A PILOT STUDY ON VOICE-CONDITIONED VOWEL RAISING COMPARISON IN THE HOCKEY COMMUNITY OF PRACTICE

SARAH ADAMS
University of Colorado Boulder

This project[1] investigates vowel raising in the hockey community of practice, specifically English-speaking athletes who are were born and raised in Central Canada or in the Northern Cities region of the United States. Research done on "Canadian raising" in North America looks at the type and location of use; I chose a narrow group of speakers based on the dominance of Canadian-born athletes in the community and the stereotype that they "sound Canadian." The effect of the voicing of a post-vocalic consonant could have a deeper sociolinguistic connection regarding identity and speakers' occupation. I compared their place of origin with their current place of residence to determine who has more contact with Canadian English speakers and would be influenced by their speech patterns to focus on the sociophonetic question.

My research question is about the cross-linguistic influence of English-speaking hockey players who are, through professional contact, exposed primarily to Canadian monolingual English speakers. The present study is motivated by sociophonetic considerations, and a focus on groups of athletes for sociolinguistic reasons influenced my choice to investigate this question. Because the raising can also be found in Inland North American English, I chose to include athletes from that region in this data. I recorded and measured examples of the athletes' connected speech from video interviews and ran t-tests comparing the Canadian-born and American-born athletes together, and then dividing them by current place of residence for additional comparison. The results show promising preliminary results in line with speakers residing in Canada "sounding more Canadian" regardless of place of origin, however the t-tests are not significant. More data being collected in an appropriate setting would enhance these results and further study of multilingual athletes would further inform the sociophonetic aspect pertaining to sense of belonging and conformity in the hockey community of practice.

Keywords: sociolinguistics, Canadian English, sports linguistics, sociophonetics, phonetics

1. INTRODUCTION

Vowel raising is an observable phenomenon where vowel sounds are changed due to the tongue being higher in the mouth. In North American English dialects, this can be observed across parts of Canada and the northern United States, even though it is most commonly called "Canadian raising" (Chambers 1973). This project investigates the effect of the voicing of a post-vocalic consonant in conjunction with the place of origin and current place of residence of several North

American athletes. I choose on the hockey community of practice because of the dominance of Canadian-born athletes in the sport, as well as the stereotype of Canadian speech associated with the community, regardless of actual place of origin. There is also a deeper sociolinguistic question about identity related to my speakers' occupation. If they are "expected" to sound Canadian, will that contribute to more evidence of raising? Or, if they feel connected to their place of origin, would that supercede the desire to fit in with a Canadian-sounding majority? Do Canadian-born players living in some parts of the United States also desire to fit in there and to not exhibit raising?

My research question is about the cross-linguistic influence of English-speaking hockey players who are, through professional contact, exposed primarily to Canadian monolingual English speakers. The present study is motivated by sociophonetic considerations, and a focus on groups of athletes for sociolinguistic reasons influenced my choice to investigate this question. Research by Dailey-O'Cain (1997) made the observation that while [aɪ] raising is part of the dialect in the northern United States, the [aʊ] raising can be found there as well. Because the raising can also be found in Inland North American English, I chose to include athletes from that region in this data to see if they exhibit influence of Canadian raising due to their community of practice.

When I was determining which athletes to find speech tokens for, I organized a list based on whether they are originally from Central Canada or the Northern Cities geographic region, and then additionally whether they play for a team in Canada or the Northern Cities geographic region. I labeled teams outside of the Canada/Northern Cities region as Other. I narrowed the list to players who have played either exclusively or primarily for their current team and who, to the best of my knowledge, had spent the majority of their formative years in their place of origin to reduce the amount of variation.

I focus on the two sound variations noted in Canadian raising: [aɪ] and [aʊ] before voiceless consonants, and I also measure these before voiced consonants as a means of comparison. If my hypotheses are accepted in the data, that would indicate that this vowel raising is found in a community of practice which gives athletes in the Canada/the Northern Cities more exposure to and reinforces their use of "Canadian raising." My hypotheses are as follows:

- HYPOTHESIS 1: Canadians will exhibit more [aɪ] and [aʊ] raising before voiceless consonants than Americans.

- HYPOTHESIS 2: Players on Canadian/Northern Cities teams will exhibit more [aɪ] and [aʊ] raising before voiceless consonants than Other teams;
    a. Canadian players on Canadian/Northern Cities teams will exhibit more raising than Canadians on Other teams.
    b. American players on Canadian/Northern Cities teams will exhibit more raising than Americans on Other teams.
- HYPOTHESIS 3: Canadians will show a smaller difference based on team location than Americans.

This paper consists of an explanation of my data collection methods, more specific information about players, and a list of data tokens in Section 2. In Section 3 (results and analysis), I include simple tables to illustrate the measured vowels in direct comparisons, and I conclude in Section 4 with a general discussion of my results, including limitations and additional questions for future research.

2. METHODS

The experimental materials included the words listed below, organized by diphthong and voiced or voiceless. I was unable to retrieve recordings of every word for every player, so while I was able to measure "about" - [aʊ] raising before voiceless consonant [t] - for every player, I was not able to find the same words for each environment and will be generalizing across phonological contexts.

TABLE 1. TARGET WORD LIST

[aɪ] before voiceless	excite- (-ing, -ed)	hype	right
guys	ice	nice	quite
alright	night/s	bite/s	type
fight	might	mic	light
advice	biased		
[aʊ] before voiceless	about	out	scouting
house	throughout	without	
[aɪ] before voiced	bide	ride	tied
side	stride	describe	inside
divide	idea	pride	tried
wide	outside	driveway	realize
wives	tiger		
[aʊ] before voiced	proud	thousand	loudest

The variables that are being manipulated can be seen in my choice of subjects and the recorded speech. I chose to analyze the speech of Canadians from the central provinces of Canada and Americans from the Northern Cities region, Minnesota and Wisconsin specifically. I chose athletes from these regions because of the assumption that they will exhibit more [aɪ] and [aʊ] raising before voiceless consonants than athletes from other regions so I will be comparing this group expecting to see raising in all speech examples. However, I am hypothesizing that the athletes who play on teams in other regions of the United States like New York, Philadelphia, Dallas, and Denver will all exhibit less raising as a result of this contact. Therefore, I am choosing words from their connected speech which contain the diphthongs in question before voiced [b], [d], [g], and [z] sounds and voiceless [p], [t], [k], and [s] sounds.

The measurement criteria changed only slightly during the data collection process. Initially, I was capturing the connected speech around the diphthong, and then cutting out the extraneous words in the recording to only get the isolated word for measurement. However, I realized that this was taking a significant amount of time and it wouldn't actually impact the results. So I

transitioned to simply measuring the diphthong from its original recording. When measuring the diphthong, I looked to the nucleus for the raising, so I needed to measure in the first third and the second third of the whole vowel sound. I measured these consistently and recorded the formant measurements in Praat and labeled the nuclei for testing.

3. RESULTS

In this section, I consider the three hypotheses found in Section 1, labeled 3.1, 3.2 with subsections 3.2a and 3.2b, and 3.3 and I used t-tests to analyze the data. I included graphs to illustrate my findings.

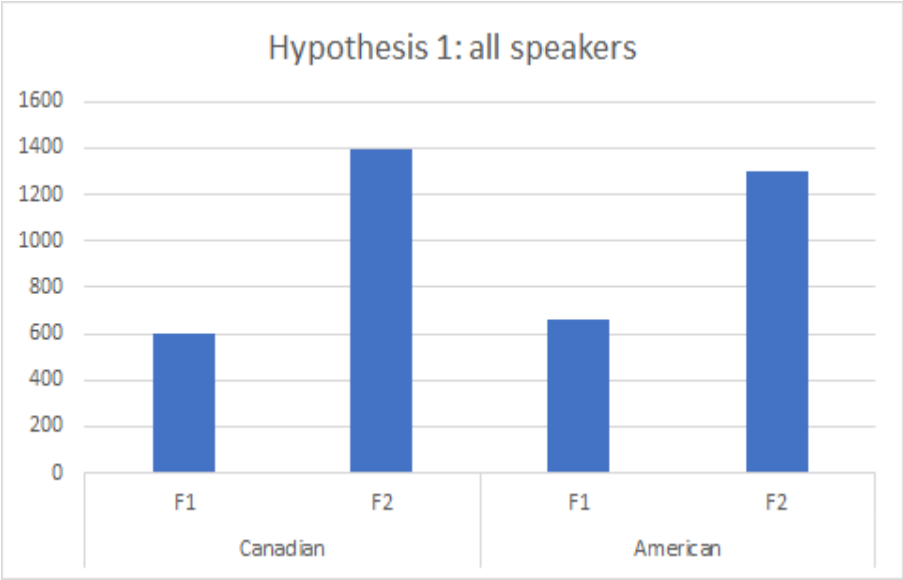
3.1. HYPOTHESIS 1: CANADIANS WILL EXHIBIT MORE RAISING THAN AMERICANS

When measuring [aɪ] and [aʊ] raising, I expected to see more raising before voiceless consonants than voiced consonants having a lower F1 and a higher F2. Among all speakers, the voiceless F1 mean is 636.3 Hz (StDev = 6437.3) and the voiced F1 mean is 690.03 Hz (StDev = 4404.5). This is as expected with a lower F1 before the voiceless consonant. $t(df)=-4.1$, $p<0.0001$ This p-value rejects the null hypothesis. Among all speakers, the voiceless F2 mean is 1342.3 Hz (StDev = 66810.7) and the voiced F2 mean is 1318.5 Hz (StDev = 33491.1). This is as expected with a higher F2 before the voiceless consonant. $t(df)=0.62$, $p=0.5$ This p-value is greater than 0.05 and cannot reject the null hypothesis.

In order to analyze the Canadian speakers data and the American speakers data separately before comparing them, I measured the F1s and F2s individually before voiceless and voiced consonants. Among Canadian speakers, the voiceless F1 mean is 604.2 Hz (StDev = 4382.9) and the voiced F1 mean is 689.9 Hz (StDev = 5188.6). This is as expected with a lower F1 before the voiceless consonant. $t(df)=-4.2$, $p=0.0004$ This p-value rejects the null hypothesis. The voiceless F2 mean is 1392.9 Hz (StDev = 93039.4) and the voiced F2 mean is 1363.2 Hz (StDev = 56167.2). This is as expected with a higher F2 before the voiceless consonant. $t(df)=0.4$, $p=0.7$ This p-value is greater than 0.05 cannot reject the null hypothesis. Among American speakers, the voiceless F1 mean is 660.9 Hz (StDev = 6679.6) and the voiced F1 mean is 690.1 Hz (StDev = 4058.5). This is expected with a lower F1 before the voiceless consonant. $t(df)=-1.7$, $p=0.09$ The voiceless F2 mean is 1303.3 Hz (StDev = 44060.3) and the voiced F2 mean is 1284.9 Hz (StDev = 15782.8). $t(df)=0.5$, $p=0.6$ Both of these p-values are greater than 0.05 and cannot reject the null hypothesis. What this

essentially means is that there is not a significant amount of [aɪ] and [aʊ] raising among American speakers.

FIGURE 1



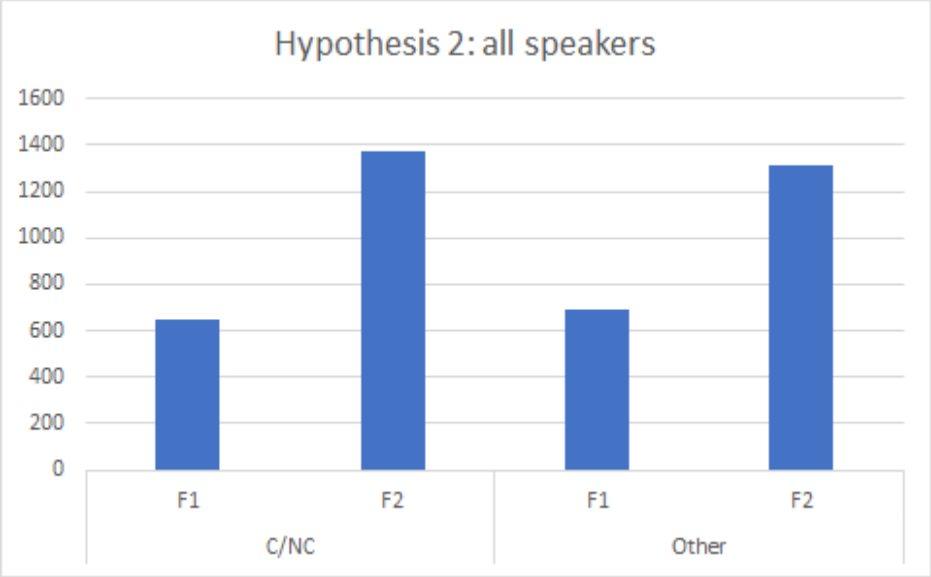
Finally, when comparing Canadian and American speakers, I expected to see more raising exhibited by Canadian speakers having a lower F1 and a higher F2 than American speakers. The voiceless F1 mean for Canadian speakers is 604.2 Hz (StDev = 4382.9) and for American speakers is 660.9 Hz (StDev = 6679.6). This is as expected with a lower F1 exhibited by Canadian speakers. t(df)=-4.4, p<0.0001 This p-value rejects the null hypothesis. The voiceless F2 mean for Canadian speakers is 1392.9 Hz (StDev = 93039.4) and for American speakers is 1303.3 Hz (StDev = 44060.3). This is as expected with a higher F2 exhibited by Canadian speakers. t(df)=1.9, p=0.06 This p-value is greater than 0.05 and cannot reject the null hypothesis.

3.2. HYPOTHESIS 2: ATHLETES ON CANADIAN/NORTHERN CITIES (C/NC) TEAMS WILL EXHIBIT MORE RAISING THAN ATHLETES ON OTHER TEAMS

In order to analyze the C/NC teams' data and the Other teams' data separately before comparing them, I measured the F1s and F2s individually before voiceless and voiced consonants. Among C/NC speakers, the voiceless F1 mean is 646.9 Hz (StDev = 8320.3) and the voiced F1 mean is 686.1 Hz (StDev = 5271.1). This is as expected with a lower F1 before the voiceless consonant. t(df)=-1.8, p=0.09 The voiceless F2 mean is 1370.7 Hz (StDev = 74765) and the voiced

F2 mean is 1324.5 Hz (StDev = 22705.8). This is as expected with a higher F2 before the voiceless consonant. t(df)=0.9, p=0.4 Both of these p-values are greater than 0.05 and cannot reject the null hypothesis. Among Other speakers, the voiceless F1 mean is 624 Hz (StDev = 4093.6) and the voiced F1 mean is 692.6 Hz (StDev = 4043.8). This is as expected with a lower F1 before the voiceless consonant. t(df)=-4.3, p<0.0001 The voiceless F2 mean is 1309.7 Hz (StDev = 56754.7) and the voiced F2 mean is 1314.5 Hz (StDev = 42133.9). This is not as expected because the F2 is lower before the voiceless consonant instead of higher. t(df)=-0.09, p=0.9 Both of these p-values are greater than 0.05 and cannot reject the null hypothesis.

FIGURE 2

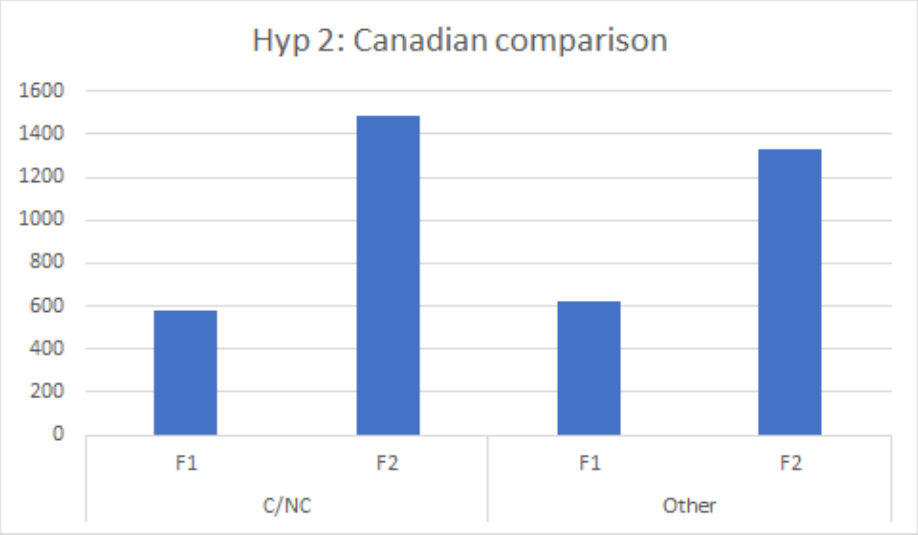


When comparing C/NC and Other teams, I expected to see more raising exhibited by C/NC teams having a lower F1 and a higher F2 than Other teams. The voiceless F1 mean for C/NC speakers is 646.9 Hz (StDev = 8320.3) and for Other speakers is 692.6 Hz (StDev = 4043.8). This is as expected with a lower F1 for C/NC speakers. t(df)=-2.6, p=0.01 The voiceless F2 mean for C/NC speakers is 1370.7 Hz (StDev = 74765) and for Other speakers is 1314.5 Hz (StDev = 42133.9). This is as expected with a higher F2 for C/NC speakers. t(df)=1.01, p=0.3 Both of these p-values are greater than 0.05 and cannot reject the null hypothesis.

HYPOTHESIS 2A: CANADIAN ATHLETES ON CANADIAN/NORTHERN CITIES (C/NC) TEAMS WILL EXHIBIT MORE RAISING THAN CANADIAN ATHLETES ON OTHER TEAMS

When comparing Canadian speakers to each other, I expected to see more raising exhibited by the speakers on C/NC teams. The voiceless F1 mean for C/NC speakers is 583 Hz (StDev = 5373.8) and for Other speakers is 617.5 Hz (StDev = 3425.7). This is as expected with a lower F1 for C/NC speakers. t(df)=-1.9, p=0.06 The voiceless F2 mean for C/NC speakers is 1489.4 Hz (StDev = 127263.9) and for Other speakers is 1332.3 Hz (StDev = 64831.9). This is as expected with a higher F2 for C/NC speakers. t(df)=1.8, p=0.08 Both of these p-values are greater than 0.05 and cannot reject the null hypothesis.

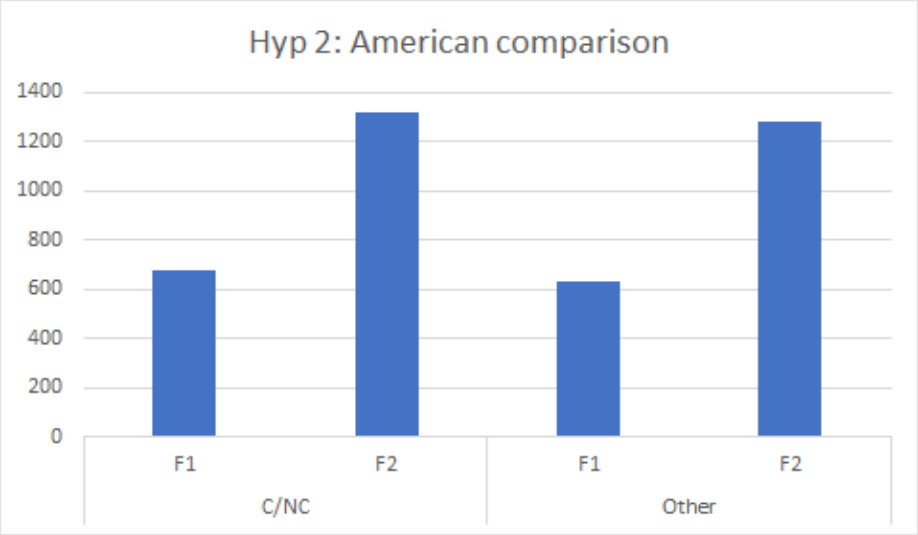
FIGURE 3



HYPOTHESIS 2B: AMERICAN ATHLETES ON CANADIAN/NORTHERN CITIES (C/NC) TEAMS WILL EXHIBIT MORE RAISING THAN AMERICAN ATHLETES ON OTHER TEAMS

When comparing American speakers to each other, I expected to see more raising exhibited by the speakers on C/NC teams. The voiceless F1 mean for C/NC speakers is 676.3 Hz (StDev = 7021.5) and for Other speakers is 632.8 Hz (StDev = 5027.5). This is not as expected with a higher F1 for C/NC speakers. t(df)=2.4, p=0.02 This p-value rejects the null hypothesis. The voiceless F2 mean for C/NC speakers is 1316.3 Hz (StDev = 43281.7) and for Other speakers is 1279.3 Hz (StDev = 46360.9). This is as expected with a higher F2 for C/NC speakers. t(df)=0.7, p=0.5 This p-value is greater than 0.05 and cannot reject the null hypothesis.

FIGURE 4



3.3. HYPOTHESIS 3: CANADIANS WILL SHOW A SMALLER DIFFERENCE BASED ON TEAM LOCATION THAN AMERICANS

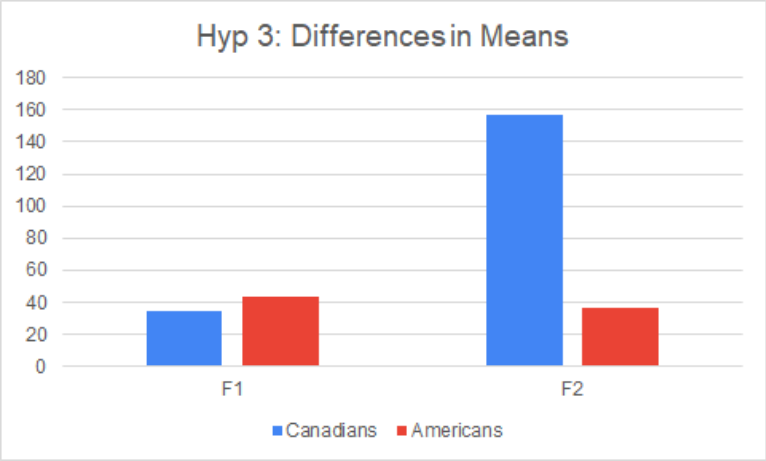
In order to answer this hypothesis, I decided to make a new table representing location divided by nationality, showing the average F1 and F2 for each group. Then, I calculated the difference in F1 between the two locations, then the F2 as well. This left me with four calculations of difference which I ran through a t-test assuming unequal variances, as I did with all my other t-tests. The results of the t-tests and the numbers used in the calculations are included in Table 2 below. In the end, I cannot be certain if this was precisely the right way to perform this calculation, but the t-test requires at least two data points for the range for each variable, so this is what I believed to be the solution. I am open to feedback on this and would like to rerun the tests if there is a better method.

TABLE 2. DIFFERENCES IN F1 AND F2

	Canadians			Americans		
	CA/NC	Other	Difference	CA/NC	Other	Difference
F1	583	617.5	34.5	676.3	632.8	43.5
F2	1489.4	1332.3	157.1	1316.3	1279.3	37

The mean difference when calculating the F1 and F2 together for Canadians is 95.8 Hz (StDev = 7515.4) and for Americans 40.25 Hz (21.1). This is different from expected as I predicted the Canadians would have a smaller difference and while they do have a smaller difference in F1, they have a larger difference in F2. t(df)=0.9, p=0.5 This p-value is greater than 0.05 and cannot reject the null hypothesis.

FIGURE 5



4. DISCUSSION, LIMITATIONS, AND FUTURE WORK

I chose to only study two examples of Canadian raising, where the [aʊ] and [aɪ] raise in the nucleus to [ʌʊ] and [ʌɪ]. However, there are other linguistic patterns attributed to a Central Canadian Accent which would be interesting to study in future research, for example, influences on Canadian English in the British Columbia region by Americans from the Pacific Northwest geographic region (Washington and Oregon) and vice versa.

In choosing this subject, I knew I was choosing to make audio recordings from YouTube videos and other videos rather than recording a person's speech. Additionally, I was recording connected speech, rather than words on a list or within carrier sentences. If either of these had been different it could have led to more clear formants and better measurements, and it may have influenced the results. Indeed, after completing everything for this assignment, I went back to the data and deleted a couple of data points which had not been very good, and it did change the results slightly, especially some of those p-values which are 0.06 or otherwise very close to the 0.05 mark. In future work on this topic, I would conduct all of the tests with recordings captured live with

appropriate technology and the samples done within carrier sentences. Finally, simply having more data would make the results better in terms of generalizing it or knowing whether I had a true sample. Two ways to address this shortcoming might be: (1) better consistency of words being measured and having more words since, for example, I had the fewest measurements for [aʊ] before voiced consonants; and (2) measuring more speakers to get results that could be better generalized.

My research question around the cross-linguistic influence of place of origin and current residence in the hockey community of practice cannot be answered conclusively in this paper. More often than not, my results looked as I expected them to but then, upon running the t-tests, it would be revealed that the p-value could not reject the null hypothesis. Additionally, the data on American speakers was less conclusive overall, by which I mean to say there were more results that were not as I expected at the outset, according to the hypotheses. I believe that the influence of Northern Cities Vowel Shift should have been better accounted for in this data with different considerations in the hypotheses. As stated in Section 1, Dailey-O'Cain (1997) observed [aɪ] raising (part of NCVS) and also [aʊ] raising in the same region. So, more clarity in the hypotheses could have accounted for variation among the American athletes in my data whose place of origin in the Northern Cities geographic region influenced their speech uniquely.

I have a follow up research question related to multilingual hockey players and foreign-born hockey players coming to Canada and the United States as young adults to work on North American teams. First, I am interested in bilingual French Canadians who speak French and English as their native languages who play exclusively in Canada and the United States on teams which are primarily English speaking (there is only one team of thirty-one which uses French in public communications). Second, I am curious about European athletes who have come to North America at some point in their professional development. There are a lot of factors to consider in both of these questions, for example, schooling in languages other than English, at what time did a player who is a non-native English speaker begin learning English, and for how long has the speaker lived in North America, primarily speaking English. A surface level analysis looking at the spectrograms for a Swedish athlete who briefly played in Ontario and currently plays in Colorado (Other team) shows raising in the [aʊ] diphthong before a voiceless consonant but not in the [aɪ] contexts. I wonder how this came about, how younger athletes who have not played on Other teams as long as he has would compare, and how this compares with athletes in similar

situations. For example, there is a strong tradition of Finnish athletes in Dallas, Texas, and I wonder about the cross-linguistic influence of Finnish with Texan English on top of these questions about Canadian English in the hockey community. The broader sociolinguistic question about identity related to occupation in the hockey community of practice needs more study. Expectations around speech patterns, public perception of the athlete, camaraderie on their team, national pride, and age or stage of professional development are all involved consciously or subconsciously in an individual's produced speech. The hypotheses considered in this paper and unanswered questions outlined in this section, along with their findings, would prove valuable in the field of sociophonetics.

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ENDNOTES

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