CANADIAN RAISING ON THE RISE IN VANCOUVER? A PHONETIC COMPARISON OF VANCOUVER, BC AND SEATTLE, WA*

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Even for trained listeners and linguists, identifying a talker as being from Seattle, WA or Vancouver, BC based on short clips of speech is no easy task. Pre-voiceless Canadian Raising of /aʊ/ (Chambers 1973), remains the stereotypical, most cited diagnostic to distinguish U.S. dialects of English from Canadian ones, despite acoustic variation in its realization across Canada and its attestations in the Northern U.S. (Vance 1987, Dailey-O'Cain 1997, Niedzielski 1999). While the variable realization of /aʊT/ is cited as a key dialect differentiator, surprisingly few studies have compared the acoustic or perceptual realities of raising among speakers of Canadian and U.S. dialects of English in the West (see Sadlier-Brown 2012 for one exception). The current study revisits the acoustic and social realities of /aʊ/ for Seattle and Vancouver speakers. The study analyzes 16,545 tokens of /aʊ/ taken from a word-list reading task completed by 19 Vancouver and 20 Seattle talkers along with responses to sociocultural interview questions. While Seattle talkers do show significant differences between /aʊT/ and /aʊD/, they demonstrate weaker, less phonologized patterns of raising than Vancouver talkers. Thus, raising continues to act as a valid differentiator for these Canadian and U.S. dialects, despite similarities in the overall phonological system. In Vancouver, women and younger speakers show characteristics of greater /aʊT/ raising and greater differentiation of their /aʊT/ and /aʊD/ tokens, but all sub-groups participate robustly in phonologized /aʊT/ raising. Findings from this study confirm that /aʊT/ raising indexes nationality, and despite a lack of explicit commentary about Canadian Raising, a link between Canadian pride and /aʊT/ raising emerges for Vancouver talkers.

1. Background

1.1 Differentiation of the West and Canada as dialect regions

The Atlas of North American English (ANAE) introduces as many questions as many questions as it does answers regarding the differentiation of the dialect regions labeled "the West" and "Canada" (Labov, Ash and Boberg 2006). The authors write that "The differentiation of the West from Canada is a more difficult question, involving the degree of activity of similar sound changes" (Labov et al. 2006: 137). In Canada, they identify the Canadian Vowel Shift (CVS) introduced by Clarke, Elms, and Youssef (1995), but are careful to note the low consistency measure for the CVS as a dialectal diagnostic for Canada since "speakers with the same characteristics are found scattered throughout other areas of the West" (Labov et al. 2006: 217). Empirical and theoretical accounts of

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the sound changes in progress in these dialect areas have emerged since their writing, but remain an opportunity.

Lacking consensus about the Third Dialect Shift, Canadian Raising remains the prototypical differentiator for U.S. and Canadian dialects of English, especially in the West. The ANAE calls Canadian Raising "the best-known characteristic of Canadian speech" and "the most popular American stereotype" thereof. Niedzielski (1999) famously showed that this stereotype involving nationality was strong enough to affect Michigan listeners' perception of the diphthong itself. Preliminary findings from Swan and Babel (forthcoming) show that Seattle listeners can only identify Vancouver talkers at chance (50%) when exposed to the words *tag, fan, path* in isolation, but successfully identify a Vancouver talker 73% of the time based on hearing the word *devout* in isolation. Swan (2016) reports that 13 out of 20 Seattle respondents mention /aʊT/ raising in words like *about* and *house* as a feature of Canadian English. As other scholars have noted, the stereotypical association of Canadian Raising with Canadian English (particularly by Americans) glosses over a more complex situation. "Canadian Raising" is not entirely uniform across Canada and is attested in various dialects of English in the U.S. such as in Upstate New York and Michigan among others (Vance 1987, Dailey-O'Cain 1997, Niedzielski 1999). This is explained, in part, by the perceptual motivations that underlie raising phenomena.

1.2 /aʊT/ raising as a perceptually motivated sound change

Moreton (2004) explores the contrast that monophthongs have higher F1 values before voiceless consonants than voiced ones while for *diphthongs*, a following voiceless consonant causes *lower* F1 values. He argues that this is due to hyperarticulation before voiceless consonants, causing a diphthong like /aɪ/ (or /aʊ/) to be pronounced more peripherally with lower F1 values and higher F2 values before a voiceless consonant. He illustrates that for American speakers the diphthongs /aɪ ɔɪ eɪ aʊ/ are all realized with lower F1 and higher F2 values before a voiceless consonant than a voiced one and that these changes act as perceptual cues for the voicing of the following consonant. This has become a phonologized effect in many languages and dialects: it acts to preserve the /aɪ/ diphthong in pre-voiceless contexts in monophthongizing dialects of African American English and Southern English and has become phonologized in Canadian Raising. Given this, the pre-voiceless lowering of F1 and raising of F2 for /aʊT/ is expected to affect both Seattle and Vancouver speakers. While Seattle speakers are expected to show this pre-voiceless hyperarticulatory effect, the effect is expected to be smaller and more proximate to the trigger (the following voiceless consonant) than for Vancouver speakers who might show lower F1 and higher F2 values from onset. Thus, the dialects are expected to be differentiated by the degree of phonologization. Additionally, there may be different strategies employed by different communities or speakers with respect to how this pre-voiceless hyperarticulation is realized (more raising vs. more fronting).

1.3 Canadian raising currently

Canadian Raising was first introduced by Joos (1942) and elaborated in a generative framework by Chambers (1973) as the raising of the nucleus of /aʊ/ before a tautosyllabic voiceless consonant. Over the past half-century, research on Canadian Raising has documented its variable phonetic shape and identified patterns of change in apparent time. Chambers (1981) finds evidence of changes on the F2 dimension for pre-voiceless /aʊT/ tokens and observes that when the nucleus is fronted for Toronto speakers, it remains lower and less raised. He speculates that fronting may replace raising and over time result in a weakening of "Canadian Raising" patterns. Chambers and Hardwick (1986) find that Canadian Raising is receding in Vancouver, particularly among young women, questioning whether weakening patterns of Canadian Raising indicate a reorientation to American norms. Chambers (2006) reassesses the situation some years later explaining that, in fact, fronting has had little effect on weakening the overall phenomenon of Canadian Raising. Still, the issue of /aʊT/ fronting as a change in progress has interested a variety of researchers (Chambers 1981, Hung et al. 1993, Rosenfelder 2005). More recently, Boberg (2008, 2010) highlights the importance of regional differences observing more fronting in Toronto than in Western Canada, but reports no difference between men and women. Hall (2016) finds more fronting of /aʊ/ in Toronto than in Vancouver, but particularly among men, and speculates that /aʊ/ fronting may be nearing completion.

The only study to compare Canadian Raising among Washington State and BC speakers is Sadlier-Brown (2012). The study includes data from a small sample of four Washington speakers (two males and two females aged 19-22) and four Vancouver speakers (two males and two females 20-24). Using single-point measurements to extract F1 and F2 values for each of the 800 vowel tokens, Sadlier-Brown finds that the Washington speakers do participate in /aʊ/ raising, as evidenced by significant differences in the F1 mean (height) of /aʊ/ in pre-voiced and pre-voiceless environments ($p<0.05$), however, the Vancouver speakers showed a stronger differentiation between the two environments ($p<0.001$). In an ANOVA comparison of the two groups, F1 differences in /aʊT/ for Vancouver and Washington speakers just reach significance at $p = 0.052$ with Vancouver speakers having higher /aʊT/ nuclei. The two groups show differences in the height of raising; Washington speakers' raised /aʊT/ variants likely do not reach levels of perceptual salience in contrast to those of Vancouver speakers. Sadlier-Brown reports that while raising persists at the group level, the incidence of non-raising at the individual level is higher among Vancouver women than men. Sadlier-Brown's study is an important step toward understanding the production differences between Washington State and Vancouver speakers, but leaves opportunities for a larger sample, the exploration of relevant ideological factors and a perceptual study.

Finally, to the author's knowledge, Canadian Raising has not been explored using ethnographic or interactional methods more typical of the Third Wave (Eckert 1989), and no study has illustrated style-shifting variation in /aʊT/ raising. Easson (1997) comments on the general lack of social awareness or consciousness speakers have for raised /aʊ/, finding little difference between stylistic contexts like word-list and free interview speech. Is it possible that raised /aʊT/ is not a socially-meaningful variant for Canadian

speakers? Is it possible Canadian speakers are not aware of or responsive to American's stereotypical association of raised /aʊT/ with their nationality?

1.4 Research questions

Several questions emerge in response to these previous findings:

1. Does raised (and/or fronted) /aʊT/ consistently distinguish Vancouver and Seattle talkers?
2. In Vancouver, do patterns among age and sex subgroups suggest a change in progress with respect to fronting or raising?
3. What are Seattle and Vancouver talkers' attitudes and ideologies about their nationality?
4. Do these ideological or attitudinal factors affect /aʊ/ realizations?

The current paper will be limited to a discussion of /aʊT/ raising with some brief comments about sociocultural identities. The reader is referred to Swan (2016a) for a more complete presentation of /aɪ/ raising and other diagnostic aspects of /æ/ in these cities.

2. Methods

2.1 Subject recruitment

Twenty adult speakers in Seattle and 19 adult speakers in Vancouver, self-identifying as native speakers of English, who had lived in their respective city since the age of 7 or before participated in this study. The sample was balanced for age and sex. Group 1 included speakers from age 18-25; Group 2 included speakers from age 26-36.

	Age Group I (18-25)	Age Group II (26-35)
Male	5	5*
Female	5	5

Table 1. Number of subjects of Vancouver and Seattle *For Age Group II in Vancouver, four male speakers were interviewed.

2.2 Word-list reading task

Research questions (1) and (2) were addressed using a word list elicitation task. These data were recorded in person by the researcher using a Zoom4H handheld digital recorder. A total of 220 tokens were included in the word list, and speakers were asked to repeat the word list three times yielding 660 total tokens per speaker. The word list contained authentic lexical words designed to elicit each of the phonemes: /aʊ/, /aɪ/, /æ/, /ɛ/, and /e/. Five tokens of each phoneme were elicited for each of six environments: _[+lab], _[+cor], _[+vel], [+lat], [+nas], [+cont] in both [+vce] and [-vce] environments (as phonological inventory allows). No tokens of [ŋ] were included in the [+nas] class.

2.3 Sociocultural survey

Subjects responded to a series of questions about their city and region as well as their attitudes and ideologies toward municipally and regionally associated activities. These questions were interspersed between the three repetitions of the word-list reading task described above. This yielded three stretches of interview speech of about 6-8 minutes in length for each respondent (these were not included in the acoustic analysis). Twenty-seven Likert-scale questions were used to assess participants' municipal pride and national pride, the perceived similarity of pairs of cities (Seattle and Vancouver and others), participants' interest in moving elsewhere, and cited importance of shopping local in their city and in the region. Subsequent open-ended questions were used to elicit their impressions of speech and language in their own city as well as the neighboring city (Seattle for Vancouverites). The sociocultural interviews were transcribed and analyzed by the researcher, both qualitatively and quantitatively. The responses to Likert-scale questions were stored in an Excel spreadsheet and were imported in R to calculate descriptive statistics, such as mean and standard deviation. The free response commentary in response to these and other open-ended questions was qualitatively analyzed using emergent coding. Numerical responses to the Likert scale questions were Lobanov normalized and tested as predictors of linguistic behavior as terms in the regression models for the acoustic analysis of the word-list reading data. Responses to specific sociocultural survey questions did emerge as significant predictors of linguistic behavior for both /aʊ/ and other variables, such as /æ/. For an account of ideological predictors of /æ/ retraction, see Swan (2016b).

2.4 Extraction of vowel formant data

The sound files from the word list reading task were analyzed in PRAAT (Boersma and Weenik 2014) and aligned using the University of Pennsylvania FAVE-align forced aligner (Rosenfelder et al. 2011). Each stressed vowel in the TextGrid was hand checked for accuracy. The boundaries for each vowel token were adjusted so as to avoid the transitions associated with the flanking consonants. FAVE-extract produces an extensive set of information about the vowel segments including time-scaled formant measurements for F1 and F2 at 20%, 35% 50%, 65% and 80% of the vowel's duration as well as the information about the phonetic environments preceding and following the extracted segment. FAVE-extract was used to extract the information for all stressed target vowels in the word-list reading task, aside from the carrier phrase words *say* and *again*. Several commonly mispronounced words were removed from the data set for all speakers: *Bethesda, dessert,* and *lead*.

2.5 Normalization

Following previous studies, the data were Lobanov (1971) normalized, creating a z-score transformation for each formant and each talker. This method has been found to be the

best at reducing anatomical variation while preserving sociolinguistic variation in the signal (Adank, Smits, and Van Hout 2004).

2.6 Time-proportional analysis

Rather than selecting a single point from the vowel's trajectory for analysis, the current study uses data from five time-proportional points across the vowel's duration. DiPaolo et al. (2011) recommend that multiple measurements be used for all vowel analyses, and certainly for diphthongal vowels characterized by greater vowel-inherent spectral change. Following this best practice, this analysis uses the proportional distance approach, which adjusts its multiple measurements according to the duration each vowel token (e.g. at 20%, 35%, 50%, 65%, and 80% of the vowel's duration). By examining F1 and F2 trajectories, a more dynamic view of the vowel is obtained, without bias for any particular point in the segment's duration. Production studies have identified significant differences in the formant trajectories of speakers across ethnicities, dialects, and generations, and perceptual data confirms that listeners make use of these fine-grained differences in formant trajectory patterns to draw social conclusions (Koops 2010, Jacewicz and Fox 2013). This suggests that, if Seattle and Vancouver speakers are differentiated by their /aʊT/ raising, this difference might be visible as the degree of phonologized raising (ie. F1 at a single measurement point) and simultaneously as the vowel trajectory (ie. the shape of the F1 trajectory over the course of the segment).

This analysis expands on previous research for a more thorough understanding of the differences between Vancouver and Seattle speakers' /aʊT/ tokens by including dynamic formant trajectory in both descriptive and statistical analysis. In the mixed-effect linear regression models described below, F1 and F2 trajectories are incorporated as a possible predictor by creating an ordered factor from the five time-proportional points. This allows for comparisons of the linear, quadratic, or cubic shapes of the vowel trajectories in different allophonic contexts and by different groups of speakers. As an ordered factor, vowel trajectory is included in the mixed-effects linear regression models as a possible predictor. This allows modeling and comparison of basic linear, quadratic, and cubic trajectory shape, which is especially useful for diphthongal vowels with greater vowel-inherent spectral change.

2.7 Hierarchical linear regression modeling

Mixed-effects linear regression models were used to conduct inferential statistics in response to the aforementioned research questions (Gorman 2009). For the entire project, presented in Swan (2016), 30 separate mixed-effects models were constructed in R using the lme4 package (Bates et al. 2015) to provide an analysis of the five allophonic variables considered. In the full analysis, pre-velar /æ/, pre-nasal /æ/, environments of /æ/ retraction, /aʊ/ raising and /aɪ/ raising were examined. For each variable, cities were examined first in isolation, and models were constructed for both F1 and F2, followed by a model for both F1 and F2 that spans both cities. The current work presents only the findings from /aʊ/ raising, focusing on a comparison of the two cities on both F1 and F2

dimensions along with a closer inspection of the age and sex sub-group variation in Vancouver, specifically, visible through the within-city models of F1 and F2.

3. Findings

Findings from the current study reveal a significant dialectal difference between Seattle and Vancouver speakers with regard to /aʊT/ raising and elucidate the question of fronting versus raising. The difference between Vancouver and Seattle talkers' /aʊT/ tokens is primarily on the F1 dimension and occurs early in the vowel's duration, indicating more established "phonologized" raising per hyperarticulatory pre-voiceless raising (Moreton 2004). Finally, the within-city analysis for Vancouver talkers suggests greater /aʊT/ raising among young, female speakers and demonstrates the relationship between speaker ideologies and linguistic behavior with respect to this variable.

3.1 /aʊT/ raising across Vancouver and Seattle

3.1.1 Number of tokens

A total of 16,545 tokens of /aʊT/ and /aʊD/ were analyzed across the two cities; 8,600 for Seattle and 7,945 for Vancouver, respectively.

Following Voicing	**Age Group 1**		**Age Group 2**		**Total**
VANCOUVER					
	Female	Male	Female	Male	
aʊVCLS	695	745	745	585	2,770
aʊVCD	1300	1380	1390	1105	5,175
TOTAL			**n=7,945**		
SEATTLE					
	Female	Male	Female	Male	
aʊVCLS	755	690	850	725	3,020
aʊVCD	1410	1270	1555	1345	5,580
TOTAL			**n=8,600**		
GRAND TOTAL			**n=16,545**		

Table 2. Number of observations (by age and sex) included in mixed-effect linear regression models of /aʊT/ ~ /aʊD/ raising among Vancouver and Seattle speakers

3.1.2 Descriptive statistics for /aʊT/ ~ /aʊD/ in Vancouver and Seattle

Below, raw formant measurements in Hertz are provided along with z-scores resulting from Lobanov normalization as the latter can be unintuitive and difficult to compare with Hertz means from other studies. Results are included for /aʊ/ before all voiced consonants and all voiceless ones, represented as /aʊD/ and /aʊT/ respectively. It is important to note that these data average the F1 or F2 values across the five time points

measured for each token, making them an average from onset to offset rather than a mid-point value.

	F1 (Hz)	SD F1 (Hz)	F2 (Hz)	SD F2 (Hz)	Dur (ms)	SD Dur (ms)	Lob. Norm F1	Lob. Norm F2
VANCOUVER VOWELS								
aʊVCD	736	129	1416	241	181	49	0.505	-1.052
aʊVCLS	646	109	1454	268	147	34	-0.037	-0.958
ʌ	686	101	1671	221	115	24	0.202	-0.435
o	499	68	1162	204	145	55	-0.935	-1.676
ʊ	530	67	1601	231	121	30	-0.762	-0.597
SEATTLE VOWELS								
aʊVCD	719	168	1420	280	192	54	0.498	-1.121
aʊVCLS	698	158	1465	263	164	41	0.379	-0.998
ʌ	630	113	1638	215	137	46	-0.072	-0.582
o	484	87	1299	226	153	60	-0.890	-1.445
ʊ	501	100	1623	252	146	49	-0.816	-0.550

Table 3. Mean of unnormalized F1/F2 values and duration, standard deviations of unnormalized F1/F2 values and duration for /aʊ/ before voiceless and voiced consonants relative to back vowels, plus Lobanov normalized z-scores across all five time-proportional points for Seattle and Vancouver speakers

The unnormalized means show lower F1 and higher F2 values for Vancouver as compared to Seattle, demonstrating that Vancouver talkers show more /aʊT/ raising than Seattle talkers. For Vancouver talkers, /aʊT/ tokens have a mean that is 90 Hz lower on the F1 dimension and 38 Hz higher on the F2 dimension than the mean for /aʊD/ tokens. Seattle talkers show much less differentiation of their /aʊT/ and /aʊD/ tokens with a mean that is 21 Hz lower on F1 and 45 Hz higher on F2 than their /aʊD/ tokens. The primary difference between Seattle and Vancouver speakers' /aʊT/ tokens is on the raising, not fronting dimension: at 646 Hz, the mean value for Vancouver talkers /aʊT/ tokens is 52 Hz lower than Seattle talkers' /aʊT/. The difference between F2 mean values of /aʊT/ for Seattle and Vancouver talkers is very small at only 9 Hz. Because these means are an average of the five points across the duration of the segment, however, taking a closer look at the trajectories of the tokens can reveal more about the degree of phonologization of /aʊT/ raising and pinpoint differences between Seattle and Vancouver speakers.

3.1.3 Comparison of F1 for Vancouver and Seattle /aʊ/

To confirm the descriptive differences observed above, the Lobanov normalized data were subject to a series of mixed-effects linear regression models. Due to space limitations, the mixed-effects models comparing the two cities will be summarized here, and the results of the within-city analyses for Vancouver will be presented in more detail.

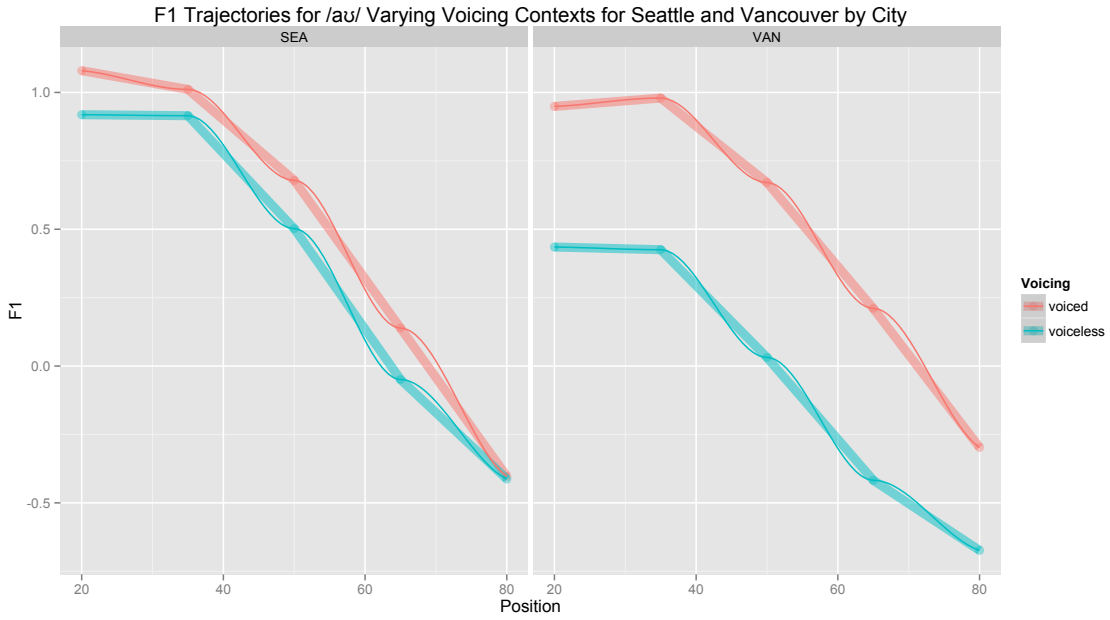

Figure 1. F1 trajectories for /aʊ/ before voiceless and voiceless consonants in Seattle (left panel) and Vancouver (right panel) with time-proportional duration point on x-axis; Lobanov normalized F1 on y-axis across five time-proportional points

For both Seattle and Vancouver speakers, the F1 values for /aʊ/ tokens are dropping over the duration of the segment as the diphthong rises in the vowel space. The formant trajectories of /aʊ/for Seattle and Vancouver speakers appear nearly identical preceding a voiced consonant (red), but are notably different before a voiceless consonant (blue). For Vancouver talkers, F1 of /aʊT/ is substantially lower from onset at 20% time proportional duration than for Seattle talkers, indicating phonologized raising. For Vancouver talkers, this difference between /aʊT/ and /aʊD/ continues over the course of the segment. The models comparing Vancouver and Seattle confirm that the differences described above between speakers' /aʊT/ tokens are statistically significant. With data from both cities pooled, the F1 values and F1 trajectories of pre-voiceless /aʊ/ tokens both differ significantly from those of /aʊ/ before a voiced consonant. The significant interaction of city and voicing of the following consonant is the largest effect in the model. Across all five time points, Vancouver speakers have lower F1 values for pre-voiceless /aʊ/ than Seattle speakers, indicating a higher vowel and more raising (t-value = -18.44, $p < .0001$). The other significant effects are quite small and involve complex interactions between the age and sex sub-groups in the different cities (reported in full in Swan 2016).

3.1.4 Comparison of F2 for Vancouver and Seattle /aʊ/

City and voicing of the following consonant also interact significantly to affect the F2 dimension, thought the effect sizes are much smaller than for the F1 model. Vancouver speakers have slightly higher F2 values than Seattle speakers for /aʊT/ tokens as compared to /aʊD/ (t-value=2.73, $p = 0.006$). The difference between Seattle and

Vancouver speakers' /aʊT/ tokens manifests to a greater extent in their F1 trajectory than their F2 trajectory. The F2 trajectories of /aʊT/ and /aʊD/ tokens show littler variation across the cities are therefore not illustrated here. For both cities, F2 values are higher for /aʊT/ than for /aʊD/ and are dropping sharply until about 70% time proportional duration as the diphthong moves back in the vowel space, and then rising slightly from 70% through offset.

3.2 Within-city analysis for Vancouver

The figure below illustrates the trajectories of /aʊ/ before voiced and voiceless consonants relative to other back vowels for the four age and sex subgroups of Vancouver speakers. Women are represented in the two left panels; men are on the right. The younger age group is represented by "1" in the two top panels; older speakers by "2."

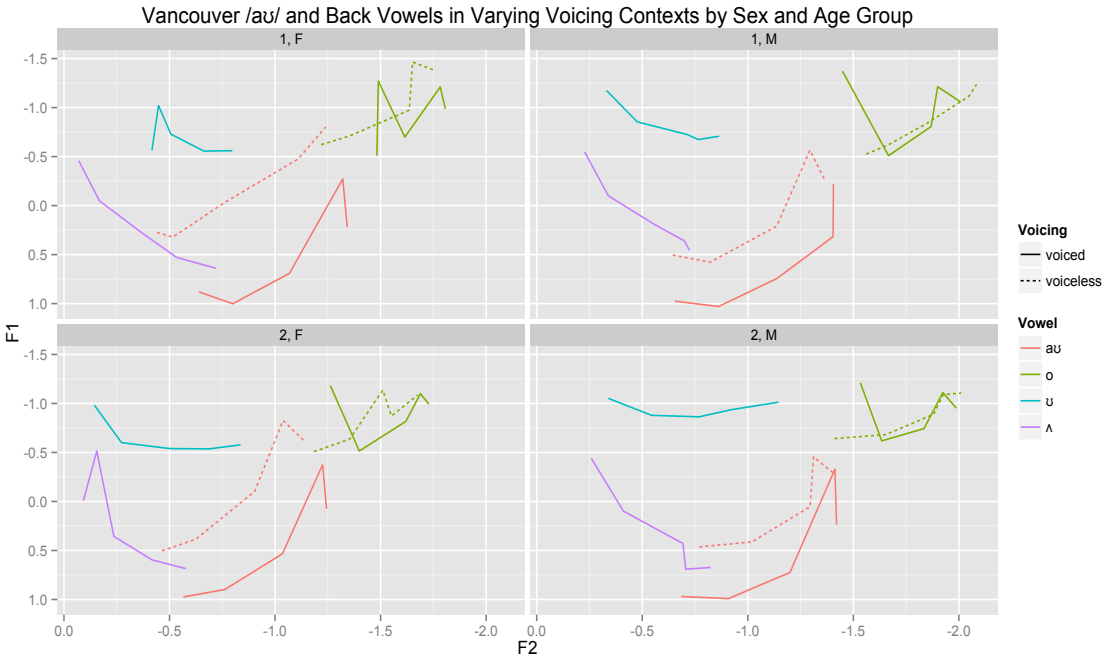

Figure 2. Vowel trajectories for /aʊ/ in pre-voiced and pre-voiceless environment for with back vowels based on Lobanov-normalized F1 and F2 values at 5 time-proportional points for Vancouver talkers by age and sex-subgroup

The mixed-effects model for /aʊT/ raising in Vancouver contained a complex four-way interaction that was shown to significantly improve the model.

```
F1.lmerM <- lmer(normF1 ~ Position.ord*as.factor(AgeGroup)*Sex*Voicing +
 PrecedingPhone + normdurms + normNationalPride + (1 + Position.ord | Name) +
 (1|Word), data=VANau)
```

	Est.	Std. Error	t -value	p
(Intercept)	0.650	0.08	8.30	< 1e-04
Position.ord.L	-0.974	0.07	-14.34	< 1e-04
Position.ord.Q	-0.370	0.04	-8.55	< 1e-04
Position.ord.C	0.128	0.03	4.38	< 1e-04
as.factor(AgeGroup)2	-0.122	0.05	-2.42	0.016
Voicingvoiceless	-0.762	0.07	-10.55	< 1e-04
PrecedingPhoneg	-0.436	0.16	-2.72	0.007
PrecedingPhoneh	-0.594	0.14	-4.18	< 1e-04
PrecedingPhoner	-0.263	0.10	-2.74	0.006
normdurms	-0.019	0.01	-3.20	0.001
normNationalPride	0.039	0.02	2.20	0.028
Position.ord.Q:as.factor(AgeGroup)2	0.145	0.06	2.38	0.017
Position.ord.Q:Voicingvoiceless	0.136	0.05	2.95	0.003
as.factor(AgeGroup)2:Voicingvoiceless	0.104	0.03	3.63	0.000
SexM:Voicingvoiceless	0.177	0.03	6.18	< 1e-04
as.factor(AgeGroup)2:SexM:Voicingvoiceless	-0.104	0.04	-2.52	0.012
Position.ord.L:as.factor(AgeGroup)2:SexM:Voicingvoiceless	0.295	0.09	3.19	0.001

Table 4. Statistically significant fixed effects for linear mixed-effects regression model of F1 for /aʊT/ ~ /aʊD/ in Vancouver

For Vancouver, the largest effect in the model is the effect of a following voiceless consonant: F1 is significantly lower for /aʊT/ than /aʊD/ indicating raising (t-value= 10.55, p<0.000). Another substantial effect reveals more raising among female talkers. F1 of /aʊT/ significantly higher for men (t-value=6.18, p<0.000). A smaller but statistically effect of age indicates that younger speakers are raising more in pre-voiceless contexts. F1 of /aʊT/ is significantly higher for older participants, denoted by Age Group 2 in the table above (t-value= 3.63, p<0.000). Finally, the three-way interaction of Age, Sex, and Voicing reveals that the difference between Vancouver men and women with respect to allophonic differentiation of /aʊT/ and /aʊD/ is different by for younger than older speakers. There is a greater discrepancy between men and women in the younger age group than the older one in terms of their differentiation of /aʊT/ and /aʊD/. This can be seen visually in Figure 2 where the red lines representing /aʊT/ and /aʊD/ are more similar left and right in the bottom two panels (from left, older women and men) than in the upper two panels (younger women and men).

```
F2.lmerH <- lmer(normF2 ~ Position.ord*Voicing*Sex +
as.factor(AgeGroup)*Position.ord*Voicing + normdurms + (1 + Position.ord | Name) +
(1|Word), data=VANau)
```

	Est.	Std.Error	t-value	p
(Intercept)	-0.950	0.07	-14.12	< 1e-04
Position.ord.L	-0.598	0.06	-10.63	< 1e-04
Position.ord.Q	0.099	0.03	3.66	0.000
Position.ord.C	0.120	0.02	4.87	< 1e-04
Voicingvoiceless	0.142	0.08	1.76	0.078
normdurms	-0.030	0.01	-5.42	< 1e-04
Position.ord.L:Voicingvoiceless	-0.100	0.04	-2.71	0.007
Position.ord.Q:Voicingvoiceless	-0.132	0.04	-3.58	0.000
Voicingvoiceless:SexM	-0.178	0.02	-9.34	< 1e-04
Voicingvoiceless:as.factor(AgeGroup)2	-0.081	0.02	-4.23	< 1e-04
Position.ord.L:Voicingvoiceless:SexM	0.149	0.04	3.51	0.000
Position.ord.Q:Voicingvoiceless:SexM	0.141	0.04	3.32	0.001
Position.ord.L:Voicingvoiceless:as.factor(AgeGroup)2	0.128	0.04	3.01	0.003
Position.ord.Q:Voicingvoiceless:as.factor(AgeGroup)2	0.118	0.04	2.77	0.006

Table 5. Statistically significant fixed effects for linear mixed-effects regression model of F2 for /aʊT/ ~ /aʊD/ in Vancouver

The results of the F2 model show that F2 is not significantly higher for /aʊT/ than /aʊD/ (p=0.078), but voicing does interact with sex and age to produce significant interactions. In one of the largest effects in the model, women have significantly fronter /aʊT/ tokens than men based on a lower F2 value for men in the interaction of Sex and Voicing (t-value = -9.34, p<0.000). Likewise, in a smaller yet significant interaction of Age Group and Voicing, older speakers have a more back realization of /aʊT/ than younger speakers (t-value= -4.23, p<0.000). Additionally, there are significant differences in F2 linear and quadratic trajectory shape for men and women as well as for younger and older speakers.

3.2.1 Ideology and /aʊT/ raising in Vancouver

The quantitative and qualitative analyses of the sociocultural interview responses discover significant differences between Vancouver and Seattle participants. While respondents from the two cities did not differ significantly with respect to their municipal pride, they did differ significantly with respect to their national pride. Vancouver speakers reported significantly higher national pride than Seattle speakers (t-value 3.29, p= 0.003). Seattle respondents reported a mean national pride of 4.2 (sd=0.54) on a 1-to-7 scale; Vancouver respondents reported a mean of 5.9 (sd=1.0). (These data were collected prior to the campaigning or election of President Donald Trump or Prime Minister Justin Trudeau.) These differences between the two cities in terms of national pride are noteworthy in the figure below:

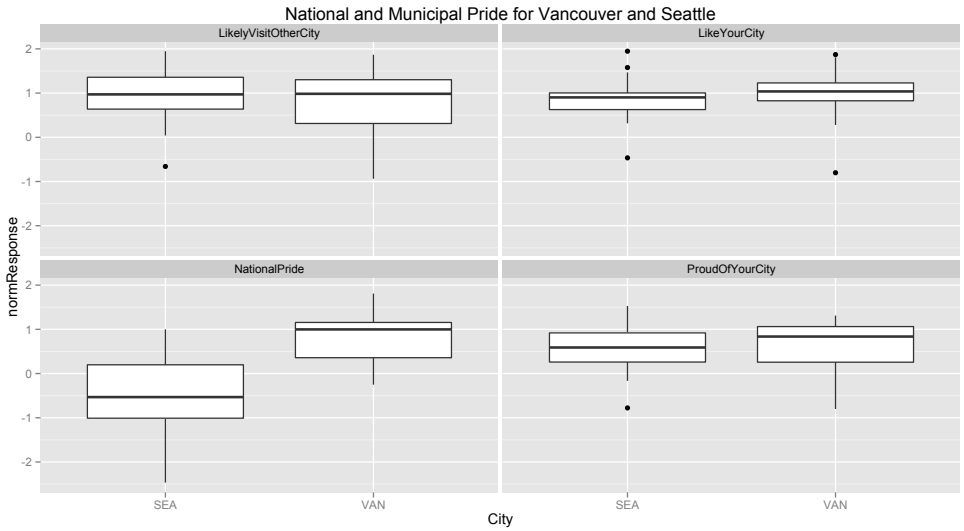

Figure 3. Lobanov normalized national and municipal pride ratings for Seattle and Vancouver participants

Participants also offered contrasting qualitative commentaries about their home countries. Compare below a quote from a Vancouver respondent with the quote from a Seattle respondent that follows:

I love where I live, I love the environment, I love my fellow Canadians, I love our freedom, I love our unity, what we stand for on a global scale, what we stand for nationally. VSF13

...I think it's also one of those things that like as of late our national identity, seems to be completely sort of conceptualized in the focus of tragedy Post 9/11, that whole concept of like we're like banding together because we have soldiers fighting in a war. We're banding together cause we got attacked, none of it... we do not have like a whole lot of distinction as a nation, in any kind of cultural happy concepts... SSM05

Returning to mixed-effects model for F1 in Vancouver, the link between national pride and /aʊT/ raising is confirmed. Among Vancouver talkers, higher ratings of national pride predict more /aʊT/ raising based on higher F1 values for baseline /aʊD/ relative to /aʊT/ (t-value= 2.20, p = .028, see Table 6 above). Among Seattle talkers, no ideological or attitudinal factors significantly predict F1 values for /aʊT/ raising. Despite Easson (1997)'s observed lack of stylistic variation, metalinguistic awareness, attitude and orientation toward macro-level sociological categories like nationality affects speaker behavior, even in so-called interview speech.

4. Discussion

This work confirms that both Seattle and Vancouver participate in pre-voiceless "Canadian" Raising of /aʊT/ on the basis of significant differences in F1 in the pre-voiceless versus pre-voiced contexts as Moreton's hypothesis predicts. Yet, the extent of differentiation for these two environments is substantially greater for Vancouver speakers than for Seattle speakers, implying that raised /aʊT/ is a perceptually salient cue that listeners may rely on to make judgments about a talker's city (or nation) of origin. Patterns of variation within Vancouver indicate that raising phenomena remain primarily raising (not fronting) for these Vancouver speakers seconding Boberg and Hall's observations about regional differences in Canada. For Vancouver speakers, more /aʊT/ fronting accompanies /aʊT/ raising, but does not appear in isolation as a change in progress. Contrary to previous studies, Canadian Raising appears to be increasing in apparent time or, perhaps more likely, it is exhibited more robustly by younger talkers and women in more interactional uses, and this may be socially motivated. In conversation with an American researcher inquiring about their orientation toward local and national identity, Vancouver women show a greater degree of /aʊT/ raising than their male counterparts. The significant effect of national pride emerges as a predictor of /aʊT/ raising for Vancouver talkers suggests that the variable may be more sensitive to style-shifting and interactional stance than has been revealed in previous research.

5. Conclusion and Future Directions

Third Wave interpretations of social meaning view it as locally-constructed and context-dependent, yet speaker orientation to a macro-demographic identity can affect production in a word-list reading task. To better understand the social meaning of this variant, opportunities remain for investigations into intraspeaker variation and for more ethnographic work: are there differences within the same talker based on task or interactional stance? What is the relationship of macro-level dialect variables to more local stylistic variables? How do these factors play out in dialect identification (Swan and Babel in progress)? Do perceptual cues correspond with production differences? Do Canadians perceive Canadian Raising and rely on it as a cue to nationality?

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