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The Contextual Effects of Nasal Vowels on Velopharyngeal Opening in Québécois French

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Introduction

Nasality in speech is typically characterized in a binary fashion (i.e [+/-NASAL]).

- Oral sounds: nasal cavity “closesd”, felum flush with posterior pharyngeal wall
- Nasal sounds: velum dropped making velopharyngeal opening (VPO)

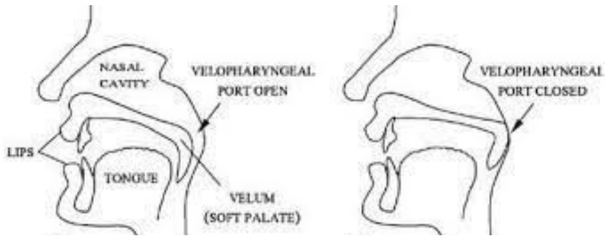

Figure 1: Sagittal view of the oral and nasal cavities, with an open (left) versus closed (right) velopharyngeal port.

Contextual Nasalisation

The coarticulatory nasalisation of a speech segment due to the nasality of the surrounding environment.

- Anticipatory: nasalisation of an oral sound preceding a nasal sound (e.g., **V**C̃, **V**Ṽ)
- Carryover: nasalisation of an oral sound following a nasal (e.g., C̃**V**, Ṽ**V**)

Background

French carryover nasalisation found to have greater VPO than anticipatory nasalisation (e.g., [1])

- However, previous studies had limitations
  - limited data (2 participants);
  - indirect measurements of VPO (e.g., airflow, EMA)

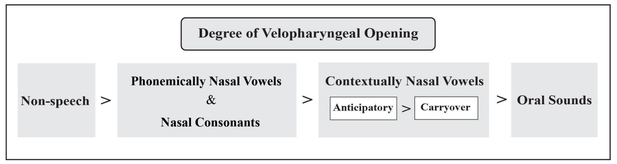

Figure 2: A summary of findings from past studies regarding gradation of nasalisation in various segments.

As such, the present study asks:

Does degree of coarticulatory nasalisation vary between different phonemic contexts?

Methods

- Université Laval’s X-ray cineflurographic database [2]
  - 9 Québécois French speakers (4F, 5M)
  - Audio and Images extracted from videos
  - Line for path of velum (Fig. 2) drawn in ImageJ for each speaker, measuring number of black pixels
  - Montreal Forced Aligner and Praat script -- align segments + extract timing information
  - R for statistical tests: linear mixed effects models for effects of type of nasalisation and sex

Figure 3: The line drawn for the path of velum movement for one speaker.

Results

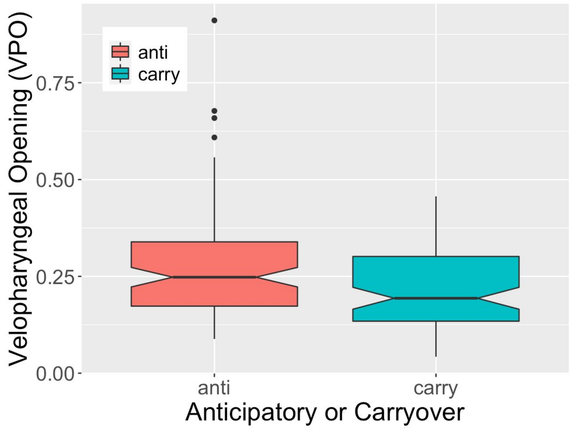

Figure 4: VPO in anticipatory (N = 108) versus carryover (N = 87) nasalisation.

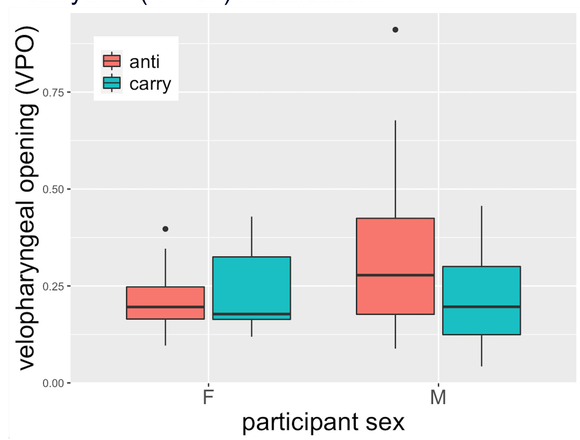

Figure 5: VPO of carryover and anticipatory nasalisation between participant sex groups.

- No main effect of type of nasalisation on VPO
- For males, VPO in anticipatory nasalisation (M = 0.31, SD = 0.16) was significantly larger than in carryover nasalisation (M = 0.21, SD = 0.10).

Discussion

- Sex affects VPO in contextual nasalisation
- Extent of VPO greater in anticipatory nasalisation than in carryover nasalisation for males in Québécois French
  - Suggests phonetic gradation in nasality depending on speech context
  - Sex difference may be due to more coronal velic closure in males than in females [3]

Study limitations and future directions:

- Unable to capture full opening due to sagittal view of videos
- May be dependent on dialect (other studies were done using France French speakers)
- Motivates looking at more contexts for contextual nasalisation and individual differences

Acknowledgements

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References

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[2] Munhall, K. G., Vatikiotis-Bateson, E., & Tohkura, Y. (1995). X-ray film database for speech research. The Journal of the Acoustical Society of America, 98(2), 1222-1224. DOI:10.1121/1.413621

[3] Jordan, H. N., Schenck, G. C., Ellis, C., Rangarathnam, B., Fang, X., & Perry, J. L. (2017). Examining velopharyngeal closure patterns based on anatomic variables. The Journal of craniofacial surgery, 28(1), 270.