1. INTRODUCTION

In Wisconsin, there have been anecdotal reports of perceptual differences between how Wisconsin speakers pronounce the word *Wisconsin* versus how non-Wisconsin speakers say the word. The "c" in the word, as some speakers describe it, is "audible" in non-Wisconsin speakers, and they will often create "a pause between the S and C" (deleted user, 2018). This "audible" quality of the /k/, as a linguist might infer, might be due to the breathiness of aspiration that accompanies an aspirated /k^h/, which contrasts the "inaudible" quality of an unaspirated /k/ that will occur after an /s/ in a /sk/, /sp/, or /st/ consonant cluster.

Although there is literature describing /s + p, t, k/ consonant clusters in English, as well as the phonology of Wisconsin English, there does not exist any literature that examines variation in SYLLABIFICATION in these consonant clusters between Wisconsin English and non-Wisconsin English speakers. Early research on the phonological definition of these consonant clusters by J. D. O'Connor and J. L. M. Trim (1959) defines /s + p, t, k/ consonant clusters in English as COMPOUND CONSONANT UNITS due to their unique ability to occur in word-initial, word-medial, and word-final contexts. This ability for these clusters to occur in a variety of word positions, for these voiceless stops to arise as aspirated or unaspirated when a user delimitates the syllable boundary (Davidsen-Nielsen, 1974; O'Connor & Trim, 1953), as well as the lack of /s + b, d, g/ clusters in English, Bauer (2015) writes, "provide a number of well-known problems for English phonology." Literature on Wisconsin English predominantly describes variation in Wisconsin English vowels compared to vowels in other varieties of American English (Clopper et al., 2005; Jacewicz et al., 2006; Labov et al., 2006; Labov et al., 1972; Thomas, 2000, 2001). Phonological variation in Wisconsin English consonants compared to non-Wisconsin English currently is limited to final voiced obstruent neutralization (Jacewicz et al., 2009), voice onset time (Litty, 2017), and interdental fricative stopping (Wilkerson et al., 2014). This lack of inquiry into this consonant clusters in Wisconsin English motivates this project.

This project compares the VOT of /k/ as it exists in the word *Wisconsin* for Wisconsin and non-Wisconsin speakers, as well as the VOT of /k/, /t/, and /p/ in these speakers' /sk/, /st/,

and /sp/ clusters, to analyze whether or not these speakers have a significant difference in whether or not they aspirate these voiceless oral stops as they occur in these clusters. Firstly, I posit that the average VOT of /k/ in *Wisconsin* will be longer for non-Wisconsin speakers than that for Wisconsin speakers. Secondly, I posit that the average VOT of /k/ in words with /sk/ clusters will be longer for non-Wisconsin speakers than that of Wisconsin speakers. Thirdly, I posit that the average VOT of /t/ in words with /st/ clusters will be longer for non-Wisconsin speakers than that of Wisconsin speakers. Lastly, I posit that the average VOT of /p/ in words with /sp/ clusters will be longer for non-Wisconsin speakers than that of Wisconsin speakers.

2. Methods

As the VOT of voiceless oral stops is shorter when they are unaspirated and longer when they are aspirated in American English, I decided that this would be an appropriate method to analyze contrasts in aspiration in voiceless oral stops. The experimental materials included the 21 three-syllable words below. These words all contained medial stress to align with the prosodic qualities of *Wisconsin.* Each word was spoken once by each of 16 female speakers, nine being cisgender; one being trans male and having undergone extensive masculinizing hormone therapy; two being transmasculine nonbinary and having undergone extensive masculinizing hormone therapy, and three being nonbinary and not having undergone extensive masculinizing hormone therapy. These speakers were selected through snowball sampling due to the short duration between the beginning of the study and its submission as a final class project.

Figure 1: Word list with /s + k, t, p/ clusters for Wisconsin and non-Wisconsin English speakers.

Words with /sk/	**Words with /st/**	**Words with /sp/**
Wisconsin	Distinction	Responsive
Muskego	Systemic	Dispensing
Mascara	Historic	Respectful
Biscotti	Establish	Suspension
Mosquito	Nostalgia	Auspicious
Discussion	Astonish	Disposal
Reschedule	Mistaken	Suspicious

Eight speakers identified as being from outside Wisconsin, and eight speakers identified as being from Wisconsin. Speakers were selected as being "Wisconsin speakers" if they had grown up in Wisconsin from the ages of 10 to 18 speaking American English. Speakers who have not met these criteria were selected as being "non-Wisconsin speakers." These speakers came from a variety of locations as depicted below.

FIGURE 2: MAP OF HOMETOWNS OF NON-WISCONSIN ENGLISH SPEAKERS.

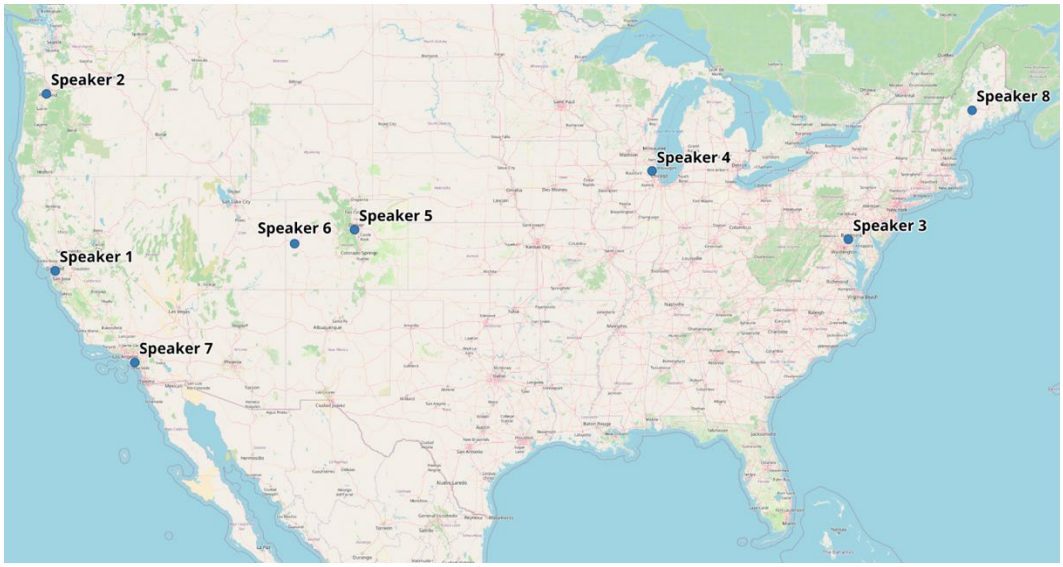
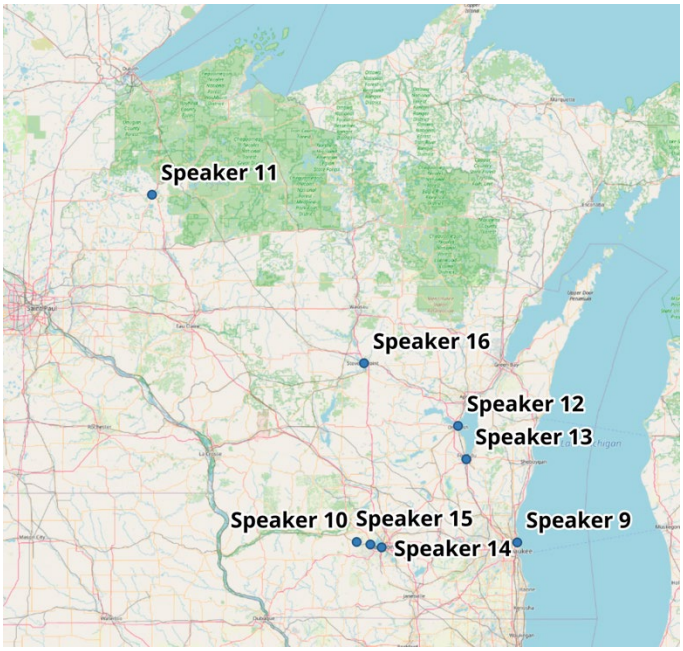


FIGURE 3: MAP OF HOMETOWNS OF WISCONSIN ENGLISH SPEAKERS.



This experiment controlled the facts that all speakers recorded were native speakers of American English, that the words used were trisyllabic with medial stress, that the speakers said each word only one time, and that each speaker had the same number and order of words. The hometown of the speaker was changed to see effects on the VOT of their voiceless oral stops in their /sk/, /st/, and /sp/ clusters. These facts will allow me to isolate variables that would not affect the VOT of voiceless oral stops in these clusters and instead focus on the independent and dependent factors at play.

In order to find how the hometown, that being from outside or inside of Wisconsin, affects the VOT of voiceless oral stops in /sk/, /st/, and /sp/ clusters, I will need to categorize my speakers into two categories: one being for non-Wisconsin speakers and the other being for Wisconsin speakers. Then, I will need to create three subcategories for each category for each voiceless oral stop: this being one subcategory for words with /sk/ clusters, one subcategory for words with /st/ clusters, and another subcategory for words with /sp/ clusters. These categories will allow me to effectively contrast how dialect affects VOT by looking at how the measurements in Wisconsin and non-Wisconsin speakers compare, and the subcategories will allow me to effectively contrast the speakers' VOT differences specifically across a single voiceless consonant. For example, I will want to compare the VOT of the /k/ in *Wisconsin* across Wisconsin and non-Wisconsin speakers; the /k/ in words with /sk/ clusters across Wisconsin and non-Wisconsin speakers; the /t/ in words with /st/ clusters across Wisconsin and non-Wisconsin speakers, and the /p/ in words with /sp/ clusters across Wisconsin and non-Wisconsin speakers.

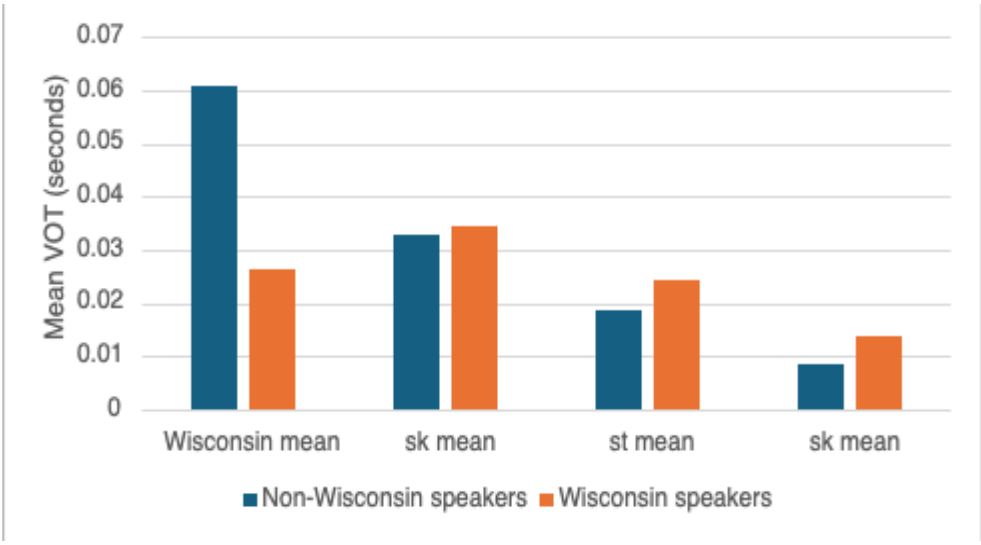
These comparisons will be made via calculations from t-tests (means, t-statistics, and p-values) and standard deviations within Microsoft Excel. Any significant increase in the length of the VOT of /k/ in *Wisconsin* for non-Wisconsin speakers compared to that of Wisconsin speakers will show evidence supporting my first hypothesis. Any significant increase in the length of the VOT of /k/ in words with /sk/ clusters for non-Wisconsin speakers compared to that of Wisconsin speakers will show evidence supporting my second hypothesis. Any significant increase in the length of the VOT of /t/ in words with /st/ clusters for non-Wisconsin speakers compared to that of Wisconsin speakers will show evidence supporting my third hypothesis. Any significant increase in the length of the VOT of /p/ in words with /sp/ clusters for non-Wisconsin

speakers compared to that of Wisconsin speakers will show evidence supporting my fourth hypothesis.

In terms of my measurement criteria, I measured the VOT of the voiceless oral stops in Praat by starting to record the initial bursts seen in the waveform and spectrogram and would stop the measurement once I saw the striations in the vowel starting to appear in the spectrogram and the waveform becoming more periodic.

3. Results

Figure 4: Mean VOT in *Wisconsin* and /s + k, t, p/ clusters



In order to find out whether or not my first hypothesis, that the average VOT of /k/ in *Wisconsin* will be longer for non-Wisconsin speakers compared to that of Wisconsin speakers, was correct, I compared the length of the VOT of /k/ in *Wisconsin* of non-Wisconsin speakers to that of Wisconsin speakers. In terms of how the length of the VOT of /k/ in *Wisconsin* compared to that of Wisconsin speakers, there was a significant difference in the length of the VOT of /k/ in *Wisconsin* for non-Wisconsin speakers ($M=0.061$, $sd=0.04$) compared to that of Wisconsin speakers ($M=0.027$, $sd=0.008$), $t(7) = 2.43$, $p<0.05$.

In order to find out whether or not my second hypothesis, that the average VOT of /k/ in words with /sk/ clusters will be longer for non-Wisconsin speakers compared to that of Wisconsin speakers, was correct, I compared the length of the VOT of /k/ in words with /sk/ clusters of non-Wisconsin speakers to that of Wisconsin speakers. In terms of how the length of the VOT of /k/ in words with /sk/ clusters compared to that of Wisconsin speakers, there was not a significant difference in the length of the VOT of /k/ in words with /sk/ clusters for non-Wisconsin speakers ($M=0.033$, $sd=0.024$) compared to that of Wisconsin speakers ($M=0.035$, $sd=0.019$), $t(55) = -0.42$, $p=0.67$.

In order to find out whether or not my third hypothesis, that the average VOT of /t/ in words with /st/ clusters will be longer for non-Wisconsin speakers compared to that of Wisconsin speakers, was correct, I compared the length of the VOT of /t/ in words with /st/ clusters of non-Wisconsin speakers to that of Wisconsin speakers. In terms of how the length of the VOT of /t/ in words with /st/ clusters compared to that of Wisconsin speakers, there was a significant difference in the length of the VOT of /t/ in words with /st/ clusters for non-Wisconsin speakers ($M=0.019$, $sd=0.008$) compared to that of Wisconsin speakers ($M=0.025$, $sd=0.013$), $t(55) = -2.87$, $p<0.05$.

In order to find out whether or not my fourth hypothesis, that the average VOT of /p/ in words with /sp/ clusters will be longer for non-Wisconsin speakers compared to that of Wisconsin speakers, was correct, I compared the length of the VOT of /p/ in words with /sp/ clusters of non-Wisconsin speakers to that of Wisconsin speakers. In terms of how the length of the VOT of /p/ in words with /sp/ clusters compared to that of Wisconsin speakers, there was not a significant difference in the length of the VOT of /p/ in words with /sp/ clusters for non-Wisconsin speakers ($M=0.009$, $sd=0.016$) compared to that of Wisconsin speakers ($M=0.014$, $sd=0.019$), $t(55) = -1.58$, $p=0.12$.

4. Discussion

My data supported my first hypothesis that the average VOT of /k/ in *Wisconsin* will be longer for non-Wisconsin speakers compared to that of Wisconsin speakers. As described previously, any significant increase in the length of the VOT of /k/ in *Wisconsin* for non-

Wisconsin speakers compared to that of Wisconsin speakers will show evidence supporting my first hypothesis. This increase was seen in the length of the VOT of /k/ in *Wisconsin* for non-Wisconsin speakers when compared to that of Wisconsin speakers as the p-value for this comparison reached below the α level of 0.05. This rejected the null hypothesis that the average VOT of /k/ in *Wisconsin* for non-Wisconsin speakers will not be longer than that of Wisconsin speakers. There is support for the alternative hypothesis that the average VOT of /k/ in *Wisconsin* will be longer for non-Wisconsin speakers compared to that of Wisconsin speakers.

My data failed to support my second hypothesis that the average VOT of /k/ in words with /sk/ clusters will be longer for non-Wisconsin speakers compared to that of Wisconsin speakers. As described previously, any significant increase in the length of the VOT of /k/ in words with /sk/ clusters for non-Wisconsin speakers compared to that of Wisconsin speakers will show evidence supporting my second hypothesis. This increase failed to be seen in my data as the p-value for this comparison surpassed the α level of 0.05. This failed to reject the null hypothesis that the average VOT of /k/ in words with /sk/ clusters will not be longer for non-Wisconsin speakers compared to that of Wisconsin speakers. Therefore, there is no support for the alternative hypothesis that the average VOT of /k/ in words with /sk/ clusters will be longer for non-Wisconsin speakers compared to that of Wisconsin speakers.

My data failed to support my third hypothesis that the average VOT of /t/ in words with /st/ clusters will be longer for non-Wisconsin speakers compared to that of Wisconsin speakers. As described previously, any significant increase in the length of the VOT of /t/ in words with /st/ clusters for non-Wisconsin speakers compared to that of Wisconsin speakers will show evidence supporting my third hypothesis. This increase was seen the opposite direction for the length of the VOT of /t/ in words with /st/ clusters for non-Wisconsin speakers when compared to that of Wisconsin speakers. This was due to the p-value for this comparison reaching below the α level of 0.05; additionally, the average VOT of /t/ in words with /st/ clusters for non-Wisconsin speakers was 0.019 seconds while it was 0.025 seconds for Wisconsin speakers. This rejected the null hypothesis that the average VOT of /t/ in words with /st/ clusters for non-Wisconsin speakers will not be shorter than that of Wisconsin speakers. There is support for the

alternative hypothesis that the average VOT of /t/ in words with /st/ clusters will be shorter for non-Wisconsin speakers compared to that of Wisconsin speakers.

Finally, my data failed to support my fourth hypothesis that the average VOT of /p/ in words with /sp/ clusters will be longer for non-Wisconsin speakers compared to that of Wisconsin speakers. As described previously, any significant increase in the length of the VOT of /p/ in words with /sp/ clusters for non-Wisconsin speakers compared to that of Wisconsin speakers will show evidence supporting my second hypothesis. This increase failed to be seen in my data as the p-value for this comparison surpassed the α level of 0.05. This failed to reject the null hypothesis that the average VOT of /p/ in words with /sp/ clusters will not be longer for non-Wisconsin speakers compared to that of Wisconsin speakers. Therefore, there is no support for the alternative hypothesis that the average VOT of /p/ in words with /sp/ clusters will be longer for non-Wisconsin speakers compared to that of Wisconsin speakers

To conclude, the average VOT of /k/ in *Wisconsin* is significantly longer for non-Wisconsin speakers than that for Wisconsin speakers and the average VOT of the /t/ in words with /st/ clusters is significantly shorter for non-Wisconsin speakers than that for Wisconsin speakers. However, the average VOT of /k/ in words with /sk/ clusters and the average VOT of the /p/ in words with /sp/ clusters are not significantly longer for non-Wisconsin speakers than those of Wisconsin speakers. Regional dialect makes a significant difference on the aspiration of /k/ in *Wisconsin* in the /t/ in words with /st/ clusters while it does not make any significant difference on the aspiration of /k/ in words with /sk/ clusters and the /p/ in words with /sp/ clusters.

5. CONCLUSION

This finding contributes to prior research on phonological variation in consonants in Wisconsin English compared to other varieties of American English. The delimitation of syllables in /s + p, t, k/ clusters in Wisconsin English remains a rich area of inquiry with the current imbalance in literature on Wisconsin English vowels compared to Wisconsin English consonants. Future studies may confirm the dialectal influence on syllable delimitation in

Wisconsin English in these clusters, finally answering how the pronunciation of the word *Wisconsin* marks regional and dialectal identity.

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