Canadian Raising or Canadian Shortening?

A Study of Vowel Abbreviation Patterns in Canadian English

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Summary

HYPOTHESIS:
- Canadian Raising (CR) is produced largely as an effect of a general process in English of shortening vowels before voiceless codas

GENERAL OBSERVATIONS:
- Canadians produce abbreviated CR diphthongs on par with abbreviation of other vowels
- Formant trajectories before voiced vs. voiceless codas exhibit distinct patterns among different sets of vowels

VOWEL ABBREVIATION PATTERNS:
- Non-round monophthongs: exhibit the simplest pattern of abbreviation in pre-voiceless context, truncating only the right portion of the vowel
- CR diphthongs: the entire glide trajectory is preserved while reducing the vowel nucleus duration, eliminating the nuclear steady state
- Round vowels: the full formant trajectory pattern is maintained for both voiced and voiceless codas, while still exhibiting abbreviation in pre-voiceless context

Participants and Data

Data collection took place in Winnipeg, Canada (pop. 793,000), centred within the *General Canadian English* (CanEng) dialect region

Dialect regions of N. American English

- n=20 female participants ages 20-59 recruited in 2014-2015 for wordlist recitation task
- Wordlist focused primarily on diphthongs /aj, aw, ɔj/ in a range of monosyllabic environments; other vowels* also included in frames /h__t/ and /h__d/
- n=3,068 tokens analyzed using *Praat* and *R*

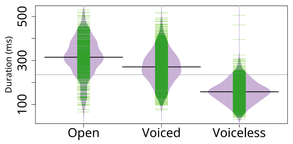
** The vowel /ʊ/ before voiced codas, e.g.* hood, *was accidentally omitted from the wordlist, and so is not included in the analysis.*

Vowel Abbreviation

- English vowels are abbreviated before voiceless codas (*Pre-Voiceless Vowel Abbreviation* or PVVA)
- PVVA and CR environments are identical: **/__ [–voice]**
- Joos (1942) argued that CR replaces PVVA in CanEng
- Data indicates otherwise; CR diphthongs are also abbreviated, on par with other vowels

Pre-voiced vs. pre-voiceless durations significantly (p<0.001) *different for all vowels*

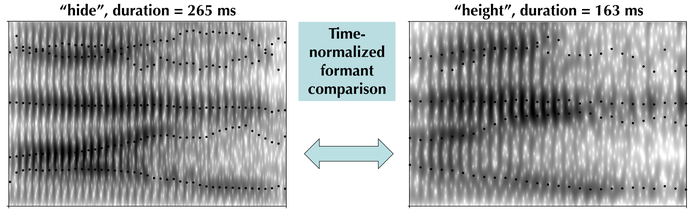
Vowel duration by coda type



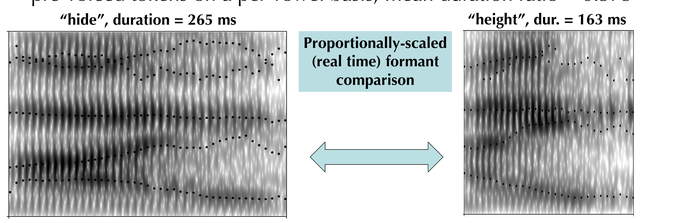
Comparing Formant Trajectories

Formants measured at 5% intervals of vowel duration (20 timepoints). Trajectories of voiced vs. voiceless codas compared via two scaling methods:

1. **Time-normalized (relative time)** – each timepoint matched one-to-one, ignoring any durational differences



2. **Proportionally-scaled (real time)** – for pre-voiceless tokens, each timepoint position is re-scaled down by the *duration ratio* of pre-voiceless : pre-voiced tokens on a per-vowel basis; mean duration ratio = 0.573

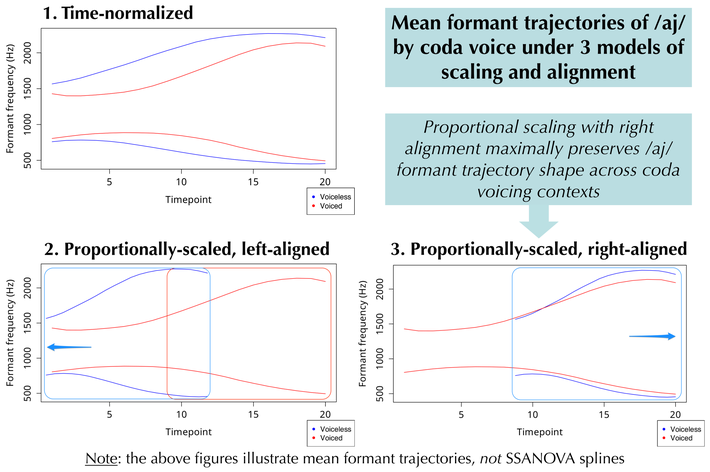


Under proportional-scaling method, timepoints aligned at either left or right edges, i.e. vowel onset/offset = three models of scaling/alignment:

1. **Time-normalized** (relative time)
2. **Proportionally-scaled** (real time)**, left-aligned** (vowel onset)
3. **Proportionally-scaled** (real time)**, right-aligned** (vowel offset)

Mean formant trajectories of /aj/ by coda voice under 3 models of scaling and alignment

Proportional scaling with right alignment maximally preserves /aj/ formant trajectory shape across coda voicing contexts



Note: the above figures illustrate mean formant trajectories, *not* SSANOVA splines

SSANOVA and **GAMMs** techniques used to evaluate the best-fitting scaling/alignment model (of three) for each vowel, which preserves formant trajectories most faithfully across coda voicing contexts:
- SSANOVA: visual comparison of splines (maximum overlap)
- GAMMs: Akaike Information Coefficient value (lowest)

SSANOVA/GAMMs agree on 9 of 12 vowels, with each scaling/alignment model represented in the inventory:
1. **Round (nucleus) vowels /o, ɔj, u/**: time-normalized
2. **Non-round monophthongs /ɑ, æ, ɛ, ʌ/**: scaled, left-aligned
3. **Low-rising diphthongs /aj, aw/**: scaled, right-aligned

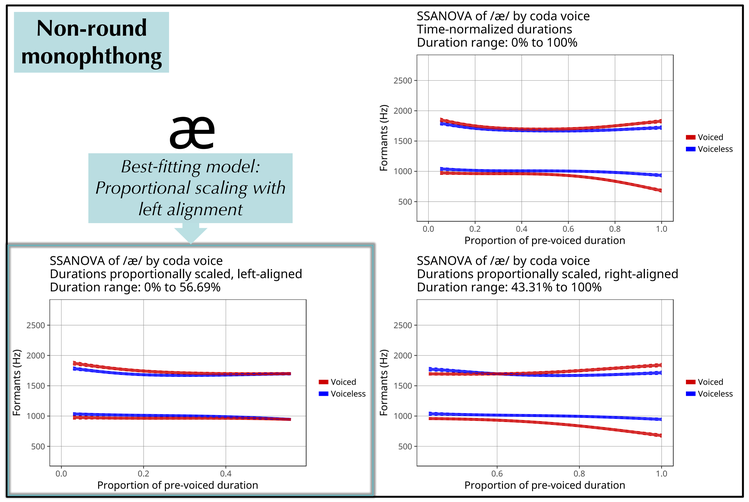
Vowel Abbreviation: Three Patterns

Three patterns of abbreviation illustrated by SSANOVAs of vowels /æ, aj, ɔj/

Non-round monophthong

æ

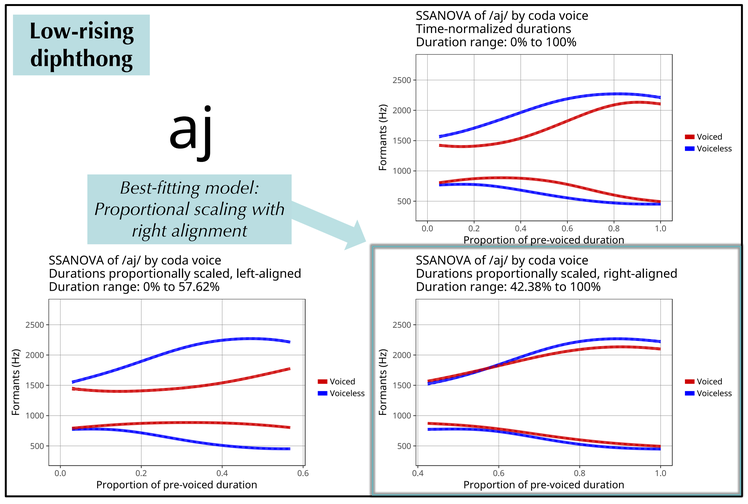
Best-fitting model: Proportional scaling with left alignment



Low-rising diphthong

aj

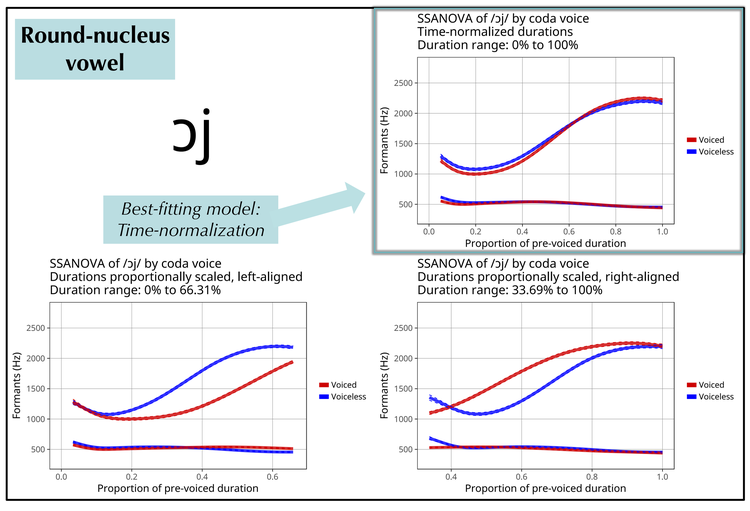
Best-fitting model: Proportional scaling with right alignment



Round-nucleus vowel

ɔj

Best-fitting model: Time-normalization

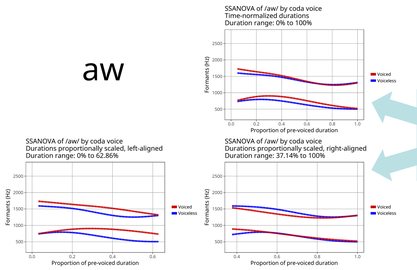


Unresolved Issues

- SSANOVA method weak on non-round monophthongs
- GAMMs reliant on very small differences in some cases
- SSANOVA/GAMMs analyses differ on /i, e/
- /ɪ/ patterns (weakly) with /aj, aw/ under both methods
- Formant patterns for (especially lax) monophthongs are very similar across both coda voice contexts, e.g. /æ/
- /aw/ could be argued to follow time-normalization, like round vowels — influence of round glide /w/?

aw

Best-fitting model: somewhat debatable



Going Forward…

- Full description of PVVA in Articulatory Phonology, implemented as OT-style constraints on coordination of gestures:
  - PVVA: constraint forcing early occurrence of coda devoicing gesture, intruding on vowel
  - Round vowels: lip-rounding gesture "anchored" at both edges of lingual gesture(s),
- Comparison of Winnipeg data to two other dialects largely similar to CanEng:
  - No diphthong-raising, e.g. Colorado (acquired)
  - Raising of /aj/ but not /aw/, e.g. North Dakota (pending)
- Account for dialect-specific formant patterns in articulatory model:
  - CR: constraint on preservation of glide gesture, forcing nuclear gesture to be temporally minimized
  - Other dialects: dependent on observed differences

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