A STUDY OF THE /O/ PHONEME AS PRONOUNCED BY WOMEN IN MORRISON, CARVER, AND LE SUEUR COUNTIES IN MINNESOTA

by

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The pronunciation of the /o/ in the Minnesotan dialect seems to be a comic element in various forms of popular media. Comedians pronounce this sound by overly lengthening the duration of the /o/. Is the production of the /o/ in Minnesota actually pronounced in this manner? Previous research seemed to suggest that it was pronounced as a pure [o] with traces of brevity for persons residing north of the Minnesota River whereas for persons residing south of the same river, the /o/ appeared to be spoken with traces of diphthongization (Allen, 1976). However, the data obtained in this study was compiled and analyzed by various researchers without the use of computers or other technological resources.

To gain a clearer understanding of how the sound was pronounced, this study focused on the pronunciation of the /o/ by women over the age of 60 years whose first language is English and who have lived in Morrison, Carver, or Le Sueur Counties in Minnesota for at least 80% of their lifetimes. Through recording the pronunciation of the /o/ in eleven research participants, over 50 samples of the /o/ were obtained. The manner in which the /o/ was pronounced, and the average amount of time that the phoneme was articulated were examined. The results of this project seemed to support previous research that suggested that the Minnesota River might be acting as an isogloss. However, more research is needed to know how inclusive the results of this study were.

ACKNOWLEDGEMENTS

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CHAPTER ONE: INTRODUCTION

In my travels to other parts of the United States, people often asked me where I was from. This was always an amusing question for me. Being from Minnesota, I had been taught that the midwestern dialect was the "accentless" form of *North American English* (NAE). I had also been told that the midwestern accent was so ideal, that television broadcasters were instructed to use this variety of English in their newscasts. As a teacher of English pronunciation, I believed that it was important for students to learn the midwestern pronunciation of NAE. Therefore, when a person questioned where my accent was from, I was confused because I was not aware that I had one. When I told people that I was from Minnesota, I would be bombarded with them mocking my pronunciation by lengthening their /o/ phonemes. After a few of these experiences, I began wondering what was the "correct" way to pronounce the /o/. Do persons living in Minnesota really elongate this phoneme, and was there any research that investigated the way that the /o/ was pronounced?

To help answer this question, I turned to various linguistic textbooks and those books that taught the NAE form of pronunciation to students who were learning to speak English. The linguistic books I read described the pronunciation of the /o/ as both [o] and [ow] (Brinton, 2000; Celce-Murcia, Brinton, & Goodwin, 1996; Clark & Yallop, 1990;

Stewart & Vaillette, 2001) whereas the student books describe the sound as a diphthongized [ow] (Ferree & Sanabria, 2004; Kozyrev, 2003; Lane, 2005). This information confused me. Were there really two ways to pronounce the /o/ phoneme? Which type of pronunciation should I be teaching to my students? How do people throughout Minnesota pronounce the /o/?

To gain a better understanding of how Minnesotans pronounce the /o/, I listened to some popular forms of radio programs and movies in search of an answer. I noticed that on some radio shows, such as Garrison Keillor's *Prairie Home Companion*, used a lengthened pronunciation of the /o/ to provide a comic element to the program. This program, which I heard on Minnesota Public Radio, is not the only instance where an exaggerated form of the Minnesota dialect is used in the mainstream media. I discovered other examples of this in Joel and Ethan Coen 1986's black comedy, *Fargo.* This movie gained so much critical acclaim that the general public became aware of many aspects of the Minnesotan dialect and, consequently, fueled possible stereotypes illustrating forms of the Minnesotan pronunciation. Despite the commonalities between the pronunciation of the /o/ in these two mediums, it was still unclear to me if the comic stereotype used in popular media, which seemed to me to be based on length, is an accurate reflection of the Minnesota /o/ or if the Minnesota /o/ has the same length as the standard NAE /o/ but is not diphthongized.

In the late 1940s, researchers from the University of Minnesota began investigating traits of the Upper Midwestern Dialect. Harold Allen (1976) studied many aspects of the Minnesota dialect, including the pronunciation of the /o/ phoneme.

However, due to limited uses of technology during that time period, Allen's team was restricted to manually transcribing the tape-recorded samples of each participant's speech. The research team focused mainly on the pronunciation of phonemes, they did note some levels of diphthongization and detected variations in the articulation periods for the /o/ phoneme. However, neither the specific amount of diphthongization nor the exact length of this articulation period was determined.

Now, nearly 70 years after Allen began his research, technology has been developed that is able to measure the exact length of the /o/ phoneme. Using these types of computer programs to analyze speech samples was not an option when Allen was completing his research because computers were the size of a large room and were used exclusively for military purposes (Gates, 1995). The advancements in technology now allow researchers to further investigate the duration of the /o/ phoneme as well as the levels of diphthongization, down to the millisecond, so as to understand the detailed traits of the Minnesotan dialect (SIL International, 2004).

For this research project, I sought to gain a better understanding of the Minnesotan dialect and, specifically, the pronunciation of the /o/ phoneme. In order to control some of the pronunciation variations that may be present in younger age groups, the persons that I will research will be over the age of 60 because they are very unlikely to adopt new pronunciation techniques (Bolinger, 1968). In addition to this research parameter, I will limit my research to the pronunciation by women whose first language is English and who have lived in rural Minnesota for at least 80% of their lifetime (note Chapter Three.) Some research suggests that the pronunciation of the /o/ north of the

Minnesota River is different than it was to the south of the same river (Allen, 1976; Allen & Underwood, 1971). Therefore, I would also like to see if a pronunciation discrepancy exists between these geographical locations. Once this data has been obtained, I would next like to analyze this information with current technology, to measure the length of the /o/ as well as note the manner in which the /o/ was pronounced, such as a pure [o] or diphthongized [ow]. In doing this, I hope to better understand how my research participants pronounce the /o/ phoneme and if is pronounced differently in various parts of Minnesota.

Summary

I explained my interest in researching the Minnesotan dialect, explored popular forms of media that elongates the /o/ phoneme, briefly discussed Allen's research, and identified areas that need further investigation. For this project, I would like to gain a better understanding of the pronunciation of the /o/ by women over the age of 60 years whose first language is English and who have lived in rural Minnesota for at least 80% of their lifetimes. In Chapter One, I discussed my interest in researching the Minnesotan dialect. In Chapter Two, I will further explore how the /o/ is pronounced in Minnesota and the various factors that can influence the length of the /o/ phoneme. Researching these areas will help enhance my understanding of the /o/ phoneme so that I can better understand the features of the /o/ phoneme and if the pronunciation varies between regions in Minnesota.

CHAPTER TWO: LITERATURE REVIEW

For this project, I am researching features of the /o/ so as to gain a better understanding of the way it is pronounced by women over the age of 60 years whose first language is English and who have lived in rural Minnesota for at least 80% of their lifetimes. In Chapter One, I discussed my interest in researching the Minnesotan dialect. In Chapter Two, I will explain how the /o/ is physically produced in the oral cavity, explore previous research that explains how the /o/ is pronounced in Minnesota, examine influences that language contact may have played in the development of the Minnesotan dialect, and compare how the linguistic environments that the /o/ is found in can influence the pronunciation. By investigating these areas, I hope to have a better understanding of the /o/ phoneme and the different traits that may influence the articulation length or levels of diphthongization.

Production of the /o/

There are a variety of factors that contribute to the production of the /o/ phoneme. The first factor in understanding the way in which the /o/ is formed is to clarify the differences between the physical production of [o] and [ow]. The second factor is to identify how many milliseconds that the /o/ is produced, and the third factor is to

specifically distinguish what pitch change constitutes a diphthong. Now that the physical production of the /o/ as well as specific qualities of the vowel sound have been established, the final stage is to begin to briefly investigate which dialects of NAE use [o] versus [ow] form of the /o/ phoneme.

Physical Production of the /o/

First, it is important to understand how the /o/ phoneme is produced physically. There are two basic ways of pronouncing the /o/ phoneme in NAE: as a pure [o] or a diphthongized [ow]. The beginning stages of the physical production of the two sounds are the same. As air leaves the lungs and travels through the larynx, the larynx vibrates. In English, vowel sounds cause the larynx to vibrate whereas the production of consonants sometimes requires the larynx to vibrate but always requires some form of blockage as air travels through the oral and nasal cavities (Brinton, 2000; Langacker, 1972). Once the air has entered the oral cavity, the tongue is placed in the mid-back region of the mouth to produce the [o] sound (Celce-Murcia, Brinton, & Goodwin, 1996). If the articulation ends here, the /o/ is considered a *pure 'o,'* however, if the [o] is followed by further jaw movement, a diphthong is created.

A *diphthong* is a sound that contains both a vowel and *glide*, /w/ or /y/, in the same syllable (Allen & Underwood, 1971; Roca, & Johnson, 1999; Stewart & Vaillette, 2001). In the case of the /ow/ diphthong, this sound begins in the mid-back region of the mouth, in much the same manner as the /o/ phoneme, and ends with a predominate up-glide in the first half of the formation of the /w/ glide. Unlike the production of the pure 'o', the diphthongized /ow/ requires additional movement in the jaw and lips. The last

step in completing the /w/ sound concludes as the air leaves the mouth and passes between the lips, the lips tighten slightly creating a rounded *O* shape for the final production of the /w/ glide (Celce-Murcia, Brinton, & Goodwin, 1996; Ripman, 1918).

Length of the /o/ Phoneme

Second, it is important to identify benchmarks for the various articulation lengths of the /o/ phoneme. The first influence that may effect the articulation period of the /o/ is the manner in which the /o/ is pronounced. For example, if the /o/ is pronounced as a pure [o], it may or may not have a shorter articulation time than if it is produced as a [ow] diphthong (Hillenbrand, Getty, Clark, & Wheller, 1995; Peterson & Lehiste, 1967a; Ripman 1918). Note Figure 2.1 for the length of time, in *milliseconds* (msec), that each sound is pronounced.

Shorter Articulation Time	⟷		Longer Articulation Time
[ŏ]*	[o]	[o:]	[ow]
> 200 msec	200 – 300 msec	< 300 msec	220 msec and 326 msec

**Note Appendix A*

Figure 2.1: Articulation Times for the /o/

The information in Figure 2.1 comes from the following sources. Hillenbrand, Getty, Clark, and Wheller (1995) reports that the [ow] was pronounced an average of 326 msec whereas Peterson and Lehiste (1967) found that the [ow] was pronounced an average of 220 msec. The data that was collected from Peterson and Lehiste (1967a) was based on

five speakers who uttered the vowel in a closed syllable in connected speech. Ripman (1918) reports the [ŏ] was articulated for less than 200 msec, the production of the [o] ranged between 200 msec to 300 msec, and the articulation of the [o:] was spoken longer than 300 msec. Ripman explains that this data was obtained by one linguistic timing the production of the /o/ of his own speech. However, the environment in which the vowel sounds were produced was not specified. Regardless of the number of milliseconds that the /o/ is articulated for, most research studies indicate that the /o/ is almost always pronounced as a diphthong and rarely pronounced as a pure [o] as indicated by research completed exclusively using participants from the Midwest (Allen, 1973; Hillenbrand, Getty, Clark, & Wheller, 1995; Peterson & Lehiste, 1967a).

Diphthongization of the /o/

Third, it is important to identify what pitch change reading constitutes a diphthongized form of the /o/. Diphthongization occurs as the tongue moves from a mid back to a high back position, the jaw closes as it rises with the tongue movement and the lips close to form an *O* shape (Celce-Murcia, Brinton, & Goodwin, 1996). The exact amount that the /o/ is diphthongized can be measured, via the *Speech Analyzer*, by subtracting the *ending frequency* (Q2) from the *beginning frequency* (Q1) of the *second formant* (F2). Note Figure 2.2 for example for the location of the Q1 and Q2 of F2 illustrated via arrows.

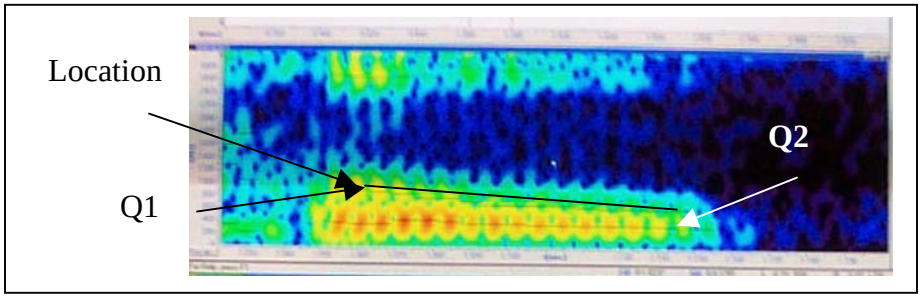


Figure 2.2: Image of the /o/ as Articulated as a Diphthong

As seen in the above diagram, the solid black line, which slightly angles downward, shows the diphthongization of the /o/ phoneme. Determining the exact frequency of the sound, otherwise know as the *pitch,* will enable researchers to determine how a sound is being produced (Ladefoged, 1982).

Researchers have determined the level of diphthongization for the [ow] by measuring the pitch of the two vowel sounds that are produced most closely to the /o/ phoneme, specifically the pitch of the /ɔ/, which averages 905.5 Hertz, from the pitch of the /ʊ/, which averages 1140.5 Hertz (Denes & Pinson, 1963; Holbrook & Fairbanks, 1967; Peterson & Barney, 1967; Peterson & Lehiste, 1967a)[1]. The difference between these two readings averages –235.0 Hertz for the diphthongization of the [ow]. The actual diphthongization of the sound, however, is articulated at a slightly narrower range. A pair of linguistic researchers measured the actual change in pitch readings for the [ow] diphthong and discovered that change in pitch averages -210.0 Hertz (Holbrook &

[1] Holbrook & Fairbanks (1967) measured the pitch of vowels in utterance-final open syllables spoken by men. Peterson & Barney's (1967) data came from vowels in closed syllables in wordlists spoken by participants of both genders. Peterson & Lehiste (1967a) measured the pitch of vowels in closed syllables in connected speech. They did not mention the gender of their participants.

Fairbanks, 1967). Determining the level of diphthongization that may occur will help to determine if the /o/ is being produced as a diphthong and to what level the diphthongization occurs.

Usage of [o] Versus [ow] in NAE

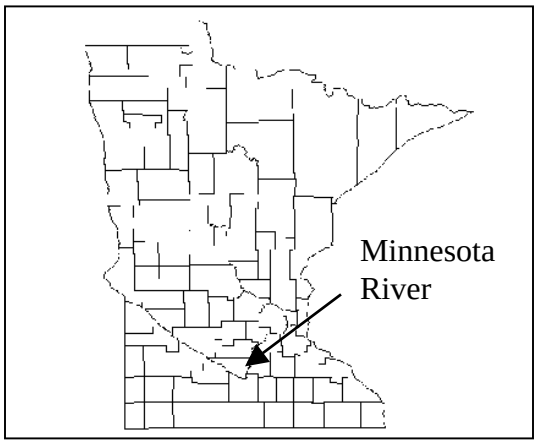
Finally, it is time to investigate the usage of [o] versus [ow] in the varieties of NAE. A speaker's usage of [o] and [ow] depends on the variety of NAE that is spoken. In the Midwestern Regions of NAE, the /o/ in *road* is pronounced as [o] or [ow] whereas in Western Regions, the /o/ in *road* is pronounced with the diphthongized [ow] (Allen, 1976; Labov, Ash, & Boberg, 1997). Because there is no lexical discrimination between these sounds and no minimal pairs are created, they are considered allophones of the same phoneme (Clark & Yallop, 1995). Hence, one of the factors that determines a speaker's usage of [o] and [ow] is the geographical area that the speaker first learned to speak NAE (Rickford, 1996; Labov, Ash, & Boberg, 1997; Stewart & Vaillette, 2001).

In addition to these general differences between the pronunciation of the /o/ phoneme in some regions in NAE, there also exist pronunciation variations within each dialectal area. For example, in the eastern parts of New England, the pronunciation of /o/ phoneme in the word *road* can vary from a slightly elongated [o:] to a type of /o/ and /u/ combination diphthong, as in [ou] (Kurath, 1939). Pronunciation variations also exist within Minnesota. For example, the /o/ in *road* is pronounced slightly longer, [o˙], in Roseau County, has traces of a diphthong, [o^{u}], in Cook County, and is spoken as a pure vowel, [o], in Washington County (Allen, 1976).

Pronunciation of the /o/ in Minnesotan

In Minnesota the sound is generally pronounced as a pure [o] or a variation of the [ow] diphthong. In the late 1940s, Harold Allen began investigating NAE's lexical and phonological traits that were unique to the Upper Midwestern region. Allen, teamed with six fieldworkers, interviewed 208 persons living in Minnesota, Nebraska, North Dakota, South Dakota, and southern parts of Canada. Fieldworkers would travel to the counties of the research participants and tape record their conversations. Later, the tapes would be analyzed and manually transcribed into a series of non-standard phonetic symbols (Appendix A). Two of the words that were of particular interest to the research team were the pronunciation of the /o/ in *ago* and *coat.* Researchers discovered that the pronunciation of the /o/ in these linguistic environments varied in vowel length as well as in the basic pronunciation of the phoneme.

The pronunciation of the /o/ in *ago* varied slightly from region to region in Minnesota, which seemed to be divided by the Minnesota River (Allen, 1976). Using a geographical border, such as a river, to separate pronunciation variations is considered an *isogloss*, a line marking when one feature of a dialect changes and another begins (Stewart & Vaillette, 2001). According to the *Linguistic Atlas of the Upper Midwest* (LAUM), the Minnesota River appeared to be this geographical line (Allen, 1976; Allen & Underwood, 1971). South of the river, the /o/ in *ago* tended to be largely pronounced with traces of a slight diphthong, as in [o^{u}]. However, north of the Minnesota River, the /o/ was pronounced as a pure vowel and with slight traces of brevity. Note the following diagram for the location of the Minnesota River.



(Minnesota Historical Society, 2004)

Figure 2.3: Location of the Minnesota River

According to the LAUM, research participants who lived north of the Minnesota River pronounced the /o/ phoneme differently than participants who lived to the south. Figure 2.3 illustrates the location of the Minnesota River, which seems to act as an isogloss between the northern [o^{u}] pronunciation and the southern [o] or [o$^{<}$] pronunciations. For example, in McLeod County, the /o/ was mainly pronounced as pure [o] but there were also some instances where the /o/ was pronounced with slight traces of brevity, as in [o$^{<}$]. In Crow Wing County, which is also located north of the Minnesota River, the phoneme was spoken with some brevity, as in [o$^{\breve{}}$^], but not as briefly as in McLeod County.

The pronunciation patterns of /o/ in *coat* do not appear to have a clear pattern as it did in *ago*. For example, south of the Minnesota River in Goodhue County, the /o/ in *coat* was pronounced either as a pure [o] sound or with a slightly elongated [o$^{\cdot}$] sound whereas in Fillmore County, the /o/ was pronounced with slight brevity, as in [o$^{\breve{}}$^].

North of the Minnesota River in McLeod County, the /o/ in *coat* was pronounced as a

pure [o] or a briefer [ŏ] version. In Crow Wing County, which is also north of the river, *coat* was both elongated, as in [o·], and spoken with some brevity, as in [o[˘]]. Therefore, it seems that there may be other factors that could influence the length of the /o/ phoneme in *coat* other than the Minnesota River acting as an isogloss.

Despite the amount of data collected in the LAUM, it is unclear how accurate the data collection methods were because of the lack of technology and the large number of researchers analyzing the data. Due to the technological limitations of the time period, linguistic research and analyzing data was limited to the eyes and ears of six separate researchers. Because of this, numerous inconsistencies may have developed. For example, researchers noted a slight diphthongization to the /o/ phoneme in some instances, yet, it is unclear if the diphthong was added by the participants or by the ears of the researcher analyzing the data. The same argument also holds true for the vowel length of the /o/ phoneme. Therefore, if one researcher believes that a vowel is possibly a diphthong but is not certain, that researcher may mark the phoneme as elongated when it is truly a diphthong, whereas the next researcher may record the opposite pronunciation pattern. Because of the possible inconsistencies in interpreting the data, it is not clear if the findings of the LAUM truly represent the actual pronunciation of the /o/ phoneme during that time period. Sixty years after Allen began his research, computer programs such as the *Speech Analyzer* have been developed to more accurately understand the pronunciation and articulation length of phonemes (SIL International, 2004). This technological advantage gives new researchers the capability to explore several linguistic nuances, which seemed unimaginable to researchers fifty years ago.

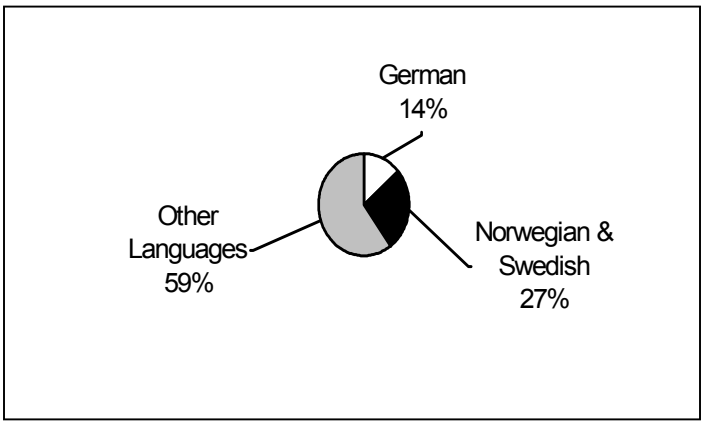
In addition to the manner in which the data was analyzed, it is also unclear exactly how many research participants were interviewed in Minnesota. Allen (1976) states that a total of 208 participants were interviewed in Minnesota, Nebraska, North Dakota, South Dakota, and southern parts of Canada, and each participant was given a number, totaling 437. These two numbers do not match, which suggests that participation numbers were assigned, possibly, according to instances that unique linguistic samples occurred from the same participant rather than simply assigning each participant one number. Therefore, when Allen gave 65 participation numbers to persons interviewed in Minnesota, it is not clear how many unique research participants were actually interviewed. In addition to this, among the 65 participants in Minnesota, three were Canadians (Allen, 1976). Because of this, some of the conclusions that were reached for Minnesota may be inaccurate.

Finally, there was also the question of when the research was actually compiled. When Allen began collecting his data, nearly 60 years ago, Minnesota consisted of 98% Caucasian residents (Gibson, & Jung, 2002). However, while Allen was compiling his research, there was population influx of immigrant groups who resettled throughout the state, primarily in the urban settings (Holmquist, 1981). Since then, there has been continual population shifts as large numbers of immigrant have moved into Minnesota, especially in the rural areas. This introduced many variations in the way that English is being pronounced. This change in the population demographics means that an increasing number of language varieties are being spoken within the state. Because Allen compiled

his research over the course of 30 years, it is unclear exactly when the language samples were obtained and the linguistic demographics of the communities.

Language Contact

It has been suggested that the Minnesotan dialect was primarily generated by the large numbers of Swedish and Norwegian immigrants who settled in the region despite Germans being the largest immigrant group (Allen, 1973; Holmquist, 1981; van der Hulst, 1999). According to the Proto-Indo-European Family Tree, all three of these languages are rooted in the same Germanic ancestry; Swedish and Norwegian are rooted in the Northeastern branch whereas German is rooted in the Western portion (Stewart & Vaillette, 2001). Due to the similarities between the Swedish and Norwegian languages, the two Scandinavian groups became more linguistically influential than German (Goblirsch, 1993; Gerald, Harbert, & Zhang, 1998). These linguistic commonalities may help to explain the extensive intermarrying between the two immigrant groups (Holmquist, 1981). Towards the later part of the 19th century, Swedish and Norwegian immigrants overwhelmed some communities in greater Minnesota. For example, in 1880, the town of Red Wing reported between 30 to 40 % of their total population consisted of Swedish immigrants whereas Lanesboro reported over 40% of their population consisted of Norwegian immigrants (Holmquist, 1981). Around the turn of the 19th century, Swedish and Norwegian contributed 27% of all languages spoken in Minnesota. Note Figure 2.4 for the percentages of languages spoken between the years 1895 – 1905.



(Gibson, & Jung, 2002; Holmquist, 1981)

Figure 2.4: Breakdown of Languages Spoken in Minnesota Between 1885-1905

As noted in Figure 2.4, 27% of Minnesotans spoke Norwegian and Swedish, 14% spoke German, while the remaining 59% spoke other languages. Some of the languages that the remaining 59% spoke included: Spanish, Polish, Native American Dakota, Finnish, and so forth (Allen, 1973; Conzen, 2003; Gibson, & Jung, 2002; Holmquist, 1981; Rooney, Zelinsky, & Louder, 1982). Due to the relatively small percentages and limited linguistic influence that each specific language had, they generally had little to no linguistic impact on the overall Minnesotan dialect. This fact made it more likely that the two Scandinavian languages had more of a contributing factor to the development of the overall Minnesotan accent than any other language group.

Due to the high percentage of immigrants who spoke Swedish and Norwegian languages in Minnesota, the possibility for *language transfer*, when language characteristics between the two languages overlap, might have occurred (Allen, 1973; van der Hulst, 1999; Karstadt, 1996; Stewart & Vaillette, 2001). Some researchers have been able to make connections between consonant sonority and their influence on vowel

length in the Swedish, Norwegian, and English languages (Goblirsch, 1993; Gerald, Harbert, & Zhang, 1998). However, the research is unable to make any definitive correlations between the length of the /o/ phoneme of any of the three languages. Because of this, it is unclear if the /o/ is truly elongated in the Minnesota dialect as a result of any language transfer. Regardless, research combined with the high percentage of Norwegian and Swedish speakers throughout Minnesota during that time period, suggests that language transfer may have been a factor in the region's phonological development.

Vowel Quality

As previously noted in this chapter, more research participants elongated the /o/ in the morpheme *coat* than in *ago* (Allen, 1976). Because of this, it is important to understand if the linguistic environment of the /o/ could be a contributing factor for the length that the /o/ is spoken. This will be investigated in the following three sections: syllable stress, sonority of the surrounding phonemes, and qualities of the final phonemes. These qualities are more likely to influence the elongation time of the /o/ phoneme than other phonological traits, such as *r*- or *l-coloring* (Celce-Murcia, Brinton, & Goodwin, 1996; Ladefoged, 1982; Roca & Johnson, 1999; Schane, 1973). Understanding the characteristics of each area may help to better identify possible relationships between the linguistic environment and the length of the /o/.

Syllable Stress

The first area that may influence the length of the /o/ phoneme is the word stress. In many multisyllabic words, those parts that are stressed carry a longer elongation time

than those phonemes that are unstressed, and thus reduced (Ladefoged, 1982). For example, the /o/ in *c**o**ping* is stressed and articulated for a longer period of time whereas the /o/ is *hot**e**l* is not stressed and reduced. Due to variations in the articulation length of the /o/ phoneme in multisyllabic words, only monosyllabic words will be used in this research project.

Sonority of the Surrounding Phonemes

The second area that can affect the time duration of the /o/ is the sonority of the following phonemes (Celce-Murcia, Brinton, & Goodwin, 1996; Roca & Johnson, 1999; Schane, 1973). Phoneme *sonority* refers to "the loudness relative to that of other sounds with the same length, stress, and pitch (Ladefoged, 1982, p. 221)." For example, low vowels, such as /a/, are considered the most sonorous, whereas high vowels, such as /u/, are slightly less sonorous. Nasals, such as /m/, have a greater sonority than voiced fricatives, such as /z/, but voiceless fricatives, such as /s/, and all voiceless stops are considered the least sonorous. To clarify this, note Table 2.1 for an illustration of the sonority scale. The phonemes at the top of the scale are considered more sonorous, gradually decreasing their sonority as they appear in the lower portions of the scale.

Table 2.1: Sonority Scale

Sonority	**Phoneme Type**	**Examples**
Most Sonorous ↓	Low Vowels	/a/ & /æ/
	High Vowels	/u/ & /i/
	Nasals	/m/ & /n/
	Voiced Fricatives	/z/ & /v/
	Voiceless Fricatives	/s/ & /ʃ/
Least Sonorous	Voiceless Stops	/t/ & /k/

(Ladefoged, 1982, p.222)

As seen in the above scale, low vowels, high vowels, and nasals are the most sonorous whereas voiceless fricatives and voiceless stops are the least sonorous. These sounds can influence the articulation length of the /o/ phoneme. For this research project, I will choose single consonants, rather than clusters, that have the same sonority so as to control possible influences that the surrounding sounds may have on the articulation length of the /o/ phoneme.

Qualities of the Final Phoneme

The third area that can influence the articulation length of the /o/ is the specific qualities of the final phonemes (Celce-Murcia, Brinton, & Goodwin, 1996; Roca & Johnson, 1999). For example, if the final phoneme is a voiceless consonant, such as in *coat* or *loaf,* then the articulation length of the /o/ will be a shorter time whereas the

reverse is true if the final consonant is absent, such as in *ago* or *snow*. Note the Table 2.2 for a visual description.

Table 2.2: Continuum of Vowel Length

Shorter Articulation Time	⟷	Longer Articulation Time
Final voiceless consonant	Final voiced nonsonorant consonant	No consonant or final voiced sonorant consonant
e.g. *goat* [gŏt] or [go^{ŏ} t]	e.g. *goad* [god] or [go$^{\cdot}$ d]	e.g. *snow* [sno:] or [sno::] *goal* [go:l] or [go::l]

(Allen, 1976; Celce-Murcia, Brinton, & Goodwin, 1996)

As noted in the diagram above, if the final consonant is voiceless, such as in *goat,* then the /o/ will have a shorter articulation time. If the final consonant is voiced, such as in *goad*, than the vowel will be slightly longer whereas if there is no final consonant or the final consonant is a voiced sonorant consonant, such as in *snow* or *goal*, than the vowel will have a longer articulation time. Hence, the duration of the /o/ phoneme changes depending on the qualities of the preceding phonemes.

According to these various types of vowel qualities, such as the qualities of the consonant following the /o/ phoneme, research participants in Minnesota should have lengthened the /o/ in *ago* more than in the morpheme *coat.* The length of the /o/ in *coat* should be the shortest articulation time because the morpheme ends with the final voiceless consonant /t/, whereas *ago* does not end in a final consonant and, hence, should have been articulated for a longer period of time (Celce-Murcia, Brinton, & Goodwin,

1996). Yet, according to the data that was presented in the LAUM, the articulation length of the /o/, as shown in the morphemes *coat* and *ago*, seemed not to have been determined by properties of the following phonemes (Allen, 1976). This suggests that there may have been contributing factors that influenced the pronunciation time of the /o/ phoneme other than the linguistic qualities of the surrounding phonemes.

Summary

In Chapter Two, I explained how the /o/ is physically produced, explored how the phoneme is pronounced within Minnesota, examined influences that language contact may have played in the development of the Minnesotan dialect, and compared how various qualities of phonemes may influence the pronunciation of the /o/. By investigating these areas, I have a better basic understanding of the /o/ phoneme and the different traits that may influence the pronunciation of the sound. In Chapter Three, I will describe the specific qualifications of my research participants, explain the setting in which the research project will take place, describe the technological resources which will be used, and outline the data collection methods. Determining these research guidelines will enable me to lay the foundation to my research so that I may investigate features of the /o/ phoneme as well as understand if the sound is diphthongized to see if the length or the amount of diphthongization varies from region to region in Minnesota.

CHAPTER TWO: LITERATURE REVIEW

For this project, I am researching features of the /o/ so as to gain a better understanding of the way it is pronounced by women over the age of 60 years whose first language is English and who have lived in rural Minnesota for at least 80% of their lifetimes. In Chapter One, I discussed my interest in researching the Minnesotan dialect. In Chapter Two, I will explain how the /o/ is physically produced in the oral cavity, explore previous research that explains how the /o/ is pronounced in Minnesota, examine influences that language contact may have played in the development of the Minnesotan dialect, and compare how the linguistic environments that the /o/ is found in can influence the pronunciation. By investigating these areas, I hope to have a better understanding of the /o/ phoneme and the different traits that may influence the articulation length or levels of diphthongization.

Production of the /o/

There are a variety of factors that contribute to the production of the /o/ phoneme. The first factor in understanding the way in which the /o/ is formed is to clarify the differences between the physical production of [o] and [ow]. The second factor is to identify how many milliseconds that the /o/ is produced, and the third factor is to

specifically distinguish what pitch change constitutes a diphthong. Now that the physical production of the /o/ as well as specific qualities of the vowel sound have been established, the final stage is to begin to briefly investigate which dialects of NAE use [o] versus [ow] form of the /o/ phoneme.

Physical Production of the /o/

First, it is important to understand how the /o/ phoneme is produced physically. There are two basic ways of pronouncing the /o/ phoneme in NAE: as a pure [o] or a diphthongized [ow]. The beginning stages of the physical production of the two sounds are the same. As air leaves the lungs and travels through the larynx, the larynx vibrates. In English, vowel sounds cause the larynx to vibrate whereas the production of consonants sometimes requires the larynx to vibrate but always requires some form of blockage as air travels through the oral and nasal cavities (Brinton, 2000; Langacker, 1972). Once the air has entered the oral cavity, the tongue is placed in the mid-back region of the mouth to produce the [o] sound (Celce-Murcia, Brinton, & Goodwin, 1996). If the articulation ends here, the /o/ is considered a *pure 'o,'* however, if the [o] is followed by further jaw movement, a diphthong is created.

A *diphthong* is a sound that contains both a vowel and *glide*, /w/ or /y/, in the same syllable (Allen & Underwood, 1971; Roca, & Johnson, 1999; Stewart & Vaillette, 2001). In the case of the /ow/ diphthong, this sound begins in the mid-back region of the mouth, in much the same manner as the /o/ phoneme, and ends with a predominate up-glide in the first half of the formation of the /w/ glide. Unlike the production of the pure 'o', the diphthongized /ow/ requires additional movement in the jaw and lips. The last

step in completing the /w/ sound concludes as the air leaves the mouth and passes between the lips, the lips tighten slightly creating a rounded *O* shape for the final production of the /w/ glide (Celce-Murcia, Brinton, & Goodwin, 1996; Ripman, 1918).

Length of the /o/ Phoneme

Second, it is important to identify benchmarks for the various articulation lengths of the /o/ phoneme. The first influence that may effect the articulation period of the /o/ is the manner in which the /o/ is pronounced. For example, if the /o/ is pronounced as a pure [o], it may or may not have a shorter articulation time than if it is produced as a [ow] diphthong (Hillenbrand, Getty, Clark, & Wheller, 1995; Peterson & Lehiste, 1967a; Ripman 1918). Note Figure 2.1 for the length of time, in *milliseconds* (msec), that each sound is pronounced.

Shorter Articulation Time	⟷		Longer Articulation Time
[ŏ]*	[o]	[o:]	[ow]
> 200 msec	200 – 300 msec	< 300 msec	220 msec and 326 msec

**Note Appendix A*

Figure 2.1: Articulation Times for the /o/

The information in Figure 2.1 comes from the following sources. Hillenbrand, Getty, Clark, and Wheller (1995) reports that the [ow] was pronounced an average of 326 msec whereas Peterson and Lehiste (1967) found that the [ow] was pronounced an average of 220 msec. The data that was collected from Peterson and Lehiste (1967a) was based on

five speakers who uttered the vowel in a closed syllable in connected speech. Ripman (1918) reports the [ŏ] was articulated for less than 200 msec, the production of the [o] ranged between 200 msec to 300 msec, and the articulation of the [o:] was spoken longer than 300 msec. Ripman explains that this data was obtained by one linguistic timing the production of the /o/ of his own speech. However, the environment in which the vowel sounds were produced was not specified. Regardless of the number of milliseconds that the /o/ is articulated for, most research studies indicate that the /o/ is almost always pronounced as a diphthong and rarely pronounced as a pure [o] as indicated by research completed exclusively using participants from the Midwest (Allen, 1973; Hillenbrand, Getty, Clark, & Wheller, 1995; Peterson & Lehiste, 1967a).

Diphthongization of the /o/

Third, it is important to identify what pitch change reading constitutes a diphthongized form of the /o/. Diphthongization occurs as the tongue moves from a mid back to a high back position, the jaw closes as it rises with the tongue movement and the lips close to form an *O* shape (Celce-Murcia, Brinton, & Goodwin, 1996). The exact amount that the /o/ is diphthongized can be measured, via the *Speech Analyzer*, by subtracting the *ending frequency* (Q2) from the *beginning frequency* (Q1) of the *second formant* (F2). Note Figure 2.2 for example for the location of the Q1 and Q2 of F2 illustrated via arrows.

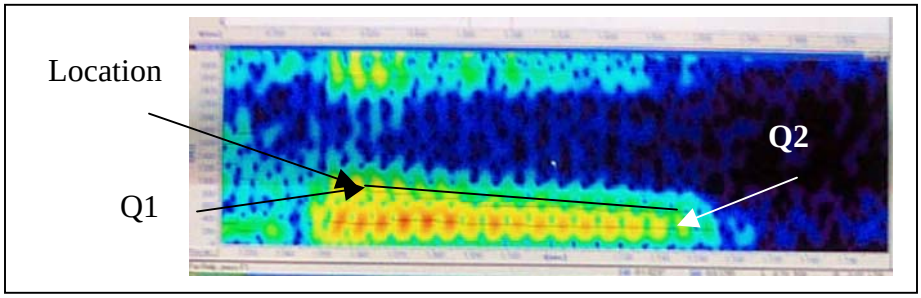


Figure 2.2: Image of the /o/ as Articulated as a Diphthong

As seen in the above diagram, the solid black line, which slightly angles downward, shows the diphthongization of the /o/ phoneme. Determining the exact frequency of the sound, otherwise know as the *pitch,* will enable researchers to determine how a sound is being produced (Ladefoged, 1982).

Researchers have determined the level of diphthongization for the [ow] by measuring the pitch of the two vowel sounds that are produced most closely to the /o/ phoneme, specifically the pitch of the /ɔ/, which averages 905.5 Hertz, from the pitch of the /ʊ/, which averages 1140.5 Hertz (Denes & Pinson, 1963; Holbrook & Fairbanks, 1967; Peterson & Barney, 1967; Peterson & Lehiste, 1967a)[2]. The difference between these two readings averages –235.0 Hertz for the diphthongization of the [ow]. The actual diphthongization of the sound, however, is articulated at a slightly narrower range. A pair of linguistic researchers measured the actual change in pitch readings for the [ow] diphthong and discovered that change in pitch averages -210.0 Hertz (Holbrook &

[2] Holbrook & Fairbanks (1967) measured the pitch of vowels in utterance-final open syllables spoken by men. Peterson & Barney's (1967) data came from vowels in closed syllables in wordlists spoken by participants of both genders. Peterson & Lehiste (1967a) measured the pitch of vowels in closed syllables in connected speech. They did not mention the gender of their participants.

Fairbanks, 1967). Determining the level of diphthongization that may occur will help to determine if the /o/ is being produced as a diphthong and to what level the diphthongization occurs.

Usage of [o] Versus [ow] in NAE

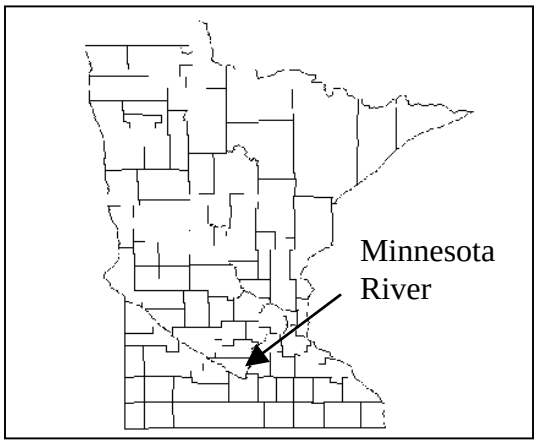
Finally, it is time to investigate the usage of [o] versus [ow] in the varieties of NAE. A speaker's usage of [o] and [ow] depends on the variety of NAE that is spoken. In the Midwestern Regions of NAE, the /o/ in *road* is pronounced as [o] or [ow] whereas in Western Regions, the /o/ in *road* is pronounced with the diphthongized [ow] (Allen, 1976; Labov, Ash, & Boberg, 1997). Because there is no lexical discrimination between these sounds and no minimal pairs are created, they are considered allophones of the same phoneme (Clark & Yallop, 1995). Hence, one of the factors that determines a speaker's usage of [o] and [ow] is the geographical area that the speaker first learned to speak NAE (Rickford, 1996; Labov, Ash, & Boberg, 1997; Stewart & Vaillette, 2001).

In addition to these general differences between the pronunciation of the /o/ phoneme in some regions in NAE, there also exist pronunciation variations within each dialectal area. For example, in the eastern parts of New England, the pronunciation of /o/ phoneme in the word *road* can vary from a slightly elongated [o:] to a type of /o/ and /u/ combination diphthong, as in [ou] (Kurath, 1939). Pronunciation variations also exist within Minnesota. For example, the /o/ in *road* is pronounced slightly longer, [o˙], in Roseau County, has traces of a diphthong, [o^{u}], in Cook County, and is spoken as a pure vowel, [o], in Washington County (Allen, 1976).

Pronunciation of the /o/ in Minnesotan

In Minnesota the sound is generally pronounced as a pure [o] or a variation of the [ow] diphthong. In the late 1940s, Harold Allen began investigating NAE's lexical and phonological traits that were unique to the Upper Midwestern region. Allen, teamed with six fieldworkers, interviewed 208 persons living in Minnesota, Nebraska, North Dakota, South Dakota, and southern parts of Canada. Fieldworkers would travel to the counties of the research participants and tape record their conversations. Later, the tapes would be analyzed and manually transcribed into a series of non-standard phonetic symbols (Appendix A). Two of the words that were of particular interest to the research team were the pronunciation of the /o/ in *ago* and *coat.* Researchers discovered that the pronunciation of the /o/ in these linguistic environments varied in vowel length as well as in the basic pronunciation of the phoneme.

The pronunciation of the /o/ in *ago* varied slightly from region to region in Minnesota, which seemed to be divided by the Minnesota River (Allen, 1976). Using a geographical border, such as a river, to separate pronunciation variations is considered an *isogloss*, a line marking when one feature of a dialect changes and another begins (Stewart & Vaillette, 2001). According to the *Linguistic Atlas of the Upper Midwest* (LAUM), the Minnesota River appeared to be this geographical line (Allen, 1976; Allen & Underwood, 1971). South of the river, the /o/ in *ago* tended to be largely pronounced with traces of a slight diphthong, as in [o^{u}]. However, north of the Minnesota River, the /o/ was pronounced as a pure vowel and with slight traces of brevity. Note the following diagram for the location of the Minnesota River.



(Minnesota Historical Society, 2004)

Figure 2.3: Location of the Minnesota River

According to the LAUM, research participants who lived north of the Minnesota River pronounced the /o/ phoneme differently than participants who lived to the south. Figure 2.3 illustrates the location of the Minnesota River, which seems to act as an isogloss between the northern [o^{u}] pronunciation and the southern [o] or [o$^{<}$] pronunciations. For example, in McLeod County, the /o/ was mainly pronounced as pure [o] but there were also some instances where the /o/ was pronounced with slight traces of brevity, as in [o$^{<}$]. In Crow Wing County, which is also located north of the Minnesota River, the phoneme was spoken with some brevity, as in [o$^{\breve{}}$^], but not as briefly as in McLeod County.

The pronunciation patterns of /o/ in *coat* do not appear to have a clear pattern as it did in *ago*. For example, south of the Minnesota River in Goodhue County, the /o/ in *coat* was pronounced either as a pure [o] sound or with a slightly elongated [o$^{\cdot}$] sound whereas in Fillmore County, the /o/ was pronounced with slight brevity, as in [o$^{\breve{}}$^].

North of the Minnesota River in McLeod County, the /o/ in *coat* was pronounced as a

pure [o] or a briefer [o̯] version. In Crow Wing County, which is also north of the river, *coat* was both elongated, as in [oː], and spoken with some brevity, as in [o̯ˑ]. Therefore, it seems that there may be other factors that could influence the length of the /o/ phoneme in *coat* other than the Minnesota River acting as an isogloss.

Despite the amount of data collected in the LAUM, it is unclear how accurate the data collection methods were because of the lack of technology and the large number of researchers analyzing the data. Due to the technological limitations of the time period, linguistic research and analyzing data was limited to the eyes and ears of six separate researchers. Because of this, numerous inconsistencies may have developed. For example, researchers noted a slight diphthongization to the /o/ phoneme in some instances, yet, it is unclear if the diphthong was added by the participants or by the ears of the researcher analyzing the data. The same argument also holds true for the vowel length of the /o/ phoneme. Therefore, if one researcher believes that a vowel is possibly a diphthong but is not certain, that researcher may mark the phoneme as elongated when it is truly a diphthong, whereas the next researcher may record the opposite pronunciation pattern. Because of the possible inconsistencies in interpreting the data, it is not clear if the findings of the LAUM truly represent the actual pronunciation of the /o/ phoneme during that time period. Sixty years after Allen began his research, computer programs such as the *Speech Analyzer* have been developed to more accurately understand the pronunciation and articulation length of phonemes (SIL International, 2004). This technological advantage gives new researchers the capability to explore several linguistic nuances, which seemed unimaginable to researchers fifty years ago.

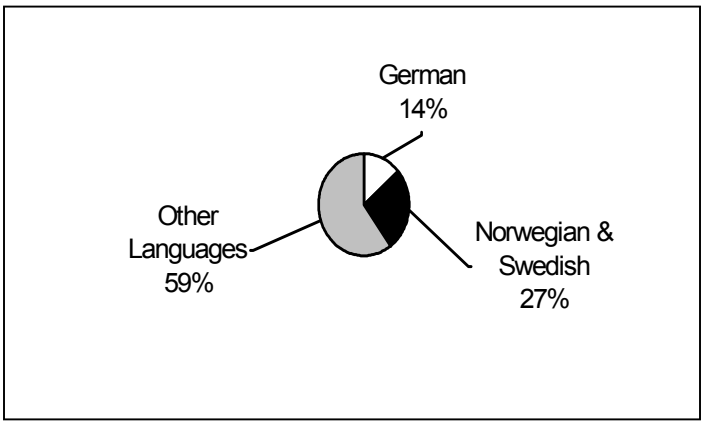
In addition to the manner in which the data was analyzed, it is also unclear exactly how many research participants were interviewed in Minnesota. Allen (1976) states that a total of 208 participants were interviewed in Minnesota, Nebraska, North Dakota, South Dakota, and southern parts of Canada, and each participant was given a number, totaling 437. These two numbers do not match, which suggests that participation numbers were assigned, possibly, according to instances that unique linguistic samples occurred from the same participant rather than simply assigning each participant one number. Therefore, when Allen gave 65 participation numbers to persons interviewed in Minnesota, it is not clear how many unique research participants were actually interviewed. In addition to this, among the 65 participants in Minnesota, three were Canadians (Allen, 1976). Because of this, some of the conclusions that were reached for Minnesota may be inaccurate.

Finally, there was also the question of when the research was actually compiled. When Allen began collecting his data, nearly 60 years ago, Minnesota consisted of 98% Caucasian residents (Gibson, & Jung, 2002). However, while Allen was compiling his research, there was population influx of immigrant groups who resettled throughout the state, primarily in the urban settings (Holmquist, 1981). Since then, there has been continual population shifts as large numbers of immigrant have moved into Minnesota, especially in the rural areas. This introduced many variations in the way that English is being pronounced. This change in the population demographics means that an increasing number of language varieties are being spoken within the state. Because Allen compiled

his research over the course of 30 years, it is unclear exactly when the language samples were obtained and the linguistic demographics of the communities.

Language Contact

It has been suggested that the Minnesotan dialect was primarily generated by the large numbers of Swedish and Norwegian immigrants who settled in the region despite Germans being the largest immigrant group (Allen, 1973; Holmquist, 1981; van der Hulst, 1999). According to the Proto-Indo-European Family Tree, all three of these languages are rooted in the same Germanic ancestry; Swedish and Norwegian are rooted in the Northeastern branch whereas German is rooted in the Western portion (Stewart & Vaillette, 2001). Due to the similarities between the Swedish and Norwegian languages, the two Scandinavian groups became more linguistically influential than German (Goblirsch, 1993; Gerald, Harbert, & Zhang, 1998). These linguistic commonalities may help to explain the extensive intermarrying between the two immigrant groups (Holmquist, 1981). Towards the later part of the 19th century, Swedish and Norwegian immigrants overwhelmed some communities in greater Minnesota. For example, in 1880, the town of Red Wing reported between 30 to 40 % of their total population consisted of Swedish immigrants whereas Lanesboro reported over 40% of their population consisted of Norwegian immigrants (Holmquist, 1981). Around the turn of the 19th century, Swedish and Norwegian contributed 27% of all languages spoken in Minnesota. Note Figure 2.4 for the percentages of languages spoken between the years 1895 – 1905.



(Gibson, & Jung, 2002; Holmquist, 1981)

Figure 2.4: Breakdown of Languages Spoken in Minnesota Between 1885-1905

As noted in Figure 2.4, 27% of Minnesotans spoke Norwegian and Swedish, 14% spoke German, while the remaining 59% spoke other languages. Some of the languages that the remaining 59% spoke included: Spanish, Polish, Native American Dakota, Finnish, and so forth (Allen, 1973; Conzen, 2003; Gibson, & Jung, 2002; Holmquist, 1981; Rooney, Zelinsky, & Louder, 1982). Due to the relatively small percentages and limited linguistic influence that each specific language had, they generally had little to no linguistic impact on the overall Minnesotan dialect. This fact made it more likely that the two Scandinavian languages had more of a contributing factor to the development of the overall Minnesotan accent than any other language group.

Due to the high percentage of immigrants who spoke Swedish and Norwegian languages in Minnesota, the possibility for *language transfer*, when language characteristics between the two languages overlap, might have occurred (Allen, 1973; van der Hulst, 1999; Karstadt, 1996; Stewart & Vaillette, 2001). Some researchers have been able to make connections between consonant sonority and their influence on vowel

length in the Swedish, Norwegian, and English languages (Goblirsch, 1993; Gerald, Harbert, & Zhang, 1998). However, the research is unable to make any definitive correlations between the length of the /o/ phoneme of any of the three languages. Because of this, it is unclear if the /o/ is truly elongated in the Minnesota dialect as a result of any language transfer. Regardless, research combined with the high percentage of Norwegian and Swedish speakers throughout Minnesota during that time period, suggests that language transfer may have been a factor in the region's phonological development.

Vowel Quality

As previously noted in this chapter, more research participants elongated the /o/ in the morpheme *coat* than in *ago* (Allen, 1976). Because of this, it is important to understand if the linguistic environment of the /o/ could be a contributing factor for the length that the /o/ is spoken. This will be investigated in the following three sections: syllable stress, sonority of the surrounding phonemes, and qualities of the final phonemes. These qualities are more likely to influence the elongation time of the /o/ phoneme than other phonological traits, such as *r*- or *l-coloring* (Celce-Murcia, Brinton, & Goodwin, 1996; Ladefoged, 1982; Roca & Johnson, 1999; Schane, 1973). Understanding the characteristics of each area may help to better identify possible relationships between the linguistic environment and the length of the /o/.

Syllable Stress

The first area that may influence the length of the /o/ phoneme is the word stress. In many multisyllabic words, those parts that are stressed carry a longer elongation time

than those phonemes that are unstressed, and thus reduced (Ladefoged, 1982). For example, the /o/ in *c**o**ping* is stressed and articulated for a longer period of time whereas the /o/ is *hot**e**l* is not stressed and reduced. Due to variations in the articulation length of the /o/ phoneme in multisyllabic words, only monosyllabic words will be used in this research project.

Sonority of the Surrounding Phonemes

The second area that can affect the time duration of the /o/ is the sonority of the following phonemes (Celce-Murcia, Brinton, & Goodwin, 1996; Roca & Johnson, 1999; Schane, 1973). Phoneme *sonority* refers to "the loudness relative to that of other sounds with the same length, stress, and pitch (Ladefoged, 1982, p. 221)." For example, low vowels, such as /a/, are considered the most sonorous, whereas high vowels, such as /u/, are slightly less sonorous. Nasals, such as /m/, have a greater sonority than voiced fricatives, such as /z/, but voiceless fricatives, such as /s/, and all voiceless stops are considered the least sonorous. To clarify this, note Table 2.1 for an illustration of the sonority scale. The phonemes at the top of the scale are considered more sonorous, gradually decreasing their sonority as they appear in the lower portions of the scale.

Table 2.1: Sonority Scale

Sonority	**Phoneme Type**	**Examples**
Most Sonorous ↓	Low Vowels	/a/ & /æ/
	High Vowels	/u/ & /i/
	Nasals	/m/ & /n/
	Voiced Fricatives	/z/ & /v/
	Voiceless Fricatives	/s/ & /ʃ/
Least Sonorous	Voiceless Stops	/t/ & /k/

(Ladefoged, 1982, p.222)

As seen in the above scale, low vowels, high vowels, and nasals are the most sonorous whereas voiceless fricatives and voiceless stops are the least sonorous. These sounds can influence the articulation length of the /o/ phoneme. For this research project, I will choose single consonants, rather than clusters, that have the same sonority so as to control possible influences that the surrounding sounds may have on the articulation length of the /o/ phoneme.

Qualities of the Final Phoneme

The third area that can influence the articulation length of the /o/ is the specific qualities of the final phonemes (Celce-Murcia, Brinton, & Goodwin, 1996; Roca & Johnson, 1999). For example, if the final phoneme is a voiceless consonant, such as in *coat* or *loaf,* then the articulation length of the /o/ will be a shorter time whereas the

reverse is true if the final consonant is absent, such as in *ago* or *snow*. Note the Table 2.2 for a visual description.

Table 2.2: Continuum of Vowel Length

Shorter Articulation Time	⟷	Longer Articulation Time
Final voiceless consonant	Final voiced nonsonorant consonant	No consonant or final voiced sonorant consonant
e.g. *goat* [gŏt] or [go^{ŏ} t]	e.g. *goad* [god] or [go$^{\cdot}$ d]	e.g. *snow* [sno:] or [sno::] *goal* [go:l] or [go::l]

(Allen, 1976; Celce-Murcia, Brinton, & Goodwin, 1996)

As noted in the diagram above, if the final consonant is voiceless, such as in *goat,* then the /o/ will have a shorter articulation time. If the final consonant is voiced, such as in *goad*, than the vowel will be slightly longer whereas if there is no final consonant or the final consonant is a voiced sonorant consonant, such as in *snow* or *goal*, than the vowel will have a longer articulation time. Hence, the duration of the /o/ phoneme changes depending on the qualities of the preceding phonemes.

According to these various types of vowel qualities, such as the qualities of the consonant following the /o/ phoneme, research participants in Minnesota should have lengthened the /o/ in *ago* more than in the morpheme *coat.* The length of the /o/ in *coat* should be the shortest articulation time because the morpheme ends with the final voiceless consonant /t/, whereas *ago* does not end in a final consonant and, hence, should have been articulated for a longer period of time (Celce-Murcia, Brinton, & Goodwin,

1996). Yet, according to the data that was presented in the LAUM, the articulation length of the /o/, as shown in the morphemes *coat* and *ago*, seemed not to have been determined by properties of the following phonemes (Allen, 1976). This suggests that there may have been contributing factors that influenced the pronunciation time of the /o/ phoneme other than the linguistic qualities of the surrounding phonemes.

Summary

In Chapter Two, I explained how the /o/ is physically produced, explored how the phoneme is pronounced within Minnesota, examined influences that language contact may have played in the development of the Minnesotan dialect, and compared how various qualities of phonemes may influence the pronunciation of the /o/. By investigating these areas, I have a better basic understanding of the /o/ phoneme and the different traits that may influence the pronunciation of the sound. In Chapter Three, I will describe the specific qualifications of my research participants, explain the setting in which the research project will take place, describe the technological resources which will be used, and outline the data collection methods. Determining these research guidelines will enable me to lay the foundation to my research so that I may investigate features of the /o/ phoneme as well as understand if the sound is diphthongized to see if the length or the amount of diphthongization varies from region to region in Minnesota.

CHAPTER THREE: METHODS

For this project, I researched features of the /o/ by women over the age of 60 years whose first language is English and who had lived in rural Minnesota for 80% of their lifetimes. I wanted to understand how the /o/ was pronounced in Morrison County, Carver County, and Le Sueur County in Minnesota. In Chapter Two, I explained how the /o/ is physically produced, investigated various ways that the /o/ phoneme is pronounced in *North American English* (NAE), explored how the /o/ is pronounced in Minnesota, examined the influence that language contact may have played in the development of the Minnesotan dialect, compared how various qualities of phonemes may influence the articulation length of the /o/ or the level that the /o/ is diphthongized. In Chapter Three, I will describe the criteria of my research participants, explain the linguistic environment in which the /o/ phoneme was presented, describe the technological resources that was used, and outline the data collection methods. Establishing these research guidelines enabled me to lay the foundation for my research so that when I investigated the features of the /o/ phoneme I could identify pronunciation variations between Morrison, Carver, and Le Sueur Counties in Minnesota.

Description of Research Participants

This research project was conducted in a quasi-experimental manner, due to the small number of participants researched in this project. In addition, the research participants were selected according to their willingness to participate rather than by pure random statistical norms. For this project, I focused on the pronunciation of women. Research participants were located via friends of the family and graduate school classmates. Once an interview time had been arranged, research participants were asked to complete the *Personal Characteristics Form* (Appendix B) that identified their first language, the percentage of years they had lived in their communities, age, gender, and educational level. The data collected on this form determined how well a research participant matched the research criteria. Specific details for each of these categories are as follows:

First Language

All of the participants contributing to this project spoke English as their first language.

Percentage of Years in the Communities

To limit the exposure that research participants had to other varieties of English, all participants lived in the same rural counties for approximately 80% of their lifetime.

Age of Participants

All of the research participants were over the age of 60 years.

Gender

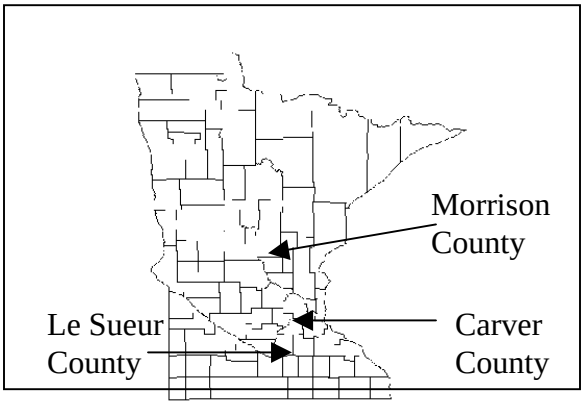
All of the research participants were women to avoid any linguistic difference that might be due to gender (Frezar, 1993; Labov, 1994; Stewart & Vaillette, 2001).

Educational Level

Like linguistic differences between men and women, the participants' educational level may also influenced their pronunciation patterns. Therefore, research participants needed to have completed no more than a two-year associates degree or some college coursework that did not result in a degree.

Participants and Geographical Location

In each county, a total of five research participants were interviewed from rural communities, with 3,000 people or less. These areas were chosen due to their limited contact with large population influxes, and hence relative linguistic isolation. The communities that were researched were Royalton in Morrison County (central Minnesota), Chaska in Carver County (south-central Minnesota, north of the Minnesota River), and Le Center in Le Sueur County (south-central Minnesota, south of the Minnesota River). For the specific location of each of these counties, note the following Figure 3.1.



(Minnesota Historical Society, 2004)

Figure 3.1: Location of Morrison, Carver, and Le Sueur Counties
As noted in the above diagram, Morrison County and Carver Counties are located to the north of the Minnesota River while Le Sueur County is located to the south of the river. In total, eleven research participants were interviewed.

Procedures

Collecting data for this research project entailed several steps. First, the participants were located. Rather than traveling throughout Minnesota randomly selecting research participants, participants were contacted by means of existing contacts. Research participants were located via personal and professional contacts that had relatives living in various places in Minnesota. After research participants had been prescreened, via informal conversations on the telephone, I drove to the rural community to formally interview the research participants and collect the data.

The formal interview process began with the research participants completing the *Personal Characteristics Form* (Appendix B). Each participant was given a number, *001* for the first participant interviewed, *002* for the second participant, and so forth, to insure their anonymity. (This number is located on the upper right-hand corner of the *Personal Characteristics Form*.) If the participant fell within the parameters of the research guidelines, the research participant signed the *Research Consent Form* (Appendix C), which states that they understood the process of the research and agreed to continue.

Once the official paperwork was completed, I modeled the data collection techniques for the participant. Modeling consisted of reading a few practice sentences from the *Practice Sheet* (Appendix D). The participants next practiced reading the additional sentences, which were also located on the form. Once the participant was familiar and comfortable with the process, I collected the linguistic data.

Collecting this data was, obviously, the most important part of the process. When I turned on the recording equipment, I stated the participant's participation number into the microphone of the tape-recorder. Next, the participants read the twelve sentences, which were located on the *Morpheme Sheet* (Appendix E). The data collection process was completed when all of the sentences had been read.

The above steps were repeated until I interviewed all of the participants, I reviewed the *Personal Characteristics Form* to see which participants fall within the research criteria. The data collected from this group were analyzed, via the *Speech Analyzer* software, to determine the features of the /o/ phoneme (SIL International, 2004).

Additional Considerations

In addition to the above guidelines, there were further considerations that were assessed before beginning this research project. These considerations were selected because they could influence the length of the /o/ phoneme (Celce-Murcia, Brinton, & Goodwin, 1996; Ladefoged, 1982; Roca & Johnson, 1999; Schane, 1973). The first consideration was the linguistic environment that the /o/ phonemes was presented within. The next consideration was the use of the software to assess the data.

Linguistic Environment

Because the articulation length of the nearby sounds and the lexical placement of the morpheme could have influenced the articulation length of the [o] or [ow], it was essential to establish the linguistic environment that lessens these extraneous factors. To do this, the /o/ was presented in an environment that minimized the sonority influence of the surrounding phonemes.

Articulation Manner of Surrounding Phonemes. The /o/ was pronounced between two consonants that were pronounced in the stopped manner of articulation, /p/, /b/, /t/, /d/, /k/, and /g/. These sounds had been selected primarily because they create frequencies that were easier to identify on the *Speech Analyzer 2.5* software (SIL International, 2004). Other phonemes, such as nasals, tended to blend together with surrounding sounds and were, therefore, not as easily distinguishable. The phonemes /r/ and /l/ were also be excluded to avoid any phonetic interferences or coloring affects that could occur. Therefore, the /o/ was displayed between two stop consonants.

The other factors that may have affected the results were the vocal patterns, such as the *voiced* or *voiceless* nature, of the consonants. For example, if the final consonant was voiceless, then the articulation length of the /o/ may be shorter, but if the final consonant was voiced, then the articulation length of the /o/ may be slightly lengthened (Celce-Murcia, Brinton, & Goodwin, 1996). To avoid possible linguistic interferences, the morphemes that were selected all contained voiceless initial and final stops: /p/, /t/, and /k/. Entailing the above phonetic and technological stipulations, the following morphemes were analyzed in this research: *Pope, poke, coke, coat,* and *cope.*

Monosyllabic versus Multisyllabic Morphemes. Research discovered that articulation length of vowels varied depending on the number of syllables in the morpheme and which part of the morpheme carried the stress (Erikson & Alstermark, 1972). To evade these linguistic influences, the /o/ was only displayed in a monosyllabic environment.

Sentential Placement. The placement of the /o/ morpheme in a sentence could have influenced the vowel length. For example, the lexical placement of a morpheme could influence the tones, such as rising or falling, and could, in turn, also change the vowel length (Brinton, 2000; Celce-Murcia, Brinton, & Goodwin, 1996). To avoid this conundrum, all morphemes were displayed in the middle of a sentence, rather than at the beginning or end (Appendix D and Appendix E).

Technology

The second area that needs further discussion was the description of the technology. To obtain a clear recording of my research participants' speech samples, a microphone attached to a tape-recorder was used. Using the microphone was important to obtain a clear sample of the linguistic data. Once a clear language sample had been obtained, the *Speech Analyzer* software (SIL International, 2004), timed the sound duration to the tens of thousands of a second. The software created a visual image, otherwise known as a *spectrogram*, which illustrated the pitches of the language and times the duration of each sound. Figure 3.2 shows a visual image of one of the sentences used in this research, "I will say coat again," as viewed via the spectrogram.

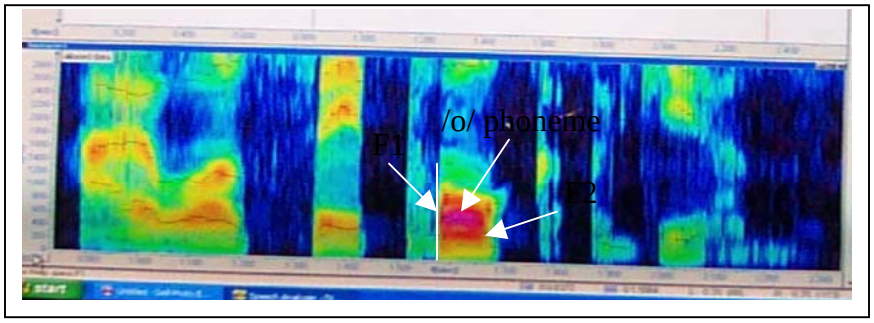


Figure 3:2: Visual Image of "*I will say coat again*" as Produced by the *Speech Analyzer*

As seen above, when a sentence is recorded into the software, it "translates a sound into a visual representation of its component frequencies" (Ladefoged, 1982, p.117). The beginning bar in the middle of the sentence, which was also pointed out in the diagram, is an example of the /o/ phoneme. To measure the articulation length of this sound, the measurement started at the end of the burst of the stop, F1, and concluded at the beginning of the gap, F2 (Figure 3.2). Only the monosyllabic morphemes that contained the initial voiceless stopped consonant, the /o/, and the final voiceless stopped consonant was analyzed.

Analyzing Data

In order to understand features of the /o/ in different areas of Minnesota, a series of formulas were created. The first formula attempted to minimize the rate of speech of each participant by creating a percentage that determined the length of the /o/ in the sentences. Doing this minimized variations in each research participant's rate of speech. The second formula determined the average percentage that the /o/ is articulated by each participant whereas the third formula determined the average percentage of the /o/ articulation for the county. Finally, the information collected was compared and analyzed for patterns.

Benchmark for the /o/. To understand if the /o/ was elongated within particular regions in Minnesota, the results will be compared to several benchmarks (Hillenbrand, Getty, Clark, & Wheller, 1995; Peterson & Lehiste, 1967, p.200; Ripman 1918).

Diphthongization. In addition to noting the length of the /o/ phoneme, the way in which the sound was produced was also recorded. To assess the *pitch change* (Pc) of the F2, the Hertz of the *beginning frequency* (F1) was compared to the Hertz of the *ending frequency* (F1) to determine if there was possible diphthongization in the /o/. This formula appears as follows:

$$F2 – F1 = Pc$$

If Pc resulted as a negative reading, then a diphthong was produced whereas a positive reading illustrated no diphthongization. As mentioned in Chapter Two, the benchmark for the change of pitch was –210.0 Hertz (Holbrook & Fairbanks, 1967).

Individual /o/ Percentage. Each research participant was asked to read a series of twelve sentences, five of which contained morphemes with the /o/ phoneme (Appendix E). The five sentences that contained the /o/ was timed, via the *Speech Analyzer* software (SIL International, 2004), to determine the percentage that the /o/ occupied in the sentence time. To determine this, the millisecond of the /o/ *phoneme* (P) was divided by the *total sentence time* (S) and multiplied by 100 to create the *percentage of the /o/ in the sentence* (X1). The formula appears as follows:

$$P / S * 100 = X1$$

Average /o/ Percentage. Because each research participant read a total of five sentences that contained morphemes with the /o/ phoneme, this process was repeated five times per participant. Once the five percentages (X1, X2, X3, X4, and X5) had been

determined, an *individual average* (A) was created adding the sum of all sentences and dividing by five. This formula appears as follows:

$$(X1 + X2 + X3 + X4 + X5) / 5 = A1$$

Community /o/ Average. In each community, a total of five research participants were interviewed. To determine the *community average* (C) of the length of the /o/, all of the participants individual averages (A1, A2, A3, A4, and A5) were again added up and then divided by five. The formula appears as follows:

$$(A1 + A2 + A3 + A4 + A5) / 5 = C1$$

Elongation Percentage Between Regions. Once all the communities had been researched and the community average was determined, the three averages were compared to see if one area seemed to pronounce their /o/ phonemes differently than the other counties.

Summary

In Chapter Three, I described the criteria for my research participants, explained the linguistic environment in which the /o/ phoneme will be presented, described the technological resources that will be used, and outlined the data collection methods. Using these data collection techniques enabled me to gain a better understanding of the pronunciation of the /o/ by women over the age of 60 years whose first language was English and who lived in rural Minnesota for at least 80% of their lifetimes. In Chapter Four, I will explain the results of my research and explain if the length or the levels of

diphthongization varies from region to region in Minnesota. By doing this, it will enable me to better understand the features of the /o/ as pronounced in Minnesota.

CHAPTER FOUR: RESULTS AND DISCUSSION

For this research project, I am studying features of the /o/ phoneme because I want to know how the /o/ is articulated in Morrison County, Carver County, and Le Sueur County in Minnesota. I am focusing on the pronunciation of women over the age of 60 years whose first language is English and who have lived in rural Minnesota for at least 80% of their lifetimes. In Chapter Three, I outlined the data collection methods. In this chapter, I will explain the results that were collected from participants in Morrison, Carver, and Le Sueur Counties. By doing this, I hope to better understand if there is a difference of how the /o/ is pronounced from region to region in Minnesota.

Results of Research Project

In this section of Chapter Four, I will discuss the results of the data that were obtained from interviewing eleven women. All of the participants who were interviewed were over the age of 60, spoke English as a first language, and had been residing in Morrison, Carver, or Le Sueur Counties for at least 80% of their lifetime. To explain the results, this portion of the paper will be divided into two sections. The first section will explain the location of the counties and the demographics of the participants. The second section will explain the averages of the total sentence length, length of the /o/ phoneme,

the percentage that the /o/ accounted for in each sentence, and the pitch of the second formant readings as they appeared in each county.

Counties Locations and Participant Demographics

In this section, the location of Morrison, Carver, and Le Sueur Counties as well as the demographics of the research participants will be explained. All three counties researched are located in central and south-central portions of Minnesota. Morrison County, which is located in central Minnesota, is geographically the most northern region that was researched. This county is located north of the Minnesota River and also almost directly north of both Carver and Le Sueur Counties. Approximately 100 miles south of Morrison County is Carver County. Carver County borders the northern banks of the Minnesota River (Map Quest, 2004). The final county, which is located approximately 35 miles south of Carver County, is Le Sueur County (Map Quest, 2004). Le Sueur County is located in south-central Minnesota and borders the southern banks of the Minnesota River.

Now that the locations of the counties have been noted, next the demographics of the research participants will be summarized. For this research project, all of the data collected was from women over the age of 60 years, who spent a minimum of 80% of their lifetime residing in the same county, completed no higher than an associates degree, and spoke English as their first language (note Appendix F). For the averages of the Research Participants in each county, note Table 4.1.

Table 4.1: Averages for Participants' Age and Years in the County Per County

Averages	Morrison Co.	Carver Co.	Le Sueur Co.
Age (years)	76	63.5	85.25
Years in County (%)	100%	100%	95.6%

As noted on the above, research participants from Morrison County averaged 76 years of age and all resided in the county for 100% of their lifetime. Research participants from Carver County also resided in their county for 100% of their lifetime, but were approximately 12.5 years younger than the participants from Morrison County. Research participants from Le Sueur County were the oldest group, on average, that participated in the research. These participants were an average of 9.25 years older than participants from Morrison County and 21.75 years older than the participants from Carver County. Unlike the other two counties, participants from Le Sueur County resided approximately of 96% of their lifetime in the county.

Summary of Results Per County

Now that the locations of the counties and the demographics of the research participants have been outlined, the next step is to explain the data that was collected. There was a variety of data that was collected from research participants in Morrison, Carver, and Le Sueur Counties. For this project, the sentence length and length for the /o/ phonemes was determined in *milliseconds* (msec). Because each participant has a slightly different rate of speech, the percentage that the /o/ encompassed in each sentence was also calculated. Once these figures were compiled, the beginning frequency and

ending frequency of the *second formant* (F2) was measured, via *Hertz* (Hz), to determine the pitch change of the /o/ phoneme. This calculation is important because if the /o/ was spoken for a longer period of time, it could help explain reasons for possible elongation. If a negative pitch reading resulted, then slight diphthongization may be present whereas a positive reading could indicate that the /o/ was spoken as a pure vowel. The above considerations as well as the averages from Morrison, Carver, and Le Sueur Counties will be discussed in more detail in the following sections.

Morrison County. The participants in Morrison County seemed to display a wide range of /o/ length, yet more consistent averages than in the F2 findings. Note the averages for Morrison County that are found in Table 4.2 (specific data on participants from Morrison County is located in Appendix G.)

Table 4.2: Averages of the /o/ Pronunciation in Morrison County

Morpheme	Sentence Length (msec)	Length of /o/ (msec)	Percentage of /o/ in Sentence	Pitch Change of F2 (Hz)
Coat	*1,401.93*	*138.67*	*9.89%*	*175.73*
Coke	*1,549.33*	*143.73*	*9.28%*	*-95.23*
Cope	*1,384.30*	*151.13*	*10.92%*	*-54.40*
Poke	*1,304.77*	*140.73*	*10.79%*	*-94.97*
Pope	*1,343.67*	*117.83*	*8.77%*	*-17.00*
Average:	*1,396.80*	*138.42*	*9.93%*	*-17.17*

As noted in Table 4.2, the average sentence length for the participants in Morrison County ranged from 1,304.8 msec to 1549.3 msec, averaging 1,396.8 msec per sentence whereas the average length of the /o/ ranged from 117.8 msec to 151.1 msec, averaging 138.4 msec. The length seems short compared to the benchmarks in Figure 2.1. In the sentences, the /o/ accounted for approximately 9.9% of the total sentence time, which ranged from 8.8% in the morpheme *pope* to 10.9% in the morpheme *cope*. There seems to be no correlation between the length of the /o/ phoneme and the total sentence length. For example, in the morpheme *pope,* the /o/ accounted for the shortest percentage time, 8.9%, and the second shortest sentence length while the morpheme *cope* had the longest time, 10.9%, but the total sentence time ranked in the middle of the group.

To better understand the pronunciation of the /o/, the movement of the F2 was also calculated. As noted in Figure 4.3, the average movement of the F2 ranged from –95.2 Hz to 175.7 Hz, averaging –17.2 Hz. The greatest pitch increase was in the morpheme *coat*, averaging 175.7 Hz whereas in the morpheme *coke*, the /o/ was diphthongized the most, averaging –95.2 Hz. Overall, the /o/ was pronounced as a diphthong four out of five times which seems to suggest that participants in Morrison County tended to pronounce the /o/ as a slight diphthong.

Carver County. Like the participants in Morrison County, the participants in Carver County also averaged a negative pitch reading. Note Table 4.3 for these averages as well as the averages for the total sentence length, the length of the /o/ phoneme, and the percentage that the /o/ accounted in the sentences (specific data on each Research Participant is located in Appendix H).

Table 4.3: Averages of the /o/ Pronunciation in Carver County

Morpheme	Sentence Length (msec)	Length of /o/ (msec)	Percentage of /o/ in Sentence	Pitch Change of F2 (Hz)
Coat	*1,384.75*	*154.40*	*11.15%*	*158.53*
Coke	*1,460.15*	*136.85*	*9.37%*	*-21.45*
Cope	*1,391.58*	*123.15*	*8.85%*	*-115.25*
Poke	*1,364.65*	*130.15*	*9.54%*	*-198.30*
Pope	*1,302.10*	*130.33*	*10.01%*	*-125.15*
Average:	*1,380.65*	*134.98*	*9.78%*	*-60.33*

As noted in Table 4.3, the average sentence length for the participants in Carver County ranged from 1,302.1 msec to 1,460.2 msec, averaging 1,380.7 msec. The length of the /o/ averaged 135.0 msec, ranging from 130.2 msec to 154. 4 msec, and contributed to an average of 9.8% of the total sentence length, ranging from 8.9% to 11.2%. The length seems short compared to the benchmarks in Figure 2.1. In the morpheme *coat*, the /o/ was spoken for the longest percentage, averaging 11.2% whereas the morpheme *cope* had the smallest percentage contributing to 8.9% of the total sentence length. As in Morrison County, there seems not to be a correlation in Carver County between the length of the /o/ phoneme and the sentence length. For example, *cope* had the longest sentence time, averaging 1,391.6 msec, whereas *pope* had the shortest sentence time, averaging 1302 Hz, yet the second longest length.

Next, the movement of the F2 was calculated. In Carver County, four out of five participants diphthongized the /o/ ranging from –21.5 Hz to 198.3 Hz (note Figure 4.4). The only instance in which the /o/ was not pronounced with a slight diphthong was in the morpheme *coat* which averaged a pitch increase of 158.5 Hz. Despite this one instance, research participants tended to diphthongize the /o/ in Carver County.

Le Sueur County. Similar to participants in both Carver and Morrison Counties, research participants in Le Sueur County also showed a negative pitch of the /o/ four out of five times. These averages, as well as the averages of sentence length, length of the /o/ phoneme, and percentage that the /o/ accounted for in each sentence time, is provided in Table 4.4 (specific data on individual Research Participants in Le Sueur County is located in Appendix I).

Table 4.4: Averages of the /o/ Pronunciation in Le Sueur County

Morpheme	Sentence Length (msec)	Length of /o/ (msec)	Percentage of /o/ in Sentence	Pitch Change of F2 (Hz)
Coat	1,472.33	153.65	*10.44%*	*487.15*
Coke	1,494.95	128.48	*8.59%*	*-208.93*
Cope	1,435.58	116.63	*8.12%*	*-114.40*
Poke	1,542.30	138.38	*8.97%*	*-94.95*
Pope	1,323.78	126.20	*9.53%*	*-275.13*
Average:	*1,453.79*	*132.67*	*9.13%*	*-41.25*

As seen in the above table, the average sentence length for Le Sueur County participants ranged from 1,323.8 msec to 1,542.3 msec, averaging 1,453.8 msec. The length of the /o/ phoneme ranged between 116.6 msec to 153.7 msec, averaging 132.7 msec, and accounted for an average of 9.1%, ranging from 8.1% to 10.4%, of the total sentence time. As in Morrison and Carver Counties, the length of the /o/ in Le Sueur County seems short compared to the benchmarks in Table 2.1 In Le Sueur County, the /o/ in the morpheme *coat* was spoken for the longest amount of time and accounted for 10.4% of the total sentence time whereas the /o/ in the morpheme *cope* was elongated the shortest percentage, averaging 8.1%. As in the discussion for Morrison and Carver Counties, there seems not to be a correlation in Le Sueur County between the length of the /o/ phoneme and the sentence length. For example, the /o/ in the morpheme *poke* accounted for the shortest length, 9.0%, of the total sentence time, but had the longest sentence time whereas the /o/ in the morpheme *coat* had the longest length, 10.4%, but the sentence time was in the middle of the group.

As also noted in Table 4.4, participants in Le Sueur County tended to diphthongize the /o/ four out of five times. The change from the pronunciation of the /o/ in *pope* was –275.1 Hz while the pronunciation of the /o/ in *poke* was –95.0 Hz. The only instance in which the /o/ was not diphthongized was in the morpheme *coat*, averaging an F2 reading of 487.2 Hz (note Appendix I).

Discussion of Results

Now that the results have been summarized, data will be examined for inconsistencies. Next, the data will be analyzed to see if the /o/ was pronounced the same in manner in all the morphemes or if there were slight variations in pronunciation. Once this has been completed, the data from each county will be compared to see if the pronunciation varies from region to region. Finally, the data collected from this project will be compared to the findings of other research (Allen, 1976; Allen & Underwood, 1971).

Data Collection Methods

Due to the quasi-experimental nature of this project, research participants were located through a social network of friends and relatives living in the Morrison, Carver, or Le Sueur Counties. Because participants were not randomly selected and only reflect a minute faction of the total population, these findings do not mirror the overall usage of the /o/ in any of the three counties. The results of this study do not represent the way that the /o/ may be used in other linguistic environments (such as at the end of a morpheme, as in *hello*), when participants are speaking freely in casual conversations (rather than reading sentences), or the usage of the /o/ in other social situations. Hence, the results can only reflect the usage of the /o/ from the eleven participants when they read predetermined sentences on the day that they were interviewed.

Initially, there were fifteen research participants interviewed for this project; however, six of the participants did not reside in the county for more than 80% of their lifetime and in addition two participants did not speak English as their first language.

Thus, the data collected from these eight participants were not included in the results of this research project. At this point, an additional four participants from Carver County were added to the study. Even though all of the Carver County participants were within the parameters of the research project, they were nearly 18 years younger than the remaining seven participants (Appendix F). After analyzing the data, it did not appear that the age difference played a factor in their pronunciation of the /o/, although it would have been more ideal if all of the participants were closer in age.

Comparison of Data Per Morpheme

To better understand the way that the /o/ is pronounced in each morpheme, the data will be compared according to the amount of movement, via pitch, of the /o/ phoneme in the second formant. Once the pitch has been analyzed, the length of the /o/ and percentage that the /o/ accounted for in the total sentence time will be analyzed. Finally, the data will be compared to see if any generalizations were discovered. Analyzing the data in this manner should help to clarify how the research participants pronounced the /o/.

The Pitch Change of the /o/ in the F2. Research participants in Morrison County, Carver County, and Le Sueur County had an average pitch change of –39.6 Hz when pronouncing the /o/ phoneme. At first glance, this would seem to indicate that participants tended to pronounce the /o/ as a diphthong because four out of the five morphemes averaged some levels of diphthongization. The numbers of participants who pronounced the /o/ with some levels of diphthongization (participants with negative pitch readings), participants who pronounced the /o/ with no amount of diphthongization

(participants with positive pitch readings), as well as the average change in the pitch of the second formant is located in Table 4.5.

Table 4.5: Participants with a Positive versus Negative F2 Pitch Readings

Morpheme	***Participants with Negative Pitch***	***Participants with Positive Pitch***	***Average Change in Pitch (Hz)***
Coat	1	10	273.80
Coke	10	1	-108.54
Cope	9	1	-94.68
Poke	10	1	-129.41
Pope	9	2	-139.09
Average	*7.8*	*3.0*	*-39.58*

As noted above, research participants generally tended to diphthongize the /o/ four out of five times. Even though there were some instances where participants did not diphthongize the /o/ (Table 4.5, Appendix G, Appendix H, and Appendix I), the only morpheme that showed more of a consistent positive pitch reading was in *coat.* The remaining four morphemes, *coke*, *cope*, *poke*, and *pope*, showed various levels of diphthongization. The pronunciation of the /o/ in the morpheme *pope* had the most diphthongization, averaging –139.1 Hz, which was followed by the morpheme *poke*, averaging –129.4 Hz. Both of these Hertz readings were approximately 35% below the benchmark of –210.0 (Holbrook & Fairbanks, 1976). The /o/ in the morpheme *coke* was diphthongized an average of –108.5 Hz whereas in the morpheme *cope* the /o/ was

diphthongized an average of –94.7 Hz. These readings suggest that the /o/ was diphthongized nearly half the amount of the benchmark. Therefore, it appears that the research participants pronounced the /o/ in four out of five instances with slight levels of diphthongization, but not diphthongized as the benchmark.

/o/ Length (msec). The average length of the /o/ in all the sentences ranged from 124.7 msec to 148.9 msec, with a mean of 135.4 msec. Note the following diagram, Table 4.6, for an overview of the averages of each morpheme.

Table 4.6: Average Length of the /o/ Per Morpheme for all Participants

Morpheme	***/o/ Length (msec)***
Coat	148.91
Coke	136.35
Cope	130.30
Poke	136.42
Pope	124.79
Average	*135.36*

The instance in which the /o/ had the longest time was found in the morpheme *coat,* which averaged 148.9 msec, whereas in morphemes *coke* and *poke* had nearly the same average of 136.4 msec. Next, the /o/ in *coke* is elongated an average of 130.3 msec whereas *cope* is elongated the shortest time, averaging 124.8 msec. In the morphemes *coke, cope, poke,* and *pope,* the /o/ fell below the [ow] benchmark an average of 220 msec suggesting that the Minnesota /o/ is rather short.

Since the /o/ in the morpheme *coat* was the only instance where the /o/ was not pronounced as a diphthong, the average pronunciation length for this phoneme will be compared to the articulation time for the pure /o/. The /o/ in *coat* was lengthened for an average of 148.9 msec which falls below the benchmark for the [o] and, thus, considered to be pronounced as an abbreviated [ŏ]. Yet, the English spoken in Minnesota is perceived to have a lengthened [o:] form. Given the data produced in this research project, the research participants articulated the /o/ in all five instances with a short length compared to previous research.

Percentage of the /o/ Length in Sentences. Next, the percentage that the /o/ accounted for in each sentence will be assessed to see if research participants tended to pronounce the /o/ in one morpheme for a greater length of time than they did in another morpheme. In general, the /o/ accounted for an average of 9.6% of the total sentence time. Note Figure 4.7 the specific averages of the percentages per morpheme.

Table 4.7: Percentage of the /o/ in Each Sentence Per Morpheme

Morpheme	***Percentage of /o/ in Sentence***
Coat	10.49%
Coke	9.08%
Cope	9.30%
Poke	9.77%
Pope	9.44%
Average	*9.61%*

As noted in Table 4.7, the /o/ in the morpheme *coat* accounted for longest percentage of sentence time, averaging 10.5%. The remaining four morphemes had a closer range in pronunciation times. The /o/ in *poke* had the second highest percentage which accounted for an average of 9.7% of the total sentence time. The third highest percentage was found in the morpheme *pope*, averaging 9.4%, which was closely followed by *cope*, averaging 9.3%. *Pope* averaged the shortest percentage of articulation time averaging 9.1%, which is approximately 1.4% shorter than the percentage time of the /o/ in *coat.* The /o/ in the morpheme *coat* may have been pronounced for a larger percentage of time because it was the only instance where diphthongization did not occur.

Overview of the Pronunciation of the /o/ Per Morpheme. The /o/ in the morpheme *coat* seems to have been pronounced differently than the /o/ in the other four instances; the /o/ in *coat* had the longest length in milliseconds and was the only instance

in which the /o/ was not pronounced as a diphthong. The pronunciation of the /o/ in *coat* could be explained when analyzing the tongue and jaw movement required in the production of this morpheme. When the mouth changes from the /o/ position to form the final /t/ consonant, the tongue refluxes from a middle-back placement to a high-front position (Celce-Murcia, Brinton, & Goodwin, 1996; Clark & Yallop, 1990). This extra movement could help explain why the *Speech Analyzer* indicated an increase in pitch readings in the second formant in the morpheme *coat*, whereas the remaining morphemes, *coke, cope, poke,* and *pope,* did not require the additional tongue and jaw movements, thus showing slight levels of diphthongization. This increased movement can also help to explain why the /o/ in *coat* tended to be articulated for a longer period of time than it was in the other four instances.

In this research project, the /o/ in the morpheme *coat* was consistently not diphthongized and, thus, pronounced differently than the /o/ in the other four environments. This shows that the linguistic environment in which the /o/ is spoken may have a large impact on the overall results. If one of the morphemes had a voiced quality or multiple syllables, the results of this research project could yield completely different data. Therefore, to gain a broader perspective when analyzing the data from this project, some of the data analyzed included results from *coat* while other data exclude it.

Comparison of Data via Geographical Location

The next step is to compare the pronunciation of the /o/ in Morrison, Carver, and Le Sueur Counties to see if any discrepancies exist. Note Table 4.8 for the averages of the length of /o/ in milliseconds, the percentage that the /o/ contributed in the total

sentence time, and the pitch of the /o/ as they appear in each county. In this figure, the data collected from *coat* is excluded because it was generally pronounced differently than the /o/ in the other four environments.

Table 4.8: Comparison of Pronunciation Averages of the /o/ Per County

Averages	Morrison Co.	Carver Co.	Le Sueur Co.
Average Pitch Change (Hz) of F2	-17.17	-60.33	-41.25
Pitch Change (Hz) of F2 excluding coat	-65.40	-115.04	-173.35
/o/ Length (msec)	138.42	134.98	132.67
Percentage of /o/ in Sentences	9.93%	9.78%	9.13%

Variations of Diphthongization. Participants in all three counties showed slight levels of diphthongization ranging from –60.3 Hz to –17.2 Hz. Participants in Morrison County averaged –17.2 Hz, participants in Carver County averaged -60.3 Hz, and participants in Le Sueur County averaged –41.3 Hz. However, because the pronunciation of the /o/ in the morpheme *coat* was generally not diphthongized, to get a clearer idea of the average amount that research participants diphthongized the /o/, readings from pronunciation of the /o/ in the morpheme *coat* needs to be excluded. With this said, the overall average diphthongization of the /o/ in the remaining four morphemes, *coke, cope, poke,* and *pope*, is –65.4 Hz in Morrison County, -115.0 Hz in

Carver County, and -173.4 Hz in Le Sueur County. This data suggests that the research participants only pronounced the /o/ with a slight diphthong. Research participants who lived in the southern most county, Le Sueur County, diphthongized their /o/ closer to the –210.0 Hz benchmark than the research participants did who lived further to the north (Holbrook & Fairbanks, 1976).

Length of the /o/ Phoneme in Milliseconds. As in the levels of diphthongization, it also appeared that research participants who were interviewed further to the south tended to pronounce that /o/ for a shorter period of time than the research subjects did who lived in the more northern counties. For example, in Le Sueur County the /o/ was pronounced an average of 132.7 msec, whereas in Carver County there was an average of 135.0 msec and in Morrison County, an average of 138.4 msec (Table 4.8). All three counties ranged from 138.4 msec to 132.7 msec, which places the pronunciation time less than the 200 msec benchmark of the shorter pronunciation of the [ð] phoneme. However, the difference in pronunciation length between the farthest south county, Le Sueur County, with the northern most county, Morrison County, was 5.75 msec. Even though the /o/ seemed to be pronounced slightly longer in Morrison County, this difference in pronunciation time translates to merely 3/500 of a second.

Length of the /o/ Phoneme in Percentages. The differences in percentage that the /o/ was accounted for in the total sentence time also did not appear to be overly substantial. As per Figure 4.8, the /o/ phoneme was pronounced an average of 9.9% of the sentence length in Morrison and Carver Counties, with a mere approximate 0.15%, that separated the two percentages. The percentage that the /o/ encompassed in Le Sueur

County was slightly shorter 0.65%, averaging 9.1% of the total sentence length. Interestingly, the geographical distance between Morrison County and Carver County is approximately 100 miles whereas the distance between Carver and Le Sueur Counties is approximately 35 miles (Map Quest, 2004). Even though the actually milliseconds that separate the pronunciation time between Morrison and Le Sueur County are less than 6/1,000 of a second, it is interesting that there seems to be more similarities between pronunciation times with research participants who live north of the river, despite larger geographical distances, than in research participants who live south of the Minnesota River. For example, the geographical distance between Morrison and Carver Counties is approximately 100 miles, but the /o/ in Morrison County was spoken for approximately 0.15% longer in the sentence whereas the distance between Carver and Le Sueur Counties is approximately 35 miles yet the /o/ was spoken approximately 0.65 longer in Carver County. This data, despite the minuscule differences, may support the theory that the Minnesota River was the deciding geographical border that separated the two dialectal regions (Allen & Underwood, 1971).

Comparison of this Data with Previous Research

Previous research done on the pronunciation of the /o/ in Minnesota determined that the Minnesota River appeared to be the isogloss that separated the pronunciation times of the /o/ (Allen, 1976; Allen & Underwood, 1971). For example, research participants who were interviewed tended to pronounce the /o/ in the morpheme *ago* longer if they lived to the north of the Minnesota River than they did if they lived to the south of the river. In this project the length of the /o/, as it appeared in the morphemes

coat, coke, cope, poke, and *pope,* was analyzed. The data gathered from research participants tended to support Allen's theory, although the pronunciation differences between the two regions seemed not to be considerable. For example, research participants who were living to the north in Morrison and Carver Counties lengthened the /o/ an average of 136.7 msec whereas the /o/ in Le Sueur County was lengthened for average of 132.7 msec. Despite the differences in pronunciation times, the actual difference between these two areas only averages 1/250 of a second.

According to the LAUM, the pronunciation patterns of /o/ in *coat* do not appear to have as a clear pattern as it did in *ago* (Allen, 1976). For example, south of the Minnesota River in Goodhue County, the /o/ in *coat* was pronounced either as a pure [o] sound or with a slightly elongated [o˙] sound whereas in Fillmore County, the /o/ was pronounced with slight brevity, as in [o$^{\breve{}}$^]. North of the Minnesota River in McLeod County, the /o/ in *coat* was pronounced as a pure [o] or a briefer [o$^{<}$] version. In Crow Wing County, which is also north of the river, *coat* was both elongated, as in [o˙], and spoken with some brevity, as in [o$^{<\breve{}}$]. Therefore, it seems that there may be other factors that could influence the length of the /o/ phoneme in *coat* other than the Minnesota River acting as an isogloss. In this research, the /o/ in *coat* seemed to have more of a consistent length. Note the following table for an overview.

Table 4.9: Comparison of the Pronunciation of the /o/ in *Coat* Per County

Averages	Morrison Co.	Carver Co.	Le Sueur Co.

Length of /o/ (msec)	138.67	154.40	153.65

As noted in Table 4.9, the /o/ in *coat* in Morrison County averages 138.7 msec, in Carver County averages 154.4 msec, and in Le Sueur County averages 153.7 msec. This again suggests a pattern that the further north a research participant resides, the longer the /o/ may be articulated. However, when analyzing the length of the /o/ in *coat,* it is not clear if the Minnesota River is the isogloss which can determine the length. Due to the limited number of research participants interviewed for this project, additional research is needed in other counties in Minnesota to see if a correlation exists.

Summary

For this project, I researched the pronunciation of the /o/ by women over the age of 60 years whose first language is English and who have lived in rural Minnesota for 80% of their lifetimes. In this chapter, I explained the results that were collected from the eleven women, residing in Morrison, Carver, and Le Sueur Counties, who participated in this project. I discussed the data that was collected, talked about the variations in data collection methods, contrasted the pronunciation of the /o/ in the five morphemes in order to understand if the pronunciation of the /o/ phoneme varies from region to region in Minnesota, and compared the results of this project to previous research. In Chapter Five, I will summarize my findings, explain areas where additional research is needed, as well as discuss how this data can enhance the knowledge base for teachers instructing students who are learning the English language.

CHAPTER FIVE: CONCLUSIONS

The purpose of this project was to gain a better understanding of the pronunciation of the /o/ by women over the age of 60 years whose first language is English and who have lived in rural Minnesota for at least 80% of their lifetimes. In Chapter Four, I discussed the data that was collected from the participants living in Morrison County, Carver County, and Le Sueur County, talked about the variations in the data collection, contrasted the pronunciation of the /o/ in the five morphemes in order to understand if the pronunciation of the /o/ phoneme varies from region to region in Minnesota, and compared the data from this project with previous research. In this chapter, I will first summarize the findings of the research project, explain areas where additional research is needed, and finally explore how this data can enhance the knowledge base for teachers instructing students who are learning the English language.

Results of the Study

The pronunciation of the /o/ as spoken in the Minnesotan dialect has stereotypically been defined as a lengthened vowel sound. This perception has been reinforced by various forms of the media by using it as a comic relief element. To better understand if the stereotypical pronunciation is an accurate reflection of language feature

in Minnesota or if it is a misperception, the language features of the /o/ were collected and analyzed through interviewing eleven women who resided in Morrison, Carver, and Le Sueur Counties for the majority of their lifetime. Once the language samples were collected, the length that the /o/ was pronounced was measured as well as the manner in which the sound was pronounced, specifically the amount of diphthongization was also investigated. In doing this, the pronunciation of the /o/ for the research participants was determined. From interviewing the research participants, three general results were discovered concerning features of the /o/ as pronounced in Minnesota.

The first result discovered was the manner that the /o/ was pronounced in the various linguistic environments. When the /o/ was presented in morphemes *cope, coke, poke,* and *pope,* research participants pronounced the /o/ more similarly than they did in the morpheme *coat.* For example, on average the /o/ in morphemes *cope, coke, poke,* and *pope* was pronounced for a shorter period of time than in *coat* and, on average, showed slight levels of diphthongization, which is combining the /o/ sound with a /w/ glide. In the morpheme *coat,* the /o/ was pronounced for a slightly longer period of time and pronounced in a pure /o/ manner.

The second result concerned the length that the /o/ was pronounced compared to other speakers of *North American English* (NAE) and within Minnesota. This research study discovered that the /o/ was actually articulated for a slightly shorter length of time than it was by other speakers of NAE, which contrasts with the stereotypical pronunciation of the /o/ in Minnesota. Within Minnesota, it was discovered that the research participants slightly varied their length of the /o/ depending on their

geographical location. For example, in the northernmost county, the /o/ was pronounced for a slightly longer period of time than the pronunciation time from the southernmost county. However, the average difference in the pronunciation time was merely six thousandths of a second.

The third result that was found in this study was concerning the manner in which the /o/ was pronounced. Research participants in Minnesota pronounced the /o/ as either a pure /o/ or showing slight levels of diphthongization. This pronunciation was also different than other speakers of NAE, where the /o/ is pronounced as a diphthong, combining the /o/ sounds with more of a pronounced /w/ gliding sound. In Minnesota, research participants did show some levels of diphthongization, but to a far lesser degree than NAE speakers in other regions of the country. This result shows that the /o/, as pronounced by the research participants in this study, differed more in the levels of diphthongization than it did in the actual length of the /o/ phoneme, as had been stereotypically perceived.

Areas for Additional Research

The results of this research only reflect the pronunciation of the eleven participants from Morrison, Carver, and Le Sueur Counties. This research project only focused on a small amount of research participants. To fully understand the pronunciation differences of research participants in these counties more participants would be needed to support inferential statistical information. Due to the quasi-experimental nature of this research project, the research participants were not selected at

random. Therefore, it is impossible to determine if their pronunciation patterns are simply a reflection of their social circle or geographical region in which live. More research is needed in Morrison, Carver, and Le Sueur Counties to clarify this. In addition to this, additional research is needed to determine if other counties, such as those counties closer to the Canada, Iowa, North Dakota, South Dakota, and Wisconsin borders, as well as rural communities bordering the Minnesota River, also follow similar pronunciation patterns of the /o/.

This research project tested the pronunciation of the /o/ between two voiceless consonants in monosyllabic words. To fully understand the length of the /o/ in Minnesota, additional research is needed. The first area that needs to be researched is to compare the length of the /o/ when it is found at the end of a word, as in *ago* or *hello,* at the end of a sentence, such as '*I will say hello,'* to see how long the vowel sound is maintained in various parts of Minnesota. The next area that needs additional research is to better understand how long the /o/ is lengthened when found in multisyllabic words, such as in *coping*. Further comparing the pronunciation of the /o/ in various parts of the state will help understand if the /o/ is lengthened, monophthongized, or if the longer length of the vowel is only a misperception of the Minnesotan dialect.

In addition to the above considerations, there is also an influx of more language groups resettling into rural areas (Gibson & Jung, 2002; U.S. Census Bureau, 2002). Thus, it is important to understand how the language is being produced as well as investigating if the new language groups are influencing the pronunciation of the English spoken in the rural communities. Understanding the ways that English is pronounced

enables us to have a better understanding of the way that we pronounce the language ourselves as well as understand the linguistic nuances between the varieties of NAE.

Classroom Application

This research project showed that there are two different pronunciations for the /o/ phoneme, both [o] and [ow]. Linguistic books tend to reference both forms of the /o/ phoneme, but vary on their explanation of when one sound is used versus another. For example, some linguistic books explain that the difference between these sounds is that [ow] is used with stressed syllables and [o] is used when the syllable is unstressed (Brinton, 2000; Celce-Murcia, Brinton, & Goodwin, 1996) whereas the other textbooks explain that there are two ways to pronounce the /o/ but give no explanation of when to use one sound versus another (Clark & Yallop, 1990; Stewart & Vaillette, 2001). The results of this project tended to support the theory that the /o/ was generally pronounced as a diphthong in four out of the five monosyllabic words, but only in slight degrees (Appendix G, Appendix H, & Appendix I). Since the /o/ was also pronounced as [o], it shows that further research is needed to definitely show how to pronounce the /o/ sound and in what environments tends to yield an [o] or [ow].

Interestingly, books that teach the pronunciation of *North American English* (NAE) focus on the pronunciation of the [ow] diphthong, but tend not to reference the second [o] pronunciation (Ferree & Sanabria, 2004; Kozyrev, 2003; Lane, 2005). The description of the /o/ sound varies from the book writing merely [ow] to describe the sound to a picture combined with an explanation. The best description was found in

Kozyrev (2003). In this student textbook, the authors provided a picture, which showed the movement of the tongue and an explanation describing how to physically produce the sound (Kozyrev, 2003, p.101). Even though this book provided a clear description of [ow], it never referenced the [o] sound.

As educators, it is important for us to understand the way in which we use the English language. Regardless of which form of the /o/ the student books teach, it is important to note that both [o] and [ow] sounds are used in English and need to be taught to our students. Because the [o] sound seems not to be included in textbooks, we need to take a moment to compare the physical production of the [ow] with the [o]. Even though [o] tends to be used to a lesser degree than the [ow], it is still important that both sounds are taught. This increased knowledge will enable us to better teach students who are learning the English language, as well as make our students aware of the various ways in which English is used in different parts of the country and around the world. Understanding the ways that the /o/ is pronounced is only a small step in this process.

Summary

The purpose of this research project was to understand how women over the age of 60 years whose first language is English and who have lived in rural Minnesota for at least 80% of their lifetimes pronounce the /o/ phoneme in Morrison, Carver, and Le Sueur Counties, Minnesota. In this chapter, I summarized the findings of the research, explained areas where additional research is needed, and explored how this data can enhance the knowledge base for teachers instructing students who are learning the

English language. In conclusion, it seems that the further north of the Minnesota River someone is living, the longer the /o/ phoneme will be pronounced. However, the difference in pronunciation times is so slight, that it is amazing that the human ear can even detect such a slight variance in length (Allen, 1973; Allen & Underwood, 1971). Participants who did pronounce the /o/ with some amount of diphthongization did to a much lesser degree than the benchmarks (Peterson & Barney, 1967). There is a perception that people who speak the Minnesota form of NAE elongate the /o/ phonemes. From the data that was collected in this research project, the participants interviewed actually shortened the /o/ rather than lengthening it. Regardless of how the /o/ is pronounced, instructors teaching the pronunciation patterns of English need to be knowledgeable of the variations so that we can make students aware that there is not a single “correct” way of pronouncing English, just a cluster of variations.

APPENDIX A:
EXPLANATION OF PHONETIC SYMBOLS USED IN THE LAUM

EXPLANATION OF PHONETIC SYMBOLS USED IN THE LAUM

Phonetic Symbols	Meaning
[o]	A back-mid rounded and tense /o/
[ou]	The /o/ is pronounced in combination with the /u/, which suggests a possible version of a diphthong.
[o ^{u}]	The /o/ is followed by slight traces of the /u/, but not as pronounced as in the [ou] form.

Vowel Length	Meaning
[$\cdot$]	Symbolizes a slight vowel elongation
[ŏ]	Symbolizes vowel brevity
[$^{\breve{}}$]	Symbolizes that the vowel is spoken with some brevity, but not as briefly as in the [ŏ] transcription

Tongue Position	Meaning
[$^{<}$]	The tongue remains in a slightly retracted position towards the back of the mouth
[^]	The tongue remains in a slightly advanced position towards the front of the mouth

(Allen, 1976)

APPENDIX B:

PERSONAL CHARACTERISTICS

Date:_____ *Participation #* _____

PERSONAL CHARACTERISTICS

Last Name:_____ First Name:_____

Address:_____

City:_____ State: MN Zip Code:_____

County:_____

Approximately how many years have you lived in this county?_____

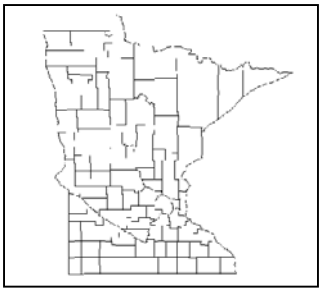
Age:_____ Date of Birth:_____ Gender: Female .

What is your first language?_____

Which is the highest level of education that was competed? (*circle one)*

Some high school
High school
Some post-secondary training
2-year associates degree
Some college classes
4-year college degree
Graduate work
Post-graduate work or higher

Office use only . . .
____ TYC sent
Y / N Within parameters?
____ Participation # entered
____ Data analyzed
____ Data entered in spreadsheet



(Minnesota Historical Society, 2004)

APPENDIX C:

RESEARCH CONSENT FORM

RESEARCH CONSENT FORM

I, _____ (*print name*), have been asked to participate in a research project that involves studying the pronunciation of the Minnesota dialect. I have not been asked to participate due to my affiliation with any public institution, such as a public school or professional organization. I understand that I can withdraw from this project at any time.

Benefits and Explanation of the Project: I understand that the purpose of this research project is to gain a better understanding of the ways that English is pronounced in Minnesota. The knowledge obtained from this study will be used to educate teachers of the various ways that English is pronounced, so as to enhance the learning process of English Language Learners. To help educate our teachers, I will be asked to provide some basic information (such as age, educational level, address, and so forth) and will be asked to read approximately 15 sentences. This project is expected to take approximately 15 to 30 minutes.

Confidentiality: All the data that I provide during this process will be treated as confidential. Thus, my information will be given a number so that the data that I provide cannot be linked to me.

Contact and Questions: This research project is being conducted by Gretchen Leach, a graduate student at Hamline University. If I have any questions, I can contact her at 651-699-4427. The Administrative Advisor for this project is Andreas Schramm. He can be reached via phone at 651-523-2009 or mail at Hamline University, c/o Andreas Schramm, 1536 Hewitt Avenue, St. Paul, MN 55104.

I have read and agree to the above statement.

Printed Name_____

Signature_____ Date_____

APPENDIX D:

PRACTICE SHEET

PRACTICE SHEET

I will model the following sentences.

1. I will say dog again.
2. I will say pen again.
3. I will say tote again.
4. I will say book again.

Now you practice. Please read the following sentences.

1. I will say rat again.
2. I will say look again.
3. I will say cup again.
4. I will say chair again.

APPENDIX E:

MORPHEME SHEET

RECORDED SHEET

Read the following twelve sentences into the microphone of the tape-recorder.

1. I will say step again.
2. I will say coat again.
3. I will say bed again.
4. I will say run again.
5. I will say coke again.
6. I will say wall again.
7. I will say girl again.
8. I will say cope again.
9. I will say Sam again.
10. I will say poke again.
11. I will say teach again.
12. I will say Pope again.

APPENDIX F:

PARTICIPANT DEMOGRAPHICS

PARTICIPANT DEMOGRAPHICS

Morrison County

Participant	*Age*	Years in County	Highest Education Level
001	76	76	Some Post-Secondary
002	71	71	High School
003	81	81	8th Grade

Carver County

Participant	*Age*	Years in County	Highest Education Level
004	61	61	High School
005	62	62	High School
006	66	66	High School
007	65	65	High School

Le Sueur County

Participant	*Age*	Years in County	Highest Education Level
008	82	82	Some High School
009	89	80	Some College
010	89	89	Some Post-Secondary
011	81	75	Some College Classes

APPENDIX G:

LANGUAGE SAMPLES FROM MORRISON COUNTY

LANGUAGE SAMPLES FROM MORRISON COUNTY

Participant #: 001

Morpheme	Sentence Length (msec)	Length of /o/ (msec)	% of /o/ in Sentence	Beginning F2 (Hz)	Ending F2 (Hz)	Pitch of F2 (Hz)
Coat	1760.0	186.3	*10.59%*	788.8	824.6	*35.8*
Coke	1842.6	163.3	*8.86%*	772.0	721.4	*-50.6*
Cope	1622.0	182.5	*11.25%*	673.8	648.0	*-25.8*
Poke	1366.3	168.8	*12.35%*	955.5	818.3	*-137.2*
Pope	1472.1	124.4	*8.45%*	737.5	759.5	*22.0*
Average:	*1612.60*	*165.06*	*10.30%*	*785.52*	*754.36*	*-31.16*

Participant #: 002

Morpheme	Sentence Length (msec)	Length of /o/ (msec)	% of /o/ in Sentence	Beginning F2 (Hz)	Ending F2 (Hz)	Pitch of F2 (Hz)
Coat	1261.3	130.2	*10.32%*	915.2	1518.1	*602.9*
Coke	1473.4	142.8	*9.69%*	920.5	804.1	*-116.4*
Cope	1272.9	145.9	*11.46%*	1081.3	1004.0	*-77.3*
Poke	1265.0	145.1	*11.47%*	1145.5	1009.0	*-136.5*
Pope	1399.7	121.0	*8.64%*	1062.2	966.3	*-95.9*
Average:	*1334.46*	*137.00*	*10.32%*	*1024.94*	*1060.30*	*35.36*

Participant #: 003

Morpheme	Sentence Length (msec)	Length of /o/ (msec)	% of /o/ in Sentence	Beginning F2 (Hz)	Ending F2 (Hz)	Pitch of F2 (Hz)
Coat	1184.5	99.5	*8.40%*	840.5	729.0	*-111.5*
Coke	1332.0	125.1	*9.39%*	937.0	818.3	*-118.7*
Cope	1258.0	125.0	*9.94%*	761.7	701.6	*-60.1*
Poke	1283.0	108.3	*8.44%*	837.1	825.9	*-11.2*
Pope	1159.2	108.1	*9.33%*	1030.5	1053.4	*22.9*
Average:	*1243.34*	*113.20*	*9.10%*	*881.36*	*825.64*	*-55.72*

Averages for Morrison County:

Morpheme	Sentence Length (msec)	Length of /o/ (msec)	% of /o/ in Sentence	Beginning F2 (Hz)	Ending F2 (Hz)	Pitch of F2 (Hz)
Coat	*1401.93*	*138.67*	*9.89%*	*848.17*	*1023.90*	*175.73*
Coke	*1549.33*	*143.73*	*9.28%*	*876.50*	*781.27*	*-95.23*
Cope	*1384.30*	*151.13*	*10.92%*	*838.93*	*784.53*	*-54.40*
Poke	*1304.77*	*140.73*	*10.79%*	*979.37*	*884.40*	*-94.97*
Pope	*1343.67*	*117.83*	*8.77%*	*943.40*	*926.40*	*-17.00*
Average:	*1396.80*	*138.42*	*9.93%*	*897.27*	*880.10*	*-17.17*

APPENDIX H:

LANGUAGE SAMPLES FROM LE SUEUR COUNTY

LANGUAGE SAMPLES FROM LE SUEUR COUNTY

Participant #: 008

Morpheme	Sentence Length (msec)	Length of /o/ (msec)	% of /o/ in Sentence	Beginning F2 (Hz)	Ending F2 (Hz)	Pitch of F2 (Hz)
Coat	1373.5	137.6	*10.02%*	897.3	1072.8	*175.5*
Coke	1172.2	112.7	*9.61%*	1012.4	860.0	*-152.4*
Cope	1332.1	110.4	*8.289%*	947.9	828.9	*-119.0*
Poke	1305.2	134.6	*10.31%*	911.9	846.9	*-65.0*
Pope	1081.1	138.7	*12.83%*	1007.0	826.8	*-180.2*
Average:	*1252.82*	*126.80*	*10.21%*	*955.3*	*887.08*	*-68.22*

Participant #: 009

Morpheme	Sentence Length (msec)	Length of /o/ (msec)	% of /o/ in Sentence	Beginning F2 (Hz)	Ending F2 (Hz)	Pitch of F2 (Hz)
Coat	1695.9	200.3	*11.81%*	928.2	1194.6	*266.4*
Coke	1917.9	161.1	*8.40%*	986.1	747.8	*-238.3*
Cope	1481.8	136.4	*9.21%*	*data was untraceable*		
Poke	2152.6	176.8	*8.21%*	853.3	700.1	*-153.2*
Pope	1674.6	153.9	*9.19%*	992.8	632.5	*-360.3*
Average:	*1784.56*	*165.70*	*9.36%*	*940.10*	*818.75*	*-121.35*

Participant #: 010

Morpheme	Sentence Length (msec)	Length of /o/ (msec)	% of /o/ in Sentence	Beginning F2 (Hz)	Ending F2 (Hz)	Pitch of F2 (Hz)
Coat	1195.9	123.4	*10.32%*	797.7	1215.1	*417.4*
Coke	1380.7	120.4	*8.72%*	993.4	759.8	*-233.6*
Cope	1276.3	99.3	*7.78%*	805.7	743.2	*-62.5*
Poke	1176.0	108.4	*9.22%*	821.0	820.7	*-0.3*
Pope	1059.0	96.6	*9.12%*	*data was untraceable*		
Average:	*1217.58*	*109.62*	*9.03%*	*854.45*	*884.70*	*30.25*

Participant #: 011

Morpheme	Sentence Length (msec)	Length of /o/ (msec)	% of /o/ in Sentence	Beginning F2 (Hz)	Ending F2 (Hz)	Pitch of F2 (Hz)
Coat	1624.0	153.3	*9.44%*	906.8	1996.1	*1089.3*
Coke	1509.0	119.7	*7.93%*	975.8	764.4	*-211.4*
Cope	1652.1	120.4	*7.29%*	823.8	662.1	*-161.7*
Poke	1535.4	133.7	*8.71%*	884.9	723.6	*-161.3*
Pope	1480.4	115.6	*7.81%*	893.3	608.4	*-284.9*
Average:	*1560.18*	*128.54*	*8.24%*	*896.92*	*950.92*	*54.00*

Averages for Le Sueur County:

Morpheme	Sentence Length (msec)	Length of /o/ (msec)	% of /o/ in Sentence	Beginning F2 (Hz)	Ending F2 (Hz)	Pitch of F2 (Hz)
Coat	1472.33	153.65	*10.44%*	882.50	1369.65	*487.15*
Coke	1494.95	128.48	*8.59%*	991.93	783.00	*-208.93*
Cope	1435.58	116.63	*8.12%*	859.13	744.73	*-114.40*
Poke	1542.30	138.38	*8.97%*	867.78	772.83	*-94.95*
Pope	1323.78	126.20	*9.53%*	964.37	689.23	*-275.13*
Average:	*1453.79*	*132.67*	*9.13%*	*913.14*	*871.89*	*-41.25*

APPENDIX H:

LANGUAGE SAMPLES FROM CARVER COUNTY

LANGUAGE SAMPLES FROM CARVER COUNTY

Participant #: 004

Morpheme	Sentence Length (msec)	Length of /o/ (msec)	% of /o/ in Sentence	Beginning F2 (Hz)	Ending F2 (Hz)	Pitch of F2 (Hz)
Coat	1349.4	169.4	*12.55%*	1228.8	1242.3	*13.5*
Coke	1201.5	144.9	*12.06%9*	2671.2	2804.7	*-62.5*
Cope	1326.4	124.5	*9.39%*	2836.6	3109.2	*-116.6*
Poke	1307.0	144.6	*11.06%*	2868.0	3090.4	*-288*
Pope	1119.5	104.0	*9.29%*	2833.9	2961.0	*-66.9*
Average:	*1260.76*	*137.48*	*10.87%*	*1107.14*	*1003.04*	*-104.1*

Participant #: 005

Morpheme	Sentence Length (msec)	Length of /o/ (msec)	% of /o/ in Sentence	Beginning F2 (Hz)	Ending F2 (Hz)	Pitch of F2 (Hz)
Coat	1381.8	156.0	*11.29%*	942.9	734.8	*164.7*
Coke	1521.0	118.3	*7.78%*	2775.3	2548.0	*-33.7*
Cope	1116.0	99.3	*8.90%*	2688.0	2898.3	*-167.5*
Poke	1368.4	117.0	*8.55%*	2692.6	2584.4	*-374.2*
Pope	1357.3	123.7	*9.11%*	2609.1	2898.3	*-208.1*
Average:	*1348.9*	*122.86*	*9.13%*	*996.60*	*872.84*	*-123.76*

Participant #: 006

Morpheme	Sentence Length (msec)	Length of /o/ (msec)	% of /o/ in Sentence	Beginning F2 (Hz)	Ending F2 (Hz)	Pitch of F2 (Hz)
Coat	1409.4	156.3	*11.09%*	837.9	870.7	*32.8*
Coke	1595.5	156.3	*9.80%*	702.5	896.5	*194*
Cope	1590.4	131.4	*8.26%*	645.3	675.6	*30.3*
Poke	1582.9	138.9	*8.78%*	683.7	730.9	*47.2*
Pope	1312.5	131.3	*10.00%*	706.4	579.9	*-126.5*
Average:	*1498.14*	*142.84*	*9.59%*	*715.16*	*750.72*	*35.56*

Participant #: 007

Morpheme	Sentence Length (msec)	Length of /o/ (msec)	% of /o/ in Sentence	Beginning F2 (Hz)	Ending F2 (Hz)	Pitch of F2 (Hz)
Coat	1398.4	135.9	*9.72%*	826.0	1249.1	*423.1*
Coke	1522.6	127.9	*8.40%*	818.3	634.7	*-183.6*
Cope	1533.5	137.4	*8.96%*	866.7	659.5	*-207.2*
Poke	1200.3	120.1	*10.01%*	983.0	804.8	*-178.2*
Pope	1419.1	162.3	*11.44%*	901.2	802.1	*-99.1*
Average:	*1414.78*	*136.72*	*9.70%*	*879.04*	*830.04*	*-49.00*

Averages for Caver County:

Morpheme	Sentence Length (msec)	Length of /o/ (msec)	% of /o/ in Sentence	Beginning F2 (Hz)	Ending F2 (Hz)	Pitch of F2 (Hz)
Coat	*1384.75*	*154.40*	*11.15%*	*966.58*	*1125.10*	*158.53*
Coke	*1460.15*	*136.85*	*9.37%*	*889.48*	*868.03*	*-21.45*
Cope	*1391.58*	*123.15*	*8.85%*	*861.78*	*746.53*	*-115.25*
Poke	*1364.65*	*130.15*	*9.54%*	*995.53*	*797.23*	*-198.30*
Pope	*1302.10*	*130.33*	*10.01%*	*909.08*	*783.93*	*-125.15*
Average:	*1380.65*	*134.98*	*9.78%*	*924.49*	*864.16*	*-60.33*

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