

The Nuances of /R/:

An Analysis of Progressive and Regressive Voicing Assimilation in Quebec French

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Introduction. Voice assimilation in French is a well-established phenomenon. It has been shown to occur across all types of consonantal sequences (C_1C_2), even across word boundaries, and to be regressive rather than progressive, meaning that the voiceless or voiced nature of C_2 impacts the realization of voicing in C_1 rather than the other way around (Hallé & Adda-Decker 2007, 2011). One type of CC sequences remains problematic, however, i.e., sequences with /R/ as either C_1 or C_2 , since /R/ is considered to be unspecified for voicing (Webb 2004): In French, it can be realized either as a voiced or a voiceless uvular fricative, sometimes approximantized (Gendrot et al. 2015), often considered as free variants (Chafcouloff 1983, Fougeron 2007). /R/ therefore supposedly assimilates to the adjacent consonant's voicing, be it preceding or following it. In the present study, we investigate read words from a lesser studied variety of French: Quebec French (QF), that displays no less than 9 allophones of /R/ (Clermont & Cedergren 1979; Santerre 1979, 1982; Sankoff & Blondeau 2007). We observe the distribution of these realizations with regards to manner of articulation and laryngeal feature of both the preceding and following consonants to establish whether the realization of /R/ in QF is more subjected to regressive assimilation (as are other CC sequences in Standard French), progressive assimilation, or both.

Methodology. Our data comes from the PFC-Québec corpus (Côté 2014), covering 32 locations. We selected 29 of them (no incomplete files or illiterate speakers), for a total of 396 speakers (206 women, 190 men) born between 1921 and 1999, reading 2 word lists. The segmentation and choice of allophone is made by a trained phonetician using Praat (Boersma 2015) according to both her perception and features in the spectrograms and oscillograms:

- apical tap [ɾ] or trill [r]: Perceived as apical + 1 to 3 flappings in the spectrogram,
- uvular trill [ʀ]: Perceived as uvular + 2 to 3 flappings in the spectrogram,
- voiceless fricative [χ]: Friction noise and no F0 or voicing bar in the spectrogram,
- voiced fricative [ʁ]: Friction noise in the spectrogram and F0 detected + voicing bar,
- retroflex [ɭ]: Perceived as a retroflex + formants in the spectrogram,
- approximant [ɹ]: Formants in the spectrogram, glide-like,
- vocalized [ə]: Very stable formants in the spectrogram, schwa-like,
- deleted: No visible trace of a phone in the spectrogram - very often in clusters.

These variants are distributed unequally among speakers as a function of age, gender and location. The present study focuses on the subset of 159 speakers with /R/ realizations closer to Metropolitan French, i.e., using the uvular fricatives. Retroflex variants (only 21 tokens in a reduced number of word-forms) were also excluded. Our data thus comprises 19,821 Rs surfacing between a consonant or pause and a vowel, or vice-versa. The data is analyzed via a multilevel multinomial logistic regression model (multinom function from *nnet* package on R; formula = $Rtype \sim LeftContext + RightContext + (1|word)$), the reported p-values are obtained thanks to post hoc tests (Tuckey HSD; *emmeans* package) run on the model.

Results. Fig.1a shows that the preceding context influences the realization of /R/ ($p < 0.001$) with 63.4% and 76.4% voiceless variants after voiceless fricatives and voiceless stops respectively, against 0% ($\Delta = 63.4\%$) and 6.4% ($\Delta = 70\%$) after voiced fricatives and voiced stops ($p < 0.005$ for all two ways comparisons). Fig.1b shows that the right context also influences the realization of /R/ ($p < 0.01$) with 65.7% voiceless realizations before a voiceless stop, against 15.9% ($\Delta = 49.8\%$) before a voiced stop ($p < 0.05$). The comparison of the two environments indicates that the preceding phone impacts /R/ realizations more than the following one, e.g., 76.4% vs 65.7% voiceless /R/ after and before voiceless stop respectively

($\Delta=10.7\%$). This does not hold for pause, however, since a preceding pause correlates with only 14.2% voiceless realizations against 40.6% ($\Delta=-26.4\%$) before a following pause.

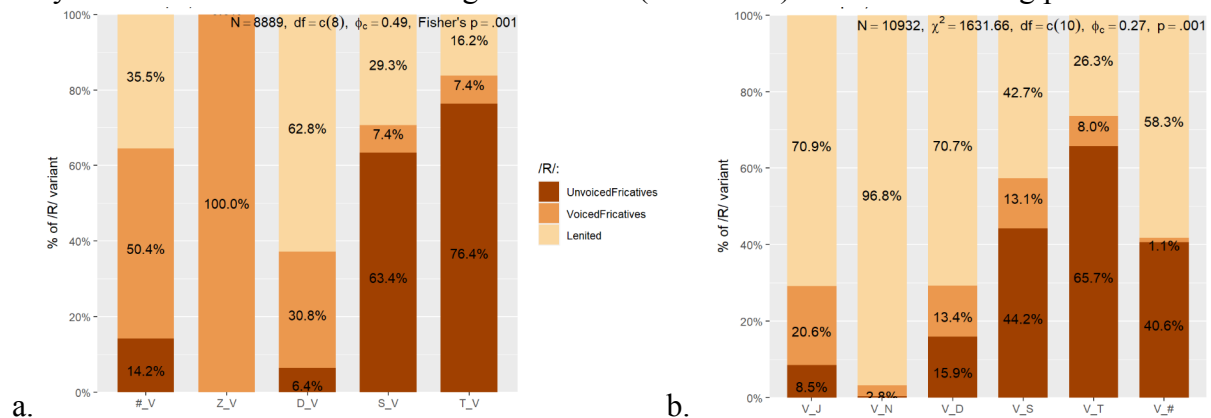


Fig. 1. Rates of voiceless, voiced or lenited (approximant-like, vowel-like and deleted) variants of /R/ among speakers using the uvular fricative as a function of the preceding (a) and following phone (b): pause (#), vowel (V), glide (J), nasal (N), voiced fricative (Z), voiceless fricative (S), voiced stop (D) or voiceless stop (T).

Conclusion and discussion. Our analysis of 19,821 tokens indicate that QF speakers favor progressive over regressive assimilation in CC sequences including a rhotic, thus patterning against the other consonantal clusters. When /R/ is not in a CC sequence, however, it is more variable before than after pause. These results seem to indicate that syllabic structure plays a role in voice assimilation, thus questioning further the phonetics-phonology interface. Future studies will investigate the other allophones of /R/ in QF and compare the present results with the realization of /R/ in Metropolitan French, as well as include acoustical measurements of /R/ voicing.

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