

## Vowel laxing in Laurentian French: lowering, centralization, and individual variation

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**Background:** The high vowels /i/, /y/, and /u/ undergo laxing in Laurentian French (LF). Work focusing on these vowels' phonological patterning (e.g., Poliquin, 2006) finds that the process is obligatory in final syllables closed by a consonant other than a voiced fricative or a rhotic. The acoustic and articulatory aspects of the process, however, remain unclear. Some studies find acoustic differences suggestive of tongue lowering and centralization in lax vowels (e.g., Martin, 2002; Polka et al., 2002), whereas Dalton (2011) only found evidence of tongue lowering. Furthermore, there is little consensus in the phonological literature on how high vowels behave before voiced fricative and rhotic codas, though experimental studies (e.g., Sigouin and Arnaud 2015) find that laxing occurs to some degree before such codas, especially rhotic ones.

**Current study:** This study is part of a larger scale project that aims to clarify the phonetic effects of vowel laxing in LF at both the population and individual level. We report our preliminary results here.

**Method:** Nine native LF speakers repeated a list of 42 words aloud six times. The list contained 24 high vowel instances (eight each of /i, y, u/) appearing evenly in four types of final syllable: open, voiced fricative coda, rhotic coda, and other coda. Formant values were measured at 25%, 50%, and 75% of the vowel's duration using Praat and the data were normalized using the Nearey 2 method.

**Results:** Two linear mixed effects models were fit for each of the three high vowels: one predicting F1, and another predicting F2. Fixed effects included syllable type (open, voiced fricative coda, rhotic coda, other coda), time, and their interactions. The models contained all possible random effects. The main findings included the following:

1. Across all participants, F1 was significantly higher before laxing codas and rhotic codas ( $p < 0.01$  for all vowels), indicating that all three high vowels become lower both in contexts where laxing is expected and before rhotics.
2. F2 was significantly lower for /i/ before laxing codas ( $p = 0.001$ ), suggesting that /i/ not only lowers, but also centralizes. However, closer inspection revealed a binary split between speakers with strong centralization and those with only lowering, suggesting individual variation in the acoustic effects of laxing.

**Discussion:** Our results support previous work that laxing involves lowering (e.g., Martin 2002, Dalton 2011) and suggest that some of the inconsistencies in existing findings on centralization could be due to interspeaker variation in the effect of laxing on F2. Furthermore, our results mirror Sigouin and Arnaud's (2015) finding that rhotic codas pattern like laxing codas, although we find what looks to be complete laxing whereas they witnessed only partial laxing. Finally, unlike Sigouin and Arnaud (2015), we witnessed no laxing before voiced fricative codas.

**Contribution & next steps:** Understanding LF laxing is important as it is the basis for an additional process of vowel harmony that has seen increased attention in the phonological literature

(e.g., Hall, 2016; Cuerrier and Reiss, 2020). We plan to complement our acoustic findings by investigating the articulatory aspects of laxing using ultrasound, and plan to rigorously assess the strength, prevalence, and distribution of LF vowel harmony.

## References

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