interspeaker variation of the linguistic variables of interest as they correlate with the predictor variables of HERITAGE-LOCATION and BILINGUALISM and the interaction between them.

5.2 The Factor of Heritage-Location

The predictor variable of HERITAGE-LOCATION is comprised of three-levels based on a combination of ancestral heritage and geographic location of residency in the Marquette County. The three groups associated with this predictor variable include the EAST-side Finns (n=11), the EAST-side Italians (n=28) and the WEST-side Finns (n=32). As a preliminary view of the overall utilization of the vowel space by the three HERITAGE-LOCATION groups, Figures 5.11 and 5.12 display F1 and F2 means of the nuclei for the monophthongs and of the nuclei and offglides for the diphthongs.

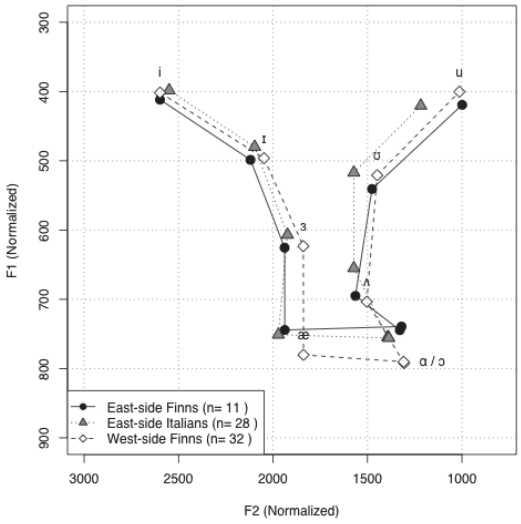


Figure 5.11: Means of monophthongs and the predictor variable of HERITAGE-LOCATION

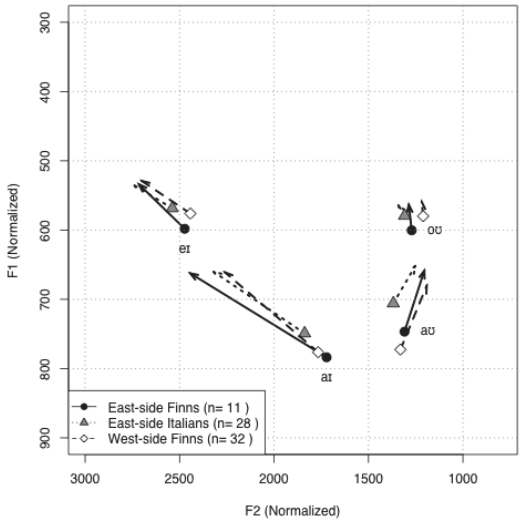


Figure 5.12: Means of diphthongs and the predictor variable of HERITAGE-LOCATION

The figures above show several striking characteristics with regards to vowels associated with the FRONT LAX, LOW BACK, HIGH BACK, SHORT DIPHTHONG, and LONG DIPHTHONG sets of linguistic variables. The first observation to note in Figure 5.11 is the general tendency of the EAST-side Finns (black-filled circles) and the EAST-side Italians (gray-filled triangles) to pattern closely together. This claim holds true for the FRONT LAX vowels and the LOW BACK vowels. Next, for the MID-HIGH BACK vowels, the WEST-side Finns (white-filled circles) and the EAST-side Finns are pat-

terning together, while the EAST-side Italians' vowels are higher and further forward in the acoustic space. In Figure 5.12, the first observation to note is the trend for the EAST-side Italians to pattern differently from either the EAST-side Finns or the WEST-side Finns for the nucleus of the [ɑj], [ɑw] and [ow] diphthongs; in other words, the [ɑj]'s nucleus is further forward, the [ɑw] is higher and the [ow] is further forward and higher for the EAST-side Italians compared to these other two groups. When comparing the [ow] vowel's nuclei and the offglides for the HERITAGE-LOCATION groups, the EAST-side Italians' [ow] is completely monophthongized while the other two have observable, albeit short, trajectories.

The remainder of this section presents each observation discussed above in turn, and for each subsection, a thorough analysis will be provided of the HERITAGE-LOCATION groups relative to each linguistic set of variables of interest. As such, Subsections 5.2.1, 5.2.2 and 5.2.3 first examine the effects of HERITAGE-LOCATION on the vowels characterized by the FRONT LAX, HIGH BACK and LOW BACK sets of linguistic variables respectively. Subsections 5.2.4 and 5.2.5 then investigate the SHORT DIPHTHONGS and LONG DIPHTHONGS in relation to the main effect of HERITAGE-LOCATION.

5.2.1 The Analysis of the Front Lax Vowels

The structural difference between the HERITAGE-LOCATION groups for the FRONT LAX vowels is visually striking and displayed in Figure 5.13. The [ɪ] vowel is statistically significant for the factor of HERITAGE-LOCATION according to both a multivariate (i.e., MANOVA reports $V=0.03$, $F(2, 632)=4.72$, $p<0.001$) and univariate analyses of variance (i.e., ANOVA of F1 reports $F(2, 632) = 6.13$, $p<0.01$; ANOVA of F2 reports $F(2, 632) = 3.74$, $p<0.05$). Similarly, the [ɛ] vowel does show significance (i.e., MANOVA reports $V=0.05$, $F(2, 847) = 10.13$, $p<0.001$, while the ANOVA of F2

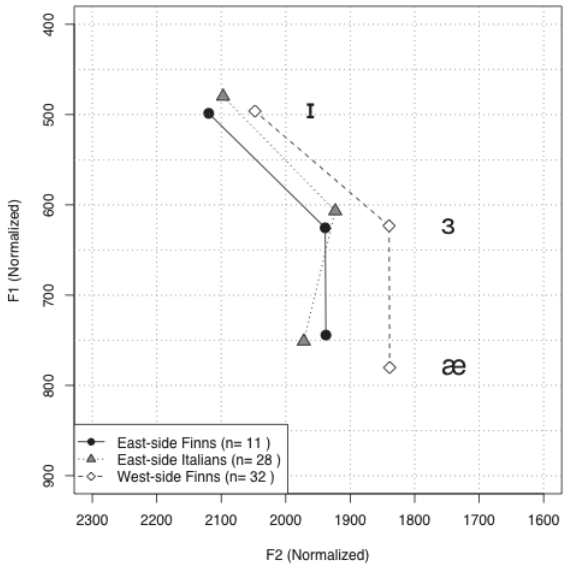
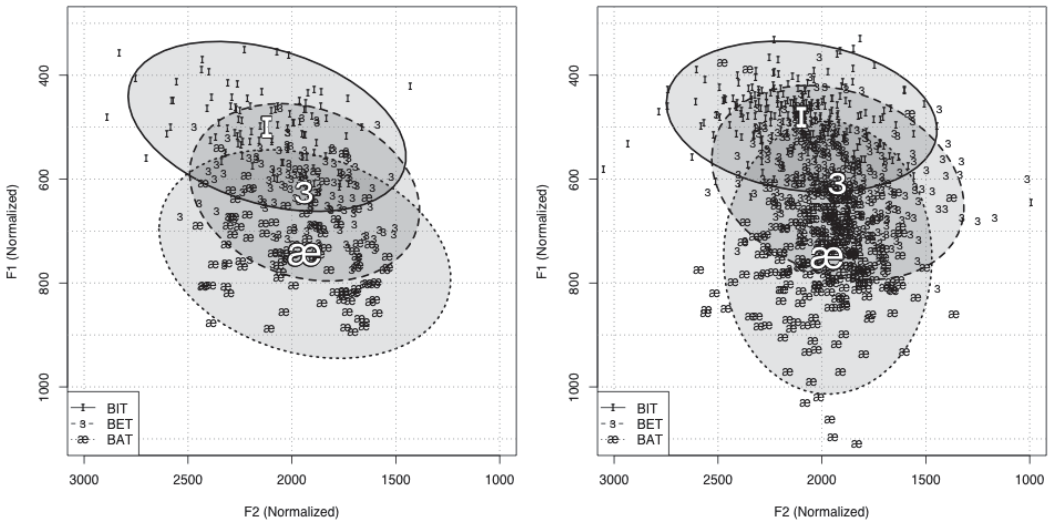


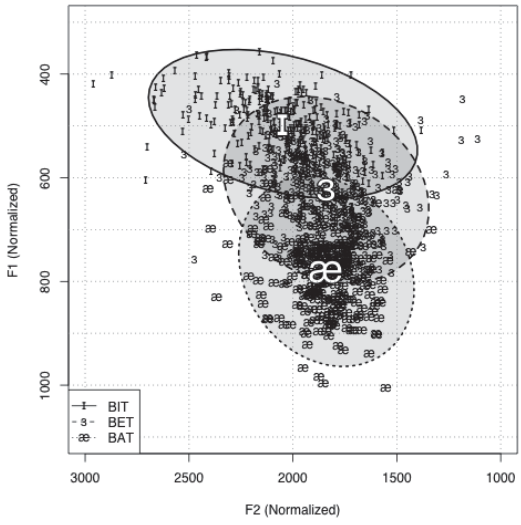
Figure 5.13: The grand means of the FRONT LAX vowels for the HERITAGE-LOCATION groups

reports F(2, 847) = 5.4, p<0.01; ANOVA of F1 reports F(2, 847) = 16.50, p<0.001). Finally, the HERITAGE-LOCATION groups are significantly different from one another when examining the [æ] vowel using multivariate and univariate analyses of variance; the MANOVA statistic reports a high significance (i.e., MANOVA reports V=0.10, F(2, 634) = 17.26, p<0.001), which corresponds to the univariate analyses of variance for F1 (i.e., ANOVA of F1 reports F(2, 634) = 9.70, p<0.001) and F2 (i.e., ANOVA of F2 reports F(2, 634) = 29.6, p<0.001). The results indicate that the EAST-side Finns and the EAST-side Italians are patterning closely to one another; in other words, the WEST-side Finns' FRONT LAX vowels are more retracted than the other two HERITAGE-LOCATION groups as a factor of LOCATION.

In order to examine more closely the claim that location of residency seems to have an effect on FRONT LAX vowels, Figure 5.14 displays the hypothetical distribution and actual token distribution of the three vowels independently for each HERITAGE-LOCATION group.



(a) East-side Finns (n=11) (b) East-side Italians (n=28)



(c) West-side Finns (n=32)

Figure 5.14: The distribution of the FRONT LAX vowels
for each HERITAGE-LOCATION group
(Based on a .95 confidence-interval)

In this figure there are three subplots for each HERITAGE-LOCATION group, each of which displays the hypothetical distribution and the actual distribution of the [ɪ], [ɛ] and [æ] tokens.[8] The [ɪ] vowels have a similar token distribution for all three subfigures; this is supported by the multivariate and univariate statistics which reported non-significant differences. In contrast, both the [ɛ] and [æ] distributions are quite

[8]The latter is based on a .95 confidence-interval and represented by ellipses.

different for each of the HERITAGE-LOCATION groups; this is particularly true when comparing the EAST-side Finnish and Italian groups' distributions, which pattern similarly to the WEST-side Finns' distribution. Also, the WEST-side Finns' [æ] hypothetical distribution and actual token distribution is notably smaller — particularly along the F2 dimension; that is to say, the WEST-side Finns' SD of F1 = 75Hz and F2 = 172Hz is significantly smaller than the other two groups (i.e., in comparison to either the EAST-side Finns' SD of F1 = 81Hz and F2 = 283Hz, p-values<0.001, or the EAST-side Italians' SD of F1 = 107Hz and F2 = 204Hz, p-values<0.01).

Another way of describing this distributional variation within vowel categories is to examine the coefficient of variation (CoV) as a statistical measure. In terms of the phonetic realization of the vowel qualities, the FRONT LAX vowels show differing patterns of dispersions. Labov (1994) suggests that vowel categories undergoing potential change may in fact have larger dispersion patterns, while those that are smaller may be more stable. CoV has been used in previous sociophonetic studies to test this claim (Bigham 2008). Recall that the CoV measurements are the ratio of the SDs and are realized as percentages, in which a lower value indicates less variation or a tight dispersion while a higher value indicates greater variation or a loose dispersion. Table 5.1 displays the CoVs for the HERITAGE-LOCATION groups for each of the FRONT LAX vowels.

Table 5.1: The coefficient of variation (CoV) of the FRONT LAX vowels as a factor of HERITAGE-LOCATION

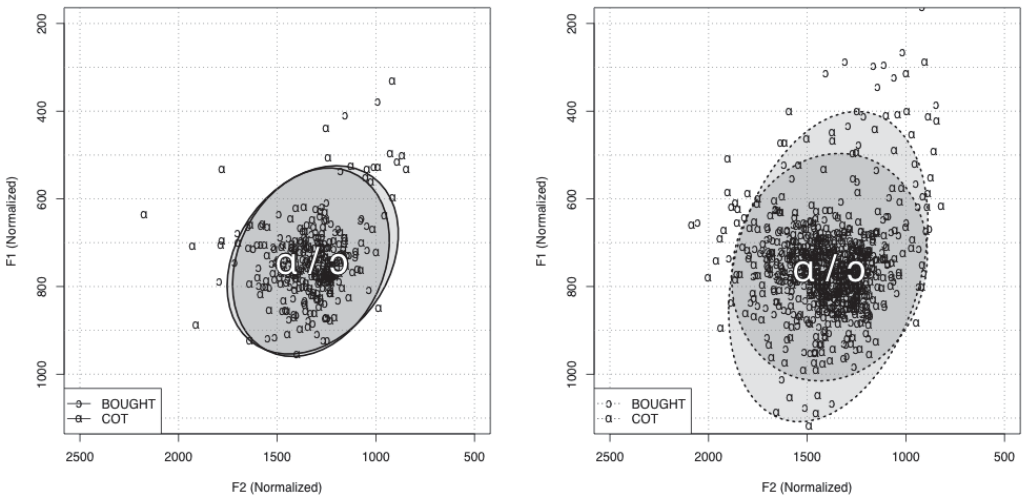
HERITAGE-LOCATION	FRONT LAX vowels		
	/ɪ/	/ɛ/	/æ/
EAST-side Finns	63.8%	52.9%	47.2%
EAST-side Italians	64.5%	54.0%	46.4%
WEST-side Finns	62.8%	50.9%	41.7%

The WEST-side Finnish group has the lowest CoV for all three FRONT LAX vowels in comparison to the other two HERITAGE-LOCATION groups. Based on the comparison

of means and SDs, along with the comparison of coefficients of variation, the present analysis shows that HERITAGE-LOCATION has a clear effect on the FRONT LAX vowels; that is to say, the more urban-based EAST-side groups are patterning together but are distinctly different from the more rurally-based WEST-side Finns.

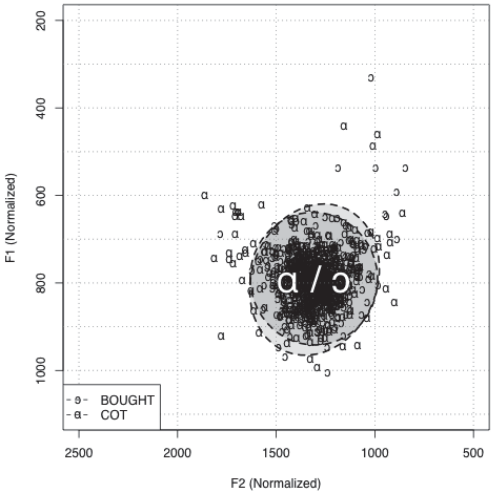
5.2.2 The Analysis of the Low Back Vowels

In Section 5.1, the low-back merger had been shown to be present among the older-aged UP speakers' system, and as a result, subsequent questions arise from this observation as it relates to the factor of HERITAGE-LOCATION. First, are these HERITAGE-LOCATION groups participating in the merger? If so, then are these groups' participation different or similar with respect to one another?



(a) East-side Finns (n=11)

(b) East-side Italians (n=28)



(c) West-side Finns (n=32)

Figure 5.15: The distribution of the LOW BACK vowels for the HERITAGE-LOCATION groups

Figure 5.15 displays both hypothetical and actual token distributions of [ɑ] and [ɔ] for the three HERITAGE-LOCATION groups: a) Subfigure 5.15a displays the merger for the EAST-side Finns, b) Subfigure 5.15b displays the merger for the EAST-side Italians, and c) Subfigure 5.15c displays the merger for the WEST-side Finns. The first question to address is if each of the HERITAGE-LOCATION groups' [ɑ] and [ɔ] are significantly different. In fact, all three groups' LOW BACK vowels report non-significance in terms of their statistical difference: (a) the EAST-side Finns (i.e.,

MANOVA reports V=0.001, F(2, 326)=0.17, p>0.05; ANOVA of F1 reports F(1, 326)=0.25, p>0.05; ANOVA of F2 reports F(1, 326)=0.19, p>0.05); (b) the EAST-side Italians (i.e., MANOVA reports V=0.0003, F(2, 824)=0.108, p>0.05; ANOVA of F1 reports F(1, 824)=0.02, p>0.05; ANOVA of F2 reports F(1, 824)=0.17, p>0.05); and, WEST-side Finns (i.e., MANOVA reports V=0.0004, F(2, 955)=0.17, p>0.05; ANOVA of F1 reports F(1, 955)=0.22, p>0.05; ANOVA of F2 reports F(1, 955)=0.12, p>0.05). Each HERITAGE-LOCATION group conclusively merges the [ɑ] and [ɔ] vowels. However, even a brief examination of Figure 5.15 yields the observation that the three HERITAGE-LOCATION groups differ in terms of their token distributions. When [ɑ] and [ɔ] are regarded as being merged and the vowel distinction is removed (i.e., a single vowel quality, and therefore a single linguistic variable), then the low-back merger as a linguistic variable reports significant differences between the three groups (i.e., MANOVA reports V=0.102, F(4, 4222), p<0.001; ANOVA of F1 reports F(2, 2111)=50.75, p<0.001; ANOVA of F2 reports F(2,2111)=53.38, p<=0.001).[9] This observation is further supported by examining each groups' SDs from the F1 and F2 means for this low-back merger. The WEST-side Finns' F1 and F2 SDs are ≈ 64.5Hz and ≈ 132.5Hz, while the EAST-side Finns' are ≈ 86.5Hz and ≈ 167.5Hz and the EAST-side Italians' are ≈ 124Hz and 203.5Hz respectively. In addition to means and SD, the CoV statistics in Table 5.2 confirm that the WEST-side Finns' LOW BACK vowels have a tighter cluster of tokens than either of the other two HERITAGE-LOCATION groups.

This suggests that the WEST-side Finns and the EAST-side Italians are the most divergent from one another, with the WEST-side Finns having the tightest distribution pattern of the low-back merger and the EAST-side Italians having the most dispersed. The two questions posed at the beginning of this subsection are both confirmed,

[9]Even when [ɑ] and [ɔ] are treated as two independent linguistic variables, both multivariate and univariate statistics report significance.

Table 5.2: The coefficient of variation (CoV) of the LOW BACK vowels as a factor of HERITAGE-LOCATION

HERITAGE-LOCATION	LOW BACK vowels /ɑ/	/ɔ/
EAST-side Finns	31.3%	30.8%
EAST-side Italians	33.1%	34.0%
WEST-side Finns	26.6%	26.5%

with all three groups actively participating in the low-back merger but participating in varying degrees in terms of their token distributions. The results from the SDs and CoVs indicate that that the WEST-side Finns and EAST-side Finns are stable in their token distribution, while the EAST-side Italians are far less so. This result may indicate that the EAST-side Italians' LOW BACK vowels are currently undergoing a linguistic change, and therefore, exhibit a more disperse token distribution.

5.2.3 The Analysis of the High Back Vowels

The HIGH BACK vowels [ʊ] and [u], while initially not found to be a distinctive set of linguistic variables in the more global older-aged UP speakers' system described in Section 5.1, are shown to be significantly different from one another in both the F1 and F2 dimensions for the three HERITAGE-LOCATION groups. Not only are there notables differences for each vowel between the factor levels, but both vowels as a set of linguistic variables show a similar pattern. The EAST-side Finns' and the WEST-side Finns' [ʊ] and [u] are patterning together while the EAST-side Italians' vowels are further forward and slightly lower in the acoustic space. Interestingly, this patterning of the Finnish-heritage groups, distinctive from the Italian-heritage group, is present for the mid-back [ʌ] vowel as well. By examining the structural relationship of these high and mid back vowels for each of the three HERITAGE-LOCATION groups, as is shown in Figure 5.16, this difference becomes quite salient.

Most noticeably in Figure 5.16, the EAST-side Italians' [u] and [ʊ] vowels are further front than either of the Finnish-heritage groups. Additionally, the EAST-side Italians' [ʌ] vowel is higher in the acoustic vowel space in comparison to these other two HERITAGE-LOCATION groups. A multivariate and univariate analyses of variance for each vowel confirms these noticeable differences that are on display in this figure.

This first analysis of variance, for the high back tense [u] vowel and the three HERITAGE-LOCATION groups, reports a significant difference (i.e., MANOVA reports V= 0.17, F(4, 416)=9.48, p<0.001; ANOVA of F1 reports F(2, 208)=3.29, p<0.05; ANOVA of F2 reports F(2, 208)=17.59, p<0.001); the univariate statistics suggest that the EAST-side Italians' and the other two groups' [u] vowels are statistically different from one another along the F2 dimension (i.e., mean difference of ≈200Hz). While the three groups' [u] report approximately equal SDs for F1 (i.e., F1's SD range = 51-62), the EAST-side Italians' SD of F2 is almost twice that of the WEST-side Finns' with the EAST-side Finns' SD falling somewhere between the two extremes (i.e., F2's SD range for the three HERITAGE-LOCATION groups is 180-317Hz).

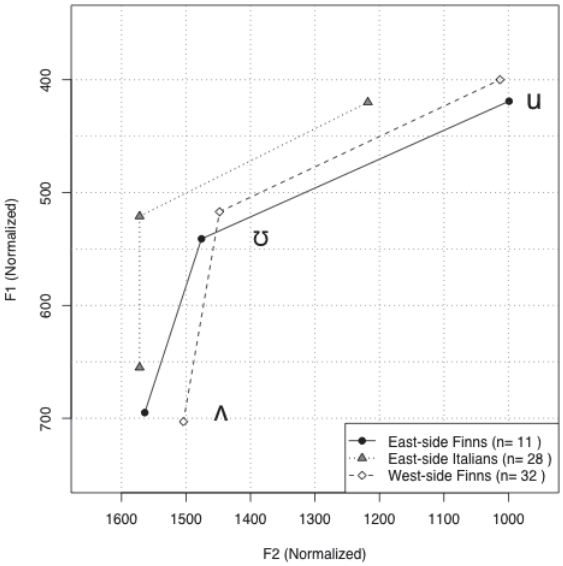


Figure 5.16: The grand means of the HIGH and MID BACK vowels for the HERITAGE-LOCATION groups

The second analysis of variance, for the high back lax [ʊ] vowel, also reports a significant difference (i.e., MANOVA reports V= 0.078, F(4, 1124)=11.38, p<0.001; ANOVA of F1 reports F(2, 562)=4.42, p<0.05; ANOVA of F2 reports F(2, 562)=19.05, p<0.001); once again, the EAST-side Italians group is divergent from the two Finnish-

heritage groups along the F2 dimension (i.e., with a mean difference of ≈ 100-125Hz); whereas, the SDs of F1 and F2 for all three groups are approximately the same (i.e., SD<40Hz).

The last analysis of variance to examine is the mid back [ʌ] vowel and the three HERITAGE-LOCATION groups, of which both the multivariate and univariate analyses report significant differences (i.e., MANOVA reports V= 0.069, F(4, 2672)=24.05, p<0.001; ANOVA of F1 reports F(2, 1336)=41.21, p<0.001; ANOVA of F2 reports F(2,1336)=18.43, p<0.001). While the EAST-side Italians' [ʌ] vowel is significantly divergent from that of the WEST-side Finns' vowel along both the F1 and F2 dimension, the EAST-side Finns' [ʌ] is only significantly different from the EAST-side Italians' vowel along the F1 dimension (i.e., ANOVA of F1 reports F(1, 732)=25.35, p<0.001) and from the WEST-side Finns' vowel along the F2 dimension (i.e., ANOVA of F2 reports F(1, 812)=17.65, p<0.001). The EAST-side Finns are patterning with the other Finnish HERITAGE-LOCATION group along the F1 dimension for the HIGH BACK vowels, but these EAST-side Finns are also patterning with the other east-side HERITAGE-LOCATION group along the F2 dimension.

The results from Sections 5.2.1, 5.2.2 and 5.2.3 exhibit several phonetic patterns worth summarizing at this juncture. First, the Finnish HERITAGE-LOCATION groups pattern together for the LOW BACK and HIGH BACK vowels, exhibiting a systematic and structural difference from that of the EAST-side Italians. When the EAST-side Finns do pattern differently from the WEST-side Finns and similar to the EAST-side Italian group (e.g., FRONT LAX vowels), this groups' token distribution is observationally dispersed and unstable (i.e., a phonetic pattern of a vowel quality typically associated with a change-in-progress). If this is a change-in-progress, such a hypothesis would account for why the EAST-side Finns' and EAST-side Italians' FRONT LAX vowels exhibit the dispersed and unstable token distributions, while WEST-side Finns

do not — the FRONT LAX vowels of the older-aged EAST-side HERITAGE-LOCATION groups' are undergoing a change (i.e, converging toward one another), while the FRONT LAX vowels of the more rurally located WEST-side HERITAGE-LOCATION group is not (i.e., remaining distinctive from the EAST-side counterparts). Under this hypothesis, the systematic and structural difference of the LOW BACK and HIGH BACK vowels that is exhibited between the HERITAGE groups may also extend to the FRONT LAX vowels. The WEST-side Finns maintain a structural difference with the EAST-side Italians for each of the three FRONT LAX linguistic variables; in contrast, the EAST-side Finnish group's FRONT LAX vowels are mirroring that of its EAST-side counterpart, which is indicative of dialect leveling as a factor of LOCATION and a diffusion process of linguistic change.

5.2.4 The Analysis of the Short Diphthongs

This section seeks to reveal if the SHORT DIPHTHONG /ow/ is monophthongized for each HERITAGE-LOCATION group, and if so, to determine the relationship and pattern in comparison to one another and neighboring vowels. To determine if monophthongalization is present for the three HERITAGE-LOCATION groups requires a comparison between the nucleus of the [ow] vowel with its offglide counterpart for each level of the HERITAGE-LOCATION factor. In Table 5.3 below, the EDs and Pearson's product-moment correlations reveal that a high correlation between the nucleus and offglide of [ow] vowel quality is correlated with the HERITAGE-LOCATION factor.

Only one of the three HERITAGE-LOCATION groups reports r^2 correlation coefficients' above .60 for both F1 and F2, with the WEST-side Finns reporting an ED of 108.2Hz, which is approximately 40Hz shorter than the other two groups (i.e., ANOVA reports $F(2, 209)=5.67$, $p<0.01$). The results suggest that the WEST-side Finns ' nuclei and offglides of the [ow] quality are closely aligned, and therefore, the

Table 5.3: Means, EDs, and pearson's product-moment correlations for the nuclei and offglides of the SHORT DIPHTHONG [ow] as a factor of HERITAGE-LOCATION

Groups	F1/F2	Nuclei's Mean (Hz)	Offglide's Mean (Hz)	ED (Hz)	r^2	t	df	p-value
East-side Finns	F1	600	563	164.5	.52	3.4	31	<0.01
	F2	1271	1286		.45	3.0		
East-side Italians	F1	579	564	150.5	.38	3.7	82	<0.001
	F2	1309	1342		.71	9.0		
West-side Finns	F1	580	559	108.2	.68	9.0	93	
	F2	1211	1218		.75	11.0		

quality likens more to a monophthong than a diphthong; although the nuclei and offglides are not as highly correlated as the WEST-side Finns', the other groups' [ow] vowels still resemble monophthongal qualities.

The next question to address is if the nucleus of the [ow] vowel shares the same acoustic space with any neighboring monophthongal qualities (e.g., [ʌ] as in "but"). A series of multivariate analyses of variance and accompanying ANOVAs reveal that for all three HERITAGE-LOCATION groups the nucleus of [ow] and [ʌ] are significantly different from one another (i.e., all three MANOVA report $p<0.001$). Essentially, the token patterning of the nucleus of [ow] and [ʌ] are inversely related to one another for all three HERITAGE-LOCATION groups, and therefore, the [ʌ] vowel and the nucleus of the [ow] for each HERITAGE-LOCATION group are treated as distinct, albeit neighboring, vowel qualities.

5.2.5 The Analysis of the Long Diphthongs

This subsection examines if the nucleus of the /ɑj/ and /ɑw/ diphthongs are patterning differently with regards to the three HERITAGE-LOCATION groups. For the first of the two LONG DIPHTHONGs, the [ɑj]'s nucleus (i.e., regardless of pre-voicing context) shows little variation between the three groups with a range of 115Hz along the F2

dimension and a range of 35Hz along the F1 dimension. Multivariate and univariate analyses both report a non-significant difference for the nucleus of [ɑj] (i.e., MANOVA report V=0.047, F(4, 272)=1.65, p>0.05; ANOVA of F1 reports F(2, 136)=1.79, p>0.05; ANOVA of F2 reports F(2, 136)=1.42, p>0.05); the lack of significant difference along the F2 dimension is a result of a small token count.[10] In contrast, the nucleus of [ɑw] does report a significant difference (i.e., MANOVA report V=0.13, F(4, 1116) = 18.75, p<0.001; ANOVA of F1 reports F(2, 558) = 27.8, p<0.001; ANOVA of F2 reports F(2, 558) = 3.07, p<0.05). Although the Finnish-heritage groups pattern similarly with each other, the nucleus of the EAST-side Italians' [ɑw] is ≈ 60Hz higher in the acoustic space. Furthermore, these EAST-side Italians have a [ɑw] nucleus that is 50Hz higher than the neighboring vowels participating in the low-back merger (i.e., t(385.061)=6.12, p<0.001). The WEST-side Finns' nucleus of [ɑw] is only 18Hz higher yet it is still marginally significant in its difference (i.e., t(315.696)=2.89, p<0.01), while the EAST-side Finns report a non-significant difference between their low-back merger and their neighboring [ɑw] nucleus. In terms of LONG DIPHTHONGs and the HERITAGE-LOCATION effect, two main claims can be stated: 1) only the EAST-side Italians are described as having the raised variant for the [ɑw]'s nucleus (i.e., <775Hz), and 2) all three HERITAGE-LOCATION groups are patterning similarly in terms of overall fronting for the [ɑj]'s nucleus (i.e., >1720Hz).

[10]Multivariate analysis of the [ɑjT], in pre-voiceless contexts, reveals a marginal significant difference between HERITAGE-LOCATION groupings (i.e., F(4, 66)=2.54, p<0.05); however, follow-up univariate analysis reveals no difference along either the F1 or F2 dimension independently.

5.3 The Factor of Bilingualism

The predictor variable of BILINGUALISM is comprised of three-levels based on a bilingual language-dominant distinction and a bilingual/monolingual distinction among the older-aged UP residence in the Marquette County. The three groups associated with this predictor variable include the HERITAGE-dominant bilinguals (n=22), the ENGLISH-dominant bilinguals (n=22) and the ENGLISH-dominant monolinguals (n=27).

As a preliminary view of the overall utilization of the vowel space by the three BILINGUALISM groups, Figures 5.17 and 5.18 display F1 and F2 means of the nuclei for the monophthongs and of the nuclei and offglides for the diphthongs.

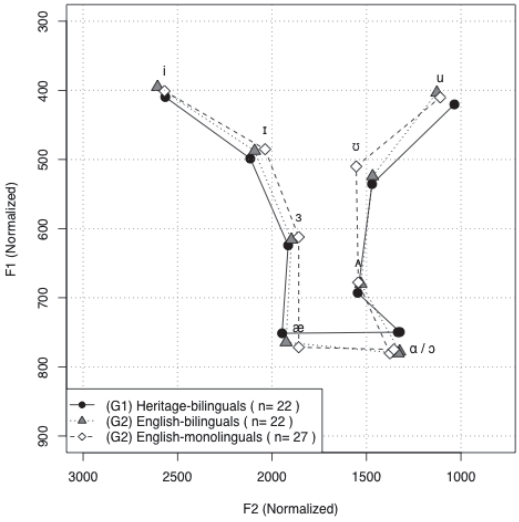


Figure 5.17: Means of monophthongs and the predictor variable of BILINGUALISM

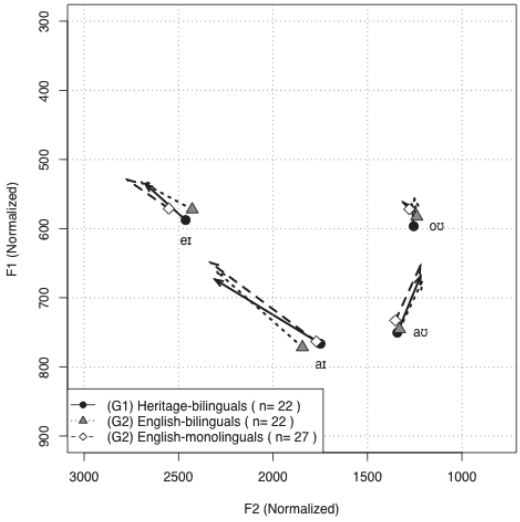


Figure 5.18: Means of diphthongs and the predictor variable of BILINGUALISM

The BILINGUALISM groups, in general, seem to be patterning similarly to one another in the figures above. Nevertheless, there are several observations that should be examined further. In Figure 5.17, the first observation is the retraction of the FRONT LAX vowels for the ENGLISH-dominant monolinguals compared to the other

two groups. Second, the advancement of the HIGH BACK vowels is present in the ENGLISH-dominant monolinguals' and ENGLISH-dominant bilinguals' systems but not in the HERITAGE-dominant bilinguals' system. Third, all three BILINGUALISM groups exhibit the low-back merger, but the ENGLISH-dominant monolinguals' and ENGLISH-dominant bilinguals' low-back mergers are lower in the acoustic space compared to that of the HERITAGE-dominant bilinguals' system. Turning to Figure 5.18, the fourth observation to note is the overall uniformity of nuclei and trajectory patterns of the SHORT DIPHTHONG among each of the three BILINGUALISM groups; in particular, the [ow] nuclei and offglides are patterning closely to one another which suggests a monophthong-like quality for all three BILINGUALISM groups. The final observation to note is the uniform patterning of the overall trajectories of the LONG DIPHTHONG vowels, and as a result, the nuclei of these LONG DIPHTHONGs are utilizing the F1 and F2 dimensions differently (i.e., following the description given in Section 5.1 on pages 75 and 76). This present section will investigate each of these initial observations described above to see if the linguistic variables of interest are correlated with the predictor variable of BILINGUALISM (i.e., regardless of ethnic-heritage language effects).[11]

5.3.1 The Analysis of the Front Lax Vowels

This section investigates the potential retraction of the FRONT LAX vowels as they correlate with the factor of BILINGUALISM. In Figure 5.19, the solid-lines and black-filled circles, dotted-lines and gray-filled triangles, and the dashed-lines and white-filled circles represent the FRONT LAX [ɪ], [ɛ] and [æ] means for HERITAGE-dominant bilinguals, ENGLISH-dominant bilinguals and ENGLISH-dominant monolinguals respectively.

[11]It is important to note that the Finnish- and Italian-heritage speakers are pooled together for each of the three BILINGUALISM groups during this section of the analysis; such an analysis is done to examine if substrate effects can be associated with one or more of the groupings for the main effect of BILINGUALISM.

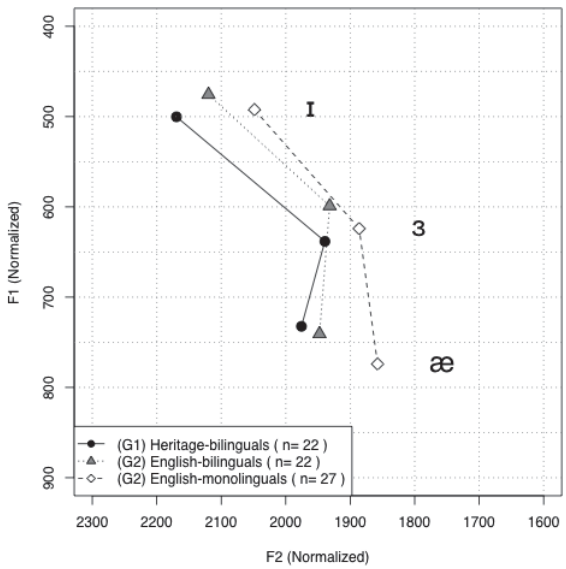


Figure 5.19: The means of the FRONT LAX vowels for the BILINGUALISM groups

Three separate multivariate analyses of variance, examining the factor of BILINGUALISM for each of the three FRONT LAX vowels, report statistical significant differences; however, subsequent univariate analyses of variance reveal that such significant differences exist only along the F2 dimension. For all three FRONT LAX vowels, the HERITAGE-dominant bilinguals and the ENGLISH-dominant monolinguals have the greatest mean difference along the F2 dimension. For the high front lax [ɪ] vowel, these two groups' F2 difference is 78.5Hz (i.e., MANOVA reports $V=0.034$, $F(4, 632)=5.50$, $p<0.001$; ANOVA of F1 reports $F(2, 632)=2.96$, $p>0.05$; ANOVA of F2 reports $F(2, 632)=5.18$, $p<0.01$). For the mid front lax [ɛ] vowel, HERITAGE-dominant bilinguals' and the ENGLISH-dominant monolinguals' F2 difference is 56Hz (i.e., MANOVA reports $V=0.020$, $F(4, 847)=4.20$, $p<0.01$; ANOVA of F1 reports $F(2, 847)=1.94$, $p<0.05$; ANOVA of F2 reports $F(2, 847)=4.72$, $p<0.01$). For the low front lax [æ] vowel, the F2 difference between these two groups is 88Hz (i.e., MANOVA reports $V=0.037$, $F(4, 634)=6.03$, $p<0.001$; ANOVA of F1 reports $F(2, 634)=2.73$, $p>0.05$; ANOVA of F2 reports $F(2, 634)=10.63$, $p<0.001$). This result indicates that the ENGLISH-dominant monolinguals' FRONT LAX vowels are more retracted in the

acoustic vowel space compared to the other two BILINGUALISM groups.

5.3.2 The Analysis of the Low Back Vowels

The low-back merger is present for each of the three BILINGUALISM groups; all multivariate and univariate analyses of variance fail to report significant differences between the [ɑ] and the [ɔ] vowels respective of each individual BILINGUALISM group (i.e., all three MANOVAs and six subsequent ANOVAs report $p>0.05$). However, the question remains as to if there is a difference between the three BILINGUALISM groups with respect to the low-back merger (i.e., treating the [ɑ] and [ɔ] as a single linguistic variable). The differences between the three BILINGUALISM groups' low-back merger is statistically significant (i.e., MANOVA reports $V=0.028$, $F(4, 1155)=8.32$, $p<0.001$; ANOVA of F1 reports $F(2, 1155)=12.34$, $p<0.001$; ANOVA of F2 reports $F(2, 1155)=12.34$, $p<0.01$). In other words, the difference of ≈30Hz along the F1 dimension for the ENGLISH-dominant bilinguals and ENGLISH-dominant monolinguals (i.e., 776-779Hz) compared to the HERITAGE-dominant bilinguals (749Hz) is statistically significant in its difference. In all other comparisons, these three groups are patterning very similarly with regards to the [ɑ] and [ɔ] vowels relative to one another in the low back quadrant of the acoustic vowel space.

5.3.3 The Analysis of the High Back Vowels

This section investigates the HIGH BACK vowels to see if differences exist between the three BILINGUALISM groups. In Figure 5.20, the solid-lines and black-filled circles, dotted-lines and gray-filled triangles, and the dashed-lines and white-filled circles represent the HIGH BACK [u], [ʊ] and [ʌ] means for the HERITAGE-dominant bilinguals, ENGLISH-dominant bilinguals and ENGLISH-dominant monolinguals respec-

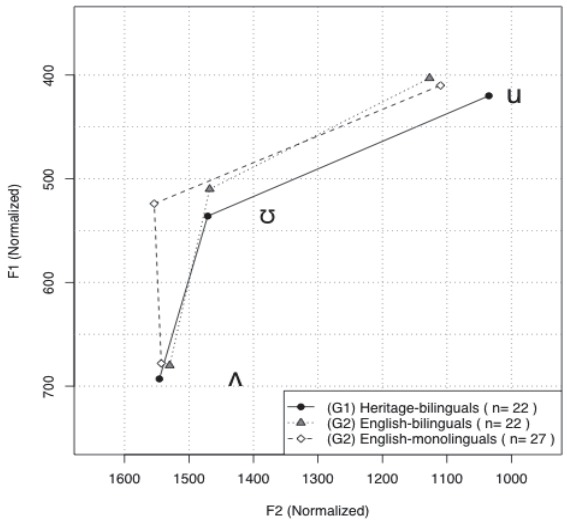


Figure 5.20: The means of the HIGH BACK vowels for the BILINGUALISM groups

tively. Both the HIGH BACK vowels and MID BACK vowel are patterning differently with regards to the three BILINGUALISM groups. For the mid back lax [ʌ] vowel, only the 16Hz difference between the HERITAGE-dominant bilinguals and ENGLISH-dominant monolinguals along the F1 dimension reports a significant difference (i.e., MANOVA reports $V=0.019$, $F(4, 725)=3.45$, $p<0.01$; ANOVA of F2 reports $F(2, 725)=4.38$, $p<0.05$; ANOVA of F2 reports $F(2, 725)=1.06$, $p>0.05$). For the high back lax [ʊ] vowel, the 26Hz difference between the HERITAGE-dominant bilinguals and ENGLISH-dominant bilinguals along the F1 dimension and the 86Hz difference between HERITAGE-dominant bilinguals and ENGLISH-dominant monolinguals along the F2 dimension reveals a significant difference (i.e., MANOVA reports $V=0.049$, $F(4, 562)=7.07$, $p<0.001$; ANOVA of F1 reports $F(2, 562)=7.90$, $p<0.001$; ANOVA of F2 reports $F(2, 562)=9.39$, $p<0.001$). For the high back tense [u] vowel, multivariate and univariate analysis of variance report non-significance even though there is a 92Hz difference between HERITAGE-dominant bilinguals and ENGLISH-dominant bilinguals along the F2 dimension (i.e., MANOVA reports $V=0.039$, $F(4, 208)=2.08$, $p>0.05$; ANOVA of F1 reports $F(2, 208)=1.50$, $p>0.05$; ANOVA of F2 reports $F(2, 208)=2.23$, $p>0.05$); however, a t-test reports a marginally significant difference along the F2 di-

mension between these two BILINGUALISM groups (i.e., $t(125.6)$=-2.09, $p<0.05$).[12] In terms of the HIGH BACK vowels, the ENGLISH-dominant bilinguals' group and the ENGLISH-dominant monolinguals' group are distinctive from the HERITAGE-dominant bilinguals; in other words, these two groups tend to be more advanced in the acoustic space compared to the latter group.

5.3.4 The Analysis of the Short and Long Diphthongs

This subsection investigates if the /ow/ SHORT DIPHTHONG exhibits any significant differences between the three BILINGUALISM groups.[13] As is shown in Table 5.4 below, BILINGUALISM does not seem to correlate with a shortened trajectory of the [ow] SHORT DIPHTHONG; all three BILINGUALISM groups report EDs greater than 250Hz.

Table 5.4: Means, EDs, and pearson's product-moment correlations for the nuclei and offglides of the SHORT DIPHTHONG [ow] as a factor of BILINGUALISM

Groups	F1/F2	Nuclei's Mean (Hz)	Offglide's Mean (Hz)	ED (Hz)	r^2	t	df	*p-value*
Heritage-dom.	F1	646	619	269.2	.48	4.4	64	<0.001
Bilinguals	F2	1359	1355		.59	5.8		
English-dom.	F1	641	631	250.8	.55	5.2	63	
Bilinguals	F2	1335	1346		.76	9.3		
English-dom.	F1	638	640	258.6	.56	6.2	76	
Monolinguals	F2	1387	1412		.75	10.0		

Similar to the SHORT DIPHTHONGs, the LONG DIPHTHONGs do not show statistical differences for any of the multivariate analyses of variance when examining the main effect of BILINGUALISM.[14] When examining the nucleus of the /ɑj/ for the main

[12] The limited significant difference may be on account of a low token count for this particular linguistic variable, as is indicated by the degrees of freedom for each test.

[13] Both multivariate and univariate analyses of variance report non-significant difference for the [ej] SHORT DIPHTHONG between-groups for the factor of BILINGUALISM ($p>0.05$).

[14] Univariate analyses of variance were also performed but reported non-significant differences.

effect of BILINGUALISM, the multivariate analysis reports non-significant differences (i.e., MANOVA reports V=0.019, F(4, 136)=0.63, p>0.05). Similarly, the /ɑw/ LONG DIPHTHONG's multivariate analysis of variance also reports non-significant differences (i.e., MANOVA reports V=0.009, F(4, 558)=1.30, p>0.05). The results indicate the main effect of BILINGUALISM to not be a salient sociolinguistic factor on its own. As a result, the next section will examine the interaction of HERITAGE-LOCATION and BILINGUALISM.

5.4 The Interaction of Heritage-Location and Bilingualism

As shown in Sections 5.2 and 5.3, the predictor variables of HERITAGE-LOCATION and BILINGUALISM differ in how each factor affects the older-aged UP speakers' vowel spaces; that is to say, differences and similarities between groups' systems reveal trends and characteristics unique to the community along the sociolinguistic categories of HERITAGE-LOCATION and BILINGUALISM. The factor of HERITAGE-LOCATION revealed more systematic differences between its groups than BILINGUALISM. Nevertheless, this final section of Chapter 5 describes such characteristics associated with each of the systems as defined by the interaction of these two factors; since each predictor variable has three levels, there are a total of nine systems that will be discussed in this section: EAST-side Finnish HERITAGE-dominant bilinguals (n=7), EAST-side Finnish ENGLISH-dominant bilinguals (n=2), EAST-side Finnish ENGLISH-dominant monolinguals (n=2), EAST-side Italian HERITAGE-dominant bilinguals (n=7), EAST-side Italian ENGLISH-dominant bilinguals (n=9), EAST-side Italian ENGLISH-dominant monolinguals (n=12), WEST-side Finnish HERITAGE-dominant bilinguals (n=8), WEST-side Finnish ENGLISH-dominant bilinguals (n=11), and WEST-side Finnish ENGLISH-dominant monolinguals (n=13).

An initial series of multivariate analyses of variance of F1 and F2 reveal that all but one of the monophthongs and two out of the four diphthongs shows statistically significant differences for the interaction of HERITAGE-LOCATION and BILINGUALISM. Table 5.5, organized by the five sets of linguistic variables, reports MANOVA Pillai statistic, F-value and accompanying degrees of freedom, and the p-value for each vowels' outcome variables of F1 and F2.[15]

[15]For diphthongal qualities, the tests' results reported in Table 5.5 are based on only the nucleus.

Table 5.5: Multivariate analyses of variance of each monophthong and diphthong and the interaction between HERITAGE-LOCATION and BILINGUALISM

Set of LV	IPA	Vowel	Pillai (V)	F-value (df)	p-value
FRONT LAX	[ɪ]	BIT	0.109	4.53 (16, 626)	p<0.001***
	[ɛ]	BET	0.100	5.47 (16, 841)	p<0.001***
	[æ]	BAT	0.186	8.04 (16, 628)	p<0.001***
LOW BACK	[ɑ]	COT	0.155	15.5 (16, 1472)	p<0.001***
	[ɔ]	BOUGHT	0.182	7.80 (16, 624)	p<0.001***
HIGH BACK	[ʊ]	PUT	0.161	6.06 (16, 556)	p<0.001***
	[u]	BOOT	0.205	2.88 (16, 202)	p<0.001***
SHORT DIPHTHONGS	[ej]	BAIT	0.083	1.48 (16, 273)	p>0.05
	[ow]	BOAT	0.107	1.92 (16, 273)	p<0.05*
LONG DIPHTHONGS	[ɑj]	BITE	0.089	0.76 (16, 130)	p>0.05
	[ɑw]	BOUGH	0.176	6.65 (16, 552)	p<0.001***
Others	[i]	BEAT	0.082	0.71 (16, 133)	p>0.05
	[ʌ]	BUT	0.089	7.71 (16, 1330)	p<0.001***

(Significant levels: * <0.05 ; ** <0.01 ; *** <0.001)

Based on the variation observed between groups for each predictor variable in the previous sections, it is not surprising to find that almost all of the monophthongs show a significant difference from one another for the interaction of predictor variables (i.e., with the exception of the high front tense [i] vowel which reports a p-value above 0.05). In addition, the nuclei of the SHORT and LONG DIPHTHONGS report significant differences for only the back counterparts; in other words, the [ej] and [ɑj] nuclei both report non-significant differences, while the [ow] and [ɑw] nuclei report differences between the interacting groups. Since the nucleus of the LONG DIPHTHONGs may in fact be contingent on the phonological conditioning environments of voiced and voiceless obstruents, a follow-up analysis was done to account for the pre-voicing context of the following obstruent. A three-factor analysis of CONTEXT, HERITAGE-LOCATION and BILINGUALISM for the [ɑj] nucleus reveals that only CONTEXT as a main effect is shown to be statistically significant along both the F1 and F2 dimension

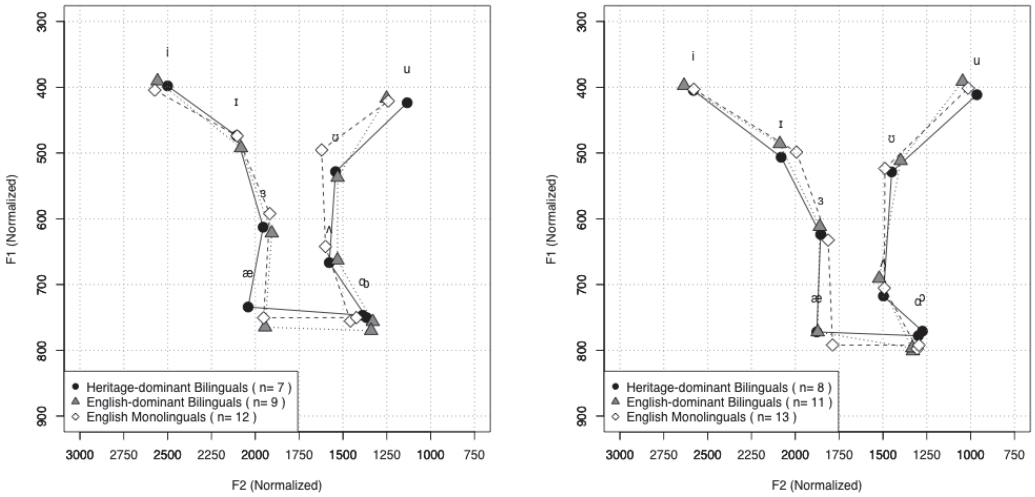
(i.e., MANOVA reports V=0.053, F(2, 121)=13.13, p<0.001; ANOVA of F1 reports F(2, 121)=21.12, p<0.001 and ANOVA of F2 reports F(1, 121)=5.37, p<05);[16] all other main effects and interactions reveal non-significant differences. While significant differences are reported in Table 5.5, the question remains as to the nature of the variation between groups, and can such variation be attributed to HERITAGE-LOCATION, BILINGUALISM, or a combination of the two factors?

5.4.1 Homogeneity and Structural Differences

A definite relationship exists for the particular groups involved in the interaction of HERITAGE-LOCATION and BILINGUALISM. In fact, most of the interspeaker variation can be accounted for by comparing the BILINGUALISM groups relative to each HERITAGE-LOCATION group. The subsequent figures show that EAST-side Italians and WEST-side Finns are structurally very different from one another, but at the same time, they are also the most stable in terms of their respective BILINGUALISM groups. In contrast, the EAST-side Finns are characterized as being structurally in-between the two other HERITAGE-LOCATION groups, and its BILINGUALISM groups are shown to be most divergent from one another (i.e., thus, accounting for much of the variation described in Table 5.5 above). Additionally, the raised-variant of LONG DIPHTHONGs are most prevalent in the speech of EAST-side Italians and ENGLISH-dominant monolinguals speakers.

Focusing on the structural differences between the EAST-side Italians and the WEST-side Finns first, Figure 5.21 displays the plots of the BILINGUALISM groups' monophthongs for each of the two HERITAGE-LOCATION groups.

[16] Accompanying t-tests, comparing the means of [ɑjC] when followed by a voiced obstruent and [ɑjT] when followed by a voiceless obstruent, report significance as well, with a 116.5Hz difference along the F2 dimension and a 67Hz difference along the F1 dimension.



(a) East-side Italians (b) West-side Finns

Figure 5.21: Means of monophthongs and
the predictor variables of HERITAGE-LOCATION and BILINGUALISM

By comparing Subfigure 5.21a with Subfigure 5.21b, there are several notable characteristics between the BILINGUALISM systems in each of the HERITAGE-LOCATIONs' subfigure. First, the two BILINGUALISM groups for most of the vowel qualities do not report significant differences with respect to either the EAST-side Italians' system or the WEST-side Finns' system; the differences that do exist between the BILINGUALISM groups are marginal in significance for univariate analyses of variance (i.e., reporting p-values between $0.01<0.05$ along either the F1 or F2 dimension). Essentially, these two HERITAGE-LOCATION systems are homogenous in terms of their respective BILINGUALISM groups, which suggests that these two groups are relatively stable in their variation. Since these two are stable in their variation between the BILINGUALISM groups, the second characteristic to note is the structural differences between the HERITAGE-LOCATION plots, in which the WEST-side Finns' low vowels and back vowels are systematically lower and WEST-side Finns' further back in the acoustic vowel space compared to the EAST-side Italians' vowels respectively. In other words, the EAST-side Italians' vowel system is more compact relative to the WEST-side Finns' system. This systematic and structural difference is similar to the previous observation made when examining only the main effect of HERITAGE-LOCATION (i.e., at

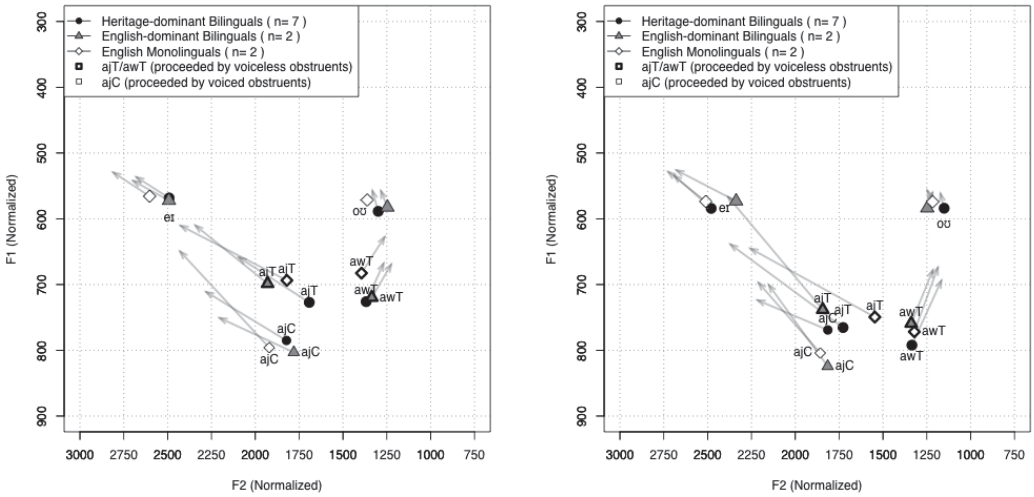
the conclusion of Subsection 5.2.3 on page 90), and it is further supported by similar results reported in Rankinen (2013c)'s analysis of the same corpus using the MANUAL METHOD of formant extraction; this previous analysis of the data examined the two-level factor of HERITAGE.[17] Furthermore, the observationally compact UP Italians-heritage system stands in contrast to wordlist data reported in Boberg (2004)'s work on Italian-, Jewish-, and Irish-heritage English speakers in Montreal, Canada. In this study, the Italian-heritage vowel system was described as having much lower low vowels than either of the two other heritage systems (Boberg 2004, 552).[18] A reasonable question that one might ask is: why are the UP EAST-side Italians' low vowels so much higher in the acoustic space compared to the WEST-side Finns (i.e., $\approx$ 50Hz difference)? This is likely an L1 effect due to phonological differences between the Finnish and Italian phonemic vowel inventory and phonetic configuration of each system.[19] In fact, this observation is not restricted to the monophthongal qualities but applies to the diphthongs as well.

The EAST-side Italians' and WEST-side Finns' diphthongs also show similar cases of the homogenous variation between the BILINGUALISM groups and the structural differences between HERITAGE-LOCATION groups. Subfigures 5.22a and 5.22b display the nuclei and offglides of the BILINGUALISM groups in the EAST-side Italians' and the WEST-side Finns' system respectively.

[17] At the time of the analysis, subjects' residency within the county was not taken into consideration.

[18] While the overall F1 difference between heritage groups is largely attributed to Italians tendancy to open their mouths more when speaking than other any of the other groups as reported in Boberg (2004), the major differences between the Italian Montreal English and Italian UP English systems can be attributed to the nature of the tasks (i.e., a wordlist versus a reading passage); the former typically yields a more peripherally spaced system of vowels compared to data obtained from a reading passage (Rankinen 2014).

[19] A thorough discussion of this hypothesis is provided in Chapter 7, Subsection 7.1.1, on page 167.



(a) East-side Italians (b) West-side Finns

Figure 5.22: Means of diphthongs and
the predictor variables of HERITAGE-LOCATION and BILINGUALISM

In the figures above, all BILINGUALISM groups for the EAST-side Italians and WEST-side Finns exhibit a preference for the raised variant of the [ɑjT] and [ɑwT] nuclei, since they are level relative to one another in terms of the F1 dimension and raised above the [ɑjC] variable along the F2 dimension (i.e., [ɑj] when followed by a voiced obstruent); independent t-tests confirm that the 93Hz F1 mean difference and the 52Hz F1 mean difference between the [ɑjT] and [ɑjC] vowels, regardless of BILINGUALISM, are distinctive from one another for both the EAST-side Italian ($p<0.001$) and WEST-side Finnish BILINGUALISM groups ($p<0.05$).[20] Second, a comparison of the SHORT DIPHTHONG reveals no significant differences across the BILINGUALISM groups; while monophthongal in trajectory, the [ow]'s nucleus remains distinctive from the neighboring [ʌ] vowel in quality for both the EAST-side Italians and WEST-side Finns. Third, limited variation exists in all other cases of analyses of variance for either the EAST-side Italians' or the WEST-side Finns' BILINGUALISM groups' SHORT or LONG DIPHTHONGS. Once again, this supports the claim that these two HERITAGE-LOCATION groups are remarkably homogenous (i.e., independent of each HERITAGE

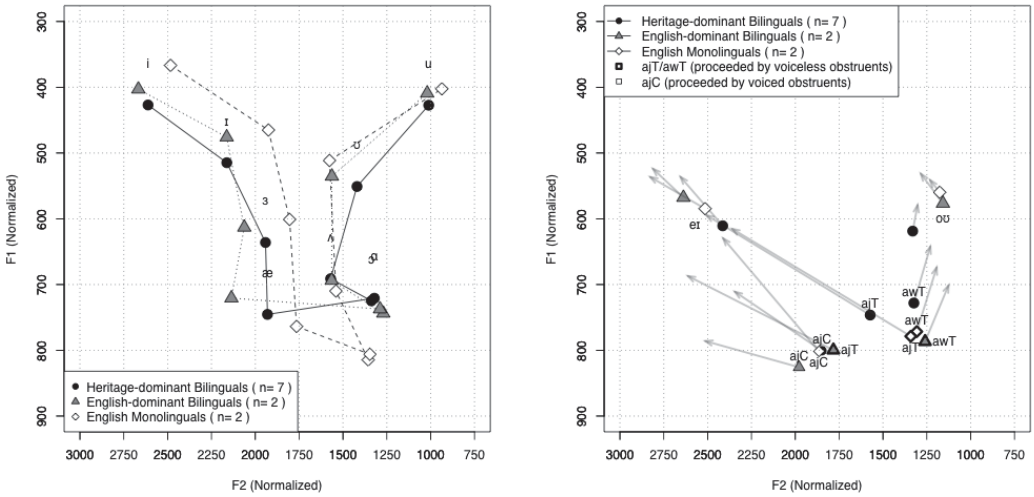
[20]Note that a three-factor multivariate analysis of CONTEXT, HERITAGE-LOCATION, and BILINGUALISM revealed no significant differences between BILINGUALISM groups for the [ɑjT] and [ɑjC] comparison.

grouping) in terms of the lack of variation found between the three BILINGUALISM groups.

In addition to homogeneity found among the diphthongs of the EAST-side Italians and WEST-side Finns, a salient structural difference is also present when comparing Subfigures 5.22a with 5.22b. While both the EAST-side Italians' and WEST-side Finns' nuclei of /ɑj/ and /ɑw/ are clearly distinct in the F2 dimension, the WEST-side Finns' nuclei of [ɑwT] and [ɑjT] are on average 47Hz lower in the acoustic space in comparison to the EAST-side Italians (i.e., independent t-test reports F1 mean difference as being significantly distinct, $t(55.9)$= -2.02, $p<0.05$). This structural difference between the EAST-side Italians and the WEST-side Finns is a characteristic present in both diphthongal and monophthongal qualities (c.f., Subfigures 5.21).

5.4.2 Heterogeneity of east-side Finns' bilingualism groups

The homogeneity of variation between the three BILINGUALISM groups and clear structural differences between the EAST-side Italians' and WEST-side Finns' HERITAGE-LOCATION groups are trends that stand in contrast to what characterizes the EAST-side Finns' HERITAGE-LOCATION group and the three BILINGUALISM systems that define it. Subfigures 5.23a and 5.23b display the monophthongs and diphthongs for the EAST-side Finns' BILINGUALISM groups.



(a) East-side Finns (monophthongs)

(b) East-side Finns (diphthongs)

Figure 5.23: Means of monophthongs and diphthongs for the EAST-side Finns and the predictor variable of BILINGUALISM

In the subfigures above, several striking observations are present regarding systematic variation occurring between the BILINGUALISM groups for these EAST-side Finns: 1) the retraction of FRONT vowels, 2) the lowering of the ENGLISH-dominant monolinguals' LOW BACK vowels compared to the other two groups, and 3) the tendency to raise the nucleus of the [ɑw] and raise and retract the nucleus of the [ɑjT] for the HERITAGE-dominant bilinguals and ENGLISH-dominant monolinguals.

The FRONT LAX vowels in Subfigure 5.23 have a significant amount of variation between the BILINGUALISM groups; in fact, this observation is confirmed with statistical support from both multivariate and univariate analyses of variance. For the high front lax [ɪ] vowel, the ENGLISH-dominant monolinguals'vowel is significantly distinctive from the other two groups along the F1 and F2 dimensions (i.e., MANOVA reports V= 0.33, $F(4, 96)=9.33$, $p<0.001$; ANOVA of F1 reports $F(2, 96)=5.84$, $p<0.01$; ANOVA of F2 reports $F(2, 96)=6.37$, $p<0.01$). For the mid front lax [ɛ] vowel, once again the ENGLISH-dominant monolinguals' vowel is significantly divergent, but this time, it is only distinct along the F2 dimension (i.e., MANOVA reports V=0.185, $F(4, 128)=6.53$, $p<0.001$; ANOVA of F1 reports $F(2, 128)=2.97$, $p>0.05$; ANOVA of F2

reports F(2, 128)=9.02, p<0.001). Similar to the [ɛ] vowel, the ENGLISH-dominant monolinguals' low front lax [æ] vowel is significantly divergent from the other two groups along only the F2 dimension (i.e., MANOVA reports V=0.165, F(4, 96)=4.31, p<0.01; ANOVA of F1 reports F(2, 96)=1.31, p>0.05; ANOVA of F2 reports F(2, 96)=9.14, p<0.001). All three of the FRONT LAX vowels show significant differences along the F2 dimension. If the back vowels are used as a baseline for the BILINGUALISM groups (i.e., which show limited vowel-internal variation between groups), the ENGLISH-dominant monolinguals' front vowels are retracting to the central vowel space relative to their back counterparts — the same degree of retraction cannot be claimed for either ENGLISH-dominant bilinguals or HERITAGE-dominant bilinguals.

All groups exhibit the low-back merger, but it seems that the ENGLISH-dominant monolinguals are once again divergent from the other two BILINGUALISM groups. The [ɑ] and [ɔ] vowels are statistically significant along the F1 dimension only (i.e., MANOVA reports V=0.156, F(4, 323)=13.68, p<0.001; ANOVA of F1 reports F(2, 323)=26.64, p<0.001; ANOVA of F2 reports F(2, 323)=2.35, p>0.05). However, while the ENGLISH-dominant monolinguals' low-back merger appears to be lower in the acoustic vowel space compared to their [æ] vowel, this difference is not found to be statistically significant (i.e., ANOVA of F1 reports F(4, 419)=2.24, p>0.05).

Turning to the nuclei of the LONG DIPHTHONGS, the EAST-side Finnish HERITAGE-dominant bilinguals' and ENGLISH-dominant monolinguals' [ɑj] are much more retracted in the acoustic vowel space than previously seen in other figures. In fact, the ENGLISH-dominant monolinguals' [ɑjT] and [ɑwT] are approximately the same in both the F1 and F2 dimension. Furthermore, it looks like the two subjects that make up the ENGLISH-dominant bilinguals' group do not show evidence for the raised variant of either /ɑj/ or /ɑw/. Unfortunately, little can be concluded about the diphthongal variation for the EAST-side Finns on account of limited token counts for

these seven HERITAGE-dominant bilinguals, two ENGLISH-dominant bilinguals and two ENGLISH-dominant monolinguals.

Nevertheless, the EAST-side Finns' group shares several characteristics with the WEST-side Finns but not with the EAST-side Italians. First, the EAST-side Finns' system has relatively retracted back vowels (i.e., the [u] vowel is located approximately at the 1000Hz boundary along the F2 dimension, while the [ʊ] and [ʌ] are both <1500Hz); in contrast, the EAST-side Italians' systems' mid and high back vowels have means >1500Hz. Second, the EAST-side Finns' have relatively higher low vowels which is a characteristic that they share with the EAST-side Italians' system (i.e., at ≈ 750Hz) rather than the WEST-side Finns's system (i.e., at ≈ 790Hz). The exception to this observation is the EAST-side Finnish ENGLISH-dominant monolinguals who report unusually low F1 values of approximately 810Hz.

The FRONT and LOW BACK vowels show a considerable amount of interspeaker variation, and as a result, structural comparisons are difficult to determine; however, much of this variation is caused by the ENGLISH-dominant monolinguals' group. If this EAST-side Finnish ENGLISH-dominant monolinguals' group is temporary suppressed, the comparison of EAST-side Finnish HERITAGE-dominant bilinguals and ENGLISH-dominant bilinguals to the EAST-side Italians' and the WEST-side Finns' groups reveals that these two bilingual groups are actually patterning more like the EAST-side Italians than the WEST-side Finns. This observation initially might be surprising, but it actually makes a lot of intuitive sense and follows the series of observations seen thus far in this chapter. Since both of these groups are older-aged bilinguals living on the east-side of the county of Marquette, it is very likely these EAST-side Finns have had more opportunities to share communities of practice (e.g., work environments, social events, community gathering) with the EAST-side Italians than with the WEST-side Finns. This falls in line with the previous hypothesis and

assumes that a dialect leveling process has or is currently taking place which has influenced the EAST-side Finns to accommodate to the linguistic norms of the more urban east-side speech communities, characterized by the EAST-side Italians in the Marquette County.

What is happening with the EAST-side Finnish ENGLISH-dominant monolinguals then? The significant retraction of the front vowels but low LOW BACK vowels requires an additional hypothesis. These ENGLISH-dominant monolinguals might be retracting their FRONT vowels and lowering their LOW BACK vowels as a way of indexing their HERITAGE identity in the linguistic marketplace (Bourdieu 1991; Milroy 1987), which if true, is most distinctive among the WEST-side Finns in terms of the retracted FRONT LAX and the low LOW BACK vowels. While one's genetic ancestry alone has never been shown to be the single motivating factor in linguistic change (Boberg 2004), these OLDER-aged ENGLISH-dominant monolinguals are perhaps interacting with their WEST-side counterparts in cultural, albeit English-driven, activities and functions held within the community (e.g., Lutheran church services, Finnish-heritage community centers, cultural festivals celebrating Finnish heritage). It is not uncommon for third generation ethnic-heritage groups to be drawn closer to their ancestral ties in comparison to first or second generations, whom tend to avoid such ties particularly due to social pressures to conform to American cultural and linguistic practices — including but not limited to the prescribed use of American English (Labov 2008; Loukinen 1980; Simon 2005). The two proposed hypotheses would account for: 1) why the BILINGUALISM systems of EAST-side Finns shares characteristics with both the EAST-side Italians' and WEST-side Finns' systems and 2) why the EAST-side Italians' and WEST-side Finns' systems are structurally distinct, yet with respect to their HERITAGE-LOCATION grouping, their BILINGUALISM systems remain relatively homogenous.

5.5 Summary

The present chapter investigated the acoustic vowel dynamics and sociolinguistic correlates of HERITAGE-LOCATION and BILINGUALISM in the speech of a 71-speaker subset of a bilingual and monolingual UP speech community. The results revealed a) systematic structural difference of low and back vowels for the EAST-side Italian and WEST-side Finnish' HERITAGE-LOCATION groups and b) homogeneity of variance for the BILINGUALISM groups respective of each HERITAGE-LOCATION grouping; in contrast, there was heterogeneity of variance found among the EAST-side Finns' BILINGUALISM groups. Additionally, all individuals in the 71-speaker subset exhibited: 1) the monophthongized variant of /ow/, 2) the low-back merger of /ɑ/ and /ɔ/, 3) the advanced and raised nucleus of [ɑjT], 4) the advanced, but non-raised, nucleus of [ɑjC], and 5) the raised, but non-advanced, nucleus of [ɑwT]. Next, Chapter 6 examines the predictor variables of HERITAGE-LOCATION, AGE, SEX and CLASS among an 85-speaker subset of monolingual UP speakers in Michigan's Marquette County.

CHAPTER 6

RESULTS II:

HERITAGE-LOCATION, AGE, SEX AND CLASS

The present chapter examines the response variables of F1, F2 and duration for the FRONT LAX, LOW BACK and HIGH BACK vowels and the SHORT and LONG DIPHTHONGs as sets of linguistic variables produced by eighty-five monolingual English speakers from Michigan's Upper Peninsula (UP). The analyses of this chapter takes into account the predictor variables of HERITAGE-LOCATION, AGE, SEX, and CLASS. As described in Chapter 3, these predictor variables are restricted to the monolingual speakers in the Upper Peninsula (UP) vowel corpus, which are grouped by the defined levels of HERITAGE-LOCATION (i.e., EAST-side Finns, EAST-side Italians or WEST-side Finns), AGE (i.e., older-, middle-, or younger-aged), SEX (i.e., male or female) and CLASS (i.e., working- or middle-class). As such, only results from this 85-speaker subset of the larger 130-speaker corpus will be reported in this chapter.[1]

This chapter reports on three specific threads of analyses. The first thread investigates the overall structure of the monolingual UP speakers' vowel system. The second thread examines the nine monophthongs (i.e., /i, ɪ, ɛ, æ, ɑ, ɔ, ʌ ʊ u/), with a particular focus placed on the FRONT LAX and LOW BACK sets of linguistic variables. The third thread focuses on the four diphthongs (i.e., /ej, ow, ɑj, ɑw/), with particular attention on the LONG DIPHTHONGs as linguistic variables. All three sections seek to determine if substrate or exogenous influences correlate with the predictor

[1]The breakdown of the demographics for this subset is located in Table 3.9 on page 42.

variables of HERITAGE-LOCATION, AGE, SEX and CLASS. Accordingly, Section 6.1 first investigates the individual placement of vowels within the structural configuration as a global system for these eighty-five monolingual English speakers. Section 6.2 examines how monophthongs as linguistic variables correlate with the predictor variables under investigation, while Section 6.3 examines the diphthongs. This chapter ultimately seeks to uncover if either substrate or exogenous characteristics are present in the vowel spaces of these monolingual UP English speakers, and if such characteristics are correlated with the predictor variables of HERITAGE-LOCATION, AGE, SEX and CLASS to account for such interspeaker variation.

6.1 The Vowel System of Monolingual Speakers

The first analysis of this chapter seeks to investigate the individual vowel placement and overall configuration of the eighty-five monolingual UP English speakers' vowel spaces as a global vowel system. The present analysis mirrors the one reported in Section 5.1 for the 75-speaker subset of the older-aged bilingual and monolingual UP speakers; although this section will demonstrate that similarities exist, more importantly, there exists subtle differences between these two subsets of the sampled UP speech community. In this chapter, the interspeaker variation of the linguistic variables within a set and for sets of variables are shown to be following similar phonetic and sociolinguistic patterns, and as such, the predictor variables are used to probe the social patterning of this variation. Ultimately, the observations in this section motivate the subsequent analyses to examine sets of linguistic variables as linguistic indicators to account for the social patterning in the speech of this sampled UP speech community.[2]

[2]The use of the term "linguistic indicator" refers to linguistic variants that correlate with different sociolinguistic groupings but do not necessarily show signs of stylistic conditioning (Labov 1972, 178-180); in contrast, variants that show stylistic effects are typically regarded as "linguistic markers" and those that are overtly stigmatized are "linguistic stereotypes". While this thesis does not address

The grand averages of the first and second formant values have been calculated for each of the nine monophthongs and four diphthongs, and each vowel is plotted in the acoustic vowel space as a global system in Figure 6.1.

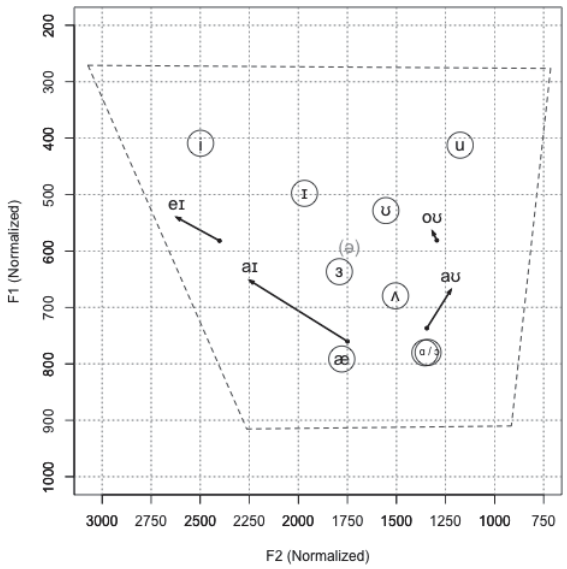


Figure 6.1: The grand F1 and F2 means of monophthongs and diphthongs for the monolingual speakers in Michigan's UP vowel corpus (n=85)

In this figure, which is similar to Figure 5.1, there are two superimposed hypothetical reference markers: 1) the hypothetical boundaries and 2) the centralized midpoint of this global acoustic vowel space as determined by the entire 130-speaker corpus. Using these reference markers as guides (c.f., Chapter 5), there are several striking observations noted in Figure 6.1 above. The first observation is in regards to the FRONT LAX vowels which are retracted and lowered in the acoustic vowel space in relation to the hypothetical schwa and the other mid and low back vowels; the [æ] vowel is lower in the F1 dimension in comparison to either the [ɑ] or the [ɔ] vowel as is indicated by the upward slant of the base of the hypothetical trapezoid — this is a characteristic that was not present among the seventy-one older-aged speakers' system described in Chapter 5. The second observation to note in the global monolingual

alternative speech styles other than speech obtained from a reading passage task, Rankinen (2013b) does report limited stylistic effects for the front lax and low back vowels when comparing wordlist and reading passage tasks.

speakers' system is the presence of the low-back merger of the [ɑ] and the [ɔ] vowels. The third observation refers to the HIGH BACK vowels, where the [ʊ] vowel is more advanced in the acoustic vowel space than either the [ʌ] or the [u] vowel — also not seen among the older-aged speakers' system described in Chapter 5. The fourth observation to note is the lack of an observable trajectory for the SHORT DIPHTHONG [ow] quality. The fifth and sixth observations to take note of in Figure 6.1 refer to the LONG DIPHTHONGs. The nucleus of the [aw] quality looks raised but not advanced in the acoustic vowel space relative to the [ɑ/ɔ] and [ʌ] vowels, while the nucleus of the [aj] quality is advanced but not raised in the acoustic vowel space relative to the [æ] and [ɑ/ɔ] vowels. By taking into consideration the factor of CONTEXT, however, closer inspection reveals that when /ɑj/ is followed by voiceless obstruents then the raised variant is preferred while in other cases the non-raised variant is preferred. The remainder of the present section will address each of these global observations in turn.

Turning attention first to the fronting and lowering of the FRONT LAX vowels, it is important to compare these vowels with a fixed point in the shared vowel space due to the nature of the observations. As a result, the three vowel qualities of the FRONT LAX set of linguistic variables will be examined in relationship to the hypothetical schwa in describing their retracted and lowered positions. Figures 6.2 and 6.3 display the value difference of this hypothetical schwa with the FRONT LAX vowels and their back counterparts.

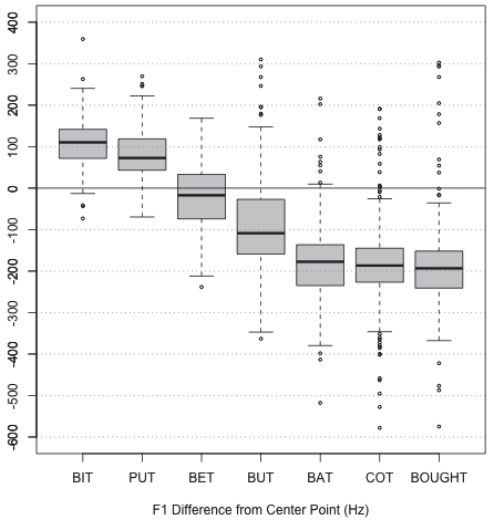


Figure 6.2: F1 differences from the center point of the global vowel space

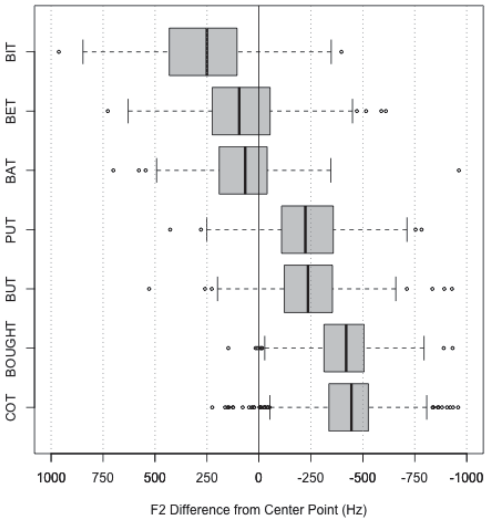


Figure 6.3: F2 differences from the center point of the global vowel space

The figures above display the [ɪ], [ɛ] and [æ] vowels with respect to the central vowel space (i.e., the midpoint is represented by a solid black line in each figure) and in comparison to other vowels' distribution for both the F1 dimension and the F2 dimension respectively. In Figure 6.2, the mid front lax [ɛ] vowel is ≈ 43Hz below the hypothetical schwa and the high back lax [ʊ] vowel is ≈ 61Hz above it. In contrast, the [ɪ] and [ʌ] vowels are respectively |95.3|Hz and |104.6|Hz from the midpoint, and the [æ] and [ɑ/ɔ] are respectively |195.6|Hz and |190|Hz from the midpoint. In Figure 6.3, the mid and low FRONT LAX vowels are clearly fronted relative to the midpoint along the F2 dimension with a difference of |23.9|Hz for the [æ] vowel and a difference of |54.5|Hz for the the [ɛ] vowel; in contrast, all other vowels report difference values above |193.5|Hz (e.g., [ʊ] = -193.5Hz, [ɪ] = 225.4Hz). These results suggest that the mid and low FRONT LAX vowels are observably retracted in the vowel space in relation to the midpoint and neighboring vowels. This chapter will determine if the retraction and lowering of these FRONT LAX vowels correlate with any of the predictor variables.

Similar to Chapter 5, the merging of the [ɑ] and [ɔ] vowels into a single quality seems to be a distinctive set of linguistic variables in the monolingual UP English

speakers' vowel system as well.

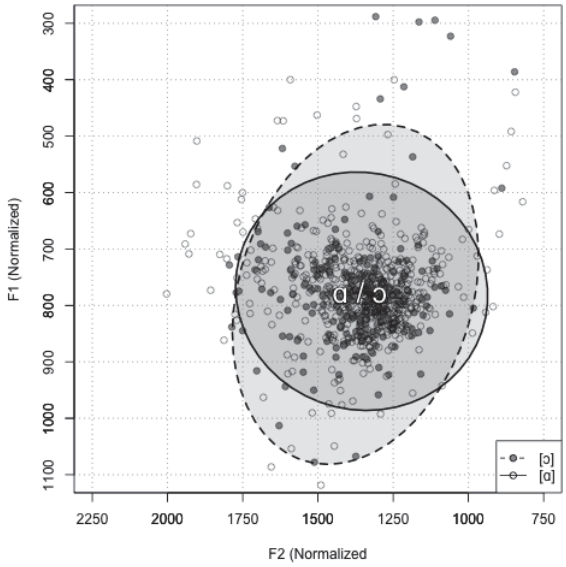


Figure 6.4: The presence of the low-back merger of the [ɑ] and [ɔ] vowels

In Figure 6.4, the hypothetical distributions (i.e., based on .95 confidence-intervals) and actual token distributions of the [ɑ] and [ɔ] display the relationship that these vowels have with one another in the low back quadrant of the acoustic vowel space. Although the [ɑ] and [ɔ] vowels are shown to represent a non-significant difference in a multivariate test of variance (i.e., MANOVA reports $V=0.002$, $F(2, 2530)=3$, $p>0.05$), subsequent univariate analyses of variance suggest that the two vowels are marginally distinct along the F2 dimension with a difference of only 16.77Hz (i.e., ANOVA of F1 reports $F(1, 2530)=0.03$, $p>0.05$; ANOVA of F2 reports $F(1, 2530)=5.72$, $p<0.01$); while small, perhaps this marginal difference is a result of systematic variation between groups' systems correlated with one or more of the predictor variables.

The third observation to address is the monophthongalization of the /ow/ vowel quality, which is traditionally regarded as a SHORT DIPHTHONG in other American English varieties. If Euclidean distance (ED) and duration are taken into consideration as well, the distance between the nuclei and the offglide of the [ow] quality is distinctly shorter than any of the other diphthongal qualities; however, duration does

not seem to be an important response variable — other than distinguishing between SHORT DIPHTHONGs and LONG DIPHTHONGs. Figure 6.5 displays the EDs and durations of the SHORT DIPHTHONGs and the LONG DIPHTHONGs. Hypothetical ellipses, based on a .5 confidence-interval, are included to display the relationship of the two outcome variables for each diphthong.

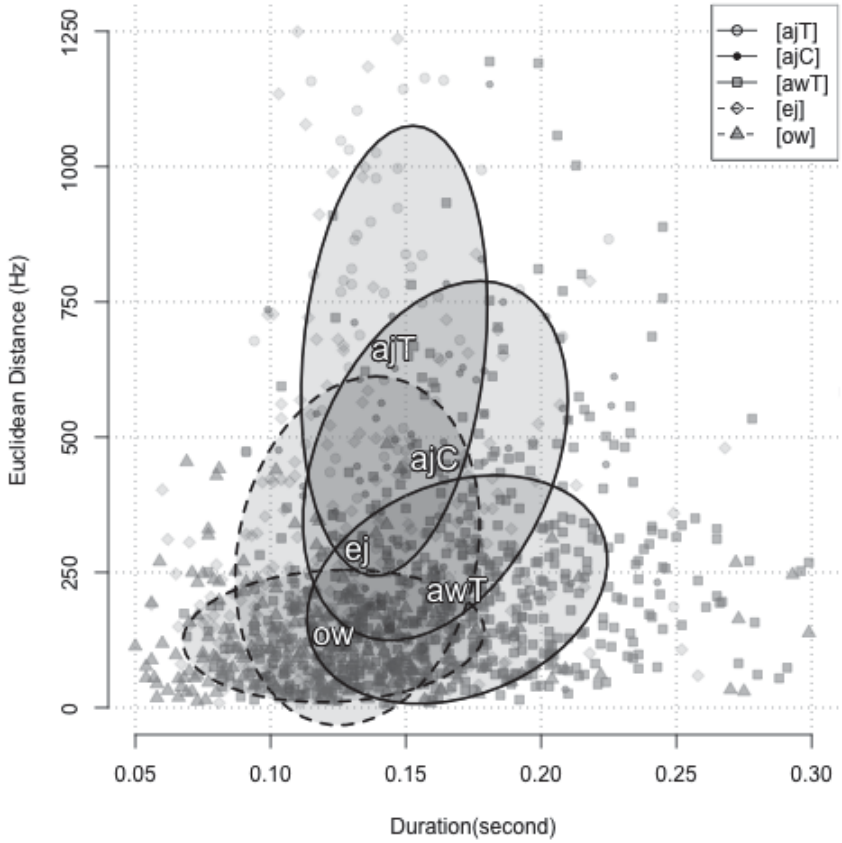


Figure 6.5: The relationship of Euclidian distance and duration for diphthongs
(ellipses based on .5 confidence-interval)

In Figure 6.5 above, the EDs and durations between the five diphthongs all report a significant difference with one another (i.e., MANOVA reports $F(6, 1426) = 114.6$, $p<0.001$); although the trajectory of the LONG DIPHTHONG [ɑjT], [ɑjC] and [ow] are quite distinct from the other two qualities and each other, [ɑwT] and [ej] qualities mean EDs are within a 58.6Hz range from one another. In fact, the mean ED of all five linguistic variables are distinctly different from one another.[3] In terms of

[3]Similar results are report in Figure 5.10 on page 78.

duration for Figure 6.5, the short and long distinction is maintained between the SHORT DIPHTHONGs and LONG DIPHTHONGs; a univariate analysis of variance for [ej], [ɑjT] and [ɑjC] reports a significant difference (i.e., ANOVA of duration reports $F(1, 501)=29.8$, $p<0.001$), while [ej] and [ow] report a non-significant difference (i.e., ANOVA of duration reports $F(1, 589)=2.774$, $p>0.05$). These results suggest that the diphthongs are patterning differently from one another in terms of both ED and duration. That is to say, the response variable of duration confirms the major distinction of SHORT DIPHTHONGs from LONG DIPHTHONGs, while EDs and overall acoustic quality help to distinguish these diphthongs from one another.

The fourth observation refers to the nuclei of the /ɑj/ and /ɑw/ LONG DIPHTHONGs. A question arises as to if these monolingual English speakers show a preference for either the raised or the non-raised variants of the LONG DIPHTHONGs' nuclei based on the following phonetic conditioning environment. As described in Chapter 5, only the /ɑj/ vowel is followed by both voiced and voiceless obstruents while the /ɑw/ vowel is only followed by voiceless obstruents in the reading passage dataset. As a result, first the nuclei of /ɑj/ will be examined to reveal if it is conditioned based on the following environment for the two tokens "tried" (i.e., [ɑjC], pre-voiced context) and "slices" (i.e., [ɑjT], pre-voiceless context).

Figure 6.6 displays the means and token distribution of the phonetical realization of the nuclei of /ɑj/ when followed by both voiced obstruents (i.e., [ɑjC] as in the case of "tried") and voiceless obstruents (i.e., [ɑjT] as in the case of "slices"). The pre-voicing environment of /ɑj/ seems to be observationally and statistically conditioning the raised and non-raised variants; a MANOVA reports statistical significance with a 67.2Hz difference along the F1 dimension (i.e., $V=0.23$, $F(2, 164)=24.4$, $p<0.001$). As previously discussed in Chapter 5, a >60Hz difference was used as a diagnostic parameter for indicating the presence of Canadian raising (Labov et al. 2006, 222),

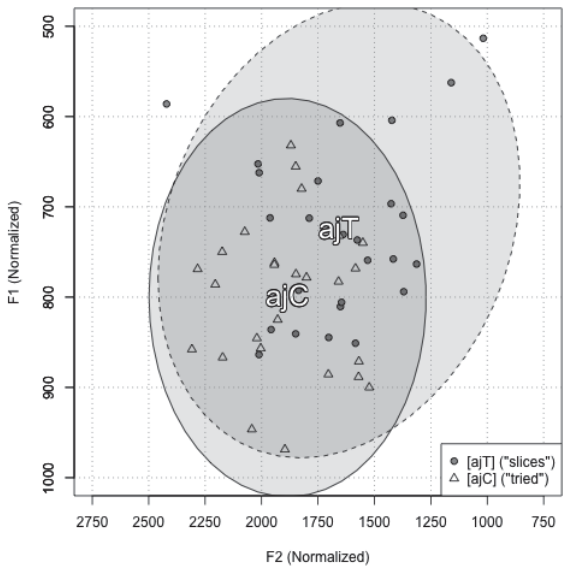


Figure 6.6: The distribution density of the [ɑjT] and [ɑjC] nuclei
(ellipses based on .95 confidence-interval)

and as such, it is reasonable to suggest that based on this diagnostic parameter [ɑjT] is clearly raised for this 85-speaker sample of monolingual UP speakers.

The question still remains as to if the nuclei of either of the LONG DIPHTHONGs share its space with neighboring vowel qualities more generally, regardless of CONTEXT. Turning first to the nucleus of the [ɑj] LONG DIPHTHONG, Figures 6.7 and 6.8 display its hypothetical and actual token distribution in relation to the [æ] and [ɑ/ɔ] vowels.

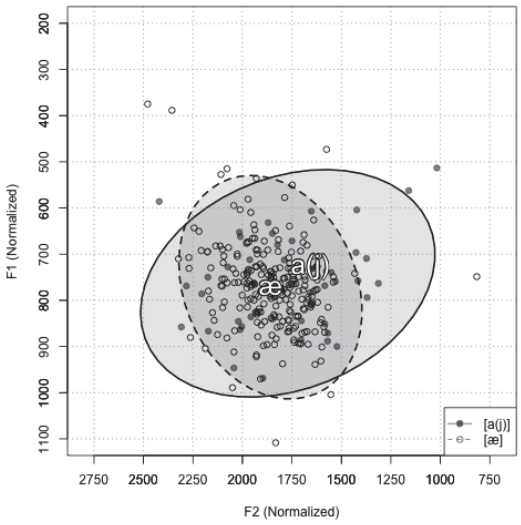


Figure 6.7: The nucleus of the [ɑj] diphthong compared to the [æ] vowel

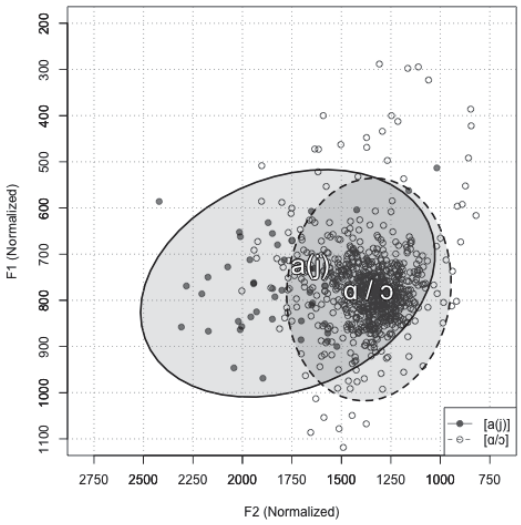


Figure 6.8: The nucleus of the [ɑj] diphthong compared to the [ɑ/ɔ] vowel

The [æ] monophthong and the nucleus of the [ɑj] diphthong are significantly different from each other (i.e., MANOVA reports V=0.022, F(2, 928)=11, p<0.001); however, univariate analyses of variance suggest these two qualities are only divergent from one another along the F1 dimensions (i.e., ANOVA of F1 reports F(1, 928)=2.82, p>0.05; ANOVA of F2 reports F(1, 928)=15.86, p<0.001). The nuclei of [ɑj] and the [æ] vowel share the central vowel space at approximately 1750Hz (i.e., remember, the hypothetical midpoint along the F2 dimension is 1741Hz) but are statistically distinct along the F1 dimension. In comparison to the low-back merger, the nucleus of [ɑj] is distinct along both the F1 and F2 dimension (i.e., MANOVA reports V = 0.256, F(4, 2695)=198, p<0.001; ANOVA of F1 reports F(2, 2695)=4.26, p<0.05; ANOVA of F2 reports F(2, 2695)=456.12, p<0.001); these results suggest that the nuclei of [ɑj] is significantly divergent from the low-back merger along the F2 dimension but only marginally significant along the F1 dimension. The figures and statistics described above indicate that the nuclei of the /ɑj/ diphthong is phonetically realized in the raised position of the low central region of the acoustic vowel space juxtaposed between the [æ] and [ɑ/ɔ] monophthongal qualities.

The nucleus of the [ɑw] LONG DIPHTHONG is observably distinct from the neighboring [ɑ/ɔ] and [ʌ] monothongs on display in Figures 6.9 and 6.10 below.

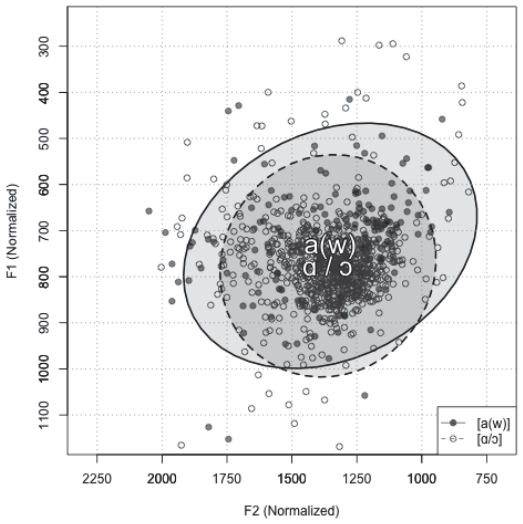


Figure 6.9: The nucleus of the [ɑw] diphthong compared to the [ɑ/ɔ] vowel

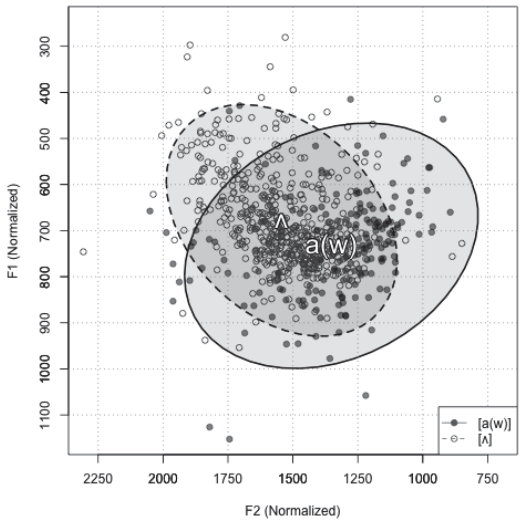


Figure 6.10: The nucleus of the [ɑw] diphthong compared to the [ʌ] vowel

The low-back merger is distinctly different from the nucleus of the [ɑw] diphthong in terms of the F1 but not the F2 dimension (i.e., MANOVA reports V=0.041, F(4, 3202)=33, p<0.001); this is confirmed in accompanying univariate analyses of variance with an F1 difference of 43Hz (i.e., ANOVA of F1 reports F(2, 3202)=64.33, p<0.001; ANOVA of F2 reports F(2, 3202)=2.34, p>0.05). In contrast, the nucleus of [ɑw] is distinctly different from the [ʌ] monophthong along both the F1 and F2 dimension (i.e., MANOVA reports V=0.172, F(2, 2269)=236, p<0.001; ANOVA of F1 reports F(1, 2269)=179.17, p<0.001; ANOVA of F2 reports F(1, 2269)=309.47, p<0.001). Both nuclei of the LONG DIPHTHONGs exhibit evidence of raising in the acoustic vowel space in relation to these neighboring monophthongs as indicated by their statistical differences along the F1 dimension. Moreover, the /ɑj/ variable regardless of CONTEXT exhibits fronting, while the /ɑw/ exhibits non-fronting.

This initial section has given a general overview of the four salient characteristics that define this 85-speaker monolingual UP English vowel system: 1) the FRONT LAX

vowels exhibit lowering and retracting, 2) the LOW BACK vowels exhibit a phonological merger, 3) the [ow] SHORT DIPHTHONG presents as a monophthongized variant, and 4) the nuclei of /ɑw/ and /ɑj/ exhibit varying degrees of raising and fronting. The subsequent sections will examine the sociolinguistic variation of the FRONT LAX, LOW BACK and LONG DIPHTHONG linguistic variables as they correlate with the factor or interaction of factors of HERITAGE-LOCATION, AGE, SEX and CLASS.

6.2 Front Lax, Low Back and High Back Vowels as Sets of Linguistic Variables

The present section investigates nine monophthongs in this 85-speaker system as they correlate with predictor variables of HERITAGE-LOCATION, AGE, SEX and CLASS. As such, this section will examine the FRONT LAX, LOW BACK and HIGH BACK linguistic variables to account for interspeaker variation and to attribute such variation to the differences between groups and the defined social categories describing them. The main predictor variable of interest is HERITAGE-LOCATION, and the reason for this is two-fold: 1) if structural similarities are shared between the Finnish-heritage groups but not with the one Italian-heritage group, then this would indicate a potential lingering substrate influence on these speakers' systems; 2) if structural differences exist between the two Finnish-heritage groups but structural similarities are shared between the two EAST-side heritage groups, then this would indicate either the potential encroachment of an exogenous influence in the more urban location or novel influences from the town locale itself. Thus, the factors of AGE, SEX, and CLASS in this section serve as interacting factors with the main factor of HERITAGE-LOCATION.

6.2.1 Structural Differences and Heritage-Location

Subsection 6.2.1 examines the structural similarities and differences that exist between the three HERITAGE-LOCATION groups' systems. The grand F1 and F2 means of the nine monophthongs (i.e., [i, ɪ, ɛ, æ, ɑ, ɔ, ʌ, ʊ, u]) for each HERITAGE-LOCATION group are displayed as three distinct systems in Figure 6.11 to the right. The solid-lines and black filled circles represent the EAST-side Finns' system, the dotted-lines and gray filled triangles represent the EAST-side Italians' system, and the dashed-lines and white filled diamonds represent the WEST-side Finns' system.

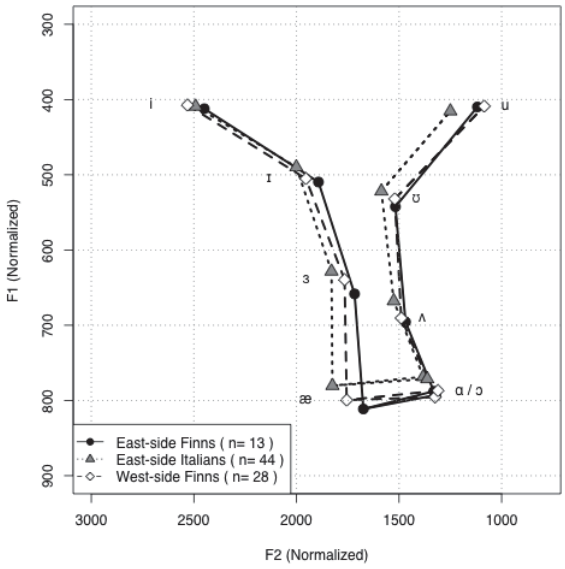


Figure 6.11: The monophthongs' F1/ F2 means for HERITAGE-LOCATION groups

In this figure, there are three observations to note — two of which refer to the shared patterning of the Finnish-heritage groups (i.e., dissimilar to the EAST-side Italians' group), while the other refers to the difference between all three HERITAGE-LOCATION groups. The first two observations refer to the structural similarities that exist between the EAST-side Finns' and WEST-side Finns' HIGH BACK and LOW BACK vowels along the F2 dimension, which is observably different from those of the EAST-side Italians. In fact, the two Finnish-heritage groups' [u] means are not significantly different from one another, $t(66.931)=0.745$, $p>0.05$. In order to compare the Finnish-heritage groups' and the EAST-side Italians' group mean of [u], the two Finnish-heritage groups' [u] means are pooled together and compared with the other Italian-heritage group; an ANOVA and a independent t-test confirm that the difference of 145.59Hz is significant (i.e., F2's ANOVA of the two HERITAGE groups' [u] mean reports $F(1, 253)=18.11$, $p<001$, and an F2's $t(224.73)= -4.319$, $p<0.001$). Similarly, the two Finnish-heritage groups' [ʊ] pattern together along the F2 dimension

as well, with $t(190.33)$=-0.119, >0.05. The EAST-side Italians' [ʊ] vowel is significantly different along the F2 dimension in comparison to these two Finnish-heritage groups with an F2 difference of 66.4Hz (i.e., F2's ANOVA reports F(1, 677)=16.51, p<0.001, and an independent t-test reports $t(673.49)$=-4.064, p<0.001). The two Finnish-heritage groups' HIGH BACK vowels are systematically more retracted in the acoustic vowel space than the EAST-side Italians' systems.

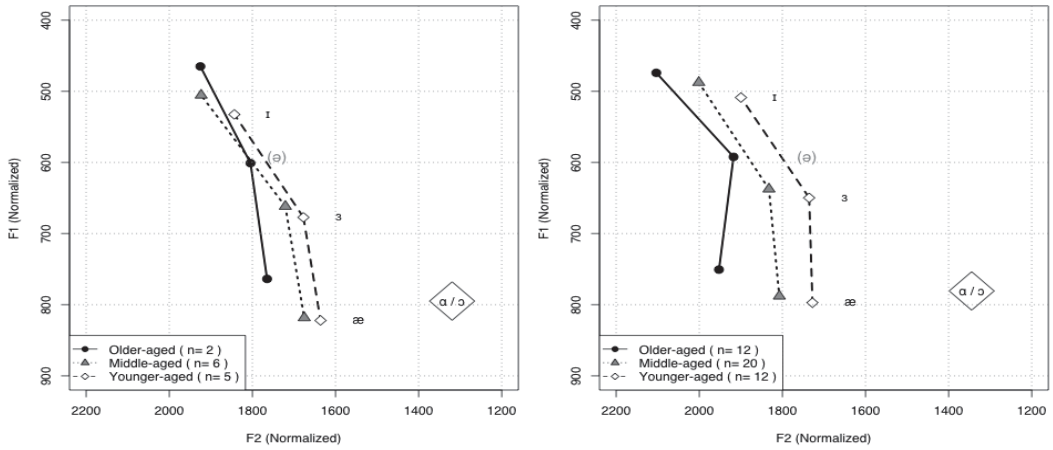
These two Finnish-heritage groups are patterning similarly with regards to one another, and differently from the EAST-side Italians, in terms of the LOW BACK vowels, albeit along only the F1 dimension. All three HERITAGE-LOCATION groups are participating in the low-back merger with <10Hz F1 difference and <20Hz F2 difference between the mean values of the [ɑ] and [ɔ] vowels respective of each groups' system (i.e., t-tests for F1 and F2 report p>0.05). This invariance between the LOW BACK vowels allows for the pooling of the [ɑ] and [ɔ] values when comparing across HERITAGE-LOCATION groups. As with the HIGH BACK vowels, the Finnish-heritage groups' low-back merger seem to be patterning closely together and both multivariate and univariate analysis of variance confirming this observation (i.e., MANOVA reports V= 0.0016, F(2, 1225)=0.994, p>0.05; F1's ANOVA reports F(1, 1225)=0.313, p>0.05; F2's ANOVA reports F(1, 1225)=1.621, p>0.05). These Finnish-heritage groups' low-back merger is significantly different from that of the EAST-side Italians, with a 19.6Hz difference along the F1 dimension and a 50.8Hz difference along the F2 dimension (i.e, MAOVA reports V=0.040, F(2, 2530), p<0.001; F1's ANOVA reports F(1, 2530)=33.94, p<0.001; F2's ANOVA reports F(1, 2530)=67.851, p<0.001). The EAST-side Finns' and the WEST-side Finns' LOW BACK and HIGH BACK vowels are structurally similar to one another but their difference from the EAST-side Italians' subsystem is not as observationally distinct as shown among HERITAGE-LOCATION groups for the older-aged bilingual and monolinguals UP speakers (c.f., Figure 5.11). This suggests that while a lingering substrate influence is still shared

by these HERITAGE-LOCATION groups, the difference may be diminishing in the speech of successive generations.

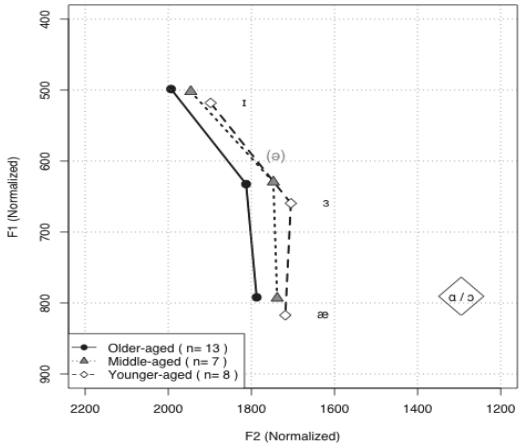
The last notable distinction between these three HERITAGE-LOCATION groups in Figure 6.11 cannot be attributed to potential substrate influences. The FRONT LAX vowels in Figure 6.11 show a striking difference between the three HERITAGE-LOCATION groups in that each group is quite distinct in both the F1 and F2 dimension. Unlike the cases of the LOW BACK or the HIGH BACK vowels, the EAST-side Finns' FRONT LAX vowels are distinct from either of these two groups regardless of shared heritage or location of residency. The remainder of this section will investigate the lowering and retraction of the [ɪ], [ɛ], and [æ] vowels as these linguistic variables interact with HERITAGE-LOCATION and either AGE, SEX, CLASS or a combination of these factors.

6.2.2 Front Lax Vowels by Heritage-Location and Age

The first interaction to examine for FRONT LAX vowels is HERITAGE-LOCATION and AGE.



(a) East-side Finns (n=13) (b) East-side Italians (n=44)



(c) West-side Finns (n=28)

Figure 6.12: The FRONT LAX vowels
for HERITAGE-LOCATION and AGE groups

Figure 6.12 displays the AGE groups for each HERITAGE-LOCATION group: Subfigure 6.12b displays the EAST-side Finns' AGE groups (n=13), Subfigure 6.12a displays the EAST-side Italians' AGE groups (n=44), and Subfigure 6.12c displays the WEST-side Finns' AGE groups (n=28). Since each subfigure displays the [ɪ], [ɛ] and [æ] vowels for each AGE group, the HERITAGE-LOCATION' low-back merger is also provided in a diamond to the lower right as a reference point for the lowering and retraction of the three AGE groups.

The present figure reveals several notable observations in reference to the variation

between the FRONT LAX vowels for the three AGE groups for each of the HERITAGE-LOCATION subfigures. The first observation, and most obvious characteristic shared by all HERITAGE-LOCATION groups, is that the YOUNGER-aged speakers' FRONT LAX vowels are all lower and retracted in their respective vowel space in comparison to the OLDER-aged speakers; the MIDDLE-aged speakers are all between the two other AGE groups. With respect to each HERITAGE-LOCATION group, the AGE groups FRONT LAX vowels are patterning distinctly from one another.

- For the EAST-side Finns in Figure 6.12a, the MIDDLE-aged speakers' and the YOUNGER-aged speakers' FRONT LAX vowels are both: 1) patterning closely to one another and 2) significantly lower and retracted in the vowel space compared to the OLDER-aged speakers. The three FRONT LAX vowels for the MIDDLE-aged speakers and YOUNGER-aged speakers report either marginal or non-significant differences; the [ɪ]'s MANOVA reports V=0.063, $F(2, 97)=3.22$, $p>0.01$, the [ɛ]'s MANOVA reports V=0.020, $F(2, 130)=1.34$, $p>0.05$, and the [æ]'s MANOVA reports V=0.019, $F(2, 97)=0.92$, $p>0.05$. In contrast, the MIDDLE-aged speakers are all significantly different from the OLDER-aged speakers' FRONT LAX vowels; the [ɪ]'s MANOVA reports V=0.115, $F(2, 70)=4.51$, $p<0.05$, the [ɛ]'s MANOVA reports V=0.115, $F(2, 94)=6.05$, $p<0.01$, and the [æ]'s MANOVA reports V=0.011, $F(2, 70)$, $p<0.05$.

- For the EAST-side Italians in Figure 6.12b, all three AGE groups differ from one another for the three FRONT LAX vowels; the [ɪ]'s MANOVA reports V=0.012, $F(4, 391)=12.25$, $p<0.001$; the [ɛ]'s MANOVA reports V=0.134, $F(4, 522)=18.72$, $p<0.001$; the [æ]'s MANOVA reports V=0.22, $F(4, 392)=24.12$, $p<0.001$. The most notable observation in this figure is the enormous F2 difference between the OLDER-aged speakers' and YOUNGER-aged speakers' FRONT LAX vowels; for example, the F2 difference between the [æ] vowels is 224.9Hz.

- For the WEST-side Finns in Figure 6.12c, the YOUNGER-aged speakers' FRONT LAX vowels are 1) patterning closely with the MIDDLE-aged speakers, and 2) patterning differently from the OLDER-aged speakers. The [ɪ] and [æ] vowels for the MIDDLE-aged speakers and YOUNGER-aged speakers report non-signficant differences; the [ɪ]'s MANOVA reports $V=0.022$, $F(2, 132)=1.47$, $p>0.05$ and the [æ]'s MANOVA reports $V=0.023$, $F(2, 133)=1.56$, $p>0.05$. While the MANOVA reports a significant difference between the MIDDLE-aged speakers' and YOUNGER-aged speakers' [ɛ] vowel, the univariate analysis of variance reveals a significant difference along only the F1 dimension (i.e., F1's ANOVA reports $F(1, 177)=7.09$, $p<0.01$, while F2's ANOVA reports $F(1, 177)=2.09$, $p>0.05$). The YOUNGER-aged speakers' FRONT LAX vowels are all significantly different from the OLDER-aged speakers' vowels (i.e., the [ɪ]'s MANOVA reports $V=0.046$, $F(2, 186)=4.49$, $p<0.05$; the [ɛ]'s MANOVA reports $V=0.077$, $F(2, 249)=10.35$, $p<0.001$; the [æ]'s MANOVA reports $V=0.082$, $F(2, 187)=8.30$, $p<0.001$).

In summary, Figure 6.12 shows that the YOUNGER-aged speakers and MIDDLE-aged speakers on the EAST-side are most advanced in the lowering and retraction of the FRONT LAX vowels relative to their respective OLDER-aged group. Between all three HERITAGE-LOCATION groups, the EAST-side Finns are also both more retracted and lower in the acoustic vowel space relative to the other two HERITAGE-LOCATION groups. This is observable in Figure 6.12 when comparing the YOUNGER-aged speakers' FRONT LAX vowels for the HERITAGE-LOCATION groups with the reference marker of the hypothetical midpoint and the low-back merger. Along both the F1 and F2 dimensions, the YOUNGER-aged and MIDDLE-aged EAST-side Finns are lower in the acoustic vowel space compared to the low-back merger and further retracted compared to the hypothetical midpoint. In contrast, only the YOUNGER-aged WEST-side Finns can claim that same degree of lowering and retraction of FRONT LAX vowels.

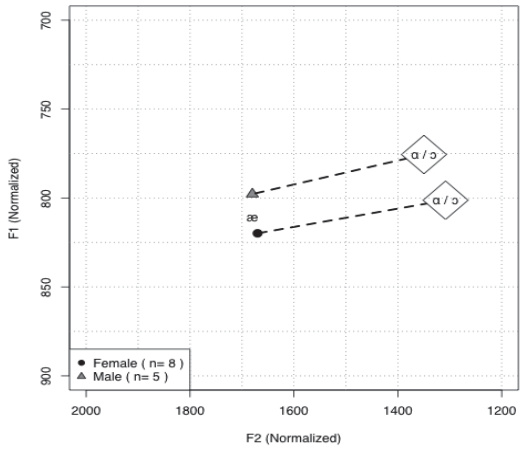
The critical linguistic variable participating in this lowering and retraction of FRONT LAX vowels is the front lax /æ/ vowel. As a result, the subsequent subsection will investigate the /æ/ vowel to examine the degree of lowering and retraction for the interaction of HERITAGE-LOCATION and SEX.

6.2.3 Low Front Lax Vowel by Heritage-Location and Sex

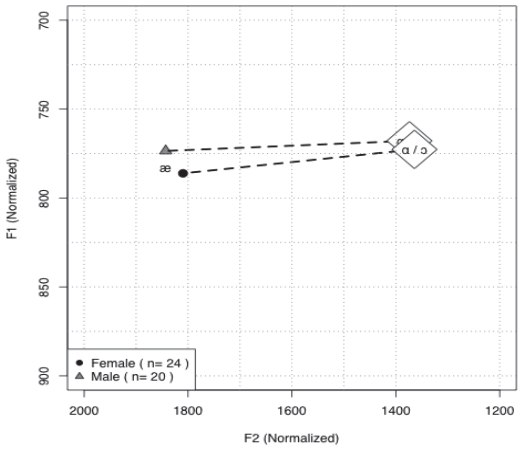
The second interaction to examine for FRONT LAX vowels is HERITAGE-LOCATION and SEX. However, this subsection will restrict its focus on the low front lax /æ/ vowel as it exhibits the most significant differential effects between groups of the three FRONT LAX linguistic variables and can be compared to the relative height of the low-back merger. Subfigure 6.13a displays the EAST-side Finns' SEX groups (n=13), Subfigure 6.13b displays the EAST-side Italians' SEX groups (n=44), and Subfigure 6.13c displays the WEST-side Finns' SEX groups (n=28).

The present figure reveals several striking characteristics with regards to how the males' and females' [æ] vowels are patterning as a factor of HERITAGE-LOCATION. There are three general observations:

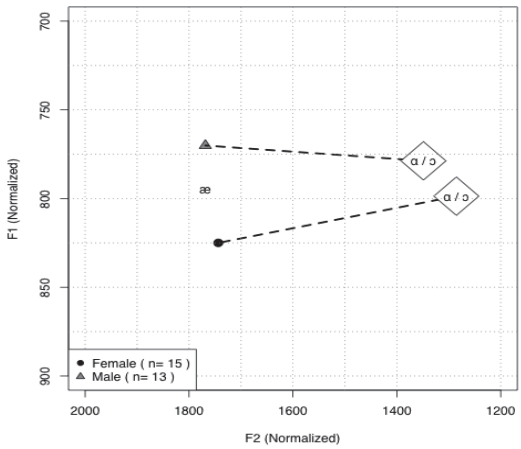
- The females in all three HERITAGE-LOCATION groups are more advanced in the lowering of the [æ] vowel compared to their male counterparts, particularly among the WEST-side Finns. Of the three HERITAGE-LOCATION groups, only the WEST-side Finnish males and females exhibit a statistically significant difference (i.e., F1's ANOVA reports $F(1, 250)=39.50$, $p<0.001$), while the other two groups' [æ] vowel, when comparing males against females, report non-significant differences. Even though not always statistically significant, females are observably lower in the F1 dimension for each HERITAGE-LOCATION group.



(a) East-side Finns (n=13)



(b) East-side Italians (n=44)



(c) West-side Finns (n=28)

Figure 6.13: The [æ] and low-back vowels for HERITAGE-LOCATION and SEX groups

- In terms of male speakers, only the EAST-side Finns exhibit lowering and retraction of the [æ] vowel (i.e., F1's ANOVA reports $F(2, 192)=3.05$, $p<0.05$). This is a striking characteristic because it seems only the EAST-side Finns, for both male and female speakers, are actively participating in the lowering and retraction of the [æ] vowel. In contrast, neither of the males nor females for the EAST-side Italians and only the females for the WEST-side Finns exhibit a F1 difference with their respective low-back merger.

- The EAST-side Finnish females exhibit the lowest and most retraction of the

[æ] vowel. In terms of the F2 dimension, the EAST-side Finnish females' [æ] vowel is significantly different from that of the WEST-side Finnish females with a difference of 73.6Hz (i.e., F2's ANOVA reports $F(1, 205)=10.39$, $p<0.01$). Using EDs, the WEST-side Finnish females' [æ] and low-back merger reports a distance of 459Hz while the EAST-side Finns on average report a distance almost a fifth shorter than that (i.e., a ED of 361.9Hz).

This subsection has revealed that the EAST-side Finns, particularly the EAST-side Finnish females, are leading the lowering and retraction of the FRONT LAX vowels as indicated by the focused examination of the low front lax [æ] vowel. However, the WEST-side Finnish females do show significant lowering of the [æ] vowel as well. The next subsection will examine the FRONT LAX vowels as they interact with the three-way interaction of HERITAGE-LOCATION, AGE and SEX.

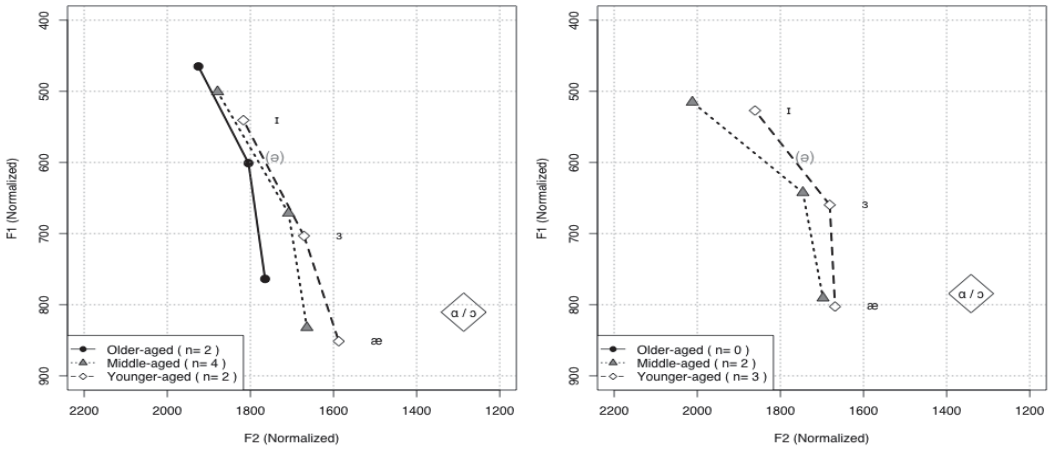
6.2.4 Front Lax Vowels by Heritage-Location, Age and Sex

The third interaction to examine for FRONT LAX vowels is the three-way analysis of HERITAGE-LOCATION, AGE and SEX. This subsection will again examine the three FRONT LAX vowels as a set of linguistic variables. Figures 6.14 through 6.16 display the SEX groups for each HERITAGE-LOCATION group in three distinct subfigures comparing the male and female AGE groups. Subfigures 6.14a and 6.14b in Subsection 6.2.4.1 display the AGE groups for the EAST-side Finnish SEX groups (female, n=8; male, n= 5), Subfigures 6.15a and 6.15b in Subsection 6.2.4.2 display the AGE groups for the EAST-side Italian SEX groups (female, n=24; male, n= 20), and Subfigures 6.16a and 6.16b in Subsection 6.2.4.3 display the AGE groups for the WEST-side Finnish SEX groups (female, n=15; male, n= 13). In each subfigure, the hypothetical midpoint and the low-back merger (i.e., averaged over the AGE groups but relative

to the HERITAGE-LOCATION and SEX grouping) are included as reference markers to help observe overall fronting and retraction of the FRONT LAX vowels within and across subfigures in this section.

6.2.4.1 EAST-SIDE FINNISH AGE AND SEX GROUPS

The first of the three figures is Figure 6.14 which displays the EAST-side Finnish male and female speakers' systems with respect to their three AGE groups. Since there are not any OLDER-aged EAST-side Finnish males in the present corpus, Subfigures 6.14a and 6.14b display five systems of the FRONT LAX vowels: the black filled circles and solid-lines represent the OLDER-aged EAST-side Finnish females (n=2), the gray filled triangles and dotted-lines represent the MIDDLE-aged EAST-side Finnish females (n=4) and males (n=2), and the white filled diamonds and dashed-lines represent the YOUNGER-aged EAST-side Finnish females (n=2) and males (n=3).



(a) East-side Finnish females (n=8) (b) East-side Finnish males (n=5)

Figure 6.14: The FRONT LAX vowels
for the EAST-side Finnish female and male AGE groups

The present figure reveals several striking characteristics:

- First, the MIDDLE-aged and YOUNGER-aged EAST-side Finnish females are pat-

terning similarly to one another. In terms of FRONT LAX vowels for the YOUNGER-aged and MIDDLE-aged EAST-side Finnish females, the high front [ɪ] vowel is the only one that reports a significant difference — albeit along only the F1 dimension (i.e., MANOVA reports V=0.095, F(2, 52)=2.67, p>0.05; F1's ANOVA reports F(1, 52)=5.436, p<0.05, with a 40Hz difference; F2's ANOVA reports F(1, 52)=0.067, p>0.05).

- Second, the OLDER-aged EAST-side Finnish females are both observationally and statistically distinct from both the MIDDLE-aged and YOUNGER-aged counterparts in Figure 6.15a for mid and low FRONT LAX vowels; this is confirmed when comparing the MIDDLE-aged and OLDER-aged EAST-side Finnish females in a multivariate analysis of variance (i.e., the [ɛ] vowel's MANOVA reports V=0.168, F(2, 70)=6.96, p<0.01; the [æ] vowel's MANOVA reports V=0.160, F(2, 52)=4.87, p<0.01).

- Third, the MIDDLE-aged and YOUNGER-aged EAST-side Finnish males are also patterning similarly to one another. Only the [ɪ] vowel reports any statistical difference between these two groups (i.e., MANOVA reports V=0.184, F(2, 43)=4.73, p<0.05; F1's ANOVA reports F(1, 43)=0.52, p>0.05; F2's ANOVA reports F(1, 43)=9.26, p<0.01, with a difference of 150.7Hz).

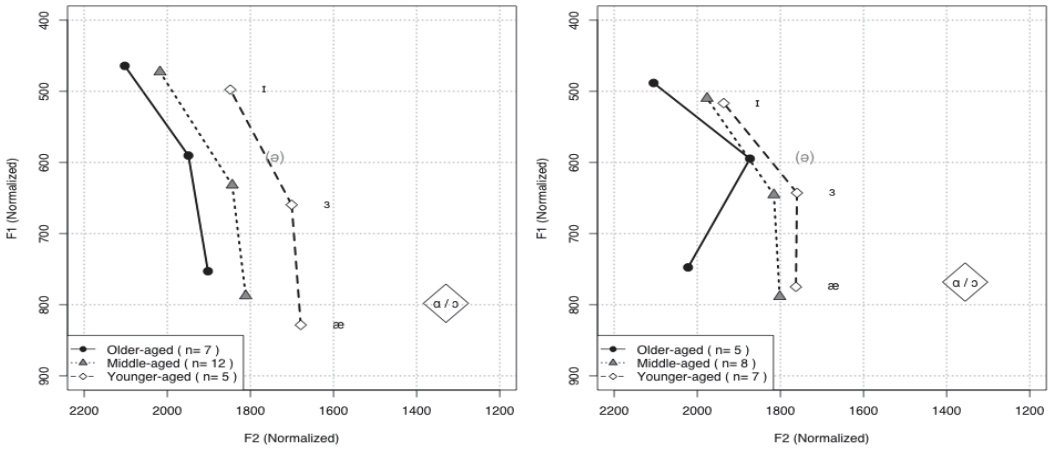
- Fourth, the YOUNGER-aged and MIDDLE-aged EAST-side Finnish males and YOUNGER-aged and MIDDLE-aged EAST-side Finnish females' [ɛ] and [æ] vowels are distinct from each other (i.e., [ɛ]'s MANOVA reports V= 0.055, F(2, 128)=3.67, p<0.05; [æ]'s MANOVA reports V=0.095, F(2, 95)=4.91, p<0.01); this was also reported in the focused analysis of the [æ] vowel in Subsection 6.2.3.

These results confirm that the YOUNGER-aged and the MIDDLE-aged EAST-side Finns pattern together, but Figure 6.14 reveals that the SEX factor is also very important

by showing that the YOUNGER-aged and MIDDLE-aged EAST-side Finnish females and the YOUNGER-aged and MIDDLE-aged EAST-side Finnish males are patterning differently from one another. The figure and subsequent results indicate that the [æ] and [ɛ] vowels are the lowest and most retracted in the speech of YOUNGER-aged and MIDDLE-aged EAST-side Finnish females, closely followed by, but distinct from, the YOUNGER-aged and MIDDLE-aged EAST-side Finnish males.

6.2.4.2 EAST-SIDE ITALIAN AGE AND SEX GROUPS

The second of the three figures is Figure 6.15 which displays the EAST-side Italian male and female speakers' systems with respect to their three AGE groups. Subfigures 6.15a and 6.15b display six systems of the FRONT LAX vowels: the black filled circles and solid-lines represent the OLDER-aged EAST-side Italian females (n=7) and males (n=5), the gray filled triangles and dotted-lines represent the MIDDLE-aged EAST-side Italian females (n=12) and males (n=8), and the white filled diamonds and dashed-lines represent the YOUNGER-aged EAST-side Italian females (n=5) and males (n=7).



(a) EAST-side Italians females (n=24) (b) EAST-side Italians males (n=20)

Figure 6.15: The FRONT LAX vowels
for the EAST-side Italian female and male AGE groups

Figure 6.15 reveals several notable differences between the AGE and SEX groups

for the EAST-side Italians:

- First, all three AGE groups for the EAST-side Italian females are significantly different from one another. Furthermore, the MIDDLE-aged and YOUNGER-aged EAST-side Italian females are statistically distinct from each other for each of the FRONT LAX vowels (i.e., [ɪ]'s MANOVA reports V=0.133, F(2, 151)=11.46, p<0.001, with a ED of 171Hz; [ɛ]'s MANOVA reports V=0.106, F(2, 199)=11.70, p<0.001, with a ED of 145.7Hz; [æ]'s MANOVA reports V=0.144, F(2, 151)=12.57, p<0.001, with a ED of 138.6Hz). This result is different from that found among the EAST-side Finns in Subsection 6.2.4.1, since the MIDDLE-aged and YOUNGER-aged EAST-side Italian females are not patterning together — though they are both lower and more retracted than their OLDER-aged counterpart.

- Second, the MIDDLE-aged and YOUNGER-aged EAST-side Italian males are patterning together (i.e., [ɪ]'s MANOVA reports V=0.009, F(2, 133)=0.60, p>0.05, with a ED of 40.8Hz; [ɛ]'s MANOVA reports V=0.020, F(2, 178)=1.69, p>0.05, with a ED of 55.6Hz; [æ]'s MANOVA reports V=0.020, F(2, 133)=1.36, p>0.05, with a ED of 41.3Hz).

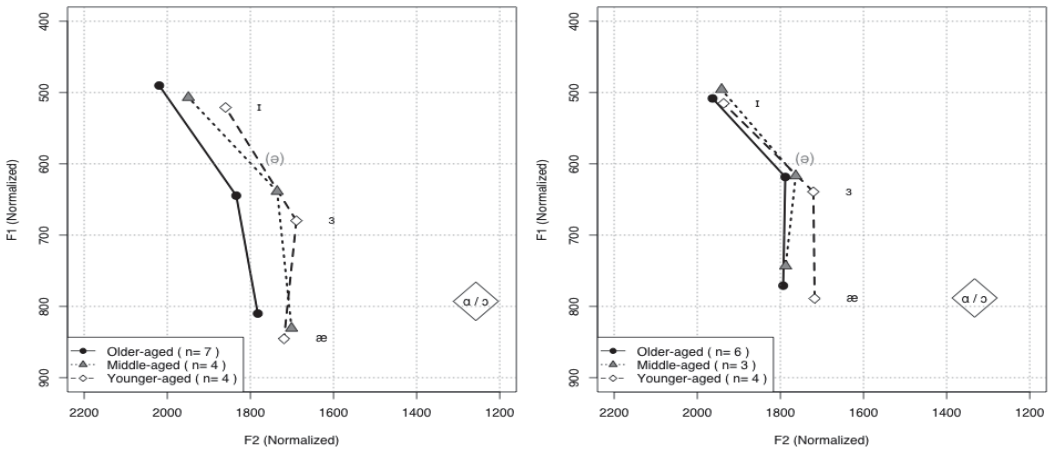
- Third, the MIDDLE-aged and YOUNGER-aged EAST-side Italian males are patterning with the MIDDLE-aged EAST-side Italian females for the mid and low FRONT LAX vowels (e.g., [æ]'s MANOVA reports V=0.008, F(2, 241)=1.02, p>0.05).

The results in this subsection indicate that YOUNGER-aged EAST-side Italian females are the ones most advanced in the lowering and retraction of the FRONT LAX vowels. Furthermore, the YOUNGER-aged EAST-side Italian males and MIDDLE-aged EAST-side Italian males and females are patterning together; that is to say, they are distinct from their OLDER-aged counterparts but yet not participating as actively in the lowering

and retraction of the FRONT LAX vowels in comparison to the YOUNGER-aged EAST-side Italian females or MIDDLE-aged and YOUNGER-aged EAST-side Finnish females.

6.2.4.3 WEST-SIDE FINNISH AGE AND SEX GROUPS

The last of the three figures is Figure 6.16 which displays the EAST-side Italian male and female speakers' systems with respect to their three AGE groups. Subfigures 6.16a and 6.16b display six systems of the FRONT LAX vowels: the black filled circles and solid-lines represent the OLDER-aged WEST-side Finnish females (n=7) and males (n=6), the gray filled triangles and dotted-lines represent the MIDDLE-aged WEST-side Finnish females (n=4) and males (n=3), and the white filled diamonds and dashed-lines represent the YOUNGER-aged WEST-side Finnish females (n=4) and males (n=4).



(a) WEST-side Finnish females (n=15) (b) East-side Finnish males (n=13)

Figure 6.16: The FRONT LAX vowels
for the WEST-side Finnish female and male AGE groups

Figure 6.16 reveals several notable differences between the AGE and SEX groups for the WEST-side Finns:

- First, the MIDDLE-aged and YOUNGER-aged WEST-side Finnish females' FRONT LAX vowels pattern together; only the [ɪ] vowel reports any statistical difference

(i.e., MANOVA reports V=0.065, F(2, 94)=3.25, p=0.043).

- Second, the MIDDLE-aged and YOUNGER-aged WEST-side Finnish females' FRONT LAX vowels are patterning distinct from their OLDER-aged counterpart (i.e., [ɪ]'s MANOVA reports V=0.084, F(4, 130)=2.85, p<0.05; [ɛ]'s MANOVA reports V=0.112, F(4, 176)=5.23, p<0.001;[æ]'s MANOVA reports V=0.082, F(4, 132)=2.81, p<0.05).

- Third, the YOUNGER-aged WEST-side Finnish males' [æ] vowel is distinct from the other two male groups (i.e., MANOVA reports V=0.156, F(4, 114)=4.83, p<0.001); in all other cases, there are no significant differences reported for FRONT LAX vowels for these male AGE groups.

The results from these subfigures indicate that MIDDLE-aged and YOUNGER-aged WEST-side Finnish females tend to be the groups most advanced in the retraction and lowering of the FRONT LAX vowels. Among the WEST-side Finns, the YOUNGER-aged males seem to be lowering and retracting only their [æ] vowel relative to the other WEST-side Finnish male groups, which may indicate that they are following the lead of their female counterparts but have not started to lower and retract the mid or high FRONT LAX vowels.

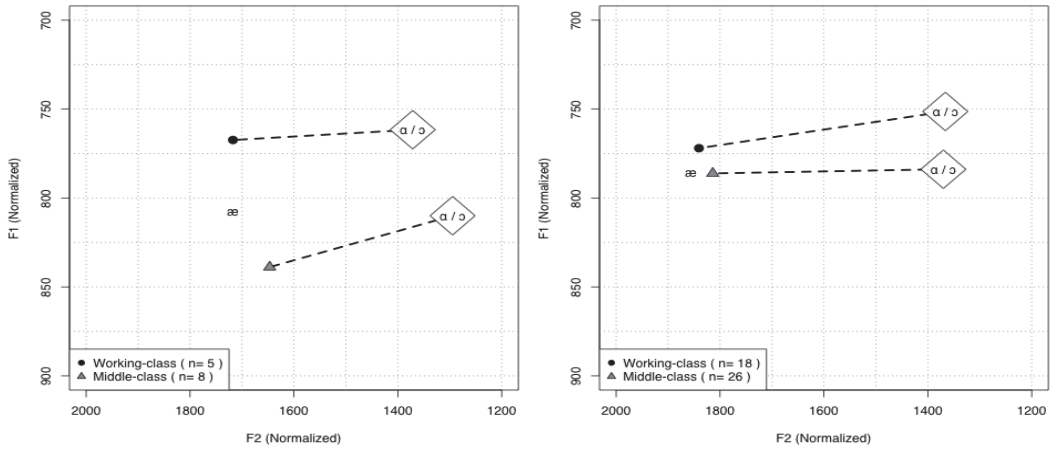
Between all three HERITAGE-LOCATION groups, the MIDDLE-aged and YOUNGER-aged Finnish females (i.e., with the EAST-side Finns leading) are most advanced in the lowering and retraction of the FRONT LAX vowels. The EAST-side Finnish males are lower and more retracted than the WEST-side Finnish males, but this group is not as low or as retracted in the acoustic space as compared to either the EAST-side Finnish or WEST-side Finnish female groups. Now that HERITAGE-LOCATION, AGE and SEX have been examined thoroughly, the following subsections will turn to CLASS to investigate if it correlates with any of the other predictor variables.

6.2.5 Low Front Lax Vowel by Heritage-Location and Class

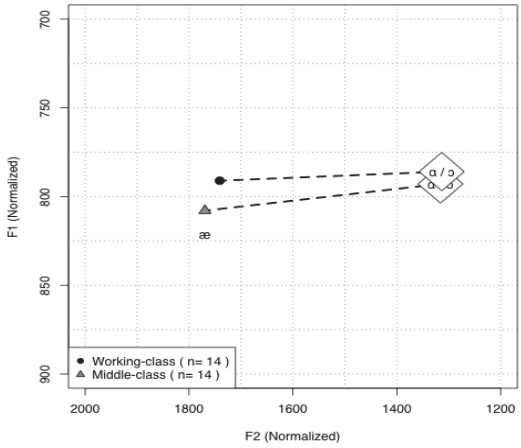
The present subsection seeks to examine if CLASS is an important factor that interacts with HERITAGE-LOCATION. Subsections 6.2.2 through 6.2.4 have revealed that AGE and SEX are important predictor variables in determining which groups are participating in the lowering and retraction of the FRONT LAX [ɪ], [ɛ] and [æ] vowels. However, the question remains as to if the binary distinction of socioeconomic status, described as CLASS in this thesis (i.e., WORKING-class and MIDDLE-class), will reveal any sociolinguistic trends in reference to the potential change-in-progress occurring with the set of linguistic variables known as the FRONT LAX vowels. Since the low front lax [æ] vowel is the most revealing of the three vowels in terms of lowering and retracting in the acoustic vowel space, this section will focus its attention on describing the trends specific to this linguistic variable.

A multivariate analysis of variance of the [æ] vowel for the interaction of HERITAGE-LOCATION and CLASS reports a significant difference between groups (i.e., MANOVA reports $V=0.022$, $F(4, 752)= 4.30$, $p<0.01$). This statistical difference is readily observable in Figure 6.17, where each of the three HERITAGE-LOCATION groups' WORKING-class speakers' and MIDDLE-class speakers' [æ] vowel are plotted in relation to their respective low-back merger. In Subfigures 6.17a, 6.17b and 6.17c, the gray-filled triangles represent the MIDDLE-class speakers' [æ] vowel while the black-filled circles represent the WORKING-class speakers' [æ] vowel.[4]

[4]Again, the dashed-line connecting the low-back merger with the [æ] vowel is included to help the reader immediately see the relationship of height along the F1 dimension between these two vowels. If the [æ] vowel is lower in the acoustic space compared to the low-back merger, then the two vowels would have a positive correlation (i.e., an incline) which would indicate that the [æ] is lowering beyond its low vowel counterpart; on the other hand, if the [æ] vowel is not lowering then the dashed-line should be either relatively horizontal or in a decline (i.e., a negative correlation, which would indicate the raising of the [æ] and a characteristic of the Northern Cities Vowel Shift (NCVS) system).



(a) East-side Finns (n=13) (b) East-side Italians (n=44)



(c) West-side Finns (n=28)

Figure 6.17: The [æ] and low-back vowels
for HERITAGE-LOCATION and CLASS groups

Figure 6.17 reveals that MIDDLE-class speakers are lowering and retracting their [æ] vowel, particularly among the EAST-side Finns. While no significant difference is reported for the EAST-side Italians' CLASS groups (i.e., MANOVA reports V=0.008, $F(2, 393)=1.53$, $p>0.05$), both the Finnish-heritage groups report statistical significant differences between WORKING-class' and MIDDLE-class' [æ] vowel (i.e., EAST-side Finns' MANOVA reports V=0.191, $F(2, 115)=13.45$, $p<0.001$; WEST-side Finns' MANOVA reports V=0.029, $F(2, 250)=3.78$, $p<0.05$). Another notable observation is that the low-back merger is lower in the acoustic space for the EAST-side Finnish and EAST-side Italian MIDDLE-class groups in comparison to their WORKING-class

counterparts (i.e., the EAST-side Finns' MANOVA, comparing the two CLASS groups' low-back merger, reports V=0.245, F(2, 386)=62.3, p<0.001; the EAST-side Italians' MANOVA, comparing the two CLASS groups' low-back merger, reports V=0.024, F(2, 1301)=15.76, p<0.001). This CLASS difference for the low-back merger, however, is not found among the WEST-side Finnish CLASS groups (i.e., MANOVA reports V=0.004, F(2, 833)=1.68, p>0.05).

The next subsection will examine this CLASS factor further by investigating the interaction of HERITAGE-LOCATION, SEX and CLASS.[5]

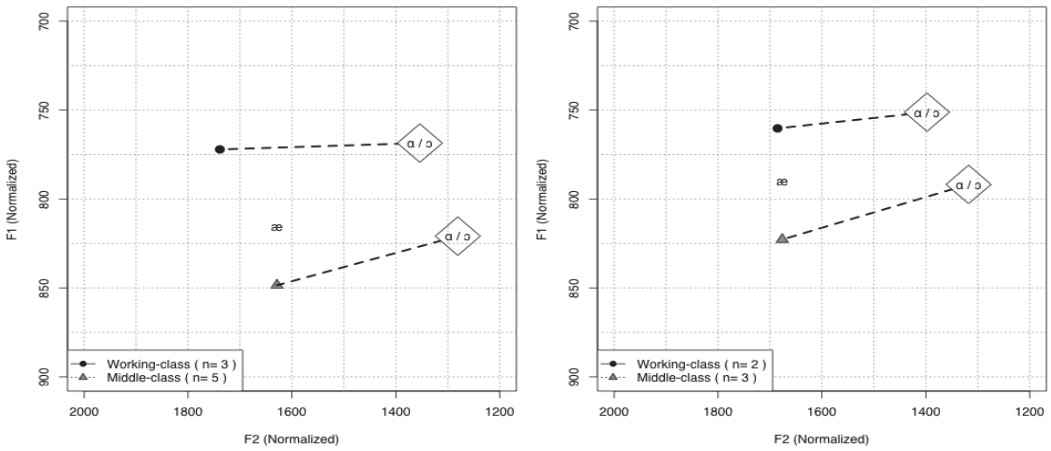
6.2.6 Low Front Lax Vowel by Heritage-Location, Sex and Class

This subsection investigates the /æ/ linguistic variable as it correlates with the three-way interaction of HERITAGE-LOCATION, SEX and CLASS. Since there is a strong SEX effect in the dataset (i.e., females are shown to have lower and retracted FRONT LAX vowels in comparison to the males as described in Sections 6.2.3 and 6.2.4), Subsection 6.2.6 reports on how the WORKING-class and MIDDLE-class groups are patterning with respect to males and females for each HERITAGE-LOCATION group. Subsection 6.2.6.1 examines the EAST-side Finnish WORKING-class and MIDDLE-class males (n=5) and females (n=8), Subsection 6.2.6.2 examines the EAST-side Italian WORKING-class and MIDDLE-class males (n=20) and females (n=14), and Subsection 6.2.6.3 examines the WEST-side Finnish WORKING-class and MIDDLE-class males (n=13) and females (n=15). Once again, the low-back merger is included in subsequent figures as a frame of reference for the lowering and retraction of the [æ] vowel for each subgroup.

[5]Another logical three-way comparison of the CLASS factor is the HERITAGE-LOCATION, AGE and CLASS comparison, which was performed, but this interaction did not reveal any significant differences for the FRONT LAX vowels (i.e., the [æ] vowel's MANOVA reports V=0.016, F(8, 746)=1.58, p>0.05). Due to the nature of the corpus design, a four-way interaction is too large of a comparison and spreads the speaker sample too thin for each subgroup — particularly for the EAST-side Finns.

6.2.6.1 EAST-SIDE FINNISH SEX AND CLASS GROUPS

Turning first to the WORKING-class and MIDDLE-class EAST-side Finnish males and females, Subfigures 6.18a and 6.18b display the [æ] vowel and its relationship with the low-back merger (i.e., indicated by a dashed-line that links the two qualities).



(a) EAST-side Finnish females (n=8)

(b) EAST-side Finnish males (n=5)

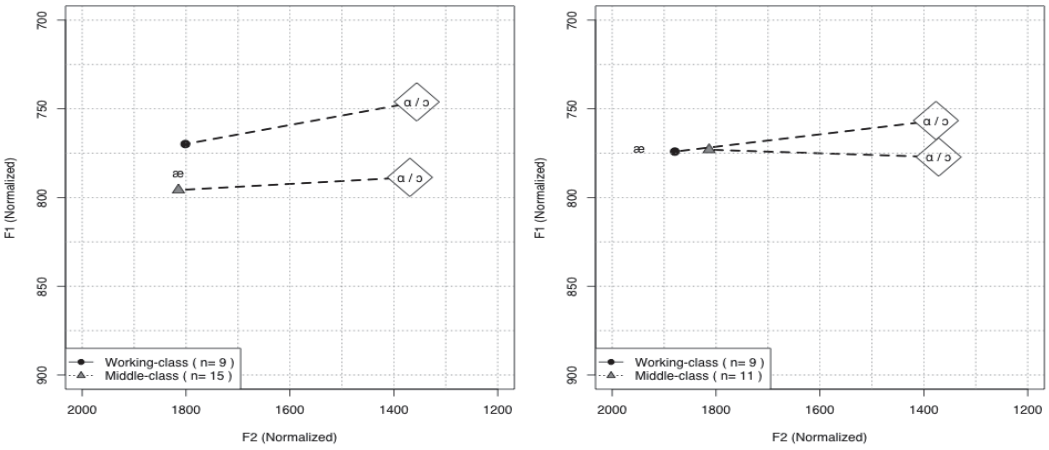
Figure 6.18: The [æ] vowels for the EAST-side Finnish working-class and middle-class AGE groups

A multivariate analysis of variance for the EAST-side Finns' CLASS and SEX groups reports statistically significant differences between the [æ] vowels (i.e., MANOVA reports V=0.112, F(2, 113)=7.06, p<0.01). The 133.8Hz difference in the EDs between WORKING-class and MIDDLE-class females and the 63.1Hz difference between WORKING-class and MIDDLE-class males are both statistically significant (i.e., the MANOVA for the females reports V=0.120, F(2, 70)=8.47, p<0.001; the MANOVA for the males reports V=0.318, F(2, 43)=9.79, p<0.001). Pertaining to the EAST-side Finns, the results suggest both the MIDDLE-class males, as well as females, are lowering and retracting their [æ] vowels much more than their WORKING-class counterparts. In fact, these MIDDLE-class EAST-side Finns male and female groups are patterning the same and do not report a significant difference (i.e., MANOVA reports V=0.034, F(2,

70)=1.23, p>0.05, with a ED of only 54Hz between the MIDDLE-class female and the male groups' [æ] vowel). The last notable observation is that the low-back merger is lower in the acoustic space for the MIDDLE-class females and males in comparison to their WORKING-class counterparts (i.e., the females' MANOVA, comparing the two CLASS groups' low-back merger, reports V=0.272, F(2, 236)=43.97, p<0.001; the males' MANOVA, comparing the two CLASS groups' low-back merger, reports V=0.232, F(2, 146)=21.89, p<0.001).

6.2.6.2 EAST-SIDE ITALIAN SEX AND CLASS GROUPS

Turning next to the WORKING-class and MIDDLE-class EAST-side Italian males and females, Subfigures 6.19a and 6.19b display the [æ] vowel and this vowel's relationship with the low-back merger.



(a) EAST-side Italian females (n=14)

(b) EAST-side Italian males (n=20)

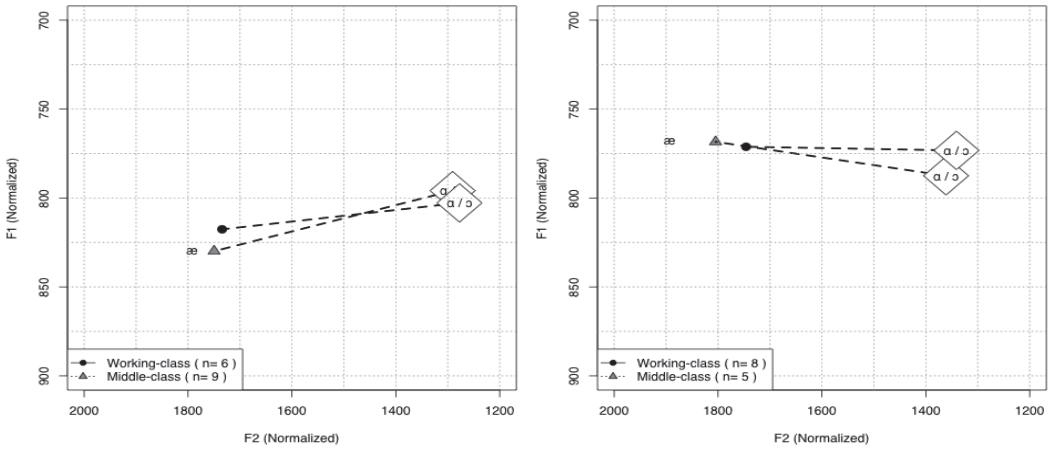
Figure 6.19: The [æ] vowels for the EAST-side Italian working-class and middle-class AGE groups

For the WORKING-class and MIDDLE-class EAST-side Italians, neither males nor females report a statistical difference (i.e., the MANOVA for the CLASS comparison of EAST-side Italian females reports V=0.0178, F(2, 213)=1.93, p>0.05; the MANOVA

for the CLASS comparison of EAST-side Italian males reports V=0.028, F(2, 178)=2.56, p>0.05). However, a two-way comparison of these EAST-side Italian CLASS and SEX groups does report a significant difference indicating the presence of a CLASS distinction (i.e., MANOVA reports V=0.024, F(2, 391)=4.77, p<0.01). The results from the EAST-side Italians suggests that once again, not only are the females leading the males in the lowering and retraction of their FRONT LAX [æ] vowel, but also that MIDDLE-class females lead WORKING-class females (i.e., similar to the EAST-side Finnish results presented in the previous subsection). Unlike the EAST-side Finnish males, however, the EAST-side Italian males regardless of CLASS do not exhibit the lowering and retraction of the [æ] vowel. The last notable observation is that the low-back merger is lower in the acoustic space for the MIDDLE-class females and males in comparison to their WORKING-class counterparts (i.e., the females' MANOVA, comparing the two CLASS groups' low-back merger, reports V=0.030, F(2, 711)=10.93, p<0.001; the males' MANOVA, comparing the two CLASS groups' low-back merger, reports V=0.016, F(2, 586)=4.72, p<0.01); this tendency for the MIDDLE-class groups to have lower low-back mergers in comparison to the WORKING-class is one shared by both EAST-side Finns and Italians.

6.2.6.3 WEST-SIDE FINNISH SEX AND CLASS GROUPS

Turning finally to the WORKING- and MIDDLE-class WEST-side Finnish males and females, Subfigures 6.20a and 6.20b display the [æ] vowel and the low-back merger.



(a) WEST-side Finnish females (n=15)

(b) WEST-side males (n=13)

Figure 6.20: The [æ] vowels for the WEST-side Finnish working-class and middle-class AGE groups

The results in Subfigures 6.20 reveal a few striking characteristics of the four WORKING-class and MIDDLE-class WEST-side Finnish male and female groups in regards to the FRONT LAX [æ] vowel. Unlike the other HERITAGE-LOCATION groups, the WEST-side Finns do not exhibit a CLASS difference in regards to this linguistic variable (i.e., the MANOVA for the CLASS comparison of WEST-side Finnish females reports $V=0.013$, $F(2, 133)=0.85$, $p>0.05$; the MANOVA for the CLASS comparison of WEST-side Finnish males reports $V=0.047$, $F(2, 115)=2.78$, $p>0.05$). The other notable observation is that both the WORKING-class and the MIDDLE-class WEST-side Finnish females are lowering and retracting their FRONT LAX [æ] vowel yet their male counterparts do not (i.e., MANOVA reports $V=0.153$, $F(2, 250)=16.97$, $p<0.001$). The last notable observation is that the low-back merger is lower in the acoustic space for the MIDDLE-class males in comparison to their WORKING-class counterpart (i.e., the males' MANOVA, comparing the two CLASS groups' low-back merger, reports $V=0.035$, $F(2, 384)=6.99$, $p<0.01$); the same CLASS distinction of the low-back merger is not true for the females (i.e., MANOVA reports $V=0.007$, $F(2, 445)=1.47$, $p>0.05$).

This section has shown in detail that the lowering and retraction of [ɪ], [ɛ] and [æ] are linguistic indicators that share both phonetic and sociolinguistic patterns; that is to say, the most extreme cases of lowering and retraction of these linguistic variables is found in the speech of the YOUNGER-aged EAST-side Finnish MIDDLE-class females. The results indicate that the lowering and retraction of the FRONT LAX vowels may in fact be seen as a prestigious variant used by women and the MIDDLE-class groups (Labov 2001).[6] In addition, the lowering of the LOW BACK variants may be co-occurring with the lowering and retraction of the [æ] variant. The next section of the present chapter will investigate the predictor variables of HERITAGE-LOCATION, AGE, SEX and CLASS as they pertain to the SHORT and LONG DIPHTHONGs.

[6] A thorough discussion of this finding will be provided in the next chapter (c.f., Section 7.2.2.1).

6.3 Short and Long Diphthongs as Sets of Linguistic Variables

This section focuses primarily on the LONG DIPHTHONGs as linguistic variables of interest; this is largely due to the fact that very little interspeaker variation exists for either the /ej/ or /ow/ SHORT DIPHTHONGs, which indicates that the variants of these linguistic variables are stable within the sample of this UP speech community (e.g., monophthongalization of /ow/). In contrast, the nuclei of LONG DIPHTHONGs are quite distinct from one another and have been shown to be interacting in different ways with the low and mid regions of the acoustic vowel space, and in the case of /ɑj/, correlated with the linguistic predictor variable of CONTEXT. The primary question of this section is to inquire if the nuclei of these LONG DIPHTHONGs are raising and advancing in the acoustic vowel space when compared to the low-back merger.[7]

As was shown in Section 6.1, the /ɑj/ is the only LONG DIPHTHONG that exhibits the advancement to the low central region of the acoustic vowel space; further analyses reveal both LONG DIPHTHONGs to be relatively invariant linguistic variables along the F2 dimension (i.e., showing limited to no interspeaker variation between groups). This suggests that the advancement of [ɑj] (i.e., fronting of [ɑj]) and this non-advancement of [ɑw] (i.e., non-fronting of [ɑw]) are relatively stable characteristics of these linguistic variables within this UP speech community. As a result, this section examines strictly the F1 dimension, using the F1 differences between each nucleus of a LONG DIPHTHONG and the low-back merger in order to determine if raising is occurring between groups according the the predictor variables of interest in an analysis. For each group based on a predictor variable or an interaction of predictor variables, a group F1 mean difference is calculated. This group F1 mean difference is used to examine

[7]It is important to note that as described in Chapter 3 these LONG DIPHTHONGs are constrained in terms of their following phonetic environment in that [ɑjT] and [ɑwT] are both followed by a voiceless obstruent, while the [ɑjC] is followed by a voiced obstruent.

the degree to which the nucleus of a LONG DIPHTHONG deviates from the low-back merger. This difference is calculated by taking the mean F1 value of the [ɑ] and [ɔ] vowels and subtracting it from the mean F1 value of the LONG DIPHTHONG' nucleus in order to obtain the mean F1 difference. Due to the nature the F1 dimension, a raised nucleus would have a negative value and a non-raised nucleus would have a positive value (or approximate zero). For example, in calculating the mean F1 difference of the [ɑw] vowel for the EAST-side Finnish, EAST-side Italian and WEST-side Finnish groups in a HERITAGE-LOCATION factor analysis, each group's mean F1 value of the [ɑw] nucleus is subtracted from the group's corresponding low-back mean value to arrive at single F1 difference; this is done for each HERITAGE-LOCATION group. For this specific analysis, a between-group comparison is then used to examine if these HERITAGE-LOCATION groups exhibit interspeaker variation in terms of the raised or non-raised variant of the /ɑw/ diphthong (and potentially, the subsequent analysis of /ɑj/ might reveal if the [ɑjT] and [ɑjC] are being raised as well).

In this final section of the chapter, two focused questions guide the present analysis:

1. Are the nuclei of the [ɑwT], [ɑjT] and [ɑjC] LONG DIPHTHONGs raised in the acoustic vowel space (i.e., raised and distinct from the height of the low-back merger)?

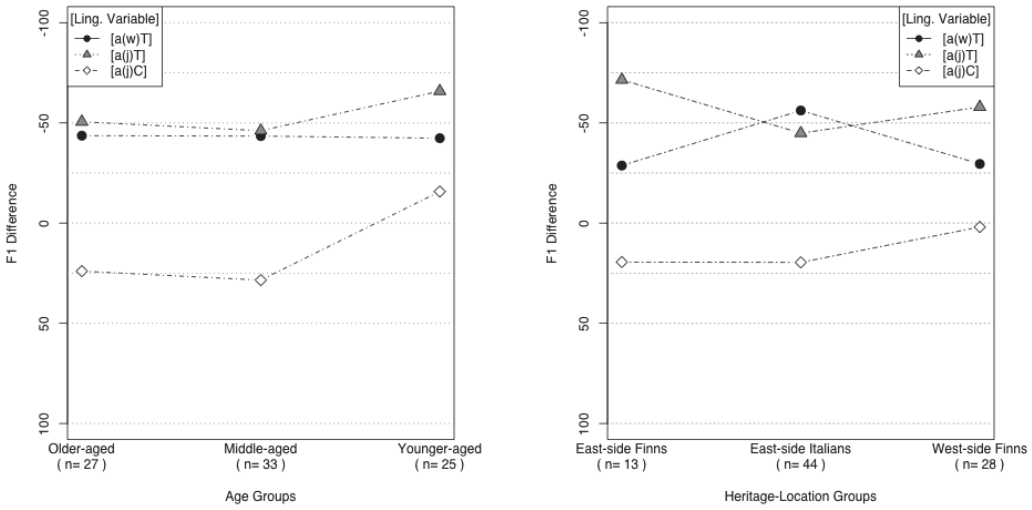
2. Does interspeaker variation exist for either of the LONG DIPHTHONGs, and if so, does it correlate with the predictor variables of HERITAGE-LOCATION, AGE, SEX or CLASS?

Subsection 6.3.1 examines the F1 difference of the LONG DIPHTHONGs' nuclei for the main effects of AGE and HERITAGE-LOCATION and then examines the two-way interaction of these factors. Subsection 6.3.2 focuses on the factor of AGE and its two-way and three-way interactions with the SEX and CLASS factors.

6.3.1 Main Effects of Age and Heritage-Location

This subsection examines the main effects of AGE and HERITAGE-LOCATION to see if the F1 difference of the /ɑw/ and /ɑj/ diphthongs' nuclei, relative to the height of the low-back merger, indicates the raised nuclei of LONG DIPHTHONGs (i.e., also known as "Canadian raising"). In addition, the inclusion of the [ɑjC] context allows one to use the >60Hz difference diagnostic as an additional tool to determine 1) if the raised or non-raised variants are preferred for either [ɑjT] or [ɑwT] and 2) if CONTEXT is still a conditioning factor predicting the use of raised and non-raised variants (i.e., at least in case of /ɑj/) for the various social groupings.

The subfigures in Figure 6.21 display the nuclei of /ɑw/ and /ɑj/ for the main effects of AGE and HERITAGE-LOCATION.



(a) Main effect of AGE

(b) Main effect of HERITAGE-LOCATION

Figure 6.21: F1 difference of the LONG DIPHTHONGs' nuclei and the low-back merger as a factor of either HERITAGE-LOCATION or AGE

In Subfigure 6.21a, there are several striking characteristics that will ultimately guide the subsequent analyses of this section.

- The nuclei of the [ɑwT] LONG DIPHTHONG is invariantly raised across the AGE groups at approximately 40Hz or more (i.e., a F1 difference of -40 to -45Hz) above the low-back merger (i.e., ANOVA reports a non-significant difference, $F(2, 670)=0.01$, $p>0.05$).

- The nuclei of the /ɑj/, for [ɑjC] and [ɑjT] LONG DIPHTHONGS, also exhibit limited interspeaker variation as a factor of AGE, with univariate analyses of variance reporting non-significance across the AGE groups (i.e., [ɑT]'s ANOVA reports $F(2, 80)=0.507$, $p>0.05$; [ɑC]'s ANOVA reports $F(2, 80)=2.79$, $p>0.05$. However with respect of each AGE grouping, the [ɑjC] and [ɑjT] are found to be statistically distinct for the OLDER-aged (i.e., ANOVA reports $F(2, 260)=5.02$, $p<0.01$) and MIDDLE-aged groups (i.e., ANOVA reports $F(2, 323)=7.94$, $p<0.001$) but not for YOUNGER-aged groups (i.e., ANOVA reports $F(2, 247)=2.89$, $p>0.05$). Additionally, an independent t-test comparing the MIDDLE-aged group's [ɑjC] mean with the YOUNGER-aged group's [ɑjC] mean does report a significant difference, $t(54.6)=2.46$, $p<0.05$.

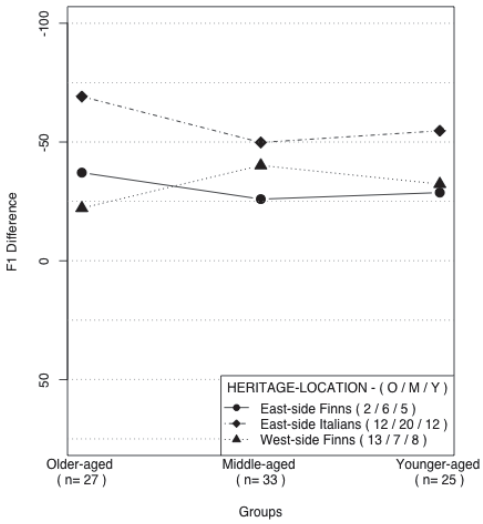
The results from this figure indicate that the main effect of AGE is an important factor for the raised variant of the /ɑj/ and /ɑw/ nuclei as linguistic variables. In contrast, it also suggests that the [ɑjC] and [ɑjT] nuclei are clearly conditioned by the following phonetic segment as being voiced or voiceless. While the pre-voicing CONTEXT is invariably conditioning the raised and non-raised variants for the OLDER-aged and MIDDLE-aged groups, it may not be as important of a predictive variable for the YOUNGER-aged group since all of the nuclei are raised, regardless of the following segment.

The F1 difference data in Subfigures 6.21b, for the three groups as a factor of HERITAGE-LOCATION, also exhibit some striking trends for the /ɑw/ and /ɑj/ nuclei as linguistic variables.

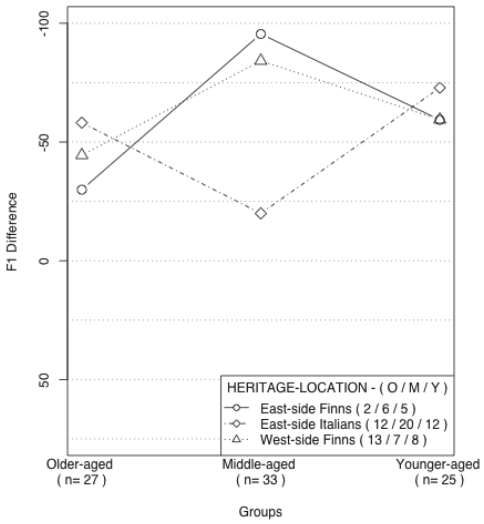
- Once again, the [ɑwT] and [ɑjT] are raised above the low-back merger and clearly distinct from [ɑjC].
- The EAST-side Finnish and WEST-side Finnish groups' [ɑwT] are patterning together, statistically distinct from the EAST-side Italians (i.e., ANOVA reports $F(2, 670)=6.79$, $p<0.01$); a subsequent independent t-test comparing the EAST-side Finns' F1 difference mean and the EAST-side Italians' difference mean confirms the statistical difference, $t(216.1)=2.9$, $p<0.01$.

The predictor variable of HERITAGE-LOCATION is less revealing in comparison to the main effect of AGE. While the EAST-side Italians' nuclei of the LONG DIPHTHONGs are quite distinct from one another, the more intriguing observation is the fact that the EAST-side Finnish and WEST-side Finnish groups are patterning together.

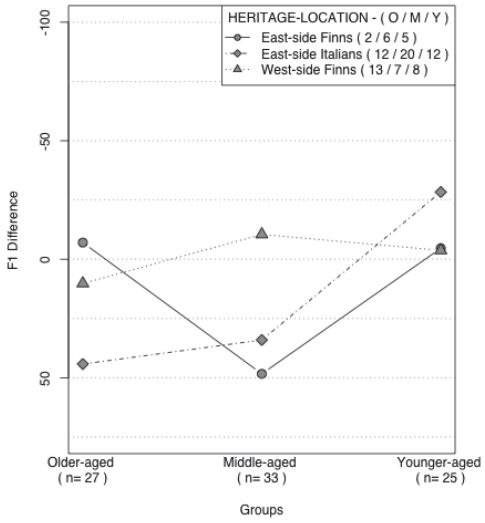
A comparison of AGE and HERITAGE-LOCATION is the natural step in teasing apart the particular interspeaker variation that is occurring for each of the LONG DIPHTHONG linguistic variables. To address this concern, Subfigures 6.22a, 6.22b and 6.22c display the interaction of the HERITAGE-LOCATION groups as a factor of AGE. The x-axis of the subfigure displays the categorical levels of the AGE factor and the y-axis displays the F1 difference of either the [ɑwT], the [ɑjT] and the [ɑjC] nuclei from the low-back merger. For the three subfigures, the circle and solid-lines represent the EAST-side Finns, the diamonds and the dashed-lines represent the EAST-side Italians, and the triangles and dotted-lines represent the WEST-side Finns; color distinguishes the linguistic variable of interest. Furthermore, each figure has a legend which displays the grouping and the number of speakers per AGE group (i.e., "O" = OLDER-aged speakers, "M" = MIDDLE-aged speakers and "Y"=YOUNGER-aged speakers).



(a) The [ɑwT] diphthong



(b) The [ɑjT] diphthong



(b) The [ɑjC] diphthong

Figure 6.22: F1 difference of the LONG DIPHTHONGs' nuclei and the low-back merger as an interaction HERITAGE-LOCATION and AGE

Several observations are worth noting in Subfigures 6.22a, 6.22b and 6.22c above:

- In terms of the /ɑw/ linguistic variable, the EAST-side Finns and the WEST-side Finns are patterning together distinct from EAST-side Italians for all three AGE groups. In other words, the EAST-side Italian AGE groups tend to have the most extreme raised variant of the [ɑwT] nucleus in comparison to the other two groups.

- In terms of the /ɑj/ linguistic variable when followed by a voiceless obstruent, all three HERITAGE-LOCATION groups are patterning together respective of the OLDER-aged and YOUNGER-aged groupings. However, MIDDLE-aged EAST-side Italians are patterning very differently from the MIDDLE-aged FINNISH-heritage groups (i.e., ANOVA reports $F(2, 29)=4.42$, $p<0.05$).

- In contrast, the nucleus of the pre-voiced /ɑj/ linguistic variable is typically not raised relative to the low-back merger; at least, the [ɑjC] and the low-back merger fail to report statistically significant differences for any of the HERITAGE-LOCATION groups for each AGE grouping (i.e., a series of univariate analyses all reveal $p>0.05$). Observationally, however, all three YOUNGER-aged HERITAGE-LOCATION groups are raising their [ɑjC] to height of the low-back merger; the same cannot be said for the OLDER-aged or MIDDLE-aged groupings.

The AGE factor is the most revealing of the two factors in terms of indicating a trend toward the use or non-use of the raised variant of either the /ɑw/ or the /ɑj/ linguistic variable. Moreover, the slightly raised variant of the [ɑjC] among the YOUNGER-aged HERITAGE-LOCATION group does indicate a trend toward the loss of an allophonic distinction between the raised and non-raised variants according to the voicing contrast of the following phonetic environment. Additionally, while there does seem to be some other interspeaker variation on account of HERITAGE-LOCATION, further investigation of this factor's interaction with the three predictor variables reveals limited to no interpretable results other than the main effect reported in Figure 6.21 or the two-way interaction of AGE and HERITAGE-LOCATION reported in Figure 6.22.

The results in Subsection 6.3.1 confirm that [ɑwT] and [ɑjT] are higher in the acoustic space (i.e., raised above the low-back merger) regardless of AGE and HERITAGE-LOCATION, while the [ɑjC] is only raised among the YOUNGER-aged speakers. Because

of the importance of AGE, the subsequent subsections will now focus on the predictor variable of AGE and this factor's interaction with SEX and CLASS in order to account for the interspeaker variation that exists in the raising of the [ɑwT], [ɑjT] and [ɑjC] LONG DIPHTHONGS.

6.3.2 Raised Variants of [ɑJ] and [ɑW] as Changes-in-Progress

In the previous section all speakers were shown to be raising both the nuclei of /ɑw/ and /ɑj/ when followed by a voiceless obstruent, while the YOUNGER-aged speakers were the only group that exhibited evidence for the raised variant of the [ɑjC] nucleus (i.e., to the height of the low-back merger, yet still below that of the [ɑjT] and [ɑwT] nuclei). As a result, the present section examines the interaction of AGE and SEX and the interaction of AGE and CLASS to see if these raised variants are associated with any particular SEX or CLASS group among these YOUNGER-aged speakers. Turning first to the interaction of AGE and SEX, Figure 6.23 displays the F1 difference for the male and female speakers' [ɑwT], [ɑjT], and [ɑjC] nuclei on the y-axis and the three AGE groups on the x-axis. Color indexes each linguistic variable, line type indexes each SEX group, and symbol type indexes each unique grouping. Furthermore, this figure has a legend which displays the linguistic variable of interest, the SEX groupings and the number of speakers per SEX group (i.e., "O" = OLDER-aged speakers, "M" = MIDDLE-aged speakers and "Y"=YOUNGER-aged speakers).

It is clear from Figure 6.23 that the raised variants of /ɑw/ and /ɑj/ are strongly preferred when followed by a voiceless obstruent for all three AGE groupings regardless of gender. Comparing the nuclei of [ɑwT] to the low-back merger, the raised variant of both male and females across the AGE groupings are all located between 34Hz and 48.5Hz above the low-back merger. Similarly, the male and female speakers' [ɑjT] nuclei are also raised, but are even more so, with a range mean difference between

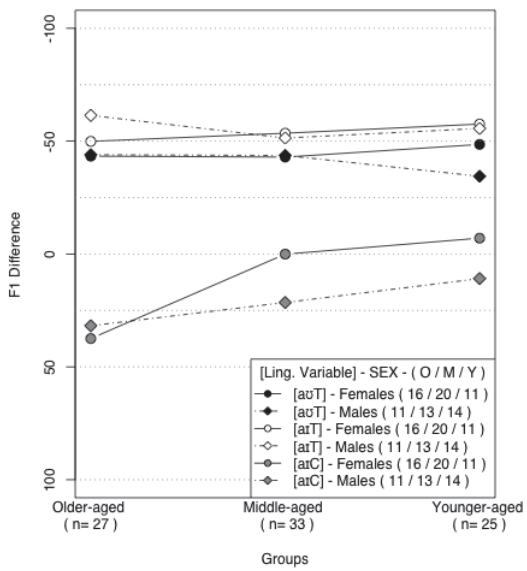


Figure 6.23: F1 difference of the LONG DIPHTHONGs' nuclei and the low-back merger as a factor of AGE and SEX

49.9Hz and 61.4Hz. In either case, there are no statistically significant differences between AGE and SEX groups for the /ɑw/ and /ɑj/ linguistic variables when followed by a voiceless obstruent. In contrast, there seems to be a certain amount of interspeaker variation for the non-raised variant of /ɑj/ in the pre-voiced CONTEXT. That is to say, the OLDER-aged male and female groups and the MIDDLE-aged females are all more than 20Hz below their respective low-back mergers, while the other three groups are all within 10Hz of their low-back mergers (i.e., either above or below it). However, a series of univariate analyses of variance report the F1 difference of [ɑjC] from the low-back merger all to be non-significant. Interestingly, the MIDDLE-aged and YOUNGER-aged females' [ɑjC] are all above the level of the low-back merger. In other words, females seem to be leading the raised variants as a change-in-progress, with the MIDDLE-aged and YOUNGER-aged women showing the most systematic raising of pre-voiced diphthongs.

Turning next to the AGE and CLASS interaction, Figure 6.24 displays the F1 difference for the MIDDLE-class and WORKING-class speakers' [ɑwT], [ɑjT] and [ɑjC] nuclei

as either raised or non-raised in comparison to the low-back merger. As before, color indexes each linguistic variable, line type indexes each CLASS grouping and symbol type indexes each unique grouping. Furthermore, this figure's legend displays the linguistic variable of interest, the CLASS groupings and the number of speakers per CLASS group (i.e., "O" = OLDER-aged speakers, "M" = MIDDLE-aged speakers and "Y"=YOUNGER-aged speakers).

This figure reveals that the factor of CLASS is an important predictor variable; this factor is predictive of the raised variant for [ɑwT] and [ɑjT] in the speech of the MIDDLE-class group — while in the speech of the WORKING-class group, the non-raised variant seems to be preferred.

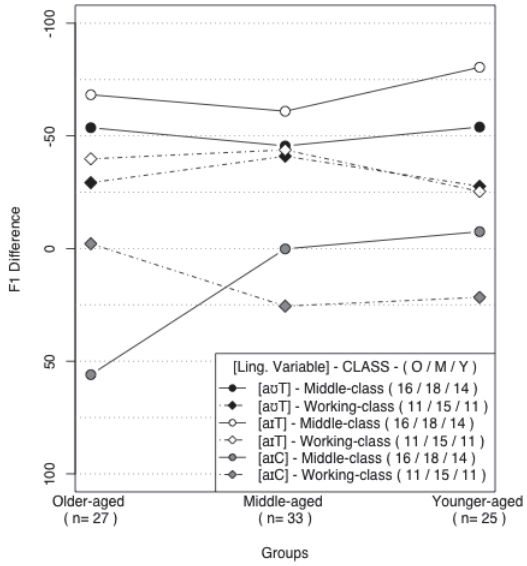
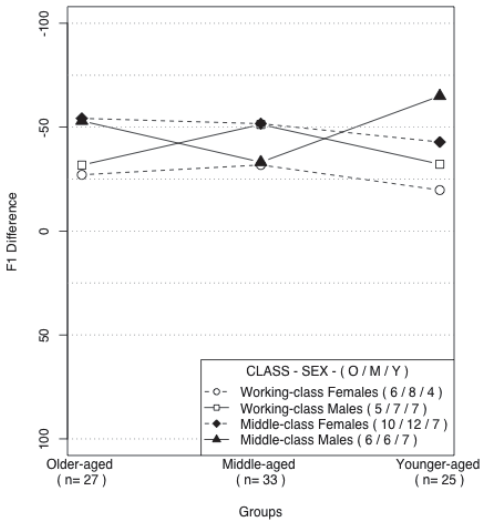


Figure 6.24: F1 difference of the LONG DIPHTHONGs' nuclei and the low-back merger as a factor of AGE and CLASS

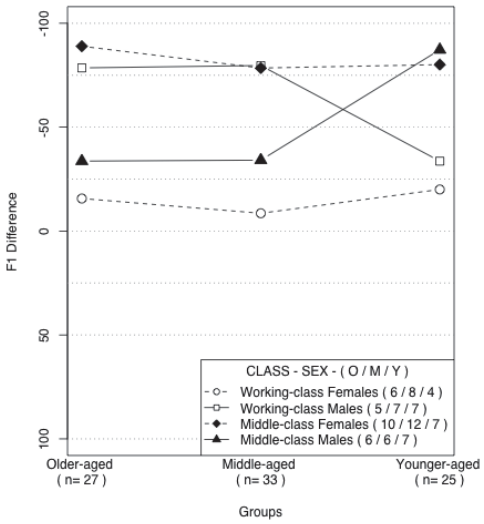
The MIDDLE-class group's [ɑwT] and [ɑjT] are patterning closely together and have the highest F1 difference from the low-back merger (i.e., the [ɑwT]'s F1 mean difference ranges from 45Hz to 53Hz, while the [ɑjT]'s F1 mean difference ranges from 61Hz to 80Hz for the three AGE groupings). Similarly, the WORKING-class groups [ɑwT] and [ɑjT] are also patterning together (i.e., the F1 mean differences ranges

from 25Hz to 41Hz above the mean). In terms of the [ɑjC] linguistic variable, there seems to be a cross-over effect for the OLDER-aged and MIDDLE-aged CLASS groups, but then the MIDDLE-aged and YOUNGER-aged CLASS groups parallel each other at or below the level of the low-back merger. Due to the unique interspeaker variation exhibited by the two-way interaction of AGE and CLASS , the three linguistic variables of the [ɑwT], [ɑjT], and [ɑjC] nuclei are examined separately in the three-way factor analysis of the AGE, SEX and CLASS predictor variables.

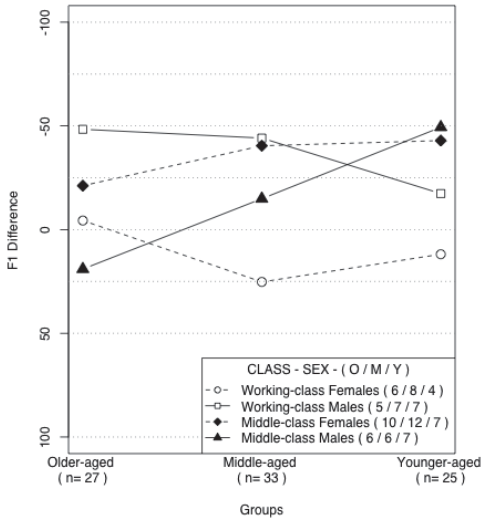
The results of the three-way comparison of AGE, SEX and CLASS is quite revealing, particularly in regards to the [ɑjT] and [ɑjC] nuclei. The first of three subfigures in Figure 6.25 displays the [ɑwT] nucleus' F1 difference from the low-back merger for the SEX and CLASS groups across the three AGE groups (i.e., in Subfigure 6.25a), while the Subfigures 6.25b and 6.25c display comparable results for the [ɑjT] and [ɑjC] nuclei. In these subfigures, color indexes each CLASS grouping, line type indexes SEX grouping and symbol type indexes each unique grouping. Furthermore, each of the three figures have a legend which displays the CLASS and SEX groupings and the number of speakers per SEX by CLASS group (i.e., "O" = OLDER-aged speakers, "M" = MIDDLE-aged speakers and "Y"=YOUNGER-aged speakers).



(a) The [ɑwT] diphthong



(b) The [ɑjT] diphthong



(b) The [ɑjC] diphthong

Figure 6.25: F1 difference of the LONG DIPHTHONGs' nuclei and the low-back merger as a three-way interaction AGE, SEX and CLASS /ɑj/

For all three linguistic variables, the YOUNGER-aged MIDDLE-class male and female groups exhibit the highest F1 mean difference from the low-back merger; while [ɑwT] and [ɑwC] exhibit F1 mean differences approximating 50Hz, the [ɑjT] exhibits a remarkable >75Hz F1 mean difference.

In Subfigure 6.25b, there exhibits a cross-over effect for the MIDDLE-aged and

YOUNGER-aged MIDDLE-class and WORKING-class male groups; however, in contrast, their female counterparts remain stable across the AGE groups. The raised variant of /ɑj/ and /ɑw/ before voiceless obstruents in words like [ʌwt] for *out* and [fʌjt] for *fight* is often regarded with significant amount of stigma, and is seen as a linguistic stereotype of Canadian speech (Chambers 1989, 76); however, it also can have local or covert prestige (Chambers 1989; Rosenfelder 2005; Chambers 2006; Tagliamonte 2012, 33). The results from Subfigure 6.25 may indicate the presence of prestige in the use of the raised and non-raised variants of [ɑjT] as a factor of CLASS, as well as, SEX in Michigan's UP speech community. Females tend to be the leaders of particular innovative forms from above (i.e., external to the system) for linguistic changes-in-progress (Labov 2001, 274; Tagliamonte 2012, 57). In the case of the raised variant of [ɑjT] in this UP speech data, MIDDLE-class females are stable in their preference for the raised variant while their male counterparts only become equal in this preference among the YOUNGER-aged speakers. Similarly, the non-raised variant of [ɑjT] is categorically used by the WORKING-class females, and only among the YOUNGER-aged males is there a tendency for this non-raised variant. The fact that the YOUNGER-aged MIDDLE-class males disfavor the non-raised variant for the raised variant suggest that there is a certain amount of prestige, albeit unconscious, for the raised variant. In contrast, the YOUNGER-aged WORKING-class males do the opposite and shift toward the non-raised variant aligning with WORKING-class females; potentially, the non-raised variant is perceived with prestige among the WORKING-class speakers.

Turning to Subfigure 6.25c, there exists clear trends for the raised and non-raised variants of the [ɑjC] linguistic variable as an interaction of AGE, SEX and CLASS. The WORKING-class male and female groups display a positive correlation toward the preference of the non-raised variant as a factor of AGE (i.e., as AGE decreases, the preference of the raise variant increases). In stark contrast, there exists a negative correlation toward the preference of the raised variant as a factor of AGE by the

MIDDLE-class male and female groups (i.e., as AGE decreases, so does the preference of the raised variant). This preference for the raised variant for [ɑjC] may be due to hypercorrection and an over application of Canadian raising or it may be indicative of an exogenous influence from neighboring regional American English varieties (Milroy 1996; Dailey-O'Cain 1997; Chambers 2006, 110). Nevertheless, the results here suggest that any raised variant of the /ɑj/ regardless of the following phonetic segment holds prestige among the MIDDLE-class groups — particularly among the YOUNGER-aged speakers, and led by the females. The non-raised variant, in contrast, may be garnering similar prestige but among the WORKING-class groups and led by the females.

This subsection has shown that the raised variant of the [ɑwT] nucleus is a relatively stable linguistic variable (i.e., with limited interspeaker variation). Additionally, the results from this subsection have also shown that all three factors, AGE, SEX and CLASS, are important for understanding the interspeaker variation that is found for the [ɑjT] and [ɑjC] nuclei. The YOUNGER-aged group's use of the raised variants of the [ɑjT] and [ɑjC] are led distinctly by the YOUNGER-aged MIDDLE-class females. In contrast, the WORKING-class females are shown to be the leaders of the non-raised variants of these linguistic variables. The clear preference toward the raised and non-raised variants, particularly among these YOUNGER-aged SEX and CLASS groups, suggest that a certain amount of prestige is associated with their usage; in fact, the MIDDLE-class and WORKING-class females are shown to be the avid users of their respective variant as a factor of AGE, which further supports the claim that these linguistic variables are changes-in-progress and hold prestige, albeit unconsciously.

6.4 Summary

The present chapter examined the acoustic vowel dynamics and sociolinguistic correlates in the speech of an 85-speaker subset of an English monolingual UP speech community. The results revealed that the raised variant of the [ɑw] nucleus and the low-back merger were stable linguistic variables. Furthermore, five linguistic variables were shown to be changes-in-progress, which included the raised variant of the /ɑj/ nuclei in pre-voiced and -voiceless CONTEXTs and the lowering and retraction of the FRONT LAX vowels (i.e., according to the apparent-time data); all five linguistic variables were led by YOUNGER-aged MIDDLE-class female speakers. Taken together, these findings stand as substantial evidence indicative of an exogenous Canadian influence on the speech of this UP speech community (i.e., exhibiting both the Canadian shift of /ɪ, ɛ, æ/ and Canadian raising of [ɑwT, ɑjT]). Additionally, while lingering substrate characteristics still remain in the speech of UP speakers (e.g., monophthongalization of [ow], the structural differences of the HIGH BACK and LOW BACK vowels as a factor of HERITAGE), it seems that the UP speech community is shifting — albeit unconsciously — toward new norms based upon exogenous regional influences.

CHAPTER 7

DISCUSSION

The present thesis examines the acoustic vowel qualities of five sets of linguistic variables (i.e., the FRONT LAX, LOW BACK, HIGH BACK monophthongs and the SHORT and LONG DIPHTHONGs) to determine if they vary with the sociolinguistic predictor variables of HERITAGE-LOCATION, BILINGUALISM, AGE, SEX, and CLASS in the speech of bilingual and monolingual Finnish- and Italian-heritage English speakers from Michigan's Upper Peninsula (UP). The 71-speaker subset of the 130-speaker corpus was the first of two analyses (c.f., Chapter 5) to determine if these sets of linguistic variables vary with the HERITAGE-LOCATION and BILINGUALISM factors among older-aged Upper Peninsula (UP) English speakers. The second analysis examined an 85-speaker subset of monolingual UP English speakers (c.f., Chapter 6) to determine if these sets of linguistic variables varied with HERITAGE-LOCATION, as well as the more traditional sociolinguistic variables of AGE, SEX, and CLASS. The two analyses revealed several vowel system characteristics of UP speech that will be argued in this chapter as developing from or have developed from both system-internal and system-external sources of linguistic change.

As such, this chapter will be closely examining the processes of transmission and diffusion as they pertain to the salient systematic patterns of the acoustic vowel qualities exhibiting sociolinguistic trends in the speech of Michigan's Upper Peninsula English speakers from Marquette County. Similar to the seminal sociophonetic vowel work done in the communities of New York City (Labov 1966), Philadephia (Labov

2001), Winnapeg (Hagiwara 2006), Toronto (Hoffman and Walker 2010), Montreal (Boberg 2004, 2005), and many other areas across North America (e.g., Boberg (2008); Labov et al. (2006)), the results presented in previous chapters are based upon a definable and stratified sample of a rural UP speech community which exhibit highly structured and salient sociolinguistic patterns. In order to investigate and account for the processes of transmission and diffusion of linguistic change, a sociolinguistic investigation must hold true to two underlying assumptions: 1) the sampled community is well-defined and 2) there are highly structured characteristics and trends within the speech of the sampled community (Labov 2007, 348). While keeping in step with the seminal sociophonetic and sociolinguistic studies previously mentioned along these lines, the thesis does offer a unique opportunity for examining transmission and diffusion as processes of change by focusing on a predominately rural and under documented English variety.[1]

Transmission and diffusion as processes of linguistic change first need to be defined. Labov (2007, 346) states that "[t]he continuity of dialects and languages across time is the result of the ability of children to replicate faithfully the form of the older generation's language . . . [and] . . . is the normal type of internal language change, termed change from below or change from within the system . . . ," which is the critical means of defining the process of *transmission*. Successive generations reproduce the structured patterns of a language variety by faithfully transmitting the linguistic and social constraints modeled by the older, adult forms (Labov 1994, 2007). However, such a "faithful" transmission is often affected by other factors that stimulates internal change between groups (e.g., inherit ages, language-dominance, ethnic-heritage). While this may lead to further divergence over time between these factor-groups, it may lead to the maintenance and the strengthening of linguistic and social continuity

[1]In the past decade, how these processes propagate throughout communities from urban to more rural communities has grown in interest among sociolinguists (Gordon 2000b).

within a particular group as well (Gordon 2000a). Structured patterns have shown to exist, albeit subtle, in the phonetic characteristics of ethnic-heritage groups (i.e., based on family heritage or ancestry) in several studies that acknowledge structural differences between groups to be in part due to the processes of transmission and change from below (Boberg 2004; Horvath 1985; Horvath and Sankoff 1987; Labov 2001, 2008).

Diffusion as a process of linguistic change, on the other hand, is the propagation of exogenous norms within a community; that is, innovative forms which have originated from outside the speech community and are used as a model for diffusing the new local norms. Since this change originates from outside the community, it is referred to as change from above (Labov 1966), and it typically results from "contact between communities" and the "transfer of features from one to another" (Labov 2007, 347; Tagliamonte 2012, 59). However, when a particular feature or set of linguistic variables diffuse from one community to another, the structural patterns of a linguistic phenomenon may weakened and be lost overtime, which " . . . implicates the constraints on variation as key indicators of mechanisms of change . . . " (Tagliamonte 2012, 59). Diffusion critically differs from transmission in that the linguistic innovation will diffuse from community to community by the way of adult speech, whereas children are a means in which structural innovations are transmitted from generation to generation with in a community.

Section 7.1 will discuss the linguistic variables that are undergoing system-internal sources of change on account of transmission of linguistic innovations generated within and propagated throughout the UP speech community. Section 7.2 will discuss the linguistic variables that are undergoing system-external sources of change as a result of dialect leveling toward older linguistic models for propagation and geographical diffusion of newer linguistic models for propagation within this UP speech community.

7.1 Substrate Influences as a Process of Transmission

In the analyses of the older-aged BILINGUALISM and HERITAGE-LOCATION UP speakers' vowel data reported in Chapter 5, HERITAGE-LOCATION groups are shown to exhibit salient structural differences (i.e., the Italian-heritage system's low vowels were higher and the back vowels were further advanced in the acoustic vowel space compared to either of the two Finnish-heritage systems). In contrast, the interaction of HERITAGE-LOCATION and BILINGUALISM revealed the BILINGUALISM groups for EAST-side Italians and WEST-side Finns (i.e., respective of HERITAGE-LOCATION grouping) were homogeneous in terms of their vowel configuration and structure. In addition to the clear divergence in the overall shape of the vowel system which is correlated with ethnic-heritage, there is evidence to suggest that dialect leveling has homogenized any marked or salient differences; such a hypothesis accounts for the lack of variation that exists between the bilingualism groups. However, it seems not all groups are conforming to local norms among these older-aged UP speakers — the EAST-side Finnish ENGLISH-dominant monolinguals are shown to be adopting forms different from their peers. While it is unclear if the retraction of the FRONT vowels and the lowering of the LOW BACK vowels among the OLDER-aged EAST-side Finnish ENGLISH-dominant monolinguals are linguistic innovations originating within the speech community or outside of it, there is strong evidence in support of systematic and structural differences between HERITAGE groups and homogeneity between BILINGUALISM groups. Subsection 7.1.1 will discuss the role of ethnic-heritage and the plausibility of these structural differences as result of a change from within the UP speech community.

7.1.1 Ethnic-heritage and Change from Below

Ethnic-heritage, or HERITAGE as operationalized in this thesis, takes into account the ancestral heritage of a speaker's background; the strict criteria that a speaker must be able to claim at least one grandparent as having full ancestry of either Finnish or Italian-heritage is used because, like many other regions of the Upper Midwest, most direct immigrants that arrived prior to the 1920s are no longer living, which leaves only first, second, third, fourth and even fifth generation ethnic-heritage speakers to make up the speech community (Loukinen 1980, 1997; Rudnicki 1987; Sturgul 1987). While the first, second and third generation immigrant-Americans are the oldest groups and tend to comprise the vast majority of the bilinguals, successive generations span a wider age range and are predominately monolingual English speakers. Furthermore, a decrease in in-group marriages based on ethnic-heritage and an increase of out-migration from the peninsula to find employment are two factors that have led to a gradual decline in the number of those that could claim Finnish or Italian as their primary ancestry (Loukinen 1997; Rudnicki 1987). In other words, many UP residents today are of mixed ethnicity (i.e., predominately a mixture of German, Cornish, Scandinavian, Finnish, Italian and/or other ancestral heritages), marry outside of their primary ethnicity, and leave their UP communities in order to find employment, complete post-secondary education, or a combination of the two.[2]

Ethnic-heritage is still an important factor to consider because it plays a critical role in defining the cultures and the group identities of the various communities located in Michigan's UP. It should be noted that this is not the only way of operationalizing and categorizing the factor of ethnic-heritage. Hoffman and Walker argue

[2]As a result, it can be quite difficult to find younger-aged UP residents that can claim full or even half ethnic ancestry of Finnish or Italian. Nevertheless, it would be interesting for further research to index this predicator variable by the degree of ethnic-heritage (e.g., quarter, half or full ethnic-heritage) and/or the degree of orientation toward one's ethnic-heritage.

that "...ethnic categorization of a speaker cannot rely (solely) on external measurements, but also must take account of the individual's' perceptions of their ethnicity" (2010, 41). Although the present thesis does not use a participant's perception of his/her ethnicity as a means of indexing ethnic-heritage,[3] the vast majority of the sociolinguistic interviews revealed that having either Finnish or Italian ancestry was a distinct, if not the most salient marker of their identity — usually second only to the identity marker of being native to Michigan's Upper Peninsula. Similar markers of identity are reported in the perception and identity using ethnolinguistic methods in Wisconsin and the Upper Peninsula (Remlinger et al. 2009; Remlinger 2006, 2009). In fact, it is likely that this strong sense of group identity, determined by one's ethnic-heritage and the community of practice shared by speakers, is a catalyst for the propagation of the structural differences reported among the speech of older-aged UP Finnish- and Italian-Americans.

The question remains, however, as to why the two immigrant-heritage vowel subsystems are systematically distinct for the low and back vowels? This finding cannot be attributed to a faulty normalization algorithm (i.e., which should have eliminated all biological/anatomical variation due to vocal tract size effects). If this were the case, the low and back vowels would have systematic and structured variation occurring orthogonal to the origin (i.e., both F1 and F2 would be affected) and thus be indicative of lingering anatomical variation. However, this does not align with the data; instead, the /ʌ/ and /ɔ/ vowels show systematic variation along only the F1 but not the F2 dimension, while /ʊ/ and /u/ vowels show systematic variation only along the F2 but not the F1 dimension. The alternative possibility is that this is actually a lingering substrate influence of Finnish and Italian as an L1 effect, first propagated by bilingual speakers but now transmitted by monolingual English speakers as well.

[3]See Hoffman and Walker (2010) for further details on how they used the perception of their speakers' ethnicity to index ethnic-heritage as a sociolinguistic predictor variable.

If this alternative hypothesis is to gain any currency, a discussion of each language's phonological system needs to be addressed.

The Finnish language has a relatively complex and symmetrical vowel system with eight vowel qualities (i.e., /i/, /y/, /e/, /ø/, /æ/, /ɑ/, /o/, /u/); additionally, this system has a complex arrangement of long and short vowel quality distinctions (Wiik 1965). This arrangement of eight phonemes, thus, exhibits a full trapezoidal vowel configuration as a system, which exists in all varieties of the Finnish language (Suomi et al. 2008, 22).[4] In contrast, the Italian system can be conservatively stated as having seven vowel phonemes (i.e., /i/, /e/, /ɛ/, /ɑ/, /ɔ/, /o/, /u/), which form a triangular configuration as a vowel system (Bertinetto and Loporcaro 2005, 136).[5] While the specific region in Italy from which these UP Italian-heritage speakers came from is not conclusively known,[6] the Italian systems in general have fewer vowel qualities and a different vowel system configuration in comparison to either the Finnish or English system (Flege et al. 1999, 1580; Escudero et al. 2014, 2978).

American English has a relatively large and complex vowel system with a diverse phonemic vowel inventory. The structural difference in the L1 vowel systems of these early Finnish- and Italian-immigrants may have transferred as an L1 influence during the acquisition of English (i.e., transition from either the Finnish trapezoidal system or the Italian triangular system to a much larger American English trapezoidal system). The subsequent transmission of this structural difference may have persisted in the speech of successive generations of immigrant-Americans. Finnish immigrants are likely to have been able to closely approximate the English system since they

[4]Some phonetic variation does occur with the /æ/, /ɑ/ and /o/ phonemes across dialects (Kuronen 2000; Suomi et al. 2008).

[5]However, there can be as many as eight and as low as five vowel qualities, particularly among southern Italian dialects (Flege et al. 1999, 2976).

[6]Between 1876-1900, Italians migrating to the Keweenaw Peninsula (i.e., a region northwest of Michigan's Marquette County) were primarily from northern regions of Italy; however, Italians that immigrated to the region in later decades were primarily from the southern regions of Italy (Menghini 2004, 1).

are both trapezoidal in shape, while the higher low vowels and retracted back vowels of the Italian-heritage English system may be due to the Italian's system being a smaller and triangular in configuration. However, under this hypothesis, the two ethnic-heritage English systems over time must have become more and more similar with only slight lingering traces of the structural differences remaining. Labov notes that children tend to avoid the "accented" speech of their caregivers and tend "not to acquire the foreign accent of their parents" (2008, 316-317). The Italian-immigrants and their children would have tried to eliminate any salient structural differences, leaving behind only the lingering structural difference of the back and low vowels. For the UP Finnish- and Italian-heritage speakers today, this structural difference between the two systems is likely below the conscious awareness of the speech community. If this hypothesis is true, the structural difference may linger yet within the community for some time as a relic of a substrate influence — eventually, however, this structural difference may weaken to the point of being lost completely within this speech community (Boberg 2012; Labov 2008).[7]

In contrast, the monophthongization of /ow/ as a substrate phenomenon does not show any sign of weakening in the UP speech. As previously shown, Finnish and Italian are languages that have the phoneme /o/ and are both regarded as having monophthongal qualities; in English, this is not the case. The phonetic realization of the American /ow/ is typically regarded as an upgliding diphthong (e.g., [oʊ] or [ou]). However, western areas of the Upper Midwest (i.e., speech communities heavily influenced by German and Scandinavian languages) have reported monopthongal variants of /ow/ (Allen 1973; Nguyen 2011; Rose 2006), and such findings have been argued to be a substratum effect (Allen 1973). Based on an ethnographic investigation of a rural town in Wisconsin, Rose (2006) found that the two variants of /ow/

[7]This may give way to dialect leveling or incoming exogenous models of linguistic innovation currently being adopted by the younger portions of the population.

was correlated with sex and the social distinctions of occupation and education; while the monophthongization of /ow/ was regarded as the default form in the community (i.e., used by the men and those in professional occupations). Females were the only ones to use the upgliding variant which might indicate an incoming form from outside the community (Labov 2001; Rose 2006). In the Marquette County, however, there does not seem to be any indication that the upgliding variant of /ow/ is taking hold among UP speakers (i.e., besides HERITAGE-LOCATION, all other sociolinguistic factors do not exhibit correlation with the Euclidean distance (ED), between the nucleus and offglide of the /ow/ linguistic variable, as reported in Chapters 5 and 6). The interspeaker variation of /ow/ that does exist in the UP speech is slight and correlates with LOCATION rather than HERITAGE; although the EAST-sided residents have longer EDs in comparison to their WEST-side counterparts, it is important to note that all exhibit EDs resembling a monophthongal quality rather than a diphthongal one.[8]

Both the structural difference of the back and low vowels and the monophthongization of /ow/ are substrate effects from both the L1 of Finnish and Italian transmitted by successive generations. However, unlike the back and low vowels in UP speech, the monophthongized variant of /ow/ does not show any sign of weakening, and in fact, it can be regarded as a relatively stable linguistic variable within this speech community.

7.2 Exogenous Influences as a Processes of Diffusion

The two main analyses performed in this thesis reveal two processes of diffusion: 1) a process of dialect leveling toward American English norms in the speech of the

[8]While the /ej/ SHORT DIPHTHONG maintains it's diphthongal quality, it's uncharacteristically short trajectory may also be on account of this substratum effect; however, further research is required to test this hypothesis.

older-aged speakers as a factor of BILINGUALISM, and 2) the more recent process of geographic diffusion of Canadian English norms among the MIDDLE- and YOUNGER-aged monolinguals as a factor of SEX and CLASS. The leveling of dialect variation refers to the disuse of "marked variants" by speakers as a way of homogenizing, or mutually converging, the speech of a particular community (Trudgill 1986, 98; Tagliamonte 2012). Geographical diffusion refers to the wave-model of diffusion in which the spread of linguistic forms propagate from urban centers to other urban centers with rural areas adopting the innovative forms endmost (Kerswill 2002, 188). The two processes of diffusion are distinct, yet they both involve the propagation of a linguistic change through the speech community based on some exogenous influence. Both types of diffusion are concurrently shaping the English language variety spoken in Michigan's Marquette County. Subsection 7.2.1 will examine the process of diffusion as it relates to dialect leveling, while Subsection 7.2.2 will examine geographic diffusion of new linguistic forms which are being adopted within this UP speech community.

7.2.1 Dialect Leveling among Older-aged UP Speakers

With the exception of the EAST-side Finnish ENGLISH-dominant monolinguals,[9] there is strong evidence of dialect leveling among the BILINGUALISM groups respective of each HERITAGE grouping. The process of dialect leveling involves the homogenization of salient linguistic forms within the speech community by purging any "marked" linguistic phenomena which are regarded as "unusual or in the minority" (Trudgill 1986, 98). Using the HERITAGE-LOCATION factor, which examines both geographic

[9]The divergence of the EAST-side Finnish ENGLISH-dominant monolinguals and the other two BILINGUALISM groups in Figure 5.23 may be due to: (1) low speaker count and therefore be subject to individual speaker's idiosyncrasies, or (2) change-in-progress led by these two speakers. The first of the two is the most likely scenario since the two speakers are patterning similarly but differ in their sex and background and have widely different ages.

residency within the county and the ethnic-heritage of the speaker, the results from the older-aged 71-speaker subset did not find differences between the EAST-side Italians' and WEST-side Finns' monophthongs — that is to say, this lack of variation in the speech of Marquette County residents from the EAST-side to the WEST-side of the county and for both HERITAGE groups indicates dialect leveling.

To account for the leveling process of dialect variation, the process of speech accommodation needs to be considered (i.e., the "convergence" of mutually intelligible dialects) (Kerswill 2002; Trudgill 1986). Explaining the community-wide phenomenon of dialect leveling with the speaker-by-speaker interaction of speech accommodation requires a unique situation. In order for dialect leveling to take root, speakers of mutually intelligible yet distinct dialects in a particular community must come together in the linguistic marketplace to participate in "short-term accommodation" acts, which over time, these continued accommodations will lead to "long-term accommodation" acts — essentially, leveling any salient dialect differences (Sankoff and Laberge 1978; Trudgill 1986; Kerswill 2002, 188).

Overt social pressure to "Americanize" (i.e., to give up immigrant-heritage practices) was also a strong linguistic motivator not only for immigrants to acquire English but to encourage their children and grandchildren to master it. This was the situation for many UP communities in the first half of the twentieth century, where established and developing rural mining towns comprised of diverse ethnic-heritage communities experienced an increase in contact between ethnolects coupled with pressure to conform to American culture (Leinonen 2014; Simon 2005). The situation was primed for the development of dialect leveling to take shape among these early UP speech communities.

Where the greatest amount of variation would be expected (i.e., between the HERITAGE-dominant bilinguals' system and the ENGLISH-dominant monolinguals' sys-

tem), there exists very little difference for either HERITAGE-LOCATION group.[10] If there were any marked L1 substrate vowel features, those features were likely purged by the children and grandchildren of UP immigrants as a way to avoid being perceived within the community as having foreign-accented speech (Labov 2008). The vast majority of the speakers in the older-aged 71-speaker sample were born after 1920,[11] and as such, these older-aged speakers comprise of the second and third generation, and even some first generation, Finnish- and Italian-Americans. Among the first, second and third generation immigrant-American children, there was immense pressure to speak the English language in the Upper Peninsula during the late nineteenth and early 20th century, even though many immigrant enclaves existed where ethnic-heritage languages were heard or read outside the home (i.e., at church services, public events and social gatherings, and in ethnic-oriented newspapers). However, by the mid-1950s and 1960s, English replaced Finnish or Italian at venues where they once were used; for example, church services held in Finnish or Italian were delivered in English instead, and many of the non-English newspapers gradually shifted to English only or went out of print entirely (Holmio 2001; Kostiainen 2014; Simon 2005). Many of the HERITAGE-dominant bilinguals and ENGLISH-dominant bilinguals reported during the sociolinguistic interview that they had a strong aversion toward the use of their heritage language outside the home, preferring to use English when at school and among their peers.[12]

The external source of pressure on the OLDER-aged speakers in the 20th century to use English rather than their heritage language, it seems, was only the first step

[10]Of course, the structural difference, previously noted regarding the back and low vowels, exists between these two groups, but differences between the BILINGUALISM groups do not exist respective of each HERITAGE-LOCATION grouping (c.f., Subfigure 5.21).

[11]Four speakers were born earlier: 1918, 1919, 1914, and 1908; the oldest subject in the 130-speaker corpus was 100 years old at the time of recording and she was a child of Finnish-immigrant parents.

[12]Most subjects reported that when given the option to use either the heritage language or English among friends, English was strongly preferred; for many of the ENGLISH-dominant bilinguals, and some of the HERITAGE-dominant bilinguals, English was even preferred in the home.

toward conforming to the linguistic models of "Americanization." The homogenization of monophthongs for the BILINGUALISM groups stands as strong evidence for dialect leveling, and it seems, the next step was taken toward the elimination of any phonetically salient vowel distinctions in their speech.[13] Thus, it can be said that the older-aged speakers (i.e., successive generations of immigrants) have favored to incrementally adjust their speech toward homogenized, non-salient local norms. This finding is not surprising since many other sociolinguistics studies have shown that immigrant-heritage languages have limited effects on the continued development of ethnolects in the United States and Canada due to the exogenous pressure on children to conform toward "non-accented" speech (Shuy et al. 1967; Woods 1979; Labov 2001; Labov et al. 2006; Labov 2008, 317, Boberg 2012).

7.2.2 Linguistic Diffusion among Monolingual UP Speakers

The other type of diffusion refers to the propagation of external linguistic norms spreading from one urban center to another with the rural regions last to be affected by the linguistic change; this is known as geographical diffusion (Kerswill 2002; Tagliamonte 2012). The population size of a social center and neighboring social centers relative to one another may be used in order to indicate where linguistic norms begin and how they propagate thereafter (Trudgill 1974). Based on the *Geographic Areas Reference Manual* (1994), the Census Bureau has consistently defined an urbanized area as having population density of 50,000 or more (LaMacchia et al. 1994). The largest city in Michigan's Upper Peninsula reports a population less than half that size (i.e., the city of Marquette in Marquette County reports approximately 21,500 residents based on 2010-2013 population estimates). In order to get a sense of the geographic and demographic landscape surrounding this relatively small UP rural-

[13] Of course, there could be other linguistic phenomena that still mark their speech as being "accented."

urban center and how it might be seen as a conduit for the propagation of exogenous linguistic forms, a comparison of proximity and population size of other urban centers to Marquette is needed.[14]

The next nearest urban center to Marquette is Sault St. Marie, Ontario. This urban center is considerably larger in population size with 79,800 residents (Statistics Canada 2011) and neighbors the second largest urban center in Michigan's Upper Peninsula (i.e., Sault St. Marie, Michigan, which reports a population size of approximately 14,000 residents). The towns of Marquette and Sault St. Marie are only 165 miles from one another along the M-28 route from central UP to the north-eastern most tip of the peninsula. Directly across the St. Marie's River, connected by the International Bridge, is Sault St. Marie, Ontario. The next closest urban center to Marquette is Green Bay, Wisconsin, with a distance of 176 miles and a population size of approximately 105,000 residents. Additionally, Appleton is only 209 miles away from Marquette and reports a population size of approximately 73,000 residents. From a strict hierarchical model of diffusion (Trudgill 1974), one would suspect that linguistic norms of the largest neighboring urban centers to have more influence on the linguistic practices of speakers living in and around the rural-urban center of Marquette.[15] However, other factors have been shown to play a vital role in directing, redirecting and stopping the propagation of linguistic forms including geological barriers (e.g., mountain ranges, rivers, lakes), social barriers (e.g., racial isolation of neighborhoods in major urban centers), and in some cases, even geopolitical borders may serve as linguistic barriers of diffusion if linguistic forms mark social affiliations and identities (Boberg 2000; Labov 1972; Labov et al. 2006).

While approximately the same distance from the much larger social centers of Wis-

[14]Marquette will be referred to as a "rural-urban" center due to its limited population size but unique status as a central social hub in Michigan's Upper Peninsula.

[15]In other cases, the complete reverse occurs where the propagation of linguistic norms begins in more rural areas and expands outwards toward more urbanized areas (Bailey et al. 1993).

consin (i.e., areas currently being affected by the Northern Cities Vowel Shift (NCVS) as reported in Labov et al. (2006)), the speech community sampled in Michigan's Marquette County exhibits no sign of the Northern Cities Vowel shift (e.g., distinct low-back vowels, raised /æ/, fronted /ɑ/). Instead, this UP speech community exhibits the salient vowel characteristics typically found in varieties of Canadian English (e.g., the stabilized low-back merger, the fronting and lowering of the FRONT LAX vowels, the raised and fronted variants of the /ay/ and /aw/ nuclei before voiceless obstruents). The remainder of this subsection seeks to reveal if the three sets of linguistic variables (i.e., LOW BACK vowels, FRONT LAX vowels, and LONG DIPHTHONGs) are in fact based upon external models of diffusion or if they are independently motivated linguistic patterns coming from and propagating within the speech community.

7.2.2.1 Stability and Linguistic Change from Above and from Below

Another way of looking at these processes of transmission and diffusion of linguistic innovations within a speech community is through the lens of linguistic stability, change from above or change from below. Labov refers to the linguistic change from above as the "importation of elements from other systems" (2007, 346); in contrast, change from below refers to the transmission of linguistic innovations originating from and and propagating throughout the speech community. Furthermore, the third outcome is linguistic stability, in which relatively stable uses of a variant or variants of a linguistic variable are present within the speech community. Four principles capture the trends of stability and diffusion from above and below that often correlate with socioeconomic status and sex within a speech community undergoing linguistic change (Labov 1994; Labov 2001, 188, 214, 266, 274, 292). Table 7.1 summarizes these four principles proposed by Labov (2001).

While not all sociolinguistic patterns follow the trends described in the table (Hi-

Table 7.1: Principles of linguistic stability and change (Labov 2001)

Principles	Type of Change	Description
(1)	CHANGE FROM BELOW	Originates from and lead by central interior social groups.
(2)	STABILITY	Women tend to adopt prestigious variants, and disfavor stigmatized variants, more than men.
(3)	CHANGE FROM ABOVE	Women tend to adopt prestigious variants more than men.
(4)	CHANGE FROM BELOW	Women tend to adopt prestigious variants more than men.

biya 1988; Morales 1986), these trends do seem to describe the findings for the vast majority of the sociolinguistic studies since Labov's seminal works in Martha's Vineyard, New York and Philadephia and equally important works thereafter (Labov 1966, 1972, 2001; Trudgill 1972; Mees 1987; Milroy et al. 1994; Tagliamonte 2012, 62-63). Such studies, as well as many others, report findings that correlate with these two important predicator variables of socioeconomic status and sex, which gives currency to these principles of linguistic stability and change. For most linguistic variables, one of the competing variants typically acquires some sort of prestige (Sturtevant 1947; Labov 1972, 3); that is, speakers denote value toward the usage of an innovative form based upon a perceived standard or variety, and the variant's usage is often associated with upward mobility (Trudgill 1972, 179-180). In terms of linguistic innovations that originate within a speech community (i.e., change from below; Principle 1), it is the middle socioeconomic groups in the social hierarchy (i.e., working and middle class) that tend to be the leaders of the propagation due to their orientation toward advancing in the social hierarchy. For the second, third and fourth principles, women tend to adopt prestigious forms at a faster rate than men, regardless if a linguistic variable is stable or if it is changing from above or below; again, this has to do with social mobility since women tend to be more upwardly mobile, and so, they use language (i.e., through the use of "linguistic extremes") to gain access to a higher socioeconomic group (Eckert 2000, 192; Labov 2001, 291). As such, prestigious vari-

ants tend to be used more often by working- or middle-class females than by working- or middle-class males, with men tending to lag a full generation behind the women in the linguistic transmission or diffusion of an innovative form (Labov 2001, 501). Labov claims that women in the working or lower-middle class groups, as upwardly mobile and motivated non-conformists, tend to possess "...the particular ability to confront established norms and the motivation to defy them ..." (2001, 516).

What is the situation regarding the linguistic stability and change among women and CLASS groups in Michigan's Upper Peninsula with regards to the monolingual UP English speech community? Based on the analysis of Chapter 6, the sets of linguistic variables can be described in terms of the phonetic patterning of variants and the sociolinguistic trends to which those patterns correspond as displayed in Table 7.2. In order to summarize the results of the various linguistic variables reported in the previous chapter and to get an overall sense of the acoustic vowel characteristics of UP English, this table displays the main sets of linguistic variables that capture the important phonetic patterns and their correlation with major sociolinguistic trends. The sets of linguistic variables are organized by type of linguistic change and each will be discussed in turn.

Table 7.2: The phonetic patterns and sociolinguistics trends of the FRONT LAX, LOW BACK, and LONG DIPHTHONG linguistic variables among the 85 monolingual English UP speakers

Type	Set of Linguistic Variables	Linguistic Variable	Description of Phonetic Patterns	Sociolinguistic Trends (lead by)
CHANGE FROM BELOW (transmission)	Low and HIGH BACK monophthongs*	/æ/ /ɑ/ /ʊ/ /u/	structural difference (i.e., reduced compared to the 71-speaker subset)	EAST-side Italians vs. Finnish-heritage groups
	SHORT diphthong*	/ow/	monophthongization	stable; no leaders
CHANGE FROM ABOVE (diffusion)	FRONT LAX monophthongs	/ɪ/ /ɛ/ /æ/	lowered/retracted (i.e., to varying degrees)	EAST-side Finns; MID-class, YNG females
	LOW BACK monophthongs	/ɑ/ /ɔ/	merged together	stable; no leaders
	LONG diphthongs	/awT/	raised nucleus of [ɑwT];	MID-class, YNG males
			non-raised nucleus of [ɑwT]	WRK-class, females
			non-fronted nucleus of [ɑwT]	stable; no leaders
		/ajT/	raised nucleus of [ɑjT];	MID-class, females;
			non-raised nucleus of [ɑjT]	WRK-class, females
			fronted nucleus of [ɑjT]	stable; no leaders
		/ajC/	raised nucleus of [ɑjC];	MID-class, females;
			non-raised nucleus of [ɑjC]	WRK-class, females
			fronted nucleus of [ɑjC]	stable; no leaders

*Notes: - The term "Low" refers to both the /æ/ and /ɑ/ vowels here; not to be mistaken for the set of LOW BACK vowels.
- The /ej/ linguistic variable does not show any relevant phonetic patterns or sociolinguistic trends.

The structural difference of the low and HIGH BACK linguistic variables is argued to originate as an L1 influence through the process of transmission, and therefore, change from below. It is shown to be present in the speech of the eighty-five monolingual UP English speakers, particularly between the EAST-side Italians and the two other Finnish-heritage groups. When this result is compared with the similar finding among the seventy-one older-aged bilingual and monolingual UP English speakers, the structural difference among these monolinguals is observationally smaller — indicative of the continued process of dialect leveling within the speech community (i.e., which is a separate process of diffusion and change from above). The other linguistic

variable of interest that is argued to be a change from below is the monophthongization of the /ow/ SHORT DIPHTHONG; while originating from an L1 influence through the process of transmission, this monophthongized variant is clearly preferred and regarded as a stable linguistic variable in the UP speech community (i.e., regardless of AGE or BILINGUALISM).

The linguistic variables undergoing changes from above, the FRONT LAX and LOW BACK vowels and the LONG DIPHTHONGs, will now be considered. The FRONT LAX vowels all exhibit various degrees of lowering and retraction as a factor of AGE, with the most extreme in the speech of MIDDLE-class YOUNGER-aged EAST-side Finnish females followed by their male counterparts and the MIDDLE-class YOUNGER-aged EAST-side Italian females. The fact that YOUNGER-aged speakers are significantly more advanced in the lowering and retraction of the FRONT LAX vowels in comparison to the MIDDLE-aged speakers (i.e., both which are more advanced than the OLDER-aged speakers) indicates a change-in-progress, and one that is argued to be from above as an exogenous influence. The first piece of evidence is indicative of change from above, where incoming variants are led by the upwardly oriented social groups (i.e., by MIDDLE-class speakers and by females). The second piece of evidence is that males are lagging behind the females as a factor of HERITAGE (Labov 2001), where the most extreme cases of fronting and retraction are reported in the speech of both the EAST-side Finnish females and males. In contrast, the same degree of fronting/retraction is only reported in the speech the EAST-side Italian females and not the males. The last piece of evidence that this is a change from above comes from the fact that the fronting and retraction of the FRONT LAX vowels is present, but just not as extreme, in the speech of the more rurally located WEST-side Finnish females and not at all among their male counterparts. This is the sociolinguistic pattern that would emerge according to the process of geolinguistic diffusion where linguistic extremes originate in the speech of those residing in the more urbanized areas of the county (i.e., EAST-side) and then dispersing to less urbanized areas (i.e.

first appearing among the WEST-side MIDDLE-class women). Middle-class women are the clear leaders in the diffusion of the fronted and retracted variants of the FRONT LAX vowels, and because other groups are following their lead it is likely that these variants garner prestige — albeit unconscious — in this UP speech community. One hypothesis as to why HERITAGE is shown to be an important factor is that the EAST-side Finns, as a larger and historically more dispersed ethnic-heritage group, are more in tune with the innovative forms that surround the rural-urban social centers in the county. In contrast, the EAST-side Italians as an ethnic-heritage group have always been established in these rural-social centers and still form close-knit internally focused groups (i.e., at least among the EAST-side Italian males, since they presently do not exhibit the use of the prestigious variant while the EAST-side Finnish males clearly do).

Clarke, Elms, and Youssef claim that the lowering and the retraction of the FRONT LAX vowels, as a set of linguistic variables defining the Canadian shift, is a chain shift started by the formation of a merger in the low back quadrant of the acoustic vowel space (1995, 212). If indeed the lowering and retraction of the FRONT LAX vowels are a geolinguistic diffusion process and change from above currently underway in the speech of UP residents (i.e., using neighboring varieties of Canadian English as linguistic models), then this presupposes that the merging of /ɑ/ and /ɔ/ must have taken place prior to the elements of the Canadian shift, and thus be further along, in the speech of the UP community. In fact, this is exactly what is found in the data for this thesis. Not only are the low-back vowels fully merged in the speech of the eighty-five UP English monolinguals, but they are merged in the speech of the older-aged bilinguals as well. While there is not any evidence of a SEX effect for the LOW BACK linguistic variables (i.e., which might indicate prestige following Labov's second principle of linguistic change), a clear preference of the merged variants indicates linguistic stability. The strong presence of the low-back merger coupled with evidence of a change-in-progress for FRONT LAX vowels support the argument that exogenous

influences from Canada are currently shaping the vowel characteristics of the UP speech community in Marquette County.

The LONG DIPHTHONGs (i.e., the nuclei of /ɑwT/, /ɑjT/ and /ɑjC/) also report evidence of stability along the F2 dimension and changes-in-progress along the F1 dimension as linguistic change from above; however, the situation is a bit more complex than previously seen with the FRONT LAX and LOW BACK vowels. The fronting of these variants in UP speech show the opposite pattern of what would be expected if they were to follow the tendencies of neighboring varieties of Canadian English. In Toronto Canadian English, /ɑw/-fronting is shown to be occurring as a change-in-progress (Easson 1997), and in all Canadian English varieties, there is not any evidence of /ɑj/-fronting. In contrast, the UP speech data reports a clear preference for the non-fronted variant of the /ɑw/ nucleus and for the fronted variant for the /ɑj/ variant. While this is true, the /ɑj/ in a pre-voiceless context (i.e., [ɑjT]) tends to be less fronted, lower in duration, and further away from its offglide than when followed by a voiced obstruent (i.e., [ɑjC]). All three characteristics follow the tendency of patterns of Canadian raising mitigating the process of undershoot common among English diphthongs (Lindblom 1963; Gottfried et al. 1993; Moreton and Thomas 2007, 41-42). Currently, it is unclear if the significant fronting of the /ɑj/ nucleus is a linguistic innovation due to transmission or diffusion (i.e., approximating the acoustic position more like [æ] rather than the centralized position of [a] or the back position of [ɑ]); however, the observational "asymmetric assimilation" pattern between the [ɑjT] and [ɑjC] along the F2 dimension is characteristic of an exogenous influence modeled from Canadian norms (Moreton and Thomas 2007, 42).

Turning to the F1 dimension, the raised variants of these three linguistic variables are clearly most advanced among MIDDLE-class female speakers, while the non-raised variants are more advanced among the WORKING-class females. Each of the three linguistic variables are exhibiting unique phonetic patterns that correspond to socio-

linguistic trends as described below:

- The raised nucleus of [ɑwT] at first seems relatively stable with YOUNGER-aged MIDDLE-class males leading; however, all other YOUNGER-aged groups have slightly lower variants than these MIDDLE-class males. Even the YOUNGER-aged MIDDLE-class females are patterning more closely with the other WORKING-class groups and all exhibit lower instances of the raised variant in comparison to either their MIDDLE-aged or OLDER-aged counterparts. This may indicate that the raised variant of [ɑwT] is losing prestige within the community, and instead the non-raised variant may be gaining prestige as an indicator of local norms led by the WORKING-class. Under this hypothesis, such a newly developing sociolinguistic trend would account for why the YOUNGER-aged MIDDLE-class males are patterning distinctly different from the other groups (i.e., they actually lag behind, as would be expected following principles of linguistic change). Such an interpretation would suggest a change from above toward local norms originating within the speech community and diffusing from WORKING-class groups. Additionally, this also suggests that there may be some degree of conscious awareness and stigmatization in the use of the raised variant of the [ɑwT] nucleus. This would not be surprising since other researchers that have examined this phenomenon in other English varieties report higher instances of overt awareness of the raised variant of /ɑw/ in words like *about* sounding more like *a boat* (Chambers 1989, 2006; Vance 1987). Interestingly, the same degree of conscious awareness through overt commentary by speakers is not reported for the raised variant of the /ɑj/ nucleus.

- The raised and non-raised variants of the [ɑjT] nuclei are relatively stable for the MIDDLE-class females and WORKING-class females respectively; in other words, MIDDLE-class females categorically prefer the raised variant while the WORKING-class females categorically prefer the non-raised variant. The categorical

usage of each variant by the female CLASS groups indicates a certain amount of prestige associated with each variant. The non-raised variant is associated with prestigious local norms led by the WORKING-class females, while the raised variant is associated with prestigious exogenous norms led by the MIDDLE-class females. This is further supported by evidence of cross-over effects showing that the YOUNGER-aged MIDDLE-class males are aligning with their female counterparts and the YOUNGER-aged WORKING-class males are aligning with their female counterparts. Once again, the males lag behind the change-in-progress led by the females respective of each CLASS grouping.

- The non-raised variant of the /ɑjC/ nucleus would align with the strict phonological conditioning environment associated with Canadian raising in varieties of Canadian English while the raised variant would be more akin to other varieties of American English (Chambers 2006). The raised variant would suggest the loss of phonetic context as an important conditioning factor for this linguistic variable. In the speech of UP residents, it seems that the raised variant of the [ɑjC] nucleus is favored by the MIDDLE-class groups and disfavored by the WORKING-class groups as a factor of AGE, suggesting a change-in-progress. Once again, in both cases the females are leading with males lagging a generation behind as a factor of AGE and CLASS. Similar to the sociolinguistic trends exhibited with the /ɑjT/ linguistic variable, the MIDDLE-class females and males are converging toward the use of the raised variant as a factor of AGE for the /ɑjC/ nucleus; the same is true for the WORKING-class females and males, except their convergence is toward the non-raised variant.

With regards to the /ɑj/ nucleus (i.e., either /ɑjT/ or /ɑjC/), there is at least two, perhaps as many as three, changes-in-progress taking place within UP speech community (i.e., MIDDLE-aged and YOUNGER-aged women lead the use of the innovative forms, while men tend to lag a generation behind). The first refers to the raised vari-

ants of /ɑjT/ or /ɑjC/ which are restricted to the MIDDLE-class group and likely due to change from above (i.e., served by linguistic models for diffusion by neighboring varieties of Canadian English). The preference for non-raised variants of /ɑjT/ or /ɑjC/ is restricted to the WORKING-class group, which may indicate either: 1) a separate change-in-progress as a change from below (i.e., the "faithful" transmission of local norms by successive generations) or 2) a change from above (i.e., as a response against the exogenous norms propagated by the MIDDLE-class females). The other change-in-progress refers to the non-raised variant of the /ɑwT/ nucleus and is led by the WORKING-class group in the use of the non-raised variant.[16]

The FRONT LAX and LOW BACK vowels and LONG DIPHTHONGs as sets of linguistic variables provide a cohesive, albeit complex, account of the acoustic vowel characteristics and sociolinguistic trends present in the speech of the predominately monolingual English speaking community in Michigan's Upper Peninsula. There is strong evidence to indicate a change-in-progress using the apparent-time construct presented in this thesis. The FRONT LAX and LOW BACK vowels and LONG DIPHTHONGs all exhibit interspeaker variation as a factor of AGE — but is this a case of generational change or age-grading? The sociolinguistic patterns examined in this thesis do not exhibit the curvilinear pattern typically associated with age-grading,[17] and the linguistic variables themselves are of the type to be below social awareness (Labov 1994, 111-112).[18] A curvilinear pattern as a result of age-grading would be indicative of a higher usage of standard forms among the MIDDLE-aged group since these speakers are active participants in the linguistic marketplace of the workplace (i.e., where conservative forms are preferred). This contrasts with the typically less conservative speech of speakers in their early twenties or speakers past retirement age

[16]It is perhaps too early in the development of this change to venture any additional claims.

[17]A curvilinear pattern is a sociolinguistic pattern typically found when MIDDLE-aged groups pattern systematically differently (i.e., toward more conservative or "standard" variants) from their older and younger peers, and as such, the data usually takes the form of a U-shaped pattern, or its inverse, as a factor of AGE.

[18]The exception to this claim is the raised variant of the /ɑw/ nucleus.

(Tagliamonte 2012).[19] However, the sociolinguistic trends in the UP data exhibit either linear patterns of linguistic change of an innovative form with the YOUNGER-aged speakers using the linguistic extreme or linguistic stability of variants for a linguistic variable regardless of the AGE factor.

At this point of the discussion, the main concern to sort out is the origin of the linguistic change that is taking hold of the YOUNGER-aged UP speakers in Michigan's Marquette County. Any one of the linguistic variables, or even a single set of linguistic variables, discussed in this subsection may not have been strong enough evidence to suggest the origin of the changes-in-progress. However, the accumulation of evidence from three sets of linguistic variables exhibiting similar sociolinguistic trends presents a strong case that these innovative forms led primarily by MIDDLE-class females are diffusing across the UP speech community based upon linguistic models of diffusion associated with varieties of Canadian English. The source of this exogenous influence likely stems from neighboring urban centers such as those located in the eastern regions of the Upper Peninsula and Ontario. The last subsection will discuss the two sources of diffusion that have taken place and are currently present in this UP speech community.

7.2.3 Sources of Diffusion as Linguistic Models of Innovation

The communities in Michigan's Upper Peninsula have undergone significant changes in the last hundred years. This subsection will offer two sources for propagation of linguistic change based upon: 1) American English perceived standards among older generations (i.e., first, second and third-generation immigrant-Americans) and 2) Canadian English norms among the younger generations.

[19] However, real-time data is needed to conclusively distinguish authentic change-in-progress across generations and age-grading (Labov 2001, 163).

7.2.3.1 Americanization as a Model for the Propagation of Linguistic Change

Early communities in Michigan's UP were comprised of a diverse mix of ethnic-immigrant groups that likely led to the beginning stages of dialect formation. The remote rural mining towns that describe many of the early communities in the peninsula created situations of "relatively intense interpersonal communication" whereby these ethnic-heritage groups spoke a heterogeneous set of English varieties (Kerswill and Trudgill 2005, 196). According to Kerswill and Trudgill's work on dialect formation, the subsequent stages that are likely to have occurred to form today's UP speech community began with the mixing of input dialects from different origins (i.e., English spoken by Finnish, Italian, Cornish, Irish and many other immigrant groups), followed by the process of dialect leveling (i.e., the perjuring of salient linguistic phenomena) and finally the process of reallocation (i.e., the retainment of non-salient linguistic phenomena) (2005, 197-199). The evidence of dialect leveling and lingering substrate effects among the seventy-one older-aged bilinguals and monolinguals in the present corpus (i.e., the homogeneity of monophthongs as a factor of BILINGUALISM, the structural difference of low and back vowels, the monophthongization of /ow/) corresponds with the second and third stages of dialect formation, where leveling and reallocating of linguistic phenomena begin to define the speech community. As a result, the UP speech communities by the mid-20th century were beginning to become a predominately monolingual English speaking community modeled after American English norms with lingering substrate effects. Dialect leveling toward American English norms was fueled by the strong presence of "Americanization" propaganda that persisted in the UP during this time in order to acculturate and shape the identity of immigrants' children and grandchildren toward American cultural and linguistic practices (Leinonen 2014; Simon 2005) — it included, but was not limited to, the prescribed use of American English.

7.2.3.2 Canadian English as a Model for the Propagation of Linguistic Change

This source of diffusion through dialect leveling toward American English norms, is not the only linguistic model in this UP speech community. The more recent linguistic model for diffusion is based upon the innovative forms associated with varieties of Canadian English (i.e., the low-back merger, the Canadian shift, raising of the /ɑw/ and /ɑj/ nuclei before voiceless obstruents), which is supported by the evidence that these innovative forms are being adopted and propagated by the MIDDLE-class women and are then followed by other adjacent social groups within this speech community. However, the situation is complicated further by contrasting evidence from the linguistic variables of /ɑw/ and /ɑj/ nuclei, where WORKING-class females seem to resist the innovative forms associated with the Canadian English model. Furthermore, MIDDLE-class groups tend to prefer the use of the raised variant of the /ɑj/ nucleus regardless of the phonological conditioning environment (i.e., raising the nucleus when followed by either a voiced or voiceless obstruent). Similar cases in other varieties of American English have reported a weakening of constraints for the linguistic phenomenon of Canadian raising, which is not present in varieties of Canadian English (Vance 1987; Rosenfelder 2005; Chambers 2006). It is due to this asymmetrical relationship that Rosenfelder suggests that "[w]ith respect to the [spread of the] phenomenon of raising, it would then be Canada that is influencing the United States, and not vice versa . . . " (2005, 97). This implies that American varieties' fail to retain the particular constraint of obstruent voicing during the diffusion process of this linguistic phenomenon (i.e., adoption and propagation of the innovative variant). It is interesting to note that while this seems to be the case in Michigan's UP speech, other areas of Michigan reporting instances of Canadian raising still maintain the conditioning environment (Dailey-O'Cain 1997). Evidence of /ɑj/-fronting and the non-fronting of /ɑw/ in UP English also stands in opposition to the Canadian model

of diffusion, since the reverse is found in Ontario and other varieties of Canadian English (Chambers 2006; Easson 1997). Nevertheless, the evidence in support of the Canadian English model of diffusion affecting the speech of the contemporary UP speech community outweighs any other competing claims of an exogenous influence (e.g., effects from the pre- or post-NCVS system).[20]

Based upon the present discussion, the Canadian model of diffusion is being spread by the YOUNGER-aged MIDDLE-class females within this UP speech community — however, the question that still remains is: how have these speakers gained access to the Canadian model in order to propagate the innovative forms in the first place? Recent migration patterns based on the 2006-2010 US Census estimates of Marquette County suggest that the community itself is relatively stable with less than 4% of the population having moved to the area from a different county within the same state, less than 1% having moved from a different state and less than one percent having moved from abroad (US Census Bureau 2000). Furthermore, a recent Canadian-immigrant presence is virtually non-existent (i.e., less than 0.05% based upon a older 2000 summary Census, which corresponds to more recent estimates). If models of linguistic change are not being brought in to the speech community by permanent residents with Canadian origins, two non-mutually exclusive hypotheses must be posed to account for this preference for Canadian norms: 1) temporary migration patterns of linguistic carriers to and from the speech community, and 2) a positive orientation toward Canada as a source of shared local identity.

The International Bridge linking the city of Sault St. Marie in Ontario and the town of Sault St. Marie in Michigan represent a vital link between the U.S. and Canada allowing for the flow of commercial truck crossing and the exchange of foreign and domestic traffic. Since the 1980s, the vast majority of the bridge traffic has consisted

[20]In addition to these phonological and phonetic traits shared with Canadian English, the UP speech is characterized as having lexical and pragmatic linguistic variables typically associated with Canadian speech (e.g., "toque" for winter cap, the ubiquitous "eh" as a pragmatic marker); such linguistic variables can be heard among older-aged, as well as, younger-aged UP residents.

of local automobiles conducting local trips across the U.S.-Canada border for employment or recreational purposes between the two social centers. In terms of commercial truck traffic across the bridge, over half of the traffic was restricted to routes between Michigan and Canada, as opposed to routes with other U.S. states (MDOT 2014c). Due to Marquette County's central location in the peninsula, a significant amount of Canadian truck traffic must pass through the central and western UP in order to get to western Canada and Wisconsin "... with local and tourism traffic" (MDOT 2007, 87). As a result, the M-28 and US-41 corridors hold statewide significance linking Sault St. Marie, MI, with Marquette, Ishpeming and Negaunee as well as other towns in the Keweenaw Peninsula such as Houghton and Hancock. While commercial truck traffic emanating from Canada is reported, there currently is not any evidence to suggest that either the strong presence of tourists originating from Canada exists in Marquette or a consistent stream of tourism traffic exists between Canada, Sault St. Marie and Marquette. As a result, the temporary migration of people between the U.S.-Canadian border by itself (i.e., based upon tourism or commercial truck traffic) is unlikely to account for why Canadian models of diffusion are taking root in the Marquette County's speech community.[21]

Upper Peninsula residents are consciously aware that their speech is perceived as "accented" or at least different from non-UP residents. During the sociolinguistic interviews, participants were asked if they have ever left the peninsula, and if so, where did they travel? Many participants took this opportunity to reminisce about short vacations taken and would even talk at length about their travels. One such participant, in her reminiscing about a trip to California taken with her husband, claimed that "... there were some people that even thought we're Canadians ... 'cause of the way we talk ..." (EAST-side Finnish MIDDLE-class Female; 42); similar reports of

[21] An additional source of temporary migration between the UP and Canada may be linked to the recreational sport of hockey (i.e., for both men and women) and other activities such as fishing, hunting and camping; however, the number of UP residents making the seasonal trips into Canada is presently unknown.

linguistic associations between UP and Canada are also reported in other work conducted in the peninsula (Remlinger 2009, 118). This participant was by no means an exception to the hundred and thirty individuals interviewed, as many of the participants showed social awareness that their speech is often marked with "Canadianisms" by non-UP residents. Though when pressed, most could not describe what "Canadianism" entailed, and those that could, usually leaned on lexical borrowings such as "toque" or "chook" (i.e., for WINTER CAP) or the pragmatic marker of "eh". Other participants talked about the recreational activities that they perceived the UP and Canada to have in common, such as fishing, hunting, hockey, snowmobiling and spending time out at a rustic cabin or cottage.[22] The shared linguistic and non-linguistic identity markers that link the UP with Canada have also been documented in the enthnolinguistic research done in the Keweenaw Peninsula (Remlinger 2006, 2009). However, Remlinger points out that UP residents, or "Yoopers", have a clear sense of an "authentic" local identity and a uniqueness of linguistic variables that define their dialect (2009, 119). The acknowledgement and use of these linguistic markers and other non-linguistic acts to express an individual's identity is known as the process of enregisterment (Milroy 2000, 2004; Silverstein 1998). Furthermore, neighboring regional identities are often contrasted against their own local identity by UP residents through the use of epithets as a way of strengthening this "Yooper" local identity.[23] For example, outsiders originating from Michigan's Lower Peninsula are known as "Trolls" since they live below or south of the Mackinac Bridge, while outsiders originating from Wisconsin are known as "Cheeseheads".[24] UP residents tend to project a positive association with Canada by associating the two regions as having similar

[22]This is also referred to as *camp* (NOUN) in the Upper Peninsula, which is wholly different from *to camp* (VERB) which is reserved for the act of camping.

[23]Historically, "Yooper" was initially a term of abuse for UP residents propagated by outsiders; several OLDER-aged participants that were interviewed still held a significant amount of abhorrence in the use of this term. However, over time the term was recasted as a term of endearment and is used by locals to mark their sense of local pride; many YOUNGER-aged UP residents now hold only a positive connotation in its usage. As of May 2014, Merriam-Webster's Collegiate Dictionary recognized the term *yooper* (Merriam-Webster, Inc. 2014).

[24]Canadians are referred to as "Canocks" following the Americanism by much of the U.S.

sets of cultural practices and linguistic markers, they also have developed a strong sense of pride that is continually shaping the local identity and linguistic practices in opposition to external influences.

The source of the Canadian model of diffusion, led by the MIDDLE-class females and propagated by adjacent social groups, is argued to be a response of shared cultural and social ties between the Canadian and UP identities, additionally supported by a limited amount of short-term limited migration of groups to and from the neighboring geographic regions. Under this hypothesis, the resistance of Canadian-like variants in the speech of the WORKING-class females is a result of their strict adherence to the registered linguistic norms of local UP speech that presently define the "Yooper" local identity. Similar results in the maintenance of local norms were also found in Belfast (Milroy 1987), where local linguistic norms were present in the speech of individuals forming strong networks typically associated with working-class groups. In contrast, weak networks exhibited a tendency toward exogenous linguistic norms and were associated with non-working-class groups (Milroy and Milroy 1992, 17). Such a situation is taking place in Michigan's UP, where the MIDDLE-class speakers form weak networks that are influenced by an more recent external model of linguistic diffusion (i.e., particularly among the younger generations). The WORKING-class speakers form close-knit, internally focused social networks, and as a result, they are presently able to resist more recent innovative linguistic forms. These WORKING-class speakers maintain the local linguistic norms defined by lingering substrate effects and older linguistic forms modeled after American English norms. For the majority of the linguistic variables considered in this thesis, the WORKING-class groups have successfully resisted the linguistic Canadianisms which are led by their CLASS counterpart; the exception to this claim is the presence of the low-back merger. Further research is required to conclusively determine if these linguistic Canadianisms will be propagated throughout the speech community, relegated to a particular social group, or resisted and replaced by defined local linguistic norms.

CHAPTER 8

FURTHER RESEARCH AND FUTURE DIRECTIONS

The present thesis stands as a significant contribution to the field's understanding of the sociophonetic characteristics in the speech variety of English spoken in Michigan's Upper Peninsula (UP). Furthermore, it documents aspects of previously underdocumented ethnic-heritage groups and the ethnolects that define them in this speech community (Boberg 2012; Labov 2008). Finally, it instantiates previous linguistic findings (Labov et al. 2006; Rakerd and Plichta 2010; Remlinger 2009), while offering new insights into the potential changes-in-progress taking shape within this rural UP speech community, and potentially, raises new questions as to the state of linguistic change for these substrate and exogenous linguistic forms in other areas of the peninsula and neighboring regions of the Upper Midwest.

The present chapter seeks to discuss the limitations faced by the thesis, supplementary avenues for on-going research, and alternative directions open to future veins of research. As such, Section 8.1 will discuss the restrictions and barriers faced by the present thesis. Section 8.2 will discuss the prospect of future research. Section 8.3 will conclude by connecting the discussion and the findings back to the larger questions posed at the onset of the thesis.

8.1 Limitations and Continuation of the Present Research

This sociophonetic study deviates from traditional introspective analysis of vowels, and instead relies heavily upon instrumental methods in the acoustic analysis of the phenomenon similar to other recent sociophonetic research (Labov et al. 2006; Rakerd and Plichta 2010; Rosenfelder 2005). Due to the continuous nature of formant structures and the traditional practices of formant extraction, the development and use of an alternative extraction procedure to objectively and efficiently measure the acoustic measurements was a decisive choice at the onset of the project, and one that may have made the results better for it (Albin and Rankinen 2012); previous results using the MANUAL METHOD did not reveal SEX or CLASS effects (Rankinen 2014), which is likely a result of the formant extraction difference.[1] Furthermore, the sociolinguistic materials developed for data collection and analysis of only the reading data naturally affected the trajectory and shape of this thesis. This subsection acknowledges other known limitations faced by the thesis and their correlations with these higher-order decisions.

1. LIMITED TOKEN COUNT: One limitation include the uneven and sparse token count of the linguistic variables, which was a result of several factors. The main factor contributing to this limitation stemmed from the task material itself. As previously mentioned in Chapter 4, the reading passage was originally developed to investigate post-NCVS speech communities located in Lower Michigan and other similar areas (Evans 2001). As a result, the reading passage contained higher token count of vowels participating in the Northern Cities Vowel Shift (NCVS) (e.g., /ɪ, ɛ, æ, ɑ, ɔ/) and fewer tokens of vowels not participating in the shift (e.g., /i, u , ɑj, ɑw/). At the time of field recording (i.e., 2007-2008), the UP's participation in the NCVS was still unknown (i.e., until the work

[1] Further research is required to empirically and more rigorously compare this proposed method to others.

of Rakerd and Plichta in 2010). The sociolinguistic interviews included the interview task and the reading passage task, which were also accompanied by a token-balanced wordlist task. However, previous sociophonetic analysis of the data from the reading passage and wordlist task types using traditional formant extraction procedures (c.f., Rankinen (2013b, 2014)) revealed that the wordlist task tended to elicit highly conservative styles of speech, and as such, it was more likely to conceal innovative and less prestigious forms (Labov 2001; Tagliamonte 2012). The author's concerns with traditional extraction methods and the desire to implement the alternative formant extraction procedure coupled with time-constraints placed upon the thesis, a rationale was motivated to extract data from the reading passage recordings instead of the wordlist recordings. As a result, the limited token-count, particularly in the case of the /ɑj/ and /ɑw/ LONG DIPHTHONGs, is a concern due to lexical effects whereby "... *any lexical item of sufficient frequency may skew the overall distributions in the data set* ..." (Tagliamonte 2012, 91). Therefore, the complexity exhibited by the LONG DIPHTHONGs may be due in part to this effect, and therefore, a more focused analysis of these linguistic variables are required to confirm the claims made in the present thesis;[2] however, all other linguistic variables report sufficient token counts and lexical variability.

2. LINGUISTIC CONSTRAINTS: The focus of the thesis was to investigate the sociolinguistic correlates of the linguistic variables of vowels in the speech of a sampled community. With this in mind, another limitation that had to be negotiated was the linguistic constraints on these linguistic variables of interest. While several important linguistic constraints were considered when constraining the data (e.g., vowels always in stressed position, vowels never occur in a pre-liquid context, LONG DIPHTHONGs occur in pre-voiceless and pre-voiced contexts), other linguistic constraints were not controlled (e.g., place of articu-

[2] A similar case can be made for the high front and back vowels (i.e., /i/ and /u/).

lation). The tightening of linguistic constraints in more focused analyses may prove insightful in teasing apart the phonological and phonetic behavior of UP vowels (c.f., Boberg (2004)). In terms of the present research, such analyses could be done in the conservative speech of the wordlist task and the casual speech of the sociolinguistic interviews.

3. Other Task Types: A natural next step for this research would be to extract and process the available data from wordlist and interview tasks in order to compare it with the data obtained from the reading passage task. Such an analysis of speech styles may further our understanding of prestige and how these innovative forms are being used in the UP speech community (Labov 1966, 1994, 2001).

The disclosure of these concerns or limitations in the research may serve to be useful for future researchers in navigating potential considerations in similar studies. Furthermore, it should be noted that such concerns do not offset the significance of the findings reported in the present thesis.

8.2 Beyond the Present Research

The findings of this thesis, that both lingering substrate and developing exogenous effects are present in the speech patterns of UP speakers, answer the main questions posed at the onset of the study. These findings also promise to generate additional questions that will likely stimulate decades of future research related but not restricted to the documentation of the variety of UP English, the sociolinguistic effects of ethnic-immigrant groups and the social dynamics involved with the propagation of linguistic norms in rural speech communities. These three veins of research are by no means exhaustive but stand as logical directions of inquiry for future research.

1. Salient Linguistic Variables: The speech in Michigan's Upper Peninsula

is a unique linguistic variety of English, exhibiting unique linguistic indicators and markers beyond that of vowel characteristics. In other areas of phonetics and phonology, the gemination of consonants and lengthening effects and the lenition of interdental fricative effects are just two non-vocalic threads of linguistic research deserving empirical attention (Remlinger et al. 2009; Remlinger 2007). There are also many unique linguistic phenomena in the UP variety spanning the breadth of linguistic inquiry such as the lexical borrowings from substrate and exogenous sources, the morpho-syntactic processes of prepositional omission (e.g, "We go (~~to~~) Shopko"), and the unique pragmatic usages of the ubiquitous "eh" (Rankinen 2013c; Remlinger 2007).

2. Ethnic-heritage Groups: This thesis also contributes toward the growing body of literature on ethnolects, which seek to document and account for the subtle nuances of substrate effects of ethnic-heritage groups within the speech community and the resilience or degrade of those effects against competing linguistic norms (Boberg 2012; Labov 2008). The UP Finnish- and Italian-Americans served as excellent contrastive ethnic-heritage groups to observe these potential outcomes in a speech community. Some substrate effects were shown to be waining, while others were much more resilient to linguistic change from above from competing exogenous sources (i.e., modeled from linguistic norms of American and Canadian English). Furthermore, ethnic-heritage was shown to be an important sociolinguistic factor correlated with innovative linguistic forms (i.e., besides sex and class, the east-side Finns were shown be at the vanguard of most linguistic changes in this UP speech community). The results of the present thesis in conjunction with the findings from previous ethnolinguistic-oriented research should continue to motivate the field toward the investigation of other less-documented ethnic-heritage communities including but not limited to: a) indigenous-heritage groups of North America (Dannenberg 1999; Labov 1963; Wolfram 1984), b) European-heritage groups

(Boberg 2004; Carlock and Wolck 1981; Haugen 1969; Laferriere 1979; Purnell et al. 2005), and c) Asian-heritage groups (Lo and Reyes 2004).[3]

3. Rural Speech Communities: The rigorous examination of the sociolinguistic characteristics of a rural speech community presented in this thesis also contributes to the field's expanding knowledge of the propagation of linguistic norms in face of competing substrate and regional influences. As reported by previous sociolinguistic work on rural speech communities (Dannenberg 1999, 2002; Labov 1963; Rose 2006), sociolinguistic correlates can be used to account for exogenous effects indicative of changes-in-progress within less populated and more rural-orientated speech communities in addition to more populated and urban-orientated speech communities (Gordon 2000b; Labov 1966; Rosenfelder 2005; Trudgill 1972). However, further research should examine regional-wide linguistic change across rural communities with similar histories and shared cultural and community identities. The Upper Midwest is an excellent example of an under-documented region, particularly among the rural speech communities along the Wisconson-Michigan state border; novel research such as this might offer a bridge of insight into the linguistic similarities and differences of English varieties in Wisconsin (Purnell et al. 2013) and Michigan's Upper Peninsula (Remlinger 2009).

[3]Other more documented ethnic-heritage/racial groups include communities of African-origin Labov (1972); Wolfram (1969, 1974) or Latino-origin (Eckert 2008; Fought 2003; Konopka and Pierrehumbert 2014).

8.3 Concluding Remarks

This thesis investigated the five sets of linguistic variables of FRONT LAX (i.e., /ɪ/, /ɛ/, /æ/), LOW BACK (i.e., /ɑ/, /ɔ/), HIGH BACK (i.e., /ʊ/, /u/), SHORT DIPHTHONGS (i.e., /ej/, /ow/) and LONG DIPHTHONGS (i.e., /ɑj/, /ɑw/) and the predictor variables of HERITAGE-LOCATION, BILINGUALISM, AGE, SEX and CLASS in order to account for substrate and exogenous influences in the speech of ethnic-heritage groups from Michigan's Upper Peninsula. This research began with two over-arching questions, both of which were stated at the onset of this thesis and ultimately guided its subsequent analyses and discussion of findings.

The first question of the thesis sought to uncover the potential substrate effects of ethnic-heritage groupings of Finnish- and Italian-Americans in the speech variety of Michigan's Upper Peninsula by examining the predictor variables of HERITAGE-LOCATION and BILINGUALISM. The findings revealed the strong presence of individual and structural phonetic patterns attributed to substrate effects in the speech of the seventy-one older-aged UP bilinguals and monolinguals (i.e., the WEST-side Finns and EAST-side Italians' structural difference of the low vowels and the HIGH BACK vowels, as well as, the monophthongization of /ow/). However, among this subset of speakers, there was considerable evidence of linguistic homogeneity across the BILINGUALISM groups indicating the strong presence of dialect leveling. The source of this homogeneity is likely due to social pressures to conform toward perceived norms based upon an American English model derived from local varieties.

The second question of the thesis sought to reveal if exogenous sources of linguistic change were present within the predominately monolingual UP speech community by examining the predictor variable of HERITAGE-LOCATION and the more traditional sociolinguistic variables of AGE, SEX and CLASS. Strong evidence from three sets of linguistic variables support the claim that changes-in-progress are taking place

within the UP speech variety, modeled from Canadian English linguistic norms (i.e., the low-back merger, Canadian shift, Canadian raising) and led by upwardly mobile MIDDLE-class women. HERITAGE and LOCATION were also found to be correlated with these linguistic extremes, particularly among EAST-side Finns. However, not all UP residents were found to be participating in these Canadianisms, and in some cases, trends away from such forms were shown to be led by WORKING-class females. These findings suggest the resistance of Canada English models of linguistic change and the orientation toward more local norms. In addition to the presence of exogenous influences, there remain lingering effects of the substratum in the speech of these monolinguals across the age range. While the structural differences on account of L1 vowel configurations were shown to be diminishing in the speech of the AGE groups (i.e., continued processes of dialect leveling), the monophthongized variant of /ow/ displayed no sign of weakening in the speech of UP residents.

The speech spoken in Michigan's Upper Peninsula is a unique variety of English comprised of lingering substrate effects as well as exogenous effects modeled from both American and Canadian English linguistic norms. The findings of this thesis shed light on the eastern regions of the "residual zone" defining the Upper Midwest in the seminal work of Labov, Ash, and Boberg (2006, 144), indicating the strong presence of a linguistic encroachment of Canadian English norms into this northern peninsula. At present, however, it remains unclear if these linguistic norms will continue to propagate throughout Michigan's Upper Peninsula (and to other areas of the Upper Midwest), or if they will be challenged by local or neighboring regional linguistic norms.

APPENDIX

"A Bad Day for Ducks"

[Created By: Dennis Preston]

Tom and Bob were supposed to meet at Tom's house. They planned to go to a pond and watch the ducks that lived there. While waiting for Bob, Tom picked up around the house. The weather had turned cold. He put the electric fan in the garage and did the dishes.

He wanted to have a snack before he left, so he peeled an apple and cut it into slices. He bit into one, but it was awful, probably rotten. He spit it out and tried to rinse his mouth out with hot coffee. He poured it into a tin cup, but when he put it up to his lips, he spilled it on his hand. His hand puffed up and hurt a lot, so he stuck it under the faucet to make it feel better.

He grabbed a dusty hat out of the closet and shook it, but he couldn't get the dirt off. He got a cap instead and put a scarf around his neck and put on his socks and boots. He saw a big hole in his sock, but Bob was already late. His alarm buzzed, and it was past two-o'clock. Nothing was working out.

Just then Bob phoned and said he wanted to talk. He told Tom that the flock of ducks had left the muddy pond. A pack of dogs had chased them off. Tom was sad; he had really wanted to see the ducks slosh around in the water, but Bob said they could go shoot some pool instead. Tom thought that was a good idea and forgot all about the ducks and his burned hand.

Table 8.1: Token words from the "*Bad Day for Ducks*" reading passage

Type	Token words									
Monophthongs	Bob1	meet	watch	ducks	lived	Bob2	picked	up	weather	put1
	(e)lectric	(ga)rage	did	dishes	have	snack	left1	apple	cut	bit
	awful	probably	rotten	spit	hot	coffee	cup	put2	up1	lips
	puffed up2	lot	stuck	faucet	better	grabbed	dusty	hat	closet	
	shook	but1	couldn't	get	off1	got	cap	(in)stead1	put3	neck
	put4	on	socks	boots	saw	big	sock	but2	Bob3	(al)ready
	buzzed	past	two	clock	Nothing	Just	Bob4	said1	talk	flock
	ducks2	left2	muddy	pack	dogs	off2	Tom	sad	see	ducks1
	slosh	water	but3	Bob5	said2	could	shoot	(in)stead2	thought	good
	ducks3	his								
Diphthongs	(sup)posed	house1	go	waiting	house2	so	slices	out1		
	tried	mouth	out2	make	out3	late	out4	chased	(a)bout	

NOMENCLATURE

IPA Symbol:	**Example:**	**Phonological Description:**
/i/	*beat*	HIGH FRONT TENSE UNROUNDED monothphong
/ɪ/	*bit*	HIGH FRONT LAX UNROUNDED monothphong
/ɛ/	*bet*	MID FRONT LAX UNROUNDED monothphong
/æ/	*bat*	LOW FRONT LAX UNROUNDED monothphong
/ɑ/	*cot*	LOW BACK LAX UNROUNDED monothphong
/ɔ/	*caught*	MID BACK LAX ROUNDED monothphong
/ʌ/	*but*	MID CENTRAL LAX UNROUNDED monothphong
/ʊ/	*put*	HIGH BACK LAX ROUNDED monothphong
/u/	*boot*	HIGH BACK TENSE ROUNDED monothphong
/ej/	*bait*	MID FRONT, SHORT FRONT-GLIDED diphthong
/ow/	*boat*	MID BACK, SHORT BACK-GLIDED diphthong
/ɑj/	*bite*	LOW CENTRAL, LONG FRONT-GLIDED diphthong
/ɑw/	*bout*	LOW CENTRAL, LONG BACK-GLIDED diphthong

Other nomenclature:	**Description:**
___T	Proceeded or followed by a voiceless obstruent
___C	Proceeded or followed by a voiced obstruent
FRONT LAX vowels	/ɪ, ɛ, æ/
LOW BACK vowels	/ɑ, ɔ/
HIGH BACK vowels	/ʊ, u/
SHORT DIPHTHONGS	/ej, ow/
LONG DIPHTHONGS	/ɑj, ɑw/

Glossary

/u/ fronting

a phonological vowel process, whereby the [u] quality significantly advances to the front of the acoustic vowel space; typically associated with other Canadian features (e.g., Canadian shift, Canadian raising, low-back merger). 8, 26, 206, 210

age

an operationalized term referring to the age of the speaker; three levels are considered in the thesis: 1) OLDER-aged (58-100), 2) MIDDLE-aged (41-57), and 3) YOUNGER-aged (19-38). 3, 36, 42, 64, 113, 163, 200

age-grading

a type of language change where the middle-aged speakers (i.e., regardless of generational differences) use more conservative, or standard, forms due to social pressures placed upon them in the linguistic marketplace, while older- and younger-aged speakers tend to display higher usage of non-conservative forms; this type of change will exhibit a curvilinear pattern in apparent-time and real-time data. 186, 205, 207

ANOVA

univariate analysis of variance; a statistical method in which the variation in a set of observations is divided into distinct components using a single predictor variable. 64, 65, 73, 75–77, 79, 81, 82, 87, 89–93, 96–98, 103, 108, 109, 118, 120, 122, 123, 125, 126, 130–133, 135, 151, 152, 154

apparent-time

a type of data collection following a synchronic approach to language change, where data is collected at a single point in time from a group of subjects spanning a relatively wide age-range; in an apparent-time construct used in the study of language change in progress, systematic variation across age groupings or generational groups are assumed to mirror the diachronic developments in a language (i.e., unless evidence to the contrary is found, such as age-grading). 22, 162, 186, 204

auditory-acoustic relations

a term that refers to the production-perception mapping of how the acoustic signal is produced and how it is perceived by the speaker/listener. 48

bilingualism

an operationalized term referring to a) a speaker's use of English and/or an immigrant-heritage language and b) the language-dominance of each language (i.e., spoken at an early age and used outside the home, even in adulthood); three levels are considered in the thesis: 1) heritage-dominant bilinguals, 2) English-dominant bilinguals and 3) English-dominant monolinguals. 3, 36, 41, 64, 67, 163, 200

California shift

an acoustic vowel shift characterized by the lowering and retracting of the front lax vowels (i.e., [ɪ, ɛ, æ]); see also the Canadian shift. 30, 206

Canadian raising

an phonological vowel process, whereby the onglides of /ɑj/ and /ɑw/ centralize to /ʌj/ and /ʌw/ when followed by a voiceless consonant; typically associated with other Canadian features Canadian shift, low-back merger, /u/ fronting).

8, 28, 150, 162, 204, 206, 210

Canadian shift

an acoustic vowel shift characterized by the lowering and retracting of the front lax vowels (i.e., [ɪ, ɛ, æ]); typically associated with other Canadian features (e.g., Canadian raising, low-back merger, /u/ fronting); see also the California shift. 4, 8, 22, 23, 26, 30, 162, 204–206, 210

change from above

a process of linguistic change, where innovative forms originate from outside the speech community; see diffusion. 165, 177, 198, 207, 211

change from below

a process of linguistic change, where innovative forms originate from within the speech community; see transmission. 165, 177, 211, 212

change-in-progress

a linguistic process (e.g., phonological, syntactic), where a subset of the population, and not the entire population, is participating/propagating the use of an innovative form. 2, 7, 90, 140

class

an operationalized term referring to the socioeconomic status of the speaker indexed by the presence of post-secondary education (i.e., which often correlated with "white" / "blue" collar distinctions in occupation); as a result, two levels are considered in the thesis: 1) WORKING-class and 2) MIDDLE-class. 3, 36, 42, 64, 113, 163, 200

curvilinear pattern

a sociolinguistic pattern of a linguistic variable's usage as a factor of age, where the middle-aged subjects are patterning distinctly different from either the

older- or younger-aged subjects (i.e., forming a U-shape pattern or its inverse); this pattern is usually associated with age-grading. 186, 204

dialect leveling

a process of language change where salient or marked variants of linguistic variables are disfavored and disused over time, whereby language varieties become less distinctive from one another (i.e., the variation between them potentially become non–existent). 6, 91, 111, 165, 200

diffusion

a type of linguistic propagation, where linguistic forms disperse throughout and outside the speech community resulting from contact between the speech communities; typically associated with change from above. 163, 206

ethnolect

a unique, native variety of English spoken by immigrant-heritage speakers, who were exposed to English at an early age; retains unique linguistic features that can be attributed to the non-native variety or substrate language. 16, 173, 194

exogenous influence

linguistic pressures external to a speech community that affect the linguistic speech pattern of subgroups within the particular speech community. 113, 172

feature

1) a sociolinguistic term referring to a set of linguistic variables that exhibit similar phonetic patterns and sociolinguistic trends as a set of linguistic indicators, markers or stereotypes (e.g., Canadian shift of /ɪ, ɛ, æ/); 2) a phonological term referring to a binary characteristic of a phoneme's feature structure (e.g., [+/- voice]). 165, 174, 204, 206, 207, 210

fixed method

a method of formant extraction where the temporal measurements are selected at "fixed" positions based upon pre-determined locations along the vowel's duration (e.g., exactly the 33rd and the 66th percentile of the vocalic duration). 44, 55

generational change

a type of language change where the use of an innovative form is associated with a particular generation or age group. 186

geolinguistic region

a geographical area within which the speech community or communities exhibit preference for a definable set of linguistic variants (e.g., phonological, syntactic) and characterizes the linguistic speech patterns of residents living in this geographical area. 1, 2

heritage

an operationalized term referring to the ancestral heritage of a speaker, who has at least one grandparent that can claim full ancestry of an immigrant-heritage; also referred to as ethnic-heritage. 36, 166, 201, 209

heritage-location

an operationalized term referring to the ancestral heritage and place of resideny of a speaker; see heritage and location. 3, 36, 37, 41, 42, 64, 67, 113, 163, 200

interspeaker variation

a type of variation referring to the linguistic differences that exist between speaker or groups of speakers (e.g., generational change, age-grading, lifespan change); this type of variation is usually contrasted with intraspeaker variation,

which refers to the linguistic differences that exist within an individual speaker (e.g., style shifting). 79, 110, 114, 171

linguistic indicator

a variant of a linguistic variable that correlates with different sociolinguistic groups but does not show signs of stylistic conditioning; typically below the conscious awareness of speakers. 114

linguistic marker

a variant of a linguistic variable that correlates with different sociolinguistic groups and does show signs of stylistic conditioning, but it may not be above the conscious awareness of speakers. 114

linguistic stereotype

a variant of a linguistic variable that correlates with different sociolinguistic groups, shows signs of stylistic conditioning, and holds stigma (i.e., being above the conscious awareness of speakers). 114

location

an operationalized term referring to the place of residency of a speaker, based upon the geo-coordinates of the subject at the time of field recording. 36, 201, 209

low-back merger

an acoustic vowel merger characterized by merging of the [ɑ] and [ɔ] vowels; typically associated with other Canadian features (e.g., Canadian shift, Canadian raising, /u/ fronting). 8, 23, 26, 30, 116, 204, 206

MANOVA

multivariate analysis of variance; a statistical method in which the variation in a set of observations is divided into distinct components using two predictor

sex

an operationalized term referring to the self-reported sex of the speaker (i.e., male or female); this term does not refer to gender identity or sexual orientation. 3, 36, 42, 64, 113, 163, 200

stability

a process of linguistic change, where innovative forms of a linguistic variable remain stable in a speech community. 177

strong network

a type of social network which is comprised of strong ties and involves interaction between close friends and family, socially and geographically immobile individuals, and limited connections between groups; such a network typically leads to agreement, resulting in the strengthening of a close-knit network structure. 193

stylization

a process of taking a large number of samples from the signal and reducing it down to a much smaller number of representative vectorized points in such a way that it still closely resembles the original raw signal. 51, 52, 211

substrate influence

linguistic pressures internal to a speech community that affect the linguistic speech pattern of subgroups within the particular community. 124, 168

transmission

a type of linguistic propagation, where linguistic forms are transmitted "faithfully" by successive generations within a speech community (i.e., by children); typically associated with change from below. 163, 206

weak network

a type of social network which is comprised of weak ties and involves causal interaction between acquaintances, socially and geographically mobile individuals, and diverse connections between groups; such a network typically leads to change and conflict, resulting in the weakening of a close-knit network structure. 193

Acronyms

ANAE

Atlas of North American English. 1, 44, 61–63

ANOVA

univariate analysis of variance. 44, 64, 73

CoV

coefficient of variation. 44, 65, 84, 87, 88

ED

Euclidean distance. xi, 64, 65, 77–79, 91, 92, 99, 118–120, 133, 137, 143, 144, 171

LP

Lower Peninsula. 24

MANOVA

multivariate analysis of variance. 44, 64, 72

MQT

Marquette County. 37–40

NCVS

Northern Cities Vowel Shift. 3, 4, 23–25, 32, 46, 47, 140, 177, 195

OCE

Ontario Canadian English. 26, 32

SD

standard deviation. 69, 70, 72, 84, 85, 87–90

UP

Upper Peninsula. xi, xii, 2–8, 10–12, 15–17, 19–26, 36, 41, 45, 47, 65–70, 73, 77, 79, 85, 88, 94, 101, 105, 112–114, 117, 121, 123, 126, 148, 160, 162–177, 179–183, 185, 187–195, 197, 198, 200, 201

Bibliography

Adamson, A. (1971). A Dialect Survey Involving Persons of Finnish Descent. In *Papers from Michigan Linguistic Society Meeting*, Volume 1. Central Michigan University.

Adank, P., R. Smits, and R. van Hout (2004). A Comparison of Vowel Normalization Procedures for Language Variation Research. *The Journal of the Acoustical Society of America 116*(5), 3099–3107.

Ahrend, E. R. (1934). Ontario Speech. *American Speech 9*, 136–139.

Albin, A. and W. Rankinen (2012, October). Hierarchical Bayesian Modeling of Vowel Formant Data. Poster presentation at the 164th Meeting of the Acoustical Society of America.

Allen, H. and G. Underwood (1977). Regional dialects, 1945-1974. *American Speech 52*(3/4), 163–261.

Allen, H. B. (1973). *The Linguistic Atlas of the Upper Midwest*. University of Minnesota Press.

Ayearst, M. (1939). A Note on Canadian Speech. *American Speech 14*, 231–233.

Bailey, G., T. Wikle, J. Tillery, and L. Sand (1993). Some Patterns of Linguistic Diffusion. *Language Variation and Change 5*, 359–390.

Bakos, J. (2008). An examination of the adaptation of the northern cities chain shift

by lebanese immigrants in dearborn. Master's thesis, Michigan State University, East Lansing, Michigan.

Bertinetto, P. M. and M. Loporcaro (2005). The sound pattern of standard italian, as compared with the varieties spoken in florence, milan and rome. *Journal of the International Phonetic Association 35*(02), 131–151.

Bigham, D. S. (2008, August). *Dialect Contact and Accommodation among Emerging Adults in a University Setting*. Ph. D. thesis, University of Texas, Austin, Texas.

Boberg, C. (2000). Geolinguistic Diffusion and the U.S.-Canada Border. *Language Variation and Change 12*, 1–24.

Boberg, C. (2004). Ethnic Patterns in the Phonetics of Montreal English. *Journal of Sociolinguistics 8*(4), 538–568.

Boberg, C. (2005, 7). The Canadian Shift in Montreal. *Language Variation and Change 17*, 133–154.

Boberg, C. (2008). Regional Phonetic Differentiation in Standard Canadian English. *Journal of English Linguistics 36*(2), 129–154.

Boberg, C. (2012). Ethnic Dialects in North American English. In T. Nevalainen and E. C. Traugott (Eds.), *The Oxford Handbook of the History of English*, Oxford Handbooks in Linguistics, Chapter 42, pp. 538–548. Oxford University Press.

Boersma, P. (2001). Praat, a System for Doing Phonetics by Computer. *Glot International 5*(9/10), 341–345.

Bourdieu, P. (1991). *Language and Symbolic Power*. Cambridge, MA: Harvard University Press.

Browman, C. P. and L. Goldstein (1985). Dynamic Modeling of Phonetic Structure. In V. Fromkin (Ed.), *Phonetic Linguistics*, pp. 35–53. New York: Academic Press.

Browman, C. P. and L. Goldstein (1990). Gestural Specification Using Dynamically-defined Articulatory Structures. *Journal of Phonetics 18*, 299–320.

Carlock, E. and W. Wolck (1981). A Method for Isolating Diagnostic Linguistic Variables: The Buffalo ethnolects experiment. In D. Sankoff and H. Cedergren (Eds.), *Variation Omnibus*, Current inquiry into language linguistics, pp. 17–24. Carbondale, USA: Linguistic Research.

Chambers, J. K. (1973). Canadian Raising. *The Canadian Journal of Linguistics 18*, 118–135.

Chambers, J. K. (1989, Spring). Canadian Raising: Blocking, Fronting, etc. *American Speech 64*(1), 75–88.

Chambers, J. K. (2006, July). Canadian Raising Retrospect and Prospect. *The Canadian Journal of Linguistics 51*(2/3), 105–118.

Clarke, S., F. Elms, and A. Youssef (1995, 7). The Third Dialect of English: Some Canadian evidence. *Language Variation and Change 7*, 209–228.

Clopper, C. G., D. B. Pisoni, and K. de Jong (2005). Acoustic Characteristics of the Vowel Systems of Six Regional Varieties of American English. *The Journal of the Acoustical Society of America 118*(3), 1661–1676.

Dailey-O'Cain, J. (1997). Canadian Raising in a Midwestern U.S. City. *Language Variation and Change 9*, 107–120.

Dannenberg, C. (1999). *Sociolinguistic Constructs of Ethnic Identity: The syntactic delineation of Lumbee English.* Ph. D. thesis, University of North Carolina, Chapel Hill.

Dannenberg, C. (2002). *Sociolinguistic Constructs of Ethnic Identity: The syntactic*

delineation of Native American English, Volume 87 of *American Dialect Society*. Durham, NC: Duke University Press.

De Decker, P. and S. Mackenzie (2000). Slept Through the Ice: A further look at lax vowel lowering in Canadian English. *Toronto Working Papers in Linguistics 18*, 1–11.

D'Imperio, M. (2001). *The Role of Perception in Defining Tonal Targets and their Alignment*. Ph. D. thesis, The Ohio State University, Columbus.

Easson, G. (1997). Out and About in Toronto: (aw)-Fronting in real time and apparent time. Master Thesis.

Eckert, P. (1996). (ay) Goes to the City: Reminiscences of Marth's Vineyard. In D. S. John Baugh, Gregroy Guy (Ed.), *Festschrift for William Labov*. John Benjamins.

Eckert, P. (2000). *Language Variation at Social Practices*. Oxford and Malden: Blackwell Publishing Ltd/Inc.

Eckert, P. (2008). Where Do Ethnolects Stop? *Internation Journal of Bilingualism 12*, 25–42.

Escudero, P., B. Sisinni, and M. Grimaldi (2014, March). The Effect of Vowel Inventory and Acoustic Properties in Salento Italian learners of Southern British English Vowels. *Journal of Acoustical Society of America 135*(3), 1577–1584.

Esling, J. H. and H. J. Warkentyne (1993). Retracting of /æ/ in Vancouver English. In S. Clarke (Ed.), *Focus on Canada*, pp. 229–246. John Benjamins Publishing Company.

Evans, B. (2001). *Dialect Contact and the Northern Cities Shift in Ypsilanti, Michigan*. Michigan State University. Department of Linguistics, Germanic, Slavic, Asian and African.

Evans, B. E., R. Ito, J. Jones, and D. R. Preston (2000). Change on top of change: Social and regional accommodation to the northern cities chain shift. In H. Bennis, H. Ryckboer, and J.Stroop (Eds.), *De Toekomst van de Variatielinguïstiek (a special issue of Taal en Tongval to honor Dr. Jo Daan on her ninetieth birthday)*, Volume 52, pp. 61–86.

Evans, B. E., R. Ito, J. Jones, and D. R. Preston. (2006). How to get to be one kind of midwesterner: Accommodation to the northern cities chain shift. In T. Murray and B. L. Simon (Eds.), *Language variation and change in the American Midland*, pp. 179–197. Amsterdam: John Benjamins Publishing Company.

Flege, J. E., I. R. A. MacKay, and D. Meador (1999, November). Native Italian Speakers' Perception and Production of English Vowels. *Journal of Acoustical Society of America 106*(5), 2973–2987.

Fought, C. (2003). *Chicano English in Context*. New York: Macmillan.

Gordon, M. J. (2000a). Phonological Correlates of Ethnic Identity: Evidence of divergence? *American Speech 75*(2), 115.

Gordon, M. J. (2000b). *Small-Town Values and Big-City Vowels: A Study of the Northern Cities Shift in Michigan*. Publication of the American Dialect Society (Book 84). Duke University Press Books.

Gottfried, M., J. D. Miller, and D. J. Meyer (1993). Three Approaches to the Classification of American English Diphthongs. *Journal of Phonetics 21*, 205–229.

Hagiwara, R. (2006). Vowel Production in Winnipeg. *Canadian Journal of Linguistics 51*(2), 127–141.

Haugen, E. I. (1969). *The Norwegian Language in America: A Study in Bilingual Behavior*. Bloomington: Indiana University Press.

Hibiya, J. (1988). *Social Stratificaiton of Tokyo Japanese*. Ph. D. thesis, University of Pennsylvania, Philadelphia.

Hillenbrand, J., L. A. Getty, M. J. Clark, and K. Wheeler (1995, May). Acoustic Characteristics of American English Vowels. *Journal of the Acoustical Society of America 97*(5), 3099–3111.

Hoffman, M. F. and J. A. Walker (2010, 3). Ethnolects and the City: Ethnic orientation and linguistic variation in Toronto English. *Language Variation and Change 22*, 37–67.

Holmio, A. (2001). *History of the Finns in Michigan*. Great Lakes books. Wayne State University Press.

Horvath, B. (1985). *Variation in Australian English*. Cambridge University Press.

Horvath, B. and D. Sankoff (1987). Delimiting the Sydney Speech Community. *Language in Society 16*, 179–204.

Isajiwa, W. W. (1985). Definitions of Ethnicity. In R. Bienvenue and J. Goldstein (Eds.), *Ethnicity and Ethnic Relations in Canada: A book of readings*, pp. 5–17. Butterworths.

Ito, R. (1999). *Diffusion of urban sound change in rural Michigan: A case of the Northern Cities Shift*. Ph. D. thesis, Michigan State University, East Lansing, Michigan.

Jones, J. (2003). *African Americans in Lansing and the Northern Cities Vowel Shift*. Ph. D. thesis, Michigan State University, East Lansing, Michigan.

Joos, M. (1942). A Phonological Dilemma in Canadian English. *Language 18*, 141–144.

Kero, R. (1969). The Background of Finnish Emigration. In R. J. Jalkanen (Ed.), *The*

Finns in North America: A social symposium, pp. 55–62. East Lansing: Michigan State University Press for Suomi College.

Kero, R. (2014). Migration from Finland to North America. In *Finns in the United States: A History of Settlement, Dissent, and Integration*, pp. 41–54. Michigan State University Press.

Kerswill, P. (2002). Models of Linguistic Change and Diffusion: New evidence from dialect levelling in British English. *Reading Working Papers in Linguistics 6*, 187–216.

Kerswill, P. and P. Trudgill (2005). The Birth of New Dialects. In P. Auer, F. Hinskens, and P. Kerswill (Eds.), *Convergence and divergence in European languages*, pp. 196–220. Cambridge University Press.

Keyser, S. J. (1963). Review of The Pronunciation of English in the Atlantic States: Based upon the Collections of the Linguistic Atlas of the Eastern United States. *Language 39*(2), 303–316.

Klatt, D. H. (1982, May). Prediction of Perceived Phonetic Distance from Critical-band Spectra: A first step. In *Acoustics, Speech, and Signal Processing, IEEE International Conference on ICASSP 1982*, Volume 7, pp. 1278–1281.

Konopka, K. and J. Pierrehumbert (2014). Vowel dynamics of mexican heritage english: Language contact and phonetic change in a chicago community. [Online article: `http://faculty.wcas.northwestern.edu/~jbp/publications.html`].

Kostiainen, A. (2014). Papers and Publications. In *Finns in the United States: A History of Settlement, Dissent, and Integration*, pp. 205–220. Michigan State University Press.

Kuronen, M. (2000). *Vokaluttalets akustik i sverigesvenska, finlandssvenska och finska.* Jyväskylä: Jyväskylä University Printing House.

Labov, W. (1963). The Social Motivation of a Sound Change. *Word 19*, 273–309.

Labov, W. (1966). *The Social Stratification of English in New York City*. Washington, D.C.: Center for Applied Linguistics.

Labov, W. (1972). *Sociolinguistic Patterns*. Philadelphia: University of Philadelphia Press.

Labov, W. (1994). *Principles of Linguistic Change: Internal Factors*. Oxford: Basil Blackwell.

Labov, W. (2001). *Principles of Linguistic Change, Social Factors*. Language in Society. Wiley.

Labov, W. (2007, June). Transmission and Diffusion. *Language 83*(2), 344–387.

Labov, W. (2008). Mysteries of the Substrate. In M. Meyerhoff and N. Nagy (Eds.), *Social Lives in Language - Sociolinguistics and multilingual speech communities: Celebrating the work of Gillian Sankoff*, pp. 315–326. John Benjamins Publishing Company.

Labov, W. (2011). *Principles of Linguistic Change: Cognitive and Cultural Factors*. Principles of Linguistic Change. Wiley.

Labov, W., S. Ash, and C. Boberg (2006). *The Atlas of North American English: Phonetics, Phonology, and Sound Change : a Multimedia Reference Tool*. Number v. 1 in The Atlas of North American English: Phonetics, Phonology, and Sound Change : a Multimedia Reference Tool. Mouton de Gruyter.

Laferriere, M. (1979). Ethnicity in Phonological Variation and Change. *Language 55*(3), pp. 603–617.

LaMacchia, R. A., R. W. Marx, and J. Sobel (1994). *The Urban and Rural Classifications*. U.S. Department of Commerce.

Leinonen, J. (2014). One Culture, Two Cultures? Families of Finns in the United States in the Twentieth Century. In *Finns in the United States: A History of Settlement, Dissent, and Integration*, pp. 285–296. Michigan State University Press.

Lindblom, B. (1963). Spectrographic Study of Vowel Reduction. *Journal of Acoustical Society of America 35*, 1773–1781.

Lindblom, B. (1986). Phonetic Universals in Vowel Systems. In J. J. Ohala and J. J. Jaear (Eds.), *Experimental Phonology*, pp. 13–43. Academic Press.

Lo, A. and A. Reyes (2004). Language, Identity and Relationality in Asian Pacific America: An introduction. *Pragmatics 14*, 115–125.

Loukinen, M. (1980). Sociolinguistic Structure of Finnish America. In R. Padilla (Ed.), *Theory in Bilingual Education*, Ethnoperspectives in Bilingual Education Research Series. Department of Foreign Languages and Bilingual Studies, Bilingual Programs, Eastern Michigan University.

Loukinen, M. (1997). Cultural Tracks: Finnish Americans in Michigan's Upper Peninsula. In M. Marsden and R. Magnaghi (Eds.), *A Sense of Place, Michigan's Upper Peninsula: Essays in Honor of the Career of William Vandament*, pp. 15–34. Northern Michigan University Press.

MacDonald, E. N., D. W. Purcell, and K. G. Munhall (2011). Probing the Independence of Formant Control using Altered Auditory Feedback. *The Journal of the Acoustical Society of America 129*(2), 955–965.

Marquette County Planning Commission (2010). US-41/M-28 Access Management Plan. Online at `http://www.co.marquette.mi.us/departments/planning/AM_Plan.php#.Ut1y9PYo4cU`.

MDOT (2007). Economic Regions Corridor Summary. State Long-Range Transportation Plan II, The Michigan Department of Transportation.

MDOT (2014a). International bridge: Bridge history. http://www.michigan.gov/mdot/0,4616,7-151-9618_48384-23856--,00.html.

MDOT (2014b). Mackinac bridge: History. http://www.michigan.gov/mdot/0,4616,7-151-9618_11016-25527--,00.html.

MDOT (2014c). Traffic trends. http://www.michigan.gov/mdot/0,4616,7-151-9618_48384-30295--,00.html.

Mees, I. (1987). Glottal Stops as a Prestigious Feature of Cardiff English. *English Word-Wide 8*, 25–39.

Menghini, C. (2004). *Examining patterns of Italian immigration to Michigan's Houghton County, 1860-1930*. Ph. D. thesis, Michigan Technological University, Houghon, Michigan.

Merriam-Webster, Inc. (2014). *Merriam-Webster's Collegiate Dictionary* (11th ed.). Merriam-Webster, Inc.

Michigan State Highway Department (1927). Official highway service map. Cateography by MSHD.

Milroy, J. (1996). Variation in /ai/ in Northern British English, with comments on Canadian Raising. *University of Pennsylvania Working Papers in Linguistics 3*(1), 213–221.

Milroy, J., L. Milroy, S. Hartley, and D. Walshaw (1994). Glottal Stops and Tyneside Glottalization: Competing patterns of variation and change in British English. *Language Variation and Change 6*(3), 327–357.

Milroy, L. (1987). Studying Language in the Community: The fieldworker and the social network. In *Language and Social Networks*, Language in Society. Wiley.

Milroy, L. (2000). Britain and the United States: Two nations divided by the same

language (and different language ideologies). *Journal of Linguistic Anthropology 10*, 56–89.

Milroy, L. (2004). Language Ideologies and Linguistic Change. In C. Fought (Ed.), *Sociolinguistic Variation: Critical Reflections*, New York, pp. 161–177. Oxford University Press.

Milroy, L. and J. Milroy (1992). Social Network and Social Class: Toward an integrated sociolinguistic model. *Language in Society 21*(1), 1–26.

Morales, H. L. (1986). Velarization of -/N/ in Purerto Rican Spanish. In D. Sankoff (Ed.), *Diversity and Diachrony*, pp. 105–113. Philadelphia: John Benjamins Publishing Company.

Moreton, E. and E. Thomas (2007). Origins of Canadian Raising in Voiceless-coda Effects: A cas study in phonologization. In J. Cole and J. I. Hualde (Eds.), *Papers in Laboratory Phonology 9*, Phonology and Phonetics, pp. 37–64. Berlin: De Gruyter Mouton.

Nearey, T. and P. Assmann (1986). Modeling the Role of Inherent Spectral Change in Vowel Identification. *The Journal of the Acoustical Society of America 80*, 1297.

Nguyen, E. (2011, October). The Urban/Rural Distinction and so much More: Monophthongal (ow) in Minnesota. Paper presented at the 40th Annual Meeting for New Ways of Analyzing Variation.

Ocumpaugh, J. (2010). *Regional variation in Chicano English: Incipient dialect formation among L1 and L2 speakers in Benton Harbor*. Ph. D. thesis, Michigan State University, East Lansing, Michigan.

Peterson, G. E. and H. L. Barney (1952). Control Methods Used in a Study of the Vowels. *The Journal of the Acoustical Society of America 24*(2), 175–184.

Peterson, J. and Z. Thundyil (1971). A Computerized Questionnaire for the Dialectal Survey of the Upper Peninsula of Michigan. Papers from the Michigan Linguistic Society Meeting.

Pierrehumbert, J. and M. Beckman (1988). *Japanese tone structure*. Linguistic inquiry monographs. Mit Press.

Preston, D. and R. Ito (1998). Identity, discourse, and language variation. *Journal of Language and Social Psychology 17*(4), 465–483.

Preston, D. R. (2003). Systemic accommodation. In D. Britain and J. Cheshire (Eds.), *Social Dialectology*, (IMPACT: Studies in Language and Society 18), pp. 39–58. John Benjamins Publishing Company.

Preston, D. R. (2007). Why can't you understand your own language? In P. Reich, W. J. Sullivan, A. R. Lommel, and T. Griffen (Eds.), *LACUS Forum XXXIII: Variation*, pp. 5–18. Houston: Linguistic Association of Canada and the United States.

Preston, D. R. (2010). Belle's body just caught the fit gnat. In D. R. Preston and N. Niedzielski (Eds.), *A reader in sociophonetics*, pp. 241–252. Berlin: De Gruyter Mouton.

Preston, D. R., B. Plichta, and B. Rakerd (2007). It's too hat in here? the perception of ncs a-fronting. *Linguistica Atlantica 27-28*, 92–95.

Purnell, T., E. Raimy, and J. Salmons (2013). *Wisconsin Talk: Linguistic Diversity in the Badger State* (1st ed.). Languages and Folklore of Upper Midwest. University of Wisconsin Press.

Purnell, T., J. Salmons, and D. Tepeli (2005). German Substrate Effects in Wisconsin English: Evidence for final fortition. *American Speech 80*(2), 135 – 164.

Rakerd, B. and B. Plichta (2010). More on Michigan Listeners' Perception of /ɑ/-fronting. *American Speech 85*(4), 431 – 449.

Rankinen, W. (2013a, April). Location and Heritage Effects: On the vowel characteristics among monolingual English speakers from Michigan's Upper Peninsula.

Rankinen, W. (2013b, November). Michigan's upper peninsula vowel system: Acoustic vowel characteristics of finnish-american communities. Submitted to Language Variation and Change.

Rankinen, W. (2013c). Where'd the Preposition Go? A perceptual-based account of locative prepositional deletion for younger raters in Michigan's Upper Peninsula Where'd the preposition go? A perceptual-based account of locative prepositional deletion for younger raters in Michigan's Upper Peninsula. Qualifying Paper II submitted to the Department of Linguistics.

Rankinen, W. (2014, June). A Michigan Upper Peninsula Vowel System: Finnish-American communities in Marquette County. Accepted for publication in American Speech on 05/20/2014.

Remlinger, K., J. Salmons, and L. Von Schneidemesser (2009, June). Revised Perceptions: Changing dialect perceptions in Wisconsin and Michigan's Upper Peninsula. *American Speech 84*(2), 176–191.

Remlinger, K. A. (2006). What It Means to Be a Yooper: Identity, language attitudes and variation in Michigan's Keweenaw Peninsula. In M. Filppula (Ed.), *Topics in Dialectal Variation: Selection of Papers from the Eleventh International Conference on Methods in Dialectology*, Studies in languages. University of Joensuu.

Remlinger, K. A. (2007). The Intertwined Histories of Identity and Dialect in Michigan's Copper Country. In A. Hoagland, E. Nordberg, and T. Reynolds (Eds.), *New Perspectives on Michigan's Copper Country*. Quincy Mine Hoist Association.

Remlinger, K. A. (2009). Everyone Up Here: Enregisterment and identity in Michigan's Keweenaw Peninsula. *American Speech 84*(2), 118 – 137.

Roeder, R. (2006). *Accommodation to the Northern Cities Shift among Mexican Americans in Lansing*. Ph. D. thesis, Michigan State University, East Lansing, Michigan.

Roeder, R. and L. G. Jarmasz (2009). The Lax Vowel Subsystem in Canadian English Revisited. *Toronto Working Papers in Linguistics 31*, 1–12.

Roeder, R. and L.-G. Jarmasz (2010). The Canadian Shift in Toronto. *Canadian Journal of Linguistics 55*(3), 387 – 404.

Rose, M. (2006). *Language, Place and Identity in Later Life*. Ph. D. thesis, Stanford University, Standford.

Rosenfelder, I. (2005). Canadian raising in victoria, b.c.: An acoustic anaylsis. Ms, University of Heidelberg.

Rudnicki, R. (1987). Patterns of italian immigrant settlement. In R. Vecoli (Ed.), *Italian Immigrants in Rural and Small Town America*, Number 9-17 in Fourteenth Annual Conference of the American Italian Historical Association. University of Minnesota Press.

Sankoff, D. and S. Laberge (1978). The Linguistic Market and the Statistical Explanation of Variability. In D. Sankoff (Ed.), *Linguistic Variation: Models and Methods*, pp. 239–250. New York: Academic Press.

Shuy, R., W. Wolfram, and W. Riley (1967). A Study of Social Dialects in Detroit. Final Report, Project 6-1347, Office of Education, Washington, D.C.

Silverstein, M. (1998). Contemporary Transformations of Local Linguistic Communities. *Annual Review of Anthropology 27*, 401–426.

Simon, B. (2005). Dago, Finlander, and Cousin Jack: Ethnicity and identity on Michigan's Upper Peninsula. In B. Joseph, C. Preston, and D. Preston (Eds.), *Language Diversity in Michigan and Ohio: Towards Two State Linguistic Profiles*. Caravan Books.

Statistics Canada (2011). Focus on geography series, 2011 census: Census agglomeration of sault ste. marie, ontario. `http://www12.statcan.gc.ca/census-recensement/2011/as-sa/fogs-spg/Facts-cma-eng.cfm?LANG=Eng&GK=CMA&GC=590`.

Stevens, K. (2000). *Acoustic Phonetics*. Current Studies in Linguistics Series. MIT Press.

Sturgul, P. A. (1987). Italians on the gogebic iron range. In R. Vecoli (Ed.), *Italian Immigrants in Rural and Small Town America*, Fourteenth Annual Conference of the American Italian Historical Association, pp. 170–178. University of Minnesota Press.

Sturtevant, E. (1947). *An introduction to linguistic science*. New Haven: Yale University Press.

Suomi, K., J. Toivanen, and R. Ylitalo (2008). *Finnish Sound Structure: Phonetics, Phonology, Phonotactics, and Prosody*. STUDIA HUMANIORA OULUENSIA 9. Oulu University Press.

Tagliamonte, S. A. (2012). *Variationist Sociolingustics: Change, Observation, Interpretation*. Wiley-Blackwell.

Thomas, E. (1991). The Origin of Canadian Raising in Ontario. *The Canadian Journal of Linguistics 36*(2), 147–170.

Thomas, E. (2011). *Sociophonetics: An Introduction*. Palgrave Macmillan.

Thomas, E. R. and T. Kendall (2007). NORM: The vowel normalization and plotting suite. [Software Resource: `http://ncslaap.lib.ncsu.edu/tools/norm/`].

Trudgill, P. (1972). Sex, Covert Prestige, and Linguistic Change in Urban British English. *Language in Society 1*(2), 179–195.

Trudgill, P. (1974). Linguistic Change and Diffusion: Description and explanation in sociolinguistic dialect geography. *Language in Society 3*, 215–246.

Trudgill, P. (1986). *Dialects in Contact*. New York: Basil Blackwell.

US Census Bureau (2000). American FactFinder. `http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml`.

Vance, T. J. (1987, Autumn). "Canadian Raising" in Some Dialects of the Northern United States. *American Speech 62*(3), 195–2010.

Wiik, K. (1965). *Finnish and English Vowels: A Comparison with special reference to the learning problems met by native speakers of Finnish learning English*. Turun Yliopiston julkaisuja. Sarja B osa 94. Turun Yliopisto.

Wolfram, W. (1969). *A Sociolinguistic Description of Detroit Negro Speech*. Center for Applied Linguistics.

Wolfram, W. (1974). *Sociolinguistic Aspects of Assimilation: Purerto Rican English in New York*. Center for Applied Linguistics.

Wolfram, W. (1984). Unmarked Tense in American Indian English. *American Speech 59*, 31–50.

Woods, H. (1979). *A Socio-dialectology Survey of the Englsih Spoken in Ottawa: A study of sociological and stylistic variation in Canadian English*. Ph. D. thesis, University of British Columbia, Vancouver.

CURRICULUM VITAE

EDUCATION

Indiana University — Bloomington, Indiana
Ph.D. in General Linguistics — August 2014

Focus:	Sociolinguistics and Phonetics
Minor:	Finnish Language Studies
Dissertation Committee:	Dr. Kenneth de Jong (chair), Dr. Dennis Preston, Dr. Stuart Davis, Dr. Julie Auger, and Dr. Pia Päiviö
Dissertation Title:	*The sociophonetic and acoustic vowel dynamics of Michigan's Upper Peninsula English*

M.A. in General Linguistics — Bloomington, Indiana

Focus:	General Linguistic	2011
Languages Studied:	Finnish, Swedish, and Susu	

Awarded three FLAS Fellowships, i.e., for two academic years (2008-2010) and one summer (2009)

Michigan State University — East Lansing, Michigan
B.A. in English — 2008

Focus:	Secondary Teacher Education
Subject Major:	English
Subject Minor:	Teaching English to Speakers of Other Languages (TESOL)
Language Studied:	Chinese

Awarded Outstanding Senior Achievement
Degree Received with High Honors

RESEARCH INTERESTS

Sociolinguistics, sociophonetics, acoustic and auditory phonetics, experimental phonology, normalization methods, production-perception mapping, language variation and change, language contact, language attitudes and perceptions, folk linguistics, and substrate and regional American English varieties.

CURRENT RESEARCH

I. Sociophonetic and statistical analysis of vowel systems collected among Finnish- and Italian-American communities in the Great Lakes region; vowel positions are determined spectrographically according to acoustic properties and data analysis is framed to trace the acquisition of and influence on English and language preservation.
II. Production/perception of locative prepositional omission of speakers in Michigan's Upper Peninsula.
III. Development of normalization procedures that account not only for the biological differences of vocal tract size effects but also factor in the phonological and sociological correlates of a given speech community; accounting for multi-dimensional acoustic-phonetic measurements, i.e., not only F1 and F2 values, when implementing normalization methods that models normalization in human-perception.
IV. Development of formant extraction procedures that account for the dynamic trajectory of vowel qualities while efficiently and accurately determining measurement points most appropriate for either a monophthongal or diphthongal vowel; the current procedure implements two models (i.e., a 1-pivot model for monophthongs and a 2-pivot model for diphthongs) uses linear-regression modeling to objectively and semi-automatically determine the "best" fitted-ness of potential measurement point(s) along an individual trajectory of a vowel token.

ACADEMIC POSITIONS

Visiting Assistant Professor (2014-2015), University of Rochester, Department of Linguistics

LIN210	- *Introduction to Language Sound Systems*	2014 Fall
LIN205	- *Language and Social Identity*	2015 Spring
LIN110	- *Introduction to Linguistic Analysis*	2014 Fall; 2015 Spring
LIN102	- *Historical Linguistics*	2015 Spring

Lecturer (2013-14), Michigan State University, Department of Linguistics and Languages

LIN491	- *Laboratory Phonetics*	2014 Spring
LIN471	- *Sociolinguistics*	2013 Fall
LIN401	- *Introduction to Linguistics*	2013 Fall; 2014 Spring

Lecturer (2012-13), Morehead State University, Department of English

ENG394	- *Language and Society* [ONLINE]		2013 Spring
ENG205	- *Language: Culture and Mind* [ONLINE]		2012/13 Fall

Associate Instructor (2010-12), Indiana University, Department of Linguistics

COLL-C103	- *The Ebonics Controversy* (TOPICS)	Dr. Stuart Davis, supervisor	2012 Fall
COLL-C103	- *Dialects and Language Variation* (TOPICS)	Dr. Brian Jose, supervisor	2012 Spring
LING–L303	- *Introduction to Linguistic Analysis*	Dr. Kenneth de Jong, supervisor	2011 Fall
LING–L541	- *Introductory Phonetics*	Dr. Kenneth de Jong, supervisor	2011 Spring
LING–L303	- *Introduction to Linguistic Analysis*	Dr. Kenneth de Jong, supervisor	2010 Fall

EDITORIAL SERVICE

Reviewer, *Journal of Phonetics*	2014 – Present
Editor's Assistant, *Journal of Phonetics*	2011 Fall

MANUSCRIPTS

"A Michigan Upper Peninsula Vowel System: Finnish-American Communities in Marquette County." American Speech: Accepted for publication on May 20th, 2014. To be published in the September 2014 issue.

"Michigan's Upper Peninsula Vowel Systems: Acoustic vowel characteristics of Finnish- and Italian-American communities." Language Variation and Change: Submitted on October 31, 2013.

WORKS-IN-PROGRESS

"*A Bayesian Statistical Approach to Vowel Normalization*." Language Variation and Change. Currently being revised for publication.

"*Where'd the Preposition go? An usage-based account of locative prepositional deletion of younger speakers in Michigan's Upper Peninsula*." Indiana University Linguistic Club Working Papers, Bloomington, IN. Currently being revised for publication.

"*The Entanglement of Dialectal Variety and Speaker Normalization.*" Indiana University Linguistic Club Working Papers, Bloomington, IN. Currently being revised for publication.

UNPUBLISHED MANUSCRIPTS

"*Acoustic Vowel Characteristics of Immigrant-heritage and Language-dominance Effects among Finnish- and Italian-American Communities."* Indiana University, Bloomington, IN. Currently being revised for publication, 2010.

"*The Optionality of Directional Prepositions in Michigan's Upper Peninsula: A descriptive analysis of a perceptual sentence acceptability-rating task*," Indiana University, Bloomington, IN. Graduate-level term paper, 2009.

"*Optionality of 'to' Deletion: A case of optional deletion for prepositions in the English language variety of Michigan's Upper Peninsula*." Indiana University, Bloomington, IN. Unpublished graduate-level course paper, 2008

"*An Upper Peninsula of Michigan Vowel System: A Preliminary Study,"* Michigan State University, Lansing, MI. Unpublished undergraduate-level course paper, 2007.

ORAL PRESENTATIONS & PUBLIC INTERVIEWS

"*The acoustic dynamics of vowels and the sociophonetics of an American English variety spoken in Michigan's Upper Peninsula*," MSU Colloquium 2013~2014, East Lansing, MI, September 2013.

"*Location and Heritage Effects on the Vowel Characteristics among Monolingual English Speakers from Michigan's Upper Peninsula*," Locating Language: A Symposium on the Linguistics of Place, Columbus, OH, April 2013.

"*Hierarchical Bayesian modeling of vowel formant data: Speaker-intrinsic and speaker-extrinsic approaches compared*," co-presented poster with Aaron Albin, Acoustical Society of America, Kansas City, MO, October 2012.

"*Where'd the Preposition go? An account of locative prepositional deletion in Michigan's UP speech community*," American Dialects Society, Portland, OR, January 2012.

"A *weird* and *peculiar* story: Variation and change in North American adjectives," presented by *Sali Tagliamonte and co-presented with students from LSA Summer Institute: Jon Bakos, Julia Cheng, Jessica Delisi, Amelia Dietrich, Devin Grammon, Ashley Hesson, Kinda Konnerth, Hank Lester, Justin McBride, Jane Mitsch, Meredith Moss, Jenna Nichols, Colin Pitet, Rachelle Price, Gabe Radovsky, Wil*

Rankinen, Na-Young Ryu, Hayley Smith, Nick Toler, & Jack Toner, Linguistic Society of America, Portland, OR, January 2012.

"*A Bayesian Statistical Approach to Vowel Normalization*," co-presented with Aaron Albin, New Ways of Analyzing Variation, Washington, DC, October 2011.

"*The Entanglement of Dialect Variety and Speaker Normalization,*" co-presented with Dr. Kenneth de Jong, Linguistic Society of America, Pittsburg, PA, January 2011.

"Michigan's Upper Peninsula Vowel System: Finnish- and Italian-American Communities," Linguistic Society of America, Baltimore, MD, January 2010.

"Sounding Out a Dialect: Michigan's Upper Peninsula Vowel Systems," Michigan's Iron Industry Museum, Negaunee, MI, August 2009.

"Michigan's Upper Peninsula Vowel Systems: Finnish- and Italian-American Communities," 3rd Annual IU Linguistics Department Graduate Student Conference*, Bloomington, IU, March 2009.*

"A Michigan Upper Peninsula Vowel System," MSU Undergraduate Research and Arts Forum, East Lansing, MI, April 2008.

"A Michigan Upper Peninsula Vowel System," MSU's sociolinguistics group - Friends of Sociolinguistics, East Lansing, MI, April 2008.

"Linguistic Patterns in Michigan," Co-interviewed with Dr. Dennis Preston on Points North News Radio, Interlochen, MI, February 2008.

"A Michigan Upper Peninsula Vowel System," American Dialect Society annual national conference, Chicago, IL, January 2008.

"A Michigan Upper Peninsula Vowel System," MSU's sociolinguistics group - Friends of Sociolinguistics, East Lansing, MI, November 2007.

"An Upper Peninsula of Michigan Vowel System Study," MSU Undergraduate Research and Arts Forum, East Lansing, MI, April 2007.

AWARDS, GRANTS, & HONORS

2012-2013	Outstanding Associate Instructor Award, Department of Linguistics, Indiana University, IN.
2012 January	ADS Travel Grant, American Dialect Society national conference, American Dialect Society
2011 December	Indiana University Linguistic Department Travel Grant, Indiana University – Bloomington, IN.
2011 July	LSA Linguistic Institute Fellowship, Boulder, CO
2010 – 2011	Honorable Mention, National Science Foundation: Graduate Research Fellowship Program, Indiana University, Bloomington, IN
2009 – 2010	IULC Travel Grant, Indiana University Linguistics Club, Bloomington, IN.
2009 – 2010	Foreign Language Area Studies (FLAS) Fellowship: Finnish, West European Studies, Indiana University, Bloomington, IN
2009 – 2010	Finlandia Foundation National Scholarship Award, Finlandia Foundation National, CA
2009 July	Center for International Mobility Travel Scholarship, CIMO Intensive Finnish language program, Savonlinna, Finland
2009 May	Foreign Language Area Studies (FLAS) Fellowship: Swedish, West European Studies, Indiana University, Bloomington, IN
2008 – 2009	Foreign Language Area Studies (FLAS) Fellowship: Finnish, West European Studies, Indiana University, Bloomington, IN
2007 – 2008	Outstanding Senior Achievement Award, College of Arts & Letters, Michigan State University, MI
2008 January	ADS Presidential Honoree, American Dialect Society national conference, Chicago, IL
2007 – 2008	CAL-URI Research Grant, College Arts & Letters Undergraduate Research Initiative, Michigan State University, East Lansing, MI
2008 January	ADS Travel Grant, American Dialect Society national conference, American Dialect Society
2005 – 2008	Dean's Lists, College of Arts & Letters and College of Education, Michigan State University, MI
2004 – 2005	Rotary Student Ambassador to Taiwan, Rotary International Exchange Program, Taipei, Taiwan.

LANGUAGE PROFIENCIES

Native – English Conversational – Finnish, Chinese Reading – Finnish Structure only – Susu, Swedish, Spanish

MEMBERSHIPS AND AFFILIATIONS

Acoustical Society of America, Linguistic Society of America, American Dialect Society, Historical Society of Michigan, and Quincy Mine Hoist Association

ACADEMIC REFERENCES

Julie Auger, Associate Professor, Indiana University, *Department of Linguistics*, jauger@indiana.edu
Stuart Davis, Professor, Indiana University, *Department of Linguistics,* davis@indiana.edu
Kenneth de Jong, Professor, Indiana University, *Department of Linguistics,* kdejong@indiana.edu
Pia-Maria Päiviö, Associate Professor, Department of Scandinavian Studies and Linguistics, hng786@hum.ku.dk
Dennis R. Preston, Regents Professor, Oklahoma State University, *Department of English,* dennis.preston@okstate.edu
Suzanne E. Wagner, Assistant Professor, Michigan State University, *Department of Linguistics and Languages,* wagnersu@msu.edu