A LITTLE FORWARD IN LAURENTIAN FRENCH: A VARIATIONIST ANALYSIS OF VOWEL FRONTING IN LAURENTIAN FRENCH*

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1. Introduction

The fronting of /ɔ/ in European varieties of French has received considerable attention and has been described as a phonetic change in progress. Words like *joli* 'pretty' and *homme* 'man', for example, can be realised with a standard /ɔ/ as in [ʒɔli] and [ɔm] or with a more fronted mid-low vowel. Martinet (1945, 1969) likens the phonetic realisation to that of the mid-low front rounded vowel /œ/, whereas Dauzat (1950) instead says the realisation is similar to the French 'schwa'.[1]

This fronting is salient, as specifically noted by Boula de Mareüil et al. (2010) and as suggested by the body of work available on the topic. Degrees of fronting show both inter- and intra-speaker variability, which can lead to misunderstandings. Malderez (2000), for example, highlights examples of cases where speakers' fronted realisations were misinterpreted as a schwa (shown in (1)) and Fónagy (2005) offers a similar example except that the confusion is between /ɔ/ and /œ/ (shown in (2).

(1) Speaker 1: *Moi, l'homosexualité ça ne me choque pas.* (Malderez 2000 : 67)
'Homosexuality doesn't bother me.'
Speaker 2: *Quoi, le mot « sexualité » ça te choque pas?*
'What, the word "sexuality" doesn't bother you?'

(2) Speaker 1: *Est-ce que c'est en rapport avec l'heure?* (Fónagy 2005 : 41)
'Does that have to do with the time?'
Speaker 2: *Non, ce n'est pas en or.*
'No, it isn't made of gold.'

The process is sufficiently widespread that Fónagy (1989) includes /ɔ/-fronting as a point of variability in the French vowel system. Armstrong and Low (2008) propose that Hexagonal French varieties are undergoing leveling, perhaps related to Carton's (2001:9) description of the phenomenon as "trendy". Boula de Mareüil et al. (2010) do not find the

I would like to thank those who attended the Canadian Linguistics Association conference for valuable discussion about this topic. Similarly, a previous version of this paper was presented at the Montreal-Ottawa-Laval-Toronto conference earlier this same year and I thank those who participated for comments and discussion. I would additionally like to thank Morgan Sonderegger for discussion as well as Marie-Hélène Côté and Hugo St-Amant Lamy for sharing PFC corpus recordings. This research was funded by a Social Sciences and Humanities Council of Canada scholarship to its author.

[1] The extent to which these two descriptions differ with respect to the vowel quality being perceived is partly uncertain. However, as both vowel comparisons reflect a fronted realisation, this will not be taken to be pivotal here or in the following discussion of the literature, where both front rounded vowels and the schwa are used in descriptions or shown to be confused with the fronted variant of the mid-low back vowel.

Actes du congrès annuel de l'Association canadienne de linguistique 2015.
Proceedings of the 2015 annual conference of the Canadian Linguistic Association.
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fronting to be present in Midi varieties, meaning that fronting may still be restricted to more northern varieties in France.

Martinet (1945, 1969) suggested that /ɔ/-fronting results from the presence of two low vowels forcing /ɔ/ further forward between the two World Wars. While this may be the period during which the phenomenon spread in its current form, fronting or alternations with more front vowels have been a recurring feature of French phonology for centuries. Walter (1976) observes that the *Petit dictionnaire du people* – from 1821 – offers *heume* as a form for *home* (in current standard spelling *homme* 'man'). Likewise, Armstrong and Low (2008) refer to Vaugelas (1647: 52) criticising speakers pronouncing *commencer* 'to start' as if it were *quemencer*, which Fónagy (2005) also notes was being lamented in 1530. This revised timeline for fronting means that it could have been introduced to the Laurentian varieties as part of colonisation, and the dialect has conserved its two low vowels meaning that there might be more pressure to front if Martinet's phonetic justifications hold.

Evidently, this process of /ɔ/-fronting or the presence of alternations between front and back rounded vowels has a long history in French, perhaps being a very slow change in progress (Fónagy 1989; Malderez 2000) that was previously associated with the working class, notably in Paris (Gadet 1992). Not restricted to French, though, we also find this tendency towards the fronting of back vowels in sociolinguistic literature, most evidently in Labov's (1994: 116) principles of linguistic change.

French might still be a bit unusual, however, in that the vowel that fronts is the mid-low vowel and not a higher one: it would seem that, cross-linguistically, *high* vowels front more and that lower vowels tend to front when higher ones also do. For example, English has /u/-fronting (eg. Labov et al. 2006), as did Old French (Calabrese 2000), while Altamura Italian saw the fronting of both /o/ and /u/ (Calabrese 2000). There is the beginning of a suggestion that this apparent implicational relationship between vowels fronting may not be absent in fronting varieties of French; Boula de Mareüil et al. (2010) did observe that /o/ fronted as well, even though only the fronting of /ɔ/ was perceptually salient. The lack of salience of fronting in /o/ – and perhaps even in /u/ – could possibly be explained by the available space in the vocal tract; /u/ and /o/ can front much more than /ɔ/ before their fronting would encroach upon the perceptual space of another vowel.

Figure 1: A map showing the six survey locations included in this study

2. Method

2.1 The *Phonologie du français contemporain* Project

The *Phonologie du français contemporain* project (PFC; Durand et al. 2002, 2009; www.projet-pfc.net) represents an international effort to make corpus data for French freely available in order to facilitate future study of the language. The surveys all follow the same protocol, which is comprised of both read and spontaneous speech tasks, to ensure that data collected in different areas and at different times will be as comparable as possible. Part of the pre-release data processing includes orthographic annotation in Praat (Boersma and Weenink 2010) so that researchers will be able to make more efficient use of the data. This study draws its data from the Laurentian sub-corpus (Côté 2014, in press) and restricts itself to the spontaneous speech portions of the data, which includes a semi-guided conversation and an unguided one. Six different survey locations (Chelsea, Chicoutimi, Hawkesbury, La Pocatière, Trois-Rivières and Quebec City) are here examined, as illustrated on the map in figure (1).

2.2 Speakers

Table 1: The speakers and their associated social factors[2]

	Older Speakers		Middle-Aged Speakers		Young Speakers	
Region	Male	Female	Male	Female	Male	Female
Chelsea	al1 (1933)	mm1 (1939)	lm1 (1958)	cm1 (1959) rl1 (1961) sl1 (1963)	am1 (1994) ml1 (1990)	km1 (1986) rm1 (1987)
Chicoutimi	rt1 (1934)	gt1 (1932)	db1 (1954) pt1 (1965)	gm1 (1958) ma1 (1953)	fv1 (1984) pl1 (1983)	cl1 (1982) jv1 (1979) mb1 (1985)
Hawkesbury	cd1 (1940)	mf1 (1939) tg1 (1936)	mg1 (1961) mt1 (1965)	lg1 (1961)	fg1 (1990) pg1 (1985)	jg1 (1985) tl1 (1984)
La Pocatière	rg1 (1927) jb1 (1932)	fs1 (1926)	gg1 (1954) pd1 (1950) sh1 (1959)	db1 (1947) lr1 (1945)	gh1 (1985)	am1 (1981) fg1 (1995) gg2 (1992)
Trois-Rivières	bp1 (1933) wd1 (1934)	cc1 (1931) hd1 (1937)	jb1 (1958)	cl1 (1957)	jg1 (1987) ll1 (1986) mc1 (1987)	ad1 (1987) lc1 (1987) sb1 (1989)
Quebec City	gr1 (1940) pb1 (1950)	jb1 (1945) yl1 (1923)	dg1 (1970) fg1 (1967)	in1 (1972) ct1 (1975)	ar1 (1989) mc1 (1986)	rc1 (1990) vw1 (1986)

[2] The codes given refer to the speaker codes assigned as part of the PFC project's data collection and anonymisation processes. For this analysis, the full speaker codes were used in order to ensure that no code erroneously collapsed two different speakers, meaning an additional three-letter code appears before the speaker codes provided here. For example, the full code for Chicoutimi's "gt1" is "cqbgt1", in which the "c" stands for the country code (Canada), the "q" is a regional subdivision ("Quebec", in this case) and the "b" identifies that this was the second survey in that regional subdivision.

This analysis draws from the data of sixty-seven speakers, spanning three generations and between reasonably balanced for region and gender within these age groups. Table 1 shows the speakers as stratified by their social factors. For the current analysis, the age groups – rather than specific birth years (in parentheses in (3)) – will be used, both due to the fact that there are gaps considerable gaps between birth years and because the age groups are about equivalent in birth year range across survey regions.

2.3 Data Extraction

The recordings and transcriptions obtained as part of the PFC project were aligned using Milne's (2011) forced aligner, which was trained on Laurentian French speakers. A Praat script then cycled through the phonemes in the aligned TextGrid and, upon reaching one of the desired phonemes, extracted the measurements and the lexical information. While previous research on this topic focused solely on /ɔ/ (with the exception of Boula de Mareüil et al. (2010), who included /o/ and found non-salient fronting to be present), this study examines data for all three non-low back vowels (/ɔ/, /o/ and /u/) in order to see not only whether /ɔ/ was fronting, but also whether /o/ and /u/ front and, if so, whether all vowls that front show the same conditioning factors. Tokens with anomalous formant settings were excluded or manually verified, and tokens with an undefined pitch or amplitude measurement were excluded (a) to avoid the possible confound of devoiced vowels and (b) because they act as predictors of alignment errors.

2.4 Factors

Factors were automatically coded for a number of variants as part of the Praat and R scripts that comprised the data extraction and analysis portions of the study. The first group of factors is the social ones previously discussed: gender (male or female), age (old, middle-aged or young) and region (Chelsea, Chicoutimi, Hawkesbury, La Pocatière, Trois-Rivières and Quebec City). Given that the literature on fronting suggests it to be a change in progress, younger speakers are expected to have more fronting than older ones should the fronting be occurring in this dialect as well. Additionally, as

The second set of factors was phonological. The basic phonological context – the identities and the features of the adjacent phonemes and the nearest vowels' identities – was noted for each token. The first three formants were measured: the second formant being the correlate of fronting, while the first was considered to examine a gradient effect of height and the third was included in order to have a means by which to estimate possible rounding. The first two formants were normalised using the Lobanov method as described in Flynn and Foulkes (2011) because they found this method to be more robust to regional variation and also because it accommodates trapezoidal vowel spaces like the one in Laurentian French. The syllable number of the vowel as well as the number of syllables in the word (based on realised syllables only, meaning that non-realised schwas were not included in the count) were also extracted.

Regarding the third group of factors, prosodic ones, the ones used in Lamontagne (2014) to examine the *loi de position* were included. The duration of the vowel was measured, since shorter tokens would be expected to show the most coarticulatory effects and reduction. For the pitch, both the mean pitch and the pitch excursion (minimum and maximum values and whether that contour is rising or falling) were extracted. Finally, the intensity was also measured and it was normalised as the z-score of that speaker's

intensity values. The prosodic effects were included both because they've been found to be at play in another study on the dialect (Lamontagne 2014) and because unstressed open-syllable /ɔ/ was found to front more in Walter's study (1976).

The last pair of factors is the lexical effects, which were limited to the lexical identity (included as a random effect) and the word frequency, which was log-transformed. More frequent words may require less acoustic information to be identified and may be realised more often and more quickly, making them susceptible to reduction, which makes the word frequency an important factor to consider. To accompany the lexical identity as a random effect was the speaker's identity in order to reduce the problem of individual speakers influencing predictions for a given group.

2.5 Statistical Analysis and Exposition

The data were analysed using the lme4 package (Bates et al. 2015) in R (R Core Team 2014). Linear mixed-effect regressions were performed with F2 as the dependant variable, speaker and word as random effects, and finally the other factors described in 2.4 as fixed effects. Each pair of age and underlying phoneme was computed individually in order to generate the separate constraint hierarchies. The plots that are presented were generated using ggplot2 (Wickham 2009), also in R.

2.6 The Variationist Framework

This study takes the Variationist framework as a starting point. As described in Tagliamonte (2006), the Variationist Method rests on three basic parts: factor weights and their ranges within a factor group, the requirement of statistical significance (here, as is typical in sociolinguistic work, at $p \leq 0.05$), and the constraint hierarchy that results from arranging significant factors in descending order of magnitude of effect. Comparing the constraint hierarchies (and the favouring or disfavouring effects of factors within them) makes it possible to compare different speaker groups.

As part of the present analysis a slight broadening is made to the method relative to the norm. None of the three basic parts have been modified, but rather than simply looking at different speaker groups (which will here be done for the age groups), the constraint hierarchies of the different phonemes' fronting will be compared. In this way we can examine not only whether there has been a change in apparent time based on the constraint hierarchies across generations, but also whether there is a difference between the hierarchies for the different phonemes.

3. Results

3.1 Preliminary Exposition

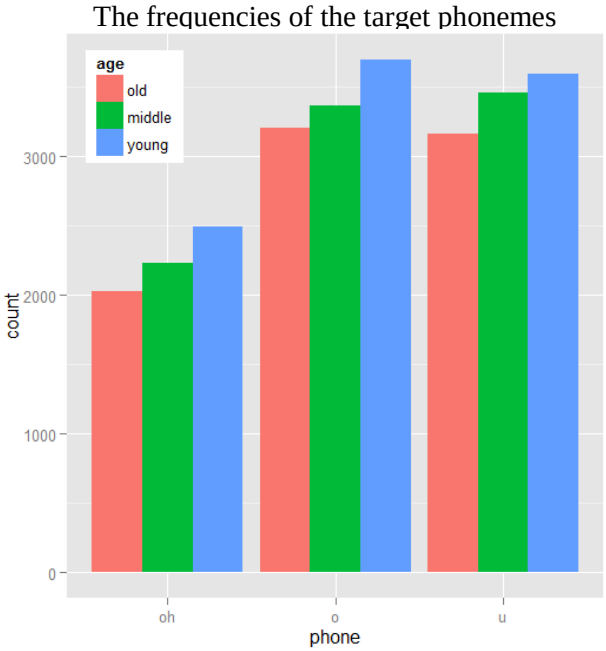

Figure 2: Frequencies of the different phonemes in the data

In total, 27 257 tokens were extracted. As shown in figure 2, the proportion of use by age remains approximately consistent for all vowels. There were 6 753 tokens of /ɔ/, the least frequent of the vowels, as well as 10 279 tokens of /o/ and 10 225 tokens of /u/.

Figure (3) shows the general trends for each combination of age group and phone. One phoneme, /u/, has been divided into three categories in the plot: *u_closed_final* (/u/ found in final syllables closed by anything other than a lengthening consonant – in other words, reliably laxed /u/), *u_open_final* (/u/ in final open syllables – where /u/ is reliably tense) and *u_non-final* (/u/ in any non-final syllable). As we can see, the latter two types of /u/ pattern together (no statistical difference throughout at $p < 0.01$, dropping to $p < 0.001$ for young and old speakers), whereas laxed /u/ is more similar to /o/. For this analysis, the /u/ in final closed syllables have been excluded to avoid the confound of laxing, which will be saved for later work and which is why generally "phones" will be favoured over "phonemes" as a descriptor for vowel categories.

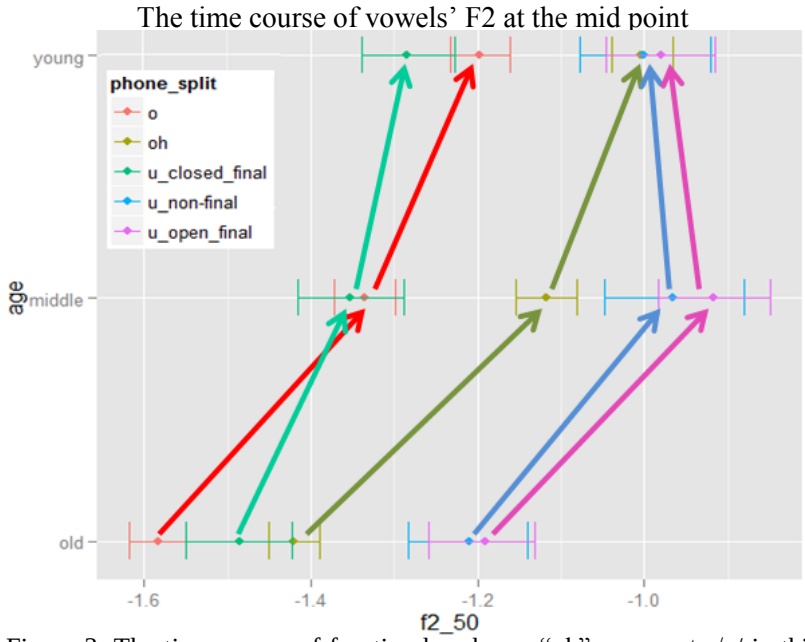

Figure 3: The time course of fronting by phone. "oh" represents /ɔ/ in this and in later plots.

3.2 An Overview of Prosodic Effects

For all phones, as shown in figure 4, shorter tokens are realised as more fronted, which is in line with predictions. We also see that the different vowels have rather distinct ranges for duration, with /ɔ/ being shortest overall. The durations as present in the model were normalised by speaker in the form of z-scores. Duration was significant in all models at $p < 0.001$, except for /u realised by middle-aged speakers, where $p = 0.009$.

The phones' patterns diverge more considerably when pitch and intensity are considered, however. As shown in figure 5, whereas amplitude is significant for all age groups in predicting the F2 of /o/ and of /u/, it is not significant at all for /ɔ/. For /o/ and /u/, greater amplitude is correlated with less fronting, suggesting more fronted realisations occur in less prominent positions. In all cases where it was significant, $p < 0.001$ within the model.

Figure 6 illustrates that mean pitch has the opposite patterns in all respects: for all age groups, the factor is not significant in the models for /u/ and for /o/, but it is for /ɔ/, where a greater mean pitch is associated with being more fronted. The trends for /o/, significant at $p < 0.001$ when tested alone but not significant within the model due to the other prosodic effect, even go in the opposite direction as compared to the effects for /ɔ/. For /ɔ/, the mean pitch (normalised by speaker) was significant at $p < 0.001$ for old speakers, at $p = 0.047$ for middle-aged speakers, and at $p = 0.007$ for young speakers.

As displayed in figure 7, vowels with greater pitch excursions during the vowel are less fronted, with this trend being significant in /o/ and in /u/ for all speaker ages at $p < 0.001$ when tested alone. In the full model, this is significant for /u/ in young and middle-aged speakers ($p = 0.022$ and $p = 0.038$, respectively) and for /o/ in young speakers ($p = 0.017$). The opposite effect for the prosodic effects, in general between /o/ and /u/ on one hand and /ɔ/ on the other, may be at play in explaining why the only one of the vowels to show salient fronting is /ɔ/: /ɔ/ is generally most fronted when it is most prominent, whereas /o/ and /u/ are most fronted when it is least prominent.

The relationship between degree of fronting and vowel duration

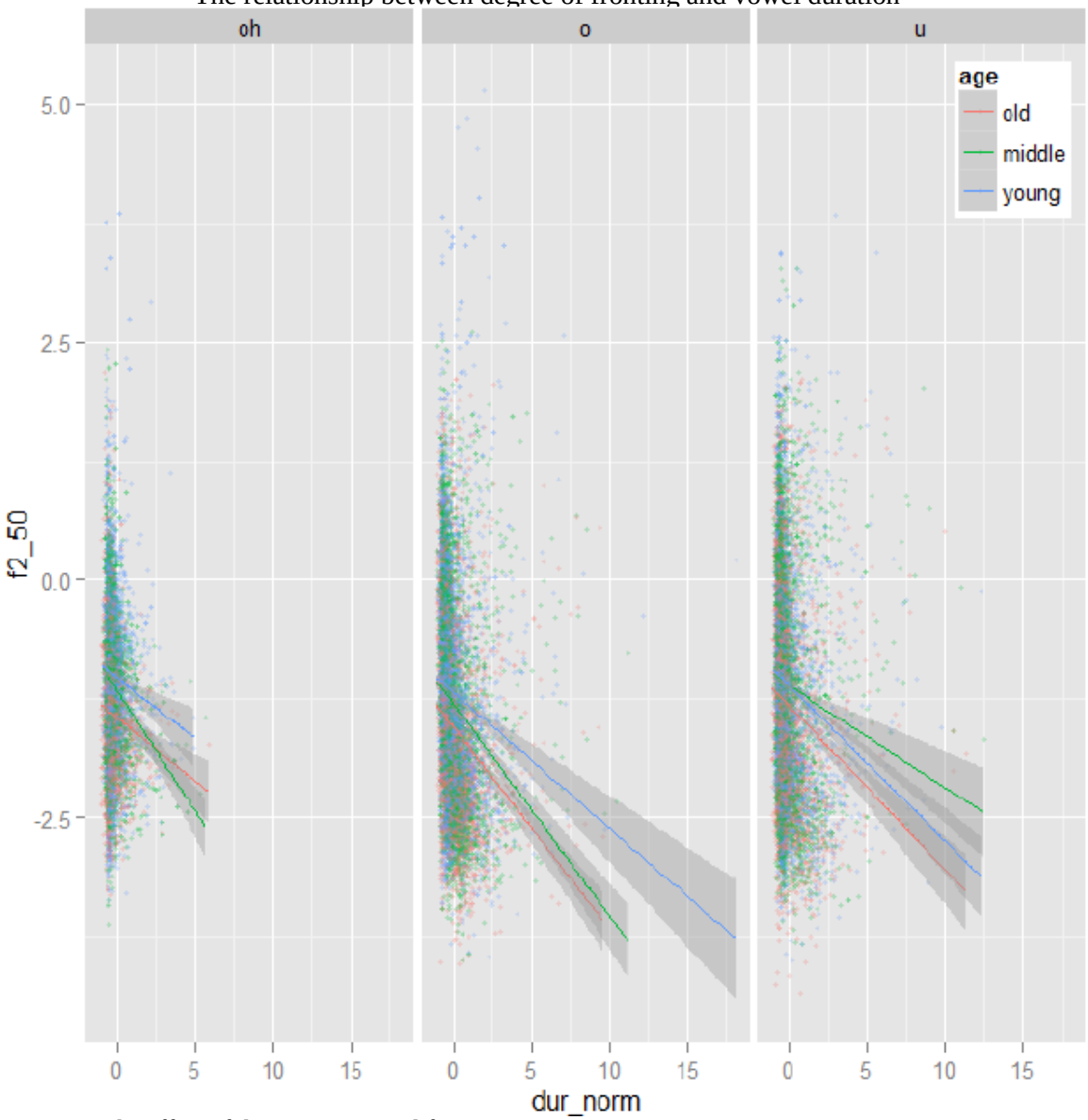

Figure 4: The effect of duration on vowel fronting.

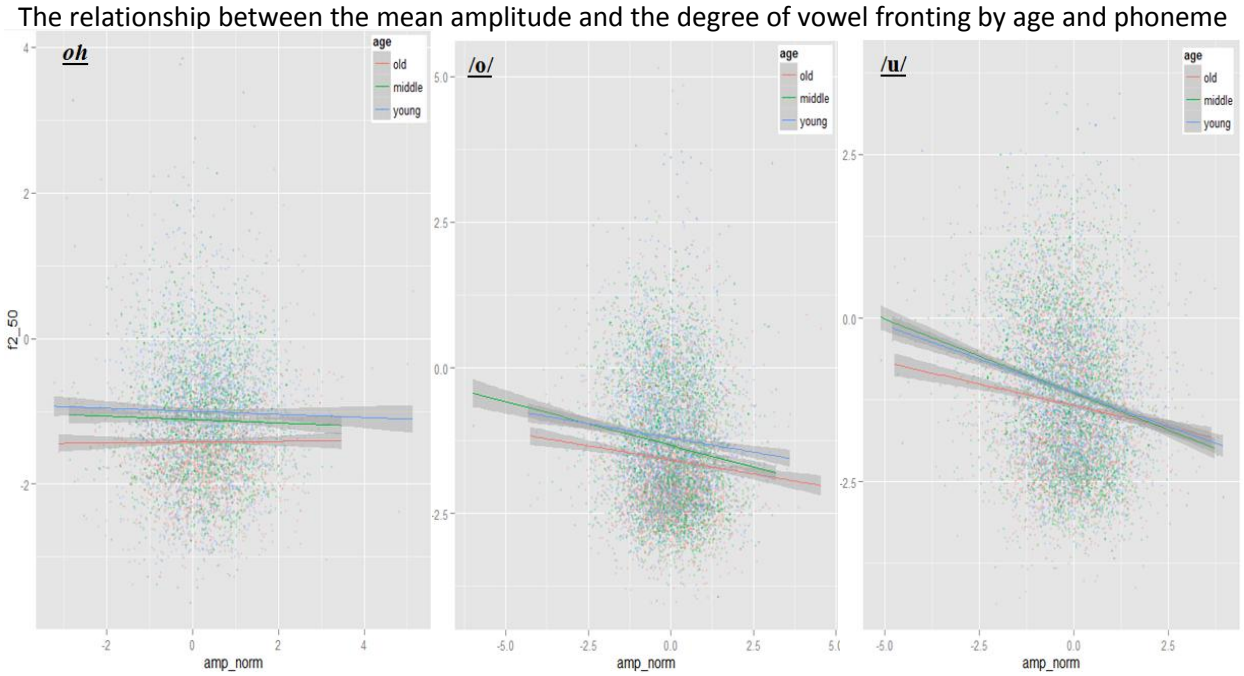

Figure 5: The effects of mean amplitude on fronting in the different vowels.

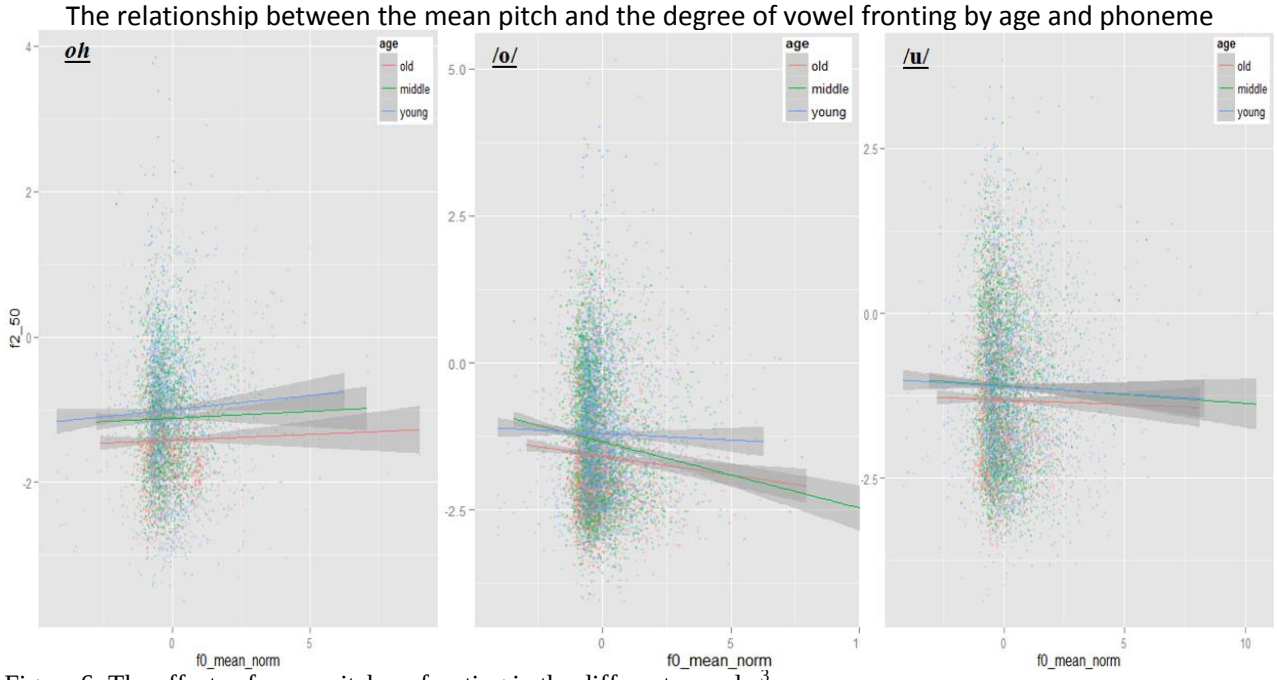

Figure 6: The effects of mean pitch on fronting in the different vowels.[3]

[3] While there are clear trends for /o/ (significant in isolation for older and middle-aged speakers at $p < 0.001$) and some trends for /u/, these are not significant in the full model (where F0 range and intensity account for the variation better) and, crucially for the discussion, go in the opposite direction compared to

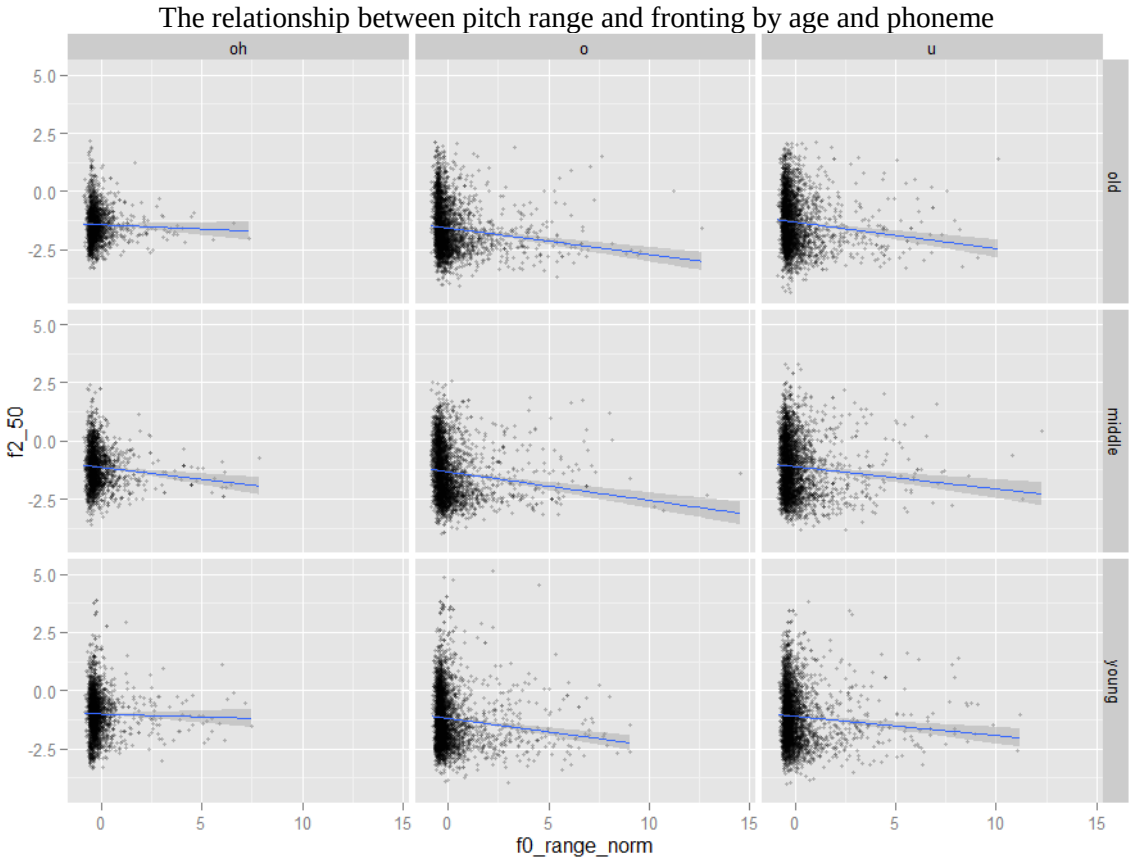

Figure 7: The effect of pitch range on F2. These trends are significant for young speakers in /o/ and in /u/ and for middle-aged speakers in /u/ in the full model, as well as for all speakers in /o/ and in /u/ when the model contains only this factor.

3.3 Constraint Hierarchies

In a Variationist analysis, it is the constraint hierarchies that are of particular interest, as they are what permit comparisons between speaker groups – and, in this case, between potentially distinct processes. In (4) – (6) can be found the constraint hierarchies based on phone and on age group. The number given in parentheses beside each factor group is the factor range, which is the difference between the coefficient of the largest magnitude of effect and the smallest one. In the case of continuous factors, the value given is the coefficient multiplied by twice the standard deviation for that factor, which makes the values statistically comparable to those for the discrete (non-numeric) factor groups.

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the relationship before F0 and F2 for /ɔ/. Further research is looking into this as well as looking into better prosodic measurements and looking at prosodic effects more generally.

(3) Older speakers' constraint hierarchies

a. For /u/	b. For /o/	c. For /ɔ/
1. Next place of articulation (1.148)	1. Next place of articulation (0.867)	1. Previous place of articulation (0.879)
2. Previous place of articulation (0.646)	2. Previous place of articulation (0.783)	2. Next place of articulation (0.484)
3. Phone Duration (0.283)	3. Phone Duration (0.298)	3. Phone Duration (0.191)
4. Intensity (0.220)	4. Intensity (0.211)	4. Mean F0 (0.093)

(4) Middle-aged speakers' constraint hierarchies

a. For /u/	b. For /o/	c. For /ɔ/
1. Next place of articulation (1.044)	1. Next place of articulation (1.183)	1. Previous place of articulation (1.114)
2. Region (0.807)	2. Previous place of articulation (0.827)	2. Next place of articulation (0.800)
3. Previous place of articulation (0.803)	3. Region (0.792)	3. Region (0.542)
4. Intensity (0.307)	4. Intensity (0.317)	4. Phone Duration (0.270)
5. F0 Range (0.139)	5. Phone Duration (0.224)	5. Style (0.134)
6. Style (0.136)	6. Style (0.138)	6. Mean F0 (0.060)
7. Phone Duration (0.118)		

(5) Younger speakers' constraint hierarchies

a. For /u/	b. For /o/	c. For /ɔ/
1. Region (1.266)	1. Region (1.020)	1.Next place of articulation (0.732)
2. Next place of articulation (0.622)	2. Previous place of articulation (0.845)	2. Previous place of articulation (0.718)
3. Previous place of articulation (0.578)	3. Next place of articulation (0.527)	3. Phone Duration (0.182)
4. Intensity (0.295)	4. Intensity (0.292)	4. Mean F0 (0.079)
5. Phone Duration (0.269)	5. Phone Duration (0.181)	
6. Style (0.176)	6. F0 Range (0.009)	
7. F0 Range (0.036)		

While we can see change in apparent time going from older to middle-aged to younger speakers in a number of respects, we find relative consistency overall when following these trends. Regional effects seem to be increasing in importance for /o/ and for /u/ in apparent time and, at least at a broader community level, these do not appear to consistently be related to the prevalence of English as might be expected given that English is exhibiting /u/ fronting (Labov et al. 2006). Instead, the Hawkesbury speakers (the only survey in Ontario, albeit right by the border with Quebec) and Chelsea speakers (in Quebec but not very far from the border with Ontario) are rather reliably in the middle range for /u/ in the case of younger speakers, although the middle-aged speakers are more consistent with this potential hypothesis in that the speakers from those two regions do front more. It is worth noting, however, that speakers from Chelsea had the most fronting

in all three phones (not significant for /ɔ/) and not solely in /u/ for which the language contact hypothesis might be strongest. In any case, further research into potential micro-variation in the different survey areas would be of use.

The main point of interest for the present paper comes not from strictly looking at the diachronic differences, but from looking at the patterns as they relate to each phone compared to the other. Here we can see that /o/ and /u/ tend to pattern similarly, but that this behaviour differs from that of /ɔ/. As previously noted, the most evident difference between the two higher phones compared to the mid-low one is apparent in the effect of prosodic factors. Not only do we see that the main factors at play differ, but we also see that the directions of effect are also different.

In the case of /o/ and /u/, intensity and duration are the main prosodic predictors, and the F0 range over the course of the vowel also begins to appear in apparent time, first for /u/ in middle-aged speakers and then for both /o/ and /u/ in young speakers. As shown in figure 8, the trend is in fact strong in all ages for /o/ and /u/ and, when tested individually, and not in the full model (where the lack of data to examine the correlated prosodic effects is problematic), this trend proves significant for all speaker ages. In /ɔ/, on the other hand, the factor is not even significant when tested alone and the trend is subtle for all speakers except middle-aged ones (although the trend goes in the same direction as for /o/ and /u/ for all speakers). The data here again suggest that /o/ and /u/ in more prominent position are less fronted, though the slight trends for /ɔ/ suggest that further research should investigate whether the type of stress or the position in the sentence (where the mean pitch would be affected differently but where an F0 excursion would still be larger) might offer additional insight.

4. Discussion

This study had two main goals. First, it sought to highlight a new type of insight offered by the Variationist methodology. Second, it aimed to shed light into the process of vowel fronting as it applies to Laurentian French. Regarding the first of these goals, we can see that using constraint hierarchies can help us further understand why – at a social or phonetic level – seemingly similar processes may not be developing in the same way. In this case, the different conditioning for /ɔ/ compared to its higher counterpart may serve to explain why only the fronting of /ɔ/ has seen such attention. That /ɔ/-fronting is more present in prominent positions may have contributed to its salience. The fronting of /o/ and /u/, despite that /u/ is often further forward and that the fronting of /o/ has been nearly identical in degree, is not perceptually salient. The explanation for this, as found in this study, may lie in the fact that it occurs in less prominent positions, where we might expect the cues are less noticeable and where perceptual compensation for coarticulation might be at its highest. Further research can test whether this hypothesis may be true.

The second goal was to better understand vowel fronting, at least in the context of Laurentian French. We first find that there has been phonetic fronting of the back vowels and that this applies not only to /ɔ/, but to all three vowel tested. Furthermore, as noted above, we observe that the conditioning for the different vowels reveals different patterns and that these might help us better explain both this process and the factors affecting salience. An additional factor to consider with regards to resulting salience is that the vowel space is more spread out for higher vowels; equal fronting of /u/ and of /ɔ/ will lead to /ɔ/ entering into the vowel space of a front vowel sooner than /u/ doing so. As such, Martinet's (1945, 1969) observation about the crowded lower vowel space may be

partly relevant whether due to low vowels pushing /ɔ/ forward or not. Comparing the results obtained in this study to results found for other varieties of French would be interesting, as it would highlight (a) whether those varieties also show similar non-salient fronting, and (b) whether those dialects also see corresponding prominence-based patterns in the phonetic process.

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