NORMATIVE NASALANCE PATTERNS IN MALE AND FEMALE SPEAKERS OF SOUTHERN AMERICAN ENGLISH NATIVE TO TEXAS

by

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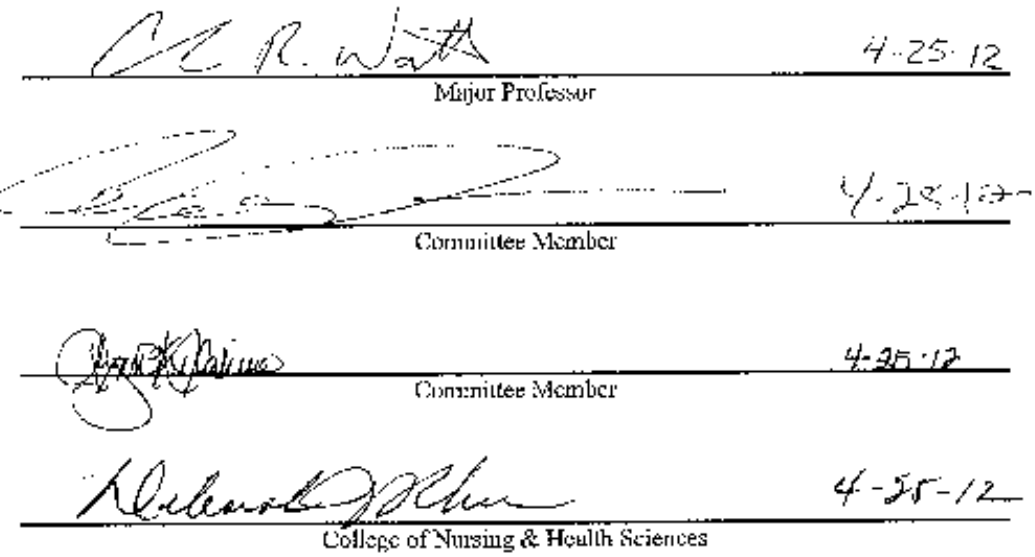

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CHAPTER 1

INTRODUCTION

Dialect refers to any variability of a language that is specific to a particular region or social group (Parker & Riley, 2000). Many dimensions differentiate dialects from each other, including phonology, grammar, lexicon, and social and internal factors. Because sound production varies among different regions, knowledge of speech production patterns characteristic of different dialects should be of clinical interest to speech-language pathologists. In fact, researchers have found that the degree of nasal resonance during speech production using a measurement called "nasalance" differs significantly across some American English dialects (Seaver et al., 1991). Additionally, it was reported that nasalance differences between males and females exist within the same dialect (Seaver et al., 1991).

Texas is located in the region identified by the Southern American English dialect. However, there are characteristics that are distinct to Texas, such as the neutralization of the /a/ and /ɔ/ vowel when used with a vocalic /r/ (i.e. /card/ "card" vs. /cɔrd/ "cord", Walsh & Monte, 1974). Additionally, Fort Worth is located in a unique American English dialect region called "Texas South," which has its own distinctive dialectal features separating it from the larger Southern American English dialect spoken in Texas (Labov, Ash, & Boberg, 2005). When obtaining a clinical measurement such as nasalance, it is important to make valid comparisons between individuals seeking treatment versus typically developing individuals. However, there are currently no normative data on Southern American English in speakers native to Texas, or on the "Texas South" dialect to which treatment-seeking populations can be compared. Although there is documented research on gender differences within the Southern American English dialect, there is no information on the possible gender differences within the Texas South dialect

region. The purpose of this study was to investigate the effects of gender on measures of nasalance in speakers native to Texas and speakers of the Texas South dialect, and also to generate a large sample of comparative nasalance data for clinical utilization, which can be compared to previously published nasalance data from speakers of other American English dialects.

CHAPTER II

REVIEW OF LITERATURE

Dialect

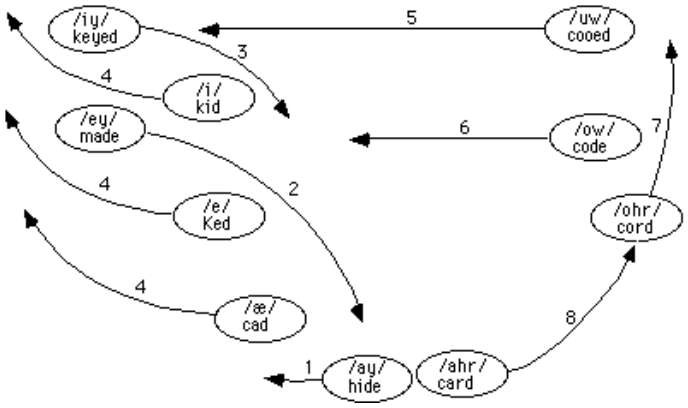
Dialect refers to any variability of a language that is specific to a particular region or social group (Parker & Riley, 2000). Many dimensions differentiate dialects from each other, including phonology, grammar, lexicon, and social and internal factors. Phonology refers to the rules of a language that dictate sound pronunciation and combinations of sounds. At the level of phonology, English dialects are identified and differentiated on a phonetic level by the positioning of vowels and sound changes within vowels (Labov, Ash, & Boberg, 2005; Nagle & Sanders, 2003; Wolfram & Ward, 2006). The different dialect regions of the United States include the North, New England, New York City and the Mid-Atlantic States, the South, the Midland, and the West (Labov et al., 2005).

The North is characterized by a Northern Vowel Shift in which the production of vowels are produced high and in the front of the mouth (i.e. /æ/ in /kæt/ "cat" and /ɔ/ as in /dɔn/ "Don"). The New England dialect is split into four different categories that consist of a north-south split, and an east-west split. The north New England differs from the south in the /ɔ/, /ɑ/ split. For example, in south New England /ɔ/ and /ɑ/ are distinct (/dɔn/ "Don" versus /dɑn/ "Don"). East and west New England differ in /r/ vocalization. For example, "yard" is produced as /jad/ (yad) in the east verses /jard/ (yard) in the west. The New York City and Mid-Atlantic states dialectal region differs from other dialects in the features of a split short /a/ system (/bæg/ "bag" vs. /pɑstʌ/ "pasta" and the /ɔ/ /lɔw/ "law") vowel being produced higher in the mouth. Speakers of the Midland dialect generally do not produce a split short /æ/ (/sæd/ "sad", /mæd/ "mad"). The /ɑ/ and /ɔ/ (/hɑt/ "hot" vs. /lɔw/ "law") are inconsistently differentiated in speaking and

perception. Also, the /oʊ/ (/roʊd/ “road,” /goʊ/ “go”) vowel is produced in the front of the mouth in the Midland dialectal region. The strong fronting of /u / in /tuzdeɪ/ (Tuesday), but no fronting of /oʊ / as in the word /roʊd/ (road) generally characterizes the West dialectal region (Labov et al., 2005).

According to Wolfram and Ward (2006), Southern American English is the most widely recognized regional dialect in American English. It can be characterized at the phonetic level by the Southern Vowel Shift. Wolfram and Schilling-Estes (2006) point out that short front vowels move up and take on gliding characteristics of long vowels in the Southern Vowel Shift. For example, the /ɛ/ in /bɛd/ (bed) becomes /beɪd/ (bed). Long front vowels (/i/ in /ki/ “key,” and /eɪ/ in /meɪd/ “made”) move down and backwards. Back vowels (/u/ in /fud/ “food,” and /oʊ/ in loʊd/ “loud”) have a more forward placement. Figure 1 below shows the Southern Vowel Shift vowel quadrilateral (Labov et al., 2005).

Figure 1. The Southern Vowel Shift



The vowel shift would theoretically affect nasalance scores, since studies show that nasality is greater for front vowels and high vowels (Lewis, Watterson, & Quint, 2000). Theoretically, if a dialect feature is characterized by vowels shifting front/back or high/low, the degree of nasalance during their production should also shift. In addition to a purported vowel

effect on nasalance, some studies have also reported a gender effect specific to some dialect regions. Seaver et al. (1991) reported differences between the nasalance scores of males and females within the Southern American English dialectal region. The authors found that for three different stimuli, females scored two percentage points of nasalance higher than males, a difference which was statistically significant.

There are two characteristics to phonological change that can be applied to the discussion of regional dialectal differences: substitution processes and phonotactic processes (Bauman-Waengler, 2009). Substitution processes refers to the association of a sound in one dialect to another sound in a different dialect. For example, the difference between the /ɔ/and /ɑ/ split (/dɔn/ "Don" versus /dɑn/ "Don") used in New England and other dialectal regions where the /ɔ/and /ɑ/ characteristic does not exist (/dɑn/ "Don"). Phonotactic processes include the addition or deletion of a phoneme in comparison to Standard American English. An example of phonotactic processes would be the /r/ vocalizations between east and west New England, (/jad/ "yad" verses /jard/ "yard"). The two other characteristics to phonological change that Bauman-Waengler (2009) describes are consonant cluster variations and prosodic variability. These characteristics refer more to changes between dialects that differ from Standard American English such as African American English or Spanish Influenced English.

According to Wolfram and Ward (2006), Texas English is a mix of elements from various dialects of English and from other languages. However, they also state that there is some difference in Texas English from other closely related varieties. In parts of Texas, there is a neutralization that occurs between the two low back vowels of /a/ and /ɔ/ as in the words /barn/ (barn) and /bɔrn/ (born). Therefore, there would be no difference in the productions of the /a/ and /ɔ/ vowels used before the /r/ phoneme. However, in other southern U.S. regions which speak

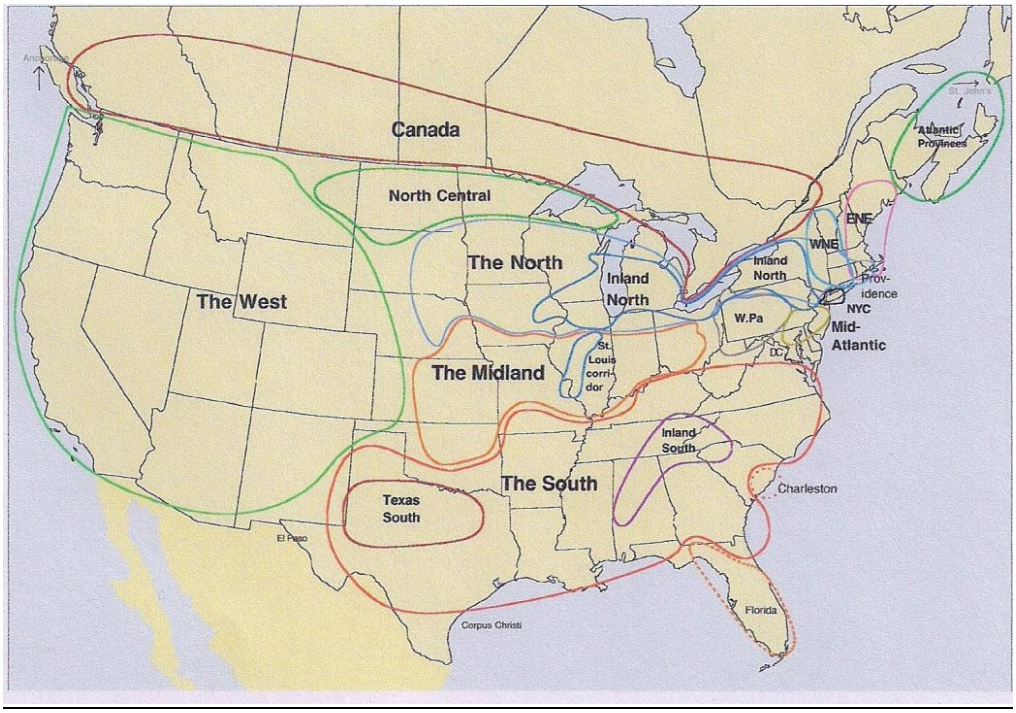
Southern American English, there is a distinction made between /a/ and /ɔ/ (Walsh & Monte, 1974).

A separate sub-regional dialect of Texas called "Texas South" was recently found during a study of the different phonological patterns in American English Speakers (Labov et al., 2005). This sub-region of Texas dialect is distinguished from other Southern American English dialects by differences in tongue positions, specifically shown in vowel glide deletions in voiced and voiceless contexts. For example, the vowels /aɪ/ (/laɪk, waɪt, raɪs/ "like," "white," "rice") and /ɔɪ/ (/ɔɪl/ "oil" and /fɔɪl/ "foil") are pronounced as a monophthongs rather than diphthongs (laɪk→lak and ɔɪl→ɔl). There are a higher percentage of speakers in the Texas South who produce /ɛ/ in /bɛt/ (bet) higher and farther in the front than /eɪ/ in /beɪt/ (bait), distinguishing them from the rest of the Southern dialect speakers. The /ɛ/ and /eɪ/ vowels can also merge together for Southern dialect speakers. Therefore, /bɛt/ (bet) and /beɪt/ (bait) would sound the same.

The Southern dialect region includes the back upglide shift as well as the southern shift. The back upglide shift is characterized by the breaking of the short front vowels. Once the vowels break they then glide up from the original placement to become /j/ and then can, in some cases, come back down to a schwa. An example would be with the short vowels in the words /bæt/ (bat), /bɛt/ (bet), and /bɪt/ (bit). Therefore, they would become /bæjət/, /bɛjət/, and /bɪjət/. The Texas South dialect region has a lower concentration of this phenomenon. However, the Texas South dialect region has a higher concentration (i.e., more people use the characteristic) of many of the other Southern dialect characteristics (i.e. /ɛ, eɪ/ merger, /aɪ/ monopthongization, and southern shift; Labov et al., 2005). As shown in Figure 2, the "Texas South" dialect region stretches from west of Odessa to east of the Dallas-Fort Worth metroplex and as far north as Lubbock (Labov et al., 2005). However, it should also be noted that people living in rural areas

and small cities present with a stronger usage of dialectal features than those living in large metropolitan areas where some dialectal stereotypes are diminishing (Wolfram & Ward, 2006).

Figure 2. Dialect Map of American English, showing the Texas South dialect region (from Labov, Ash, & Boberg, 2005).



Seaver et al. (1991) is the only known study to date with nasalance scores influenced by dialects across North America. As mentioned previously, this study reported that speakers from the general Southern English dialect produced significantly lower nasalance scores than those from the other dialectal regions. In this case, the participants from the Southern geographical region were from Alabama and Illinois (Seaver et al., 1991).

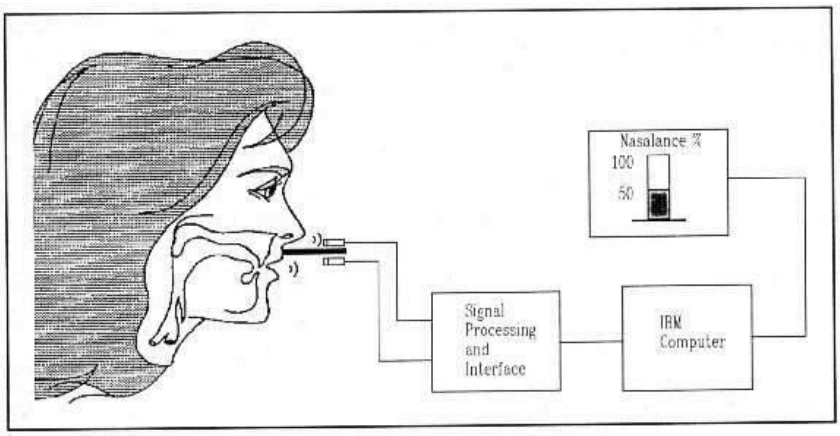
Nasality

Nasometry is the process of measuring the degree of nasal resonance, which occurs during speech, yielding a clinically important measurement referred to as nasalance (Kummer, 2008). Nasalance values, which are obtained using a specialized piece of instrumentation called a

Nasometer, represent the ratio of nasal acoustic energy to oral acoustic energy in the speech signal. Clinically, nasalance values are used with the population suspect to have velopharyngeal dysfunction. It is used during assessment and diagnosis to give quantitative data on function and to provide reliability to the perceptual impression of the clinician. Thus, the validity and reliability of the normative nasalance scores are important to problem detection since they determine how much an individual deviates from the typical population.

The Nasometer II, Model 6400 (Kay PENTAX, Lincoln Park, NJ) is a commercially available instrument used for nasometry. The Nasometer II is computer-based, consisting of a headset device that separates the oral and nasal cavities with a metal plate worn by a speaker using a head-mounted strap. As illustrated in Figure 3, a microphone on either side of the metal plate transmits acoustic energy from the oral and nasal microphones to a computer, which can both store and analyze the resulting signals (Dalston, 1992). Using the KayPentax nasalance algorithm, high nasalance scores represent greater degrees of nasal resonance during speech compared to low nasalance scores. Typically, higher nasalance scores also correspond to greater perceived nasal resonance (e.g., nasality), although there is not a perfect correlation between these two factors (McKay & Kummer, 2005).

Figure 3. A typical setup for acquiring nasalance measures



Clinical assessment of nasality begins with calibration of the Nasometer II according to the manufacturer's specifications. The headset device is fitted onto the patient's head by adjusting the top band, then fastening the Velcro strip at the rear of the head. When properly fitted, the metal plate fits between the nose and upper lip horizontally, with the microphones directly facing the nose and mouth. The clinical protocol consists of the patient reading standardized speech passages such as the Zoo Passage, *The Rainbow Passage*, and Nasal Sentences (Fairbanks, 1960). The different passages each have clinical importance during the typical assessment of nasality. The Zoo Passage contains sentences void of nasal consonants, allowing the evaluator to assess if the patient can attain and sustain velopharyngeal closure throughout connected speech. Assessment of velopharyngeal movement is obtained through reading *The Rainbow Passage*, which consists of 11.5 % of nasal consonants, the average amount of nasal consonants in normal Standard American English (Kummer, 2001). The Nasal Sentences are used if the evaluator anticipates hyponasality (Kummer, 2001). These sentences contain 35% nasal consonants, which represent three times the average amount typically occurring in Standard American English (Kummer, 2001). MacKay and Kummer (1994) developed the Simplified Nasometric Assessment Procedures (SNAP Test-R) to allow for

simpler administration with children. The SNAP Test contains three subtests that are normed for children three to nine years old.

Dalston et al. (1991) suggested nasalance scores of less than 32% on the Zoo Passage for adults and children indicate normal velopharyngeal function. Adults receiving a nasalance score higher than 32% perceptually had a hypernasal quality to their speech production (Dalston et al., 1991). Table 1 is abstracted from Ann Kummer's *Cleft Palate and Craniofacial Anomalies Effects on Speech and Resonance* (2008) and shows the normative data from several studies for children and adults using a sustained /a/ vowel, *The Rainbow Passage*, Nonnasal (Zoo) Passage, and highly "Nasal" Sentences:

Table 1. Normative nasalance values (in percentages) for different age ranges across four different stimuli (from Kummer, 2008).

Subjects		Sustained /a/		Rainbow Passage		Nonnasal Passage		Highly "Nasal" Sentences	
Age	N	Mean	(SD)	Mean	(SD)	Mean	(SD)	Mean	(SD)
Children									
4-6	20	-	-	32.6	(6.7)	15.4	(3.3)	-	-
3-9	246	-	-	-	-	-	-	56.1	(7.4)
3-9	76	-	-	-	-	15.4	(2.8)	-	-
3-9	76	-	-	-	-	10.8	(3.1)	-	-
4-9	238	-	-	-	-	13.1	(5.9)	-	-
4-9	243	-	-	-	-	-	-	59.6	(8.1)
5-12	117	-	-	35.7	(5.2)	15.5	(4.9)	61.1	(6.9)
Men									
18-38	11	8.0	(10.6)	16.8	(5.8)	8.7	(1.9)	32.9	(13.0)
23±5	40	-	-	-	-	17.2	(4.7)	58.8	(7.4)
24±2	15	-	-	36	(4)	19	(4)	63	(4)
38-63	56	-	-	35	(6)	15	(7)	61	(6)
50-80	50	16.2	(6.2)	23.5	(5.1)	16.7	(4.2)	38.2	(8.4)
Women									
18-38	11	6.5	(9.4)	18.8	(5.8)	8.3	(2.5)	38.9	(14.50
23±6	40	-	-	-	-	18.1	(5.1)	59.8	(6.7)
28±8	15	-	-	37	(4)	19	(4)	64	(4)
16-50	92	-	-	36	(6)	16	(7)	63	(6)
50-80	50	23.6	(4.4)	32.0	(10.7)	27.3	(8.4)	47.5	(14.5)

The normative nasalance scores for children were consistently between 32% and 35% during *The Rainbow Passage*, at 15% for the Nonnasal passage, and between 56% and 61% for the highly nasal sentences (Fletcher et al., 1989; MacKay & Kummer, 1994; van Doorn & Purcell, 1998; Watterson et al., 1996). The normative data regarding adults shows that males between the ages of 18 and 38 have a higher nasalance score than females in the same age range when using sustained /a/, and Nonnasal sentences. However, for ages 50-80, women have a higher nasalance score across the three diagnostic prompts than males. The majority of the studies from which the normative nasalance scores were extracted from included subjects who spoke with a Mid-Atlantic American English Dialect (Fletcher, 1976; Litzaw & Dalston, 1992; Mayo et al., 1996).

Seaver et al. (1991) reported data on males aged between 38-63 years old and females aged 16-50 years old. These speakers represented four different geographic regions with specific speech patterns: the Mid-Atlantic, Southern, Mid-Western, and Ontario Canada. The authors reported that men had significantly lower nasalance scores than women. The authors noted there were statistically significant effects on nasalance scores due to gender and dialectal differences. Specifically, they found female speakers to have significantly higher nasalance scores than males across all dialectal regions. The Mid-Atlantic dialectal speakers presented with significantly higher nasalance scores than any other dialectal group across all three stimuli. Other researchers also support the supposition that gender and dialect can have a significant impact on nasalance scores. While the gender effect has been demonstrated in many languages including English, results have not been unequivocal (Dalston, Neiman & Gonzalez-Landa, 1993; Mishima, Sugii, Yamada, Imura & Sugahara, 2008; Nichols, 1999; Seaver et al., 1991; Van Lierde et al., 2001).

CHAPTER III

STATEMENT OF PURPOSE

Clinically it is important to make valid comparisons of nasalance values for those seeking treatment versus typical individuals. Thus, nasalance scores should be compared to scores from other speakers of the same dialect. There are currently no normative data on speakers of Southern American English native to Texas, or on the "Texas South" dialect. Therefore, it is not known whether the nasalance score of speakers from Texas or more specifically the "Texas South" dialect differ from nasalance scores from the larger Southern American dialect, or whether gender effects nasalance scores of speakers from the "Texas South." The purpose of this study was to investigate the effects of gender on measures of nasalance in native speakers of Texas and of the Texas South dialect. The second purpose of this study was to generate a large sample of comparative nasalance data for clinical utilization, which can be compared to previously published data from speakers of other American English dialects. Specifically the following questions will be addressed:

1. Will gender differences influence the nasalance scores on isolated prolonged vowels of speakers native to Texas and of the Texas South dialect?
2. Will gender differences influence the nasalance scores on nasal and non-nasal sentences of speakers native to Texas and of the Texas South dialect?
3. Will gender differences influence the nasalance scores on a standard paragraph (*The Rainbow Passage*) of speakers native to Texas and of the Texas South dialect?
4. Will the nasalance scores of speakers native to Texas and of the Texas South dialect differ from those of the Southern English dialect as compared to previously published data?

CHAPTER IV

METHODOLOGY

Participants

Fifty speakers, 25 adult males and 25 adult females (female age range: 19-28 years, mean female age: 21.6, male age range: 19-31, mean male age: 21.8), were recruited from areas throughout Texas, including those to the west of the Dallas/Fort Worth metroplex corresponding to the Texas South dialect region outlined by Labov et al. (2005). Age, gender, region of upbringing (urban versus suburban/rural) and race have all been demonstrated to influence dialect patterns, and were controlled for in this study (Wolfram & Schilling-Estes, 2006). To control for these factors, inclusion criteria for recruited speakers consisted of: (a) male and female speakers born between 1980 and 1993. These ranges correspond to the Generation Y identified by Strauss & Howe (1991), and consisted of individuals between the ages of 18 and 31 years of age in 2011-12; (b) minimum education level of High School diploma; (c) Caucasian; (d) born and raised in Texas (e) no history or current self-reported speech or hearing disorder; (f) no perceptual speech or language disorder as judged by a licensed speech-language pathologist (Dr. Christopher Watts).

Instrumentation

Participants were recorded in the laboratory of Dr. Christopher Watts, located in the Miller Speech & Hearing Clinic on the campus of Texas Christian University. Participants wore the head-mounted microphones of the Nasometer system (two microphones, separated by a metal plate, one placed outside the nose and one placed outside the mouth). Participants also wore the head-mounted microphone of the Computerized Speech Lab (CSL) system.

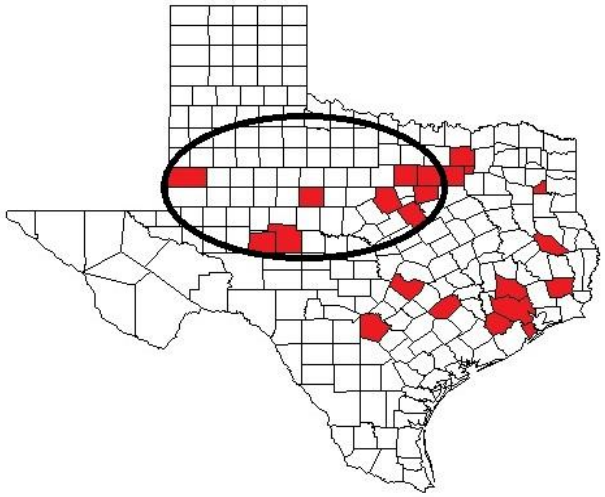
Procedures

Participants were asked to produce speech consisting of isolated vowels (high front and back vowels, low front and back vowels), sentences (Nasal and non-nasal sentences), and a standard paragraph (*The Rainbow Passage*), at comfortable pitch and loudness levels. Recordings were digitized via a digital computer connected to the Nasometer, and a nasalance score was calculated for each production using software of the Nasometer system.

Analyses

Once the samples were collected, it was determined which subjects were native to the Texas South dialect region. A separate analysis was conducted on this population (n=25, 10 females and 15 males). Figure 4 shows the distribution of subjects according to where they were raised. The counties within the Texas South dialect are circled.

Figure 4. Subject Distribution



Parametric statistical analyses were conducted on the nasalance scores. An initial three-way ANOVA with gender, vowel, and sentence as the independent variables and nasalance score as the dependent variable was applied to the data. Separate analyses (two-way ANOVAs) were then conducted for the factors of vowel type (i.e., gender x vowel type, with 4 levels of vowel

type: high front, low front, high back, low back) and sentence type (gender x sentence type, with 2 levels of sentence type: nasal and non-nasal). Additional univariate (t-tests and other post-hoc tests) were then applied to different means to compare the effects of gender on separate stimulus items. As such, any significant interaction effects were further investigated using independent samples t-tests to compare. Planned comparisons were also targeted to assess the effect of gender on nasalance at each separate level of the speaking context independent variable (vowels and sentences). Criterion for significances was set at the 0.05 levels. Intra-rater reliability was calculated by having the experimenter randomly re-measure 15% of the nasalance scores from *The Rainbow Passage.* A second trained experimenter randomly re-measured 15% of the nasalance scores from *The Rainbow Passage* to assess inter-rater reliability.

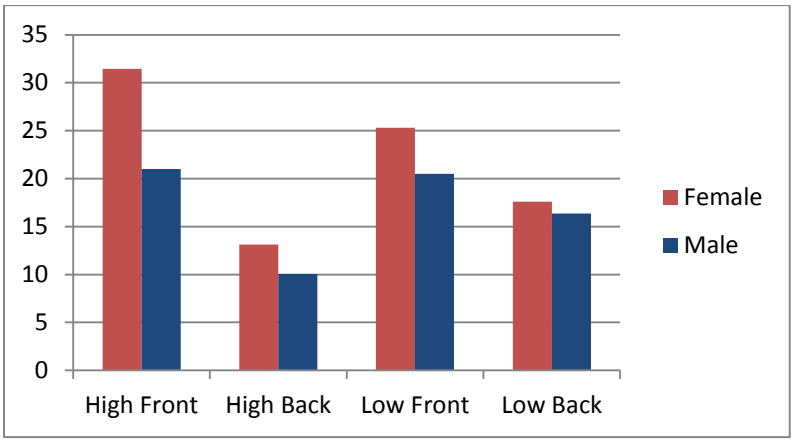
CHAPTER V

RESULTS

The nasalance scores were compared using a Pearson product-moment correlation. Both intra-rater (r=0.99) and inter-rater reliability (r=0.99) were high, and the comparison revealed a significant correlation for both ($p < 0.05$) suggesting that the degree of measured correlation was not due to chance.

The nasalance scores for gender on the vowel type are displayed in figure 5. As can be seen, each vowel type had a different nasalance score. The means given are the total male and female means, pooled across both dialect regions. Along with vowel type, the female group always produced a higher nasalance score than the male group. The greatest difference between the female and male mean nasalance scores was during the production of the high front vowel.

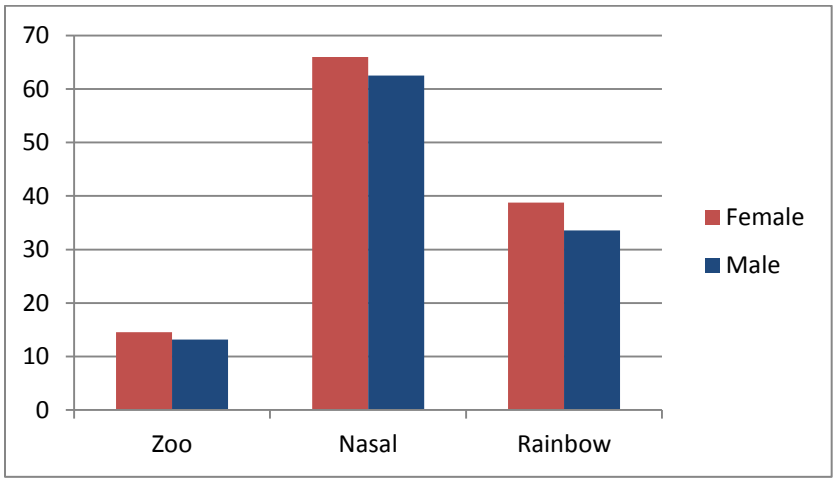
Figure 5. Nasalance score means for gender on vowel type for all participants.



The nasalance scores for gender on the sentence type are displayed in figure 6. As can be seen, each sentence type had a different nasalance score. In addition to sentence type, the female group always produced a higher nasalance score than the male group. The largest difference between the mean nasalance scores between the female and male group appeared during *The*

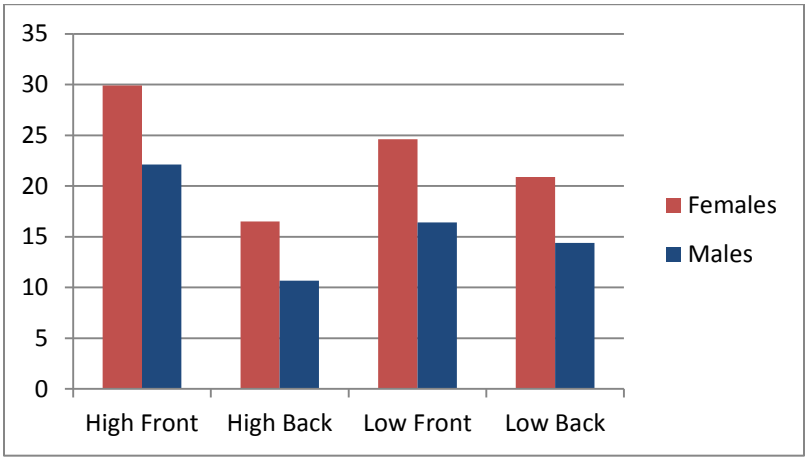
Rainbow Passage. The pattern of female nasalance scores always being greater than male scores is consistent with the results from the Seaver et al. (1991) study.

Figure 6. Nasalance score means for gender on sentence type for all participants.



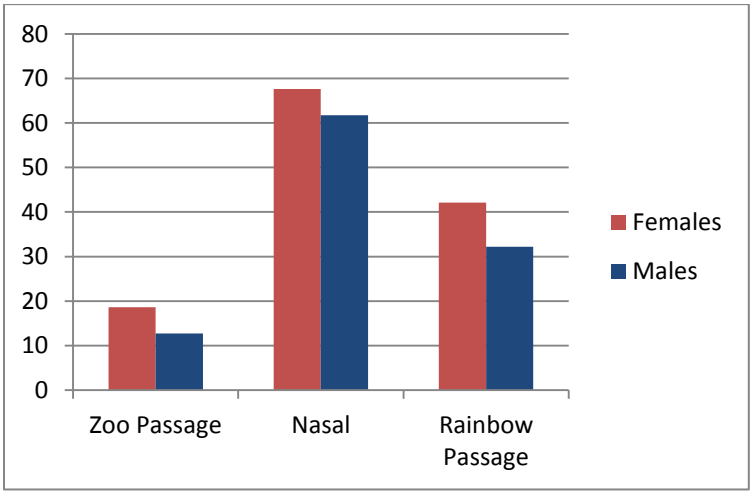
The nasalance scores for gender and the Texas South dialect on vowel type are displayed in figure 7. As can be seen, each vowel type had a different nasalance score. The female Texas South subjects always produced higher nasalance scores then the male Texas South subjects. The largest difference between the means of each group can be seen during the production of the low front vowel. This pattern is consistent with what we would expect from looking at the characteristics of speakers of the Texas South dialect (Labov et al., 2005).

Figure 7. Nasalance score means for only Texas South dialect speakers gender on vowel type.



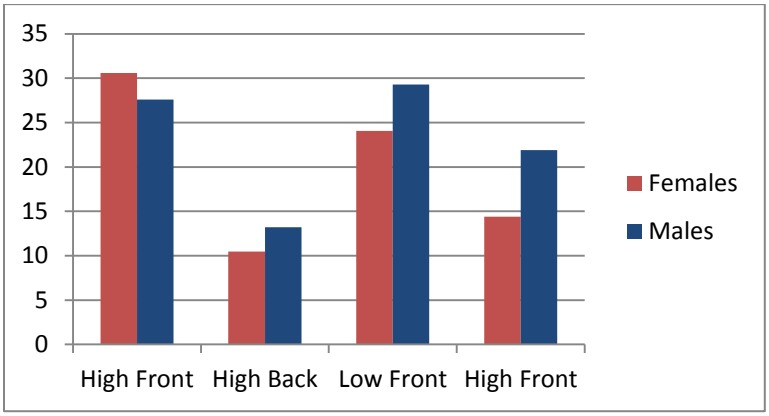
The nasalance scores for gender and the Texas South dialect on sentence type are displayed in figure 8. As can be seen, each sentence type had a different nasalance score. The female Texas South subjects always produced higher nasalance scores than the male Texas South subjects. The largest difference between the means of each group can be seen during the production of *The Rainbow Passage*.

Figure 8. Nasalance score means for only Texas South dialect speakers gender on sentence type.



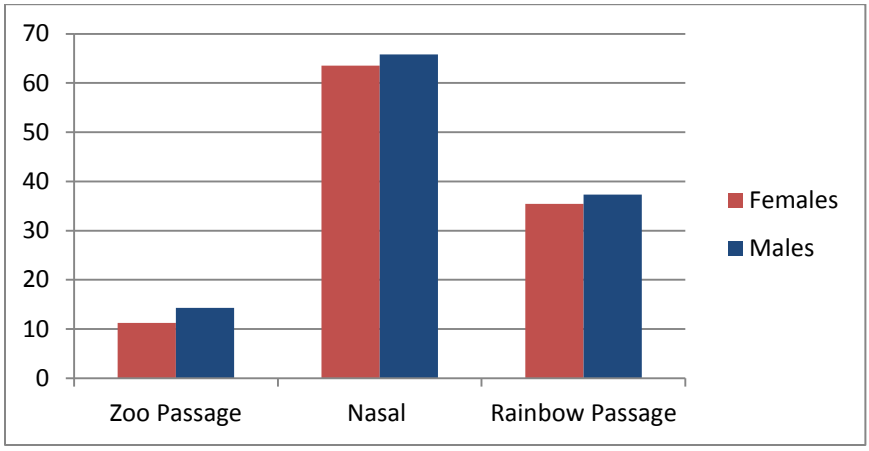
The nasalance scores for gender and the Southern dialect on vowel type are displayed in figure 9. As can be seen, each vowel type had a different nasalance score. The Southern male population had a higher nasalance score for the high back, low front, and low back vowels. However, during the production of the high front vowel, the Southern female population had a higher mean nasalance score.

Figure 9. Nasalance score means for Southern American English dialect speakers gender on vowel type.



The nasalance scores for gender and the Southern dialect on sentence type are displayed in figure 10. As can be seen, each sentence type had a different nasalance score. The Southern male population had a slightly higher mean nasalance score for all sentence types.

Figure 10. Nasalance score means for Southern American English dialect speakers gender on sentence type.



Statistical analysis was completed with a three-way (gender x dialect x vowel) analysis of variance (ANOVA) with repeated measures on vowel type (high front, high back, low front, low back). Gender and dialect were between subject factors. Table 2 illustrates the statistical results of this analysis.

Table 2. Within-subject effects for gender, dialect, and vowel type on nasalance scores for all participants.

Type	Df	F	P
Vowel	2.456	25.245	.000
Vowel x Gender	2.456	1.823	.158
Vowel x Dialect	2.456	.638	.561
Vowel x Gender x Dialect	2.456	.251	.821

Results revealed a significant main effect for vowel type on nasalance ($F(2.456, 112) = 25.45$, $p < .001$). There was no effect of gender ($F(2.456, 112) = 1.823$, $p=.158$), dialect ($F(2.456, 112) = .638$, $p=.561$), and no interaction effect ($F(2.456, 112) = .251$, $p=.821$). Table 3 displays the between-subjects effects for gender, dialect, and the interaction between gender and dialect

on vowel type. The results indicated there was no significant effect of gender or dialect on nasalance scores during vowel production.

Table 3. Between-subject effects for gender and dialect for all participants.

Type	F	P	Partial Eta Squared
Gender	1.973	.167	.041
Dialect	.658	.421	.014
Gender x Dialect	1.801	.186	.038

Follow-up pairwise comparisons also showed there was no significant difference between the two genders (p= .167) or dialects (p= .421). However, pairwise comparisons did show significant differences between specific vowel types. Results are displayed in table 4.

Table 4. Pairwise comparison on vowel type for all subjects

Vowel		P
High Front	High Back	.000
	Low Front	.542
	Low Back	.000
High Back	High Front	.000
	Low Front	.000
	Low Back	.007
Low Front	High Front	.542
	High Back	.000
	Low Back	.005
Low Back	High Front	.000
	High Back	.007
	Low Front	.005

When data is pooled across genders and across dialects, the high front vowel was found to be significantly different from the high back vowel and low back vowel. The high back vowel was found to be significantly different from the low front and low back vowel. The low front vowel was found to be significantly different from the low back vowel.

Statistical analyses were completed via a three-way (gender x dialect x sentence) analysis of variance (ANOVA) with repeated measures on sentence type, with gender and dialect as between subject factors. Table 5 shows the within-subjects effects.

Table 5. Within-Subject effects for gender, dialect, and sentence type on nasalance scores for all participants.

Type	df	F	p
Sentence	1.505	2280.531	.000
Sentence x Gender	1.505	2.569	.098
Sentence x Dialect	1.505	.585	.513
Sentence x Gender x Dialect	1.505	1.109	.321

Results revealed a significant main effect for sentence type on nasalance ($F(1.505, 69) = 2280.53$, $p < .001$). There was no effect of gender ($F(1.505, 69) = 2.569$, $p=.098$), dialect ($F(1.505, 69)= .585$, $p=.513$), and no interaction effect ($F(1.505, 69) = 1.109$, $p=.321$). Table 6 displays the between-subjects effects for gender, dialect, and the interaction between gender and dialect on sentence type. The results indicated there was no significant effect of gender or dialect on nasalance scores during sentence production.

Table 6. Between subject effects for gender and dialect for sentence type for all participants.

Type	F	P	Partial Eta Squared
Gender	3.416	.071	.069
Dialect	.044	.835	.001
Gender x Dialect	3.568	.065	.072

Follow-up pairwise comparisons also showed there was no significant difference between the two genders ($p= .071$) or dialects ($p= .835$). However, pairwise comparisons did show

significant differences between specific sentence types. The results showed that each different sentence type was significantly different from the others ($p < .001$).

Statistical analyses were completed with a two-way (gender x vowel) analysis of variance (ANOVA) with repeated measures applied to the data for nasalance scores with the high front, high back, low front, and low back vowels. Results revealed a significant main effect for vowel type on nasalance ($F = 27.041$, $p < .001$). There was no effect of gender ($F = 2.533$, $p = .118$) and no interaction effect ($F = 2.082$, $p = .118$) on nasalance scores. Pairwise comparisons were used to look at the effects of gender on the nasalance scores of separate vowel type. The results are displayed in table 7.

Table 7. Pairwise comparison effects of gender on nasalance scores of separate vowel type for all participants.

Vowel		P
High Front	High Back	.000
	Low Front	.482
	Low Back	.000
High Back	High Front	.000
	Low Front	.000
	Low Back	.010
Low Front	High Front	.482
	High Back	.000
	Low Back	.002
Low Back	High Front	.000
	High Back	.010
	Low Front	.002

Results showed a significant difference between the high front and high back ($p < .001$) and low back ($p < .001$) vowels. There was a significant difference between the high back vowel and the low front ($p < .001$) and low back ($p = .010$) vowels. There was also a significant difference between the low front and low back vowel ($p = .002$).

Statistical analyses were completed with a two-way (gender x sentence type) analysis of variance (ANOVA) with repeated measures applied to the data for nasalance scores with the Zoo passage, Nasal sentences, and Rainbow passage. Results revealed a significant main effect for sentence type on nasalance ($F= 2374.77$, $p< .001$). However, there was no effect on gender ($F= 3.288$, $p=.076$) and no interaction effect ($F= 3.031$, $p= .068$). Pairwise comparisons were used to look at the effects of gender on the nasalance scores of the separate sentence types. The results showed that each different sentence type was significantly different from the others ($p< .001$).

Statistical analysis was completed with a two-way (Texas South gender x vowel) analysis of variance (ANOVA) with repeated measures applied to the data for nasalance scores for the subjects who qualified as Texas South dialect speakers. The results showed a significant effect of vowel on nasalance ($F(2.049, 47) = 8.760$, $p<.001$). There was no interaction effect ($F(2.049, 47) = .097$, $p=.912$). However, the between-subject test showed there was a significant effect of the Texas South gender on nasalance ($F= 5.656$, $p=.026$, $\eta^2=.197$). Pairwise comparisons on vowel typed showed there was a significant difference between many of the four different vowels. Table 8 displays the results.

Table 8. Pairwise comparison effects of Texas South gender on vowel type.

Vowel		P
High Front	High Back	.000
	Low Front	.094
	Low Back	.010
High Back	High Front	.000
	Low Front	.005
	Low Back	.106
Low Front	High Front	.094
	High Back	.005
	Low Back	.182
Low Back	High Front	.010
	High Back	.106
	Low Front	.182

Results showed a significant difference between the high front from the high back ($p < .001$) and low back ($p = .010$) vowels. There was a significant difference between the high back and the low front ($p = .005$) vowel.

Statistical analysis was completed with a two-way (Texas South gender x sentence) analysis of variance (ANOVA) with repeated measures applied to the data for nasalance scores for the subjects who qualified as Texas South dialect speakers. The results showed a significant effect of sentence on nasalance ($F(1.371, 31) = 891.016$, $p < .001$). There was no interaction effect ($F(1.371, 31) = 2.002$, $p = .163$). However, the between-subject test showed there was a significant effect of the Texas South gender on nasalance ($F = 5.312$, $p = .031$, $\eta^2 = .188$). Pairwise comparison tests showed that each different sentence type was significantly different from the others ($p < .001$).

Statistical analysis was completed with a two-way (Southern gender x vowel) analysis of variance (ANOVA) with repeated measures applied to the data for nasalance scores for the subjects who qualified as Southern dialect speakers. The results showed a significant effect of vowel on nasalance ($F(3,69) = 17.763$, $p < .001$). However, there was no interaction effect ($F(3, 69) = 1.437$, $p = .239$) and no significant effect of gender on nasalance ($F = .586$, $p = .452$, $\eta^2 = .025$). Pairwise comparisons on vowel type showed there was a significant difference between the four different vowels. Table 9 displays the results.

Table 9. Pairwise comparison effects of vowel type on nasalance for Southern American English dialect speakers.

Vowel		P
High Front	High Back	.000
	Low Front	.448
	Low Back	.001
High Back	High Front	.000
	Low Front	.000
	Low Back	.005
Low Front	High Front	.448
	High Back	.000
	Low Back	.002
Low Back	High Front	.001
	High Back	.005
	Low Front	.002

Results showed a significant difference between the high front from the high back ($p < .001$) and low back ($p = .001$) vowels. There was a significant difference between the high back vowel from the low front ($p < .001$) and low back ($p = .005$) vowels. There was also a significant difference between the low front and low back vowels ($p = .002$).

Statistical analysis was completed with a two-way (Southern gender x sentence) analysis of variance (ANOVA) with repeated measures applied to the data for nasalance scores for the subjects who qualified as Southern dialect speakers. The results showed a significant effect of sentence type on nasalance ($F(2, 46) = 1588.109$, $p < .001$). However, there was no interaction effect ($F(2, 46) = .197$, $p = .822$) and no significant effect of gender on nasalance ($F = 1.253$, $p = .275$, $\eta^2 = .052$). Pairwise comparison tests showed that each different sentence type was significantly different from the others ($p < .001$).

To summarize, the results found significant differences in nasalance scores between male and female Texas South speakers when producing both vowels and sentences. However, there

were no significant differences between Texas speakers of Southern American English. When both dialects were pooled together, there were also significant differences when producing vowels and sentences. Table 10 lists the significant findings of the study.

Table 10. Significant differences found in the study.

Comparison	**Condition**	**P**
Texas South Male and Females	Vowels	.026
Texas South Male and Females	Sentences	.031
Gender and Dialect	Vowels	.000
Gender and Dialect	Sentences	.000
Zoo and Rainbow and Nasal Passages	Sentences	.000
High front and High back vowel	Texas South, Southern, Combined Vowel	.000
High front and Low back vowel	Texas South Vowel	.010
High back and Low front vowel	Texas South Vowel	.005
High front and low back	Southern Vowel	.001
High back and low front	Southern and Combined Vowel	.000
High back and low back	Southern Vowel	.005
Low front and low back	Southern Vowel	.002
High front and low back	Combined dialect/gender vowel	.000
Low front and Low back	Combined dialect/gender vowel	.005

CHAPTER VI

DISCUSSION

The purpose of this study was to investigate the effects of gender on measures of nasalance in speaker's native to Texas and those of the Texas South dialect. The second purpose of this study was to generate a large sample of comparative nasalance data for clinical utilization, which can be compared to previously published data from speakers of other American English dialects. The first research question of this study asked: "Will gender differences influence the nasalance scores on isolated prolonged vowels of speakers native to Texas and of the Texas South dialect?". The results showed no significant effects of gender or dialect on the nasalance scores, on prolonged vowels, when both gender and dialect data were combined. However, regardless of gender or dialect, there was a significant effect of vowel type on the nasalance scores, as illustrated in Table 10. Subsequent analyses investigated the separate effect of gender within each dialect, so that data from Texas South and Southern were not pooled together.

The second and third research questions of this study asked: "Will gender differences influence the nasalance scores on nasal and non-nasal sentences of speakers native to Texas and of the Texas South dialect? Will gender differences influence the nasalance scores on a standard paragraph (*The Rainbow Passage*) of speakers native to Texas and of the Texas South dialect?". The results showed no significant effects of gender or dialect on the nasalance scores, on nasal, non-nasal, and standard paragraphs, when the nasalance scores were pooled across gender and across dialect. However, regardless of gender or dialect, there was a significant effect of sentence type on the nasalance scores as illustrated in Table 10. Similar to the follow-up to the first research question, subsequent analyses investigated the separate effect of gender within each dialect, so that data from Texas South and Southern were not pooled together.

The fourth research question of this study asked: "Will the nasalance scores of speakers native to Texas and of the Texas South dialect differ from those of the Southern English dialect as compared to previously published data?". The results of the study revealed significant effects of gender on vowel and sentence type on nasalance scores for only those individuals born and raised in the Texas South dialect region. The female Texas South speakers were found to have significantly higher nasalance scores than the males of the same dialectal region. There was no significant effect of gender on vowel and sentence type on nasalance from those subjects born and raised in the Southern dialect region. This is illustrated in Table 10.

Changes to nasalance occur with different tongue placements. The Southern Shift that occurs within the Southern American English dialect region includes changes in tongue placement. The Texas South dialect region has a higher concentration of the Southern American characteristics, such as the /ɛ, eɪ/ merger, and lower concentration of the back upglide shift. This may account for the significant effect of Texas South dialect on nasalance. The results of this study confirm the recent work of Labov, Ash, & Boberg (2005), who defined a new sub-region of the Southern American English dialect, the Texas South.

When comparing the nasalance scores between dialects during this study, the high front, high back, and low front vowels were different for the individuals from the Texas South Dialect region. In regards to those vowels, the Southern dialect group was significantly different on all vowel comparisons except the high front – low front comparison. This can be attributed to the Southern Vowel Shift, where the high front vowels move to a lower position, the low front and the low back vowels move to a higher position. With the lower tongue position, a lower nasalance score would be expected. As previously stated, the Texas South is characterized by having a higher concentration of the Southern Vowel Shift. The higher concentration means that

more individuals from the Texas South region would have lower tongue positions, thus lower nasalance scores. This is what the results indicated for the high front vowel. The difference in the low front vowel can be attributed in the merger of /ɛ/ and /eɪ/ in words such as ‘bet’ and ‘bait’.

The only difference between dialects that was found for the sentence type was during the production of the Zoo passage. The Texas South dialect speakers had slightly higher nasalance scores. This result shows that when nasal sounds are eliminated during connected speech it allows the characteristics of the vowels to affect the nasalance score.

The results showed an overall gender difference when looking at the mean nasalance scores. The female Texas South speakers always had higher nasalance scores during vowels and sentences than the males. However, the reverse was true for Southern dialect speakers. The males had higher nasalance scores than females on all sentences and some vowels. The difference is inconsistent with what the Seaver et al. (1991) study found. This finding supports the notion that speakers of the Texas south dialect resonate sound in the nasal cavity differently than speakers from other regions of Texas, speakers of the Southern American English dialect, and speakers used in the Seaver et al. (1991 study). It should also be noted that the participants in the Seaver et al. (1991) study were not controlled based on region of upbringing or length of stay in a particular region, but on perceptual speech patterns. The participants used in this study were controlled by region of birth and upbringing. As noted in the study limitations section, this discrepancy could also be attributed to the relatively small sample size of the current study.

When the data were pooled from both genders and across both dialects, no change was found. This is also inconsistent with what the Seaver et al. (1991) study found. Their research concluded that females had significantly higher nasalance scores across the four dialectal regions they surveyed. Seaver et al. (1991) also had a sample size of 158 participants: 92 females and 56

males. Their larger sample size could have attributed to the overall significant effect of gender on nasalance scores. This study showed no significant gender differences across the combined dialectal regions. It was not until the two dialect regions were separated that a significant gender difference was found. This finding indicates that the data from the Southern dialect speakers, which was in the opposite direction for males and females compared to the Texas South speakers, caused equalization of the nasalance values between genders causing a lack of statistical significance. Once again, an alternative explanation would be that this finding could be attributed to the relatively small sample size. This discrepancy between the two findings could also be because the Seaver et al. (1991) study used speakers from Alabama and Illinois. Although the Seaver et al. (1991) study had an overall higher sample size, when looking specifically at the Southern American English dialect region, they had few participants who qualified as those dialect speakers. Their sub-analysis of Southern American English speakers included 23 participants. That is in contrast to this study, which used 50 Southern American English speakers. The difference could have also affected the outcome. This study used both speakers of the Texas South dialect and speakers of the Southern American English dialect. This combined dialect, and the specific characteristics associated to each, could have attributed to the opposing findings.

Nasometry is a clinical measurement that is used by speech language pathologists to assess how well the soft palate works. Therefore, it is clinically important that there is a valid comparison of normative nasalance scores. If the comparison is invalid then the assessment findings may not be reliable. The norms previously found by Dalston et al. (1991) suggest that a 32% or below nasalance score represented typical velopharyngeal function. The subjects that he used to find those norms were from the North Carolina region and had a perceptual Mid-Atlantic

dialect. The present study found different mean nasalance values for the speakers from the Southern American English and Texas South dialect region. Therefore, more research should be conducted on normative nasalance scores for different dialect regions, so that valid and reliable assessments can be provided for individuals suspected of having velopharyngeal incompetence.

CHAPTER VII

STUDY LIMITATIONS

Several limitations in the methodology of this study and suggestions for further research should be noted.

1. This study used 50 participants, 25 males and 25 females, to assess nasalance scores. This is a relatively small sample size when looking at a dialectal region. There is a need for larger sample sizes to look at the normative nasalance patterns for each dialect region. Further research should include a larger Texas South population to confirm the results of this study.
2. This study included participants between the ages of 18 and 30 because of the location of the study. Dialect characteristics are always changing. Typically, those of the older generations will have stronger dialectal characteristics than those of the younger generations. Therefore, further research should extend the age range to include an older population to ensure that a larger population can be analyzed.
3. This study did not control for where the participants' parents were born and raised. Other dialect studies have not been as rigidly controlled, as they only use perceptual, over the phone, ratings to characterize dialects. The other studies did not include where parents were born and raised, thus neither did this study. However, the fact that parents birth place and region of upbringing was not controlled for, could be considered a limitation. Further research should consider adding parental birthplace and upbringing as a controlled condition.

CHAPTER VIII

CONCLUSIONS

Nasalance scores were gathered for four different prolonged vowels (high front, high back, low front, and low back) and three sentence types (Zoo passage, Nasal sentences, and Rainbow passage) with the factors of gender and dialect (Texas South vs. Southern American English). A significant nasalance difference was found between the males and females of the Texas South dialect region, with females always having a greater nasalance score. Vowel and sentence type always significantly affected nasalance scores, regardless of dialect region. Some of the vowels were significantly different from each other during opposing contexts, which can be explained by the degree of vowel shift used by the Texas South speakers. The sentence types were always significantly different from each other irrelevant to the context. These results indicate that the Texas South dialect has a higher concentration of the Southern American English characteristics, accounting for the significant effect on nasalance and possibly the common perception that speakers from Texas have a distinct "accent."

Further research of normative regional nasalance scores should include larger sample sizes which include an extended age range and control for parental birthplace and upbringing. Since most of the research on gender, dialect, and nasalance up to this point has focused on larger regions, more research on the sub-regions of dialect is needed, in order to build normative data for clinical use.

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VITA

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ABSTRACT

NORMATIVE NASALANCE PATTERNS IN MALE AND FEMALE SPEAKERS OF SOUTHERN AMERICAN ENGLISH NATIVE TO TEXAS

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The purpose of this proposed study was to investigate the effects of gender on measures of nasalance in speakers native to Texas and speakers of the Texas South dialect. Speakers (n=25 males, n=25 females, ages 18-30) were recruited from the Texas South dialect region and across Texas. Participants wore the head-mounted microphones of the Nasometer system and produced speech consisting of isolated vowels and sentences. A significant main effect of gender on nasalance was found in the speakers of the Texas South dialect region during vowels ($F= 5.656$, $p= .026$) and sentences ($F= 5.312$, $p=.031$). No significant differences were found for Southern dialect ($p>.05$), Southern gender ($p>.05$), or both dialects combined ($p>.05$) on nasalance scores. Although a limited sample was used, the findings suggest that speakers born and raised in the Texas South dialect region have different nasalance scores than speakers born and raised in other parts of Texas.