Vowel-specific metrics of phonological nasalization in French

Canadian Linguistics Association

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Plan

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- **Case study:** Many instrumental studies on nasal coarticulation in French show high rates of nasality on high vowels (esp. Delvaux et al. 2008, Rochet & Rochet 1991, Spears 2006)...
- ...to the point where we might consider it phonological.
- But not all vowels are nasalized equal. How to fairly & accurately model nasality, then?

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- Pilot a vowel-specific measurement of nasality for an instrumental corpus of French, and
- Compare these results against durational data to show that /i, y/ nasalization in French is phonological.

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The high > low parameter

- **Aerodynamics:** High vowels produced with high degree of intraoral pressure → greater nasal airflow (e.g., Clarke & Mackiewicz-Krassowska 1977, Shosted 2012) and less velopharyngeal opening (e.g., Al-Bamerni 1983).

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- **Acoustics:** Same amount of nasal coupling has stronger effects on high vowels (House & Stevens 1956).
- **Perception:** Low vowels require much greater nasal coupling and time to be perceived as nasal, compared with high vowels (e.g., Maeda 1982).

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- Lower position on low vowels → easier to nasalize (e.g., Straka 1955)?
- BUT also leads to "leakage" in oral contexts (Bell-Berti 1973, Chen & Wang 1975).

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- **Solution:** Let's let each vowel quality define its own nasal threshold.

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- Lower aperture may then favour nasality.

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- The velum as a sluggish articulator (Bell-Berti 1993, Ohala 1975), with oro-nasal transition times around 250 msec. (e.g., Bell-Berti 1980, Dalston & Seaver 1990).

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- Reports of significant high vowel nasalization in French may be an artefact of this interaction.
- **Solution:** Let's see how nasality interacts with duration, vowel by vowel (*à la* Solé 1992, 2007).

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- **Procedure:** Self-paced reading task. List(s) randomized 3 times for each speaker.

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- *Nasal phase*: no. points whose nasal energy > nasal threshold (of most interest for vowels in **pre-nasal** settings)
- Hypothetical example:
  - Mean nasal energy of all /i/ vowels of speaker x in non-nasal settings = 0.023 $\text{Pa}^2\cdot\text{s}$; sd = 0.019
  - x's /i/ nasal threshold = 0.061
  - How many points of /i/ in /in/ exceed? Overall V length?

Results

Average vowel nasality threshold & standard deviation

Vowel	*Threshold*	*sd*
/a/	0.015	0.014
/e/	0.021	0.018
/ø/	0.032	0.032
/o/	0.024	0.027
/i/	0.023	0.019
/y/	0.024	0.017
/u/	0.026	0.022

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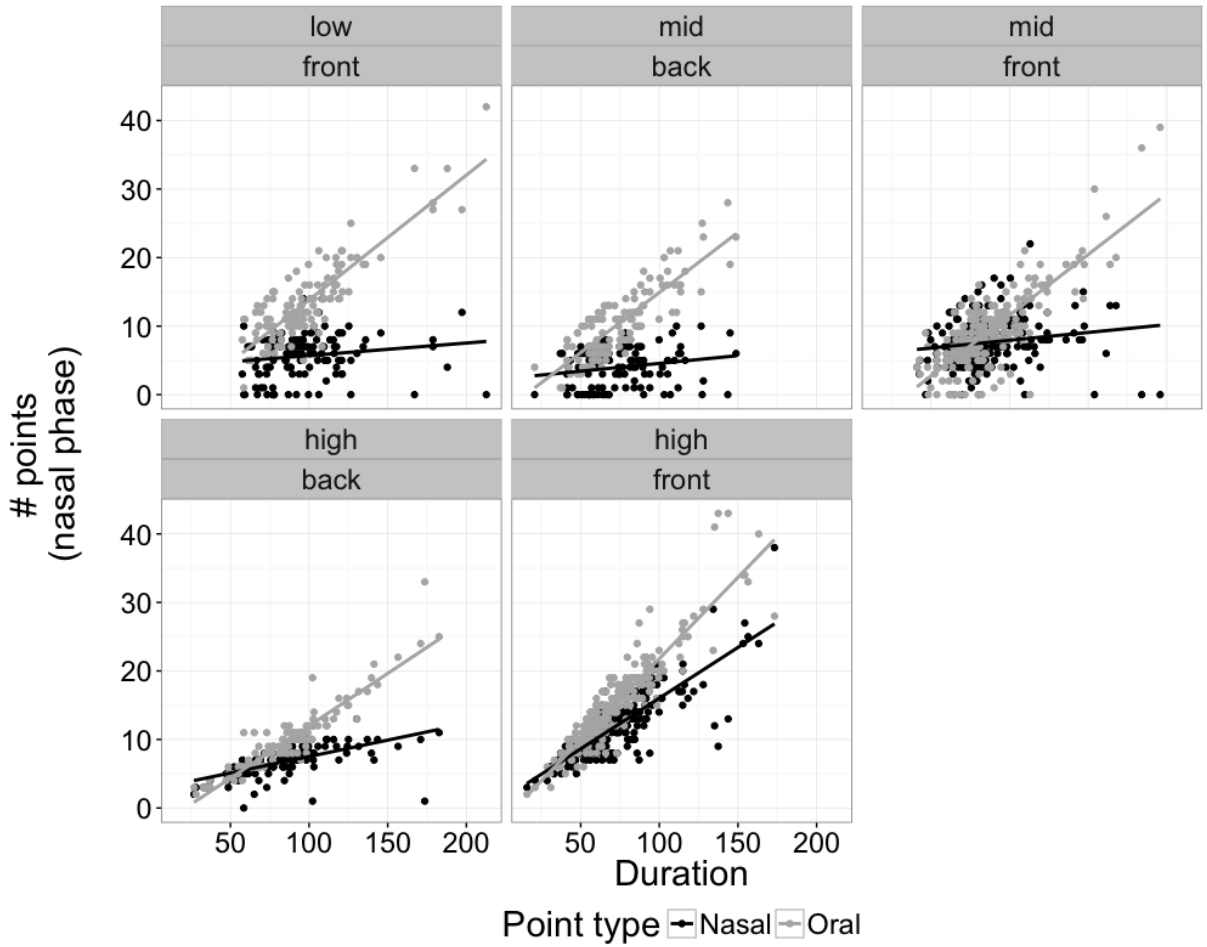
- **NB:** Some speakers show greater diversity among thresholds than others.



Nasal phase duration increases only for high front vowels, suggesting gestural anchorage with respect to V, not N.

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- Even after attempting to remove acoustic/aerodynamic bias, high (front) vowels demonstrate high levels of nasal coarticulation.
- Though on average shortest in the corpus, these vowels demonstrate a nasal phase increasing proportionately to their overall duration, suggesting a deliberate, phonological function.

Open questions

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- Progressive nasalization is more pervasive and intense in French. Is it phonological as well?
- Does syllable structure matter, e.g., what about internal /i.n/?

Fin

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