

First Results of an RT-MRI study on the influence of context in the synchronization of European Portuguese nasal vowels

Conceição Cunha¹, Samuel Silva², António Teixeira², Nuno Almeida², Jens Frahm³ Arun Joseph³,

¹ Institute of Phonetics, LMU Munich, Germany; ² Aveiro University, Portugal; ³ Max Planck Institute for biophysical Chemistry, Germany
contact: cunha@phonetik.uni-muenchen.de

European Portuguese (EP)

- 5 phonemic nasal vowels with three different tongue heights & two high vowels /i, u, ẽ, õ, ẽ/.
- The coordination of oral and nasal gestures is delayed in EP (Oliveira, 2009, Martins, 2012)
- Late alignment of the gestures in Brazilian Portuguese (Meireles et al, 2015)
- Influence of nasal context for the velum synchronization in unknown
- Barlaz et al. (2018) showed significant differences in tongue fronting, height, and shape between oral /a, e, u/ and their nasal counterparts /a~/, /e~/, and /u~/ in this variety.
- Cunha et al (2018, 2019) shows adjustments in tongue height, between oral vowels and their nasal counterparts in EP.
- Quality differences between oral and nasal vowels not yet studied.

MAIN AIMS:

- a better description of the nasal system of EP
- influence of preceding consonant (oral or nasal bilabial) on the synchronisation of the velum gesture with the lips

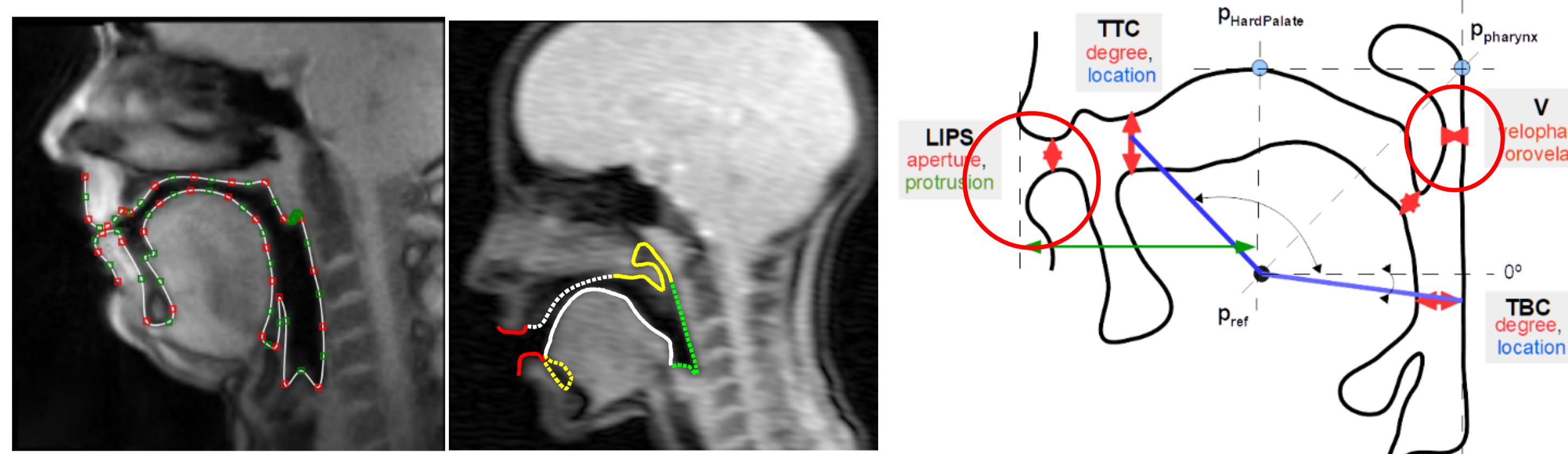
Predictions

- nasal gestures start late in EP nasal vowels
- nasal vowel starts earlier in nasal consonantal context

Methods

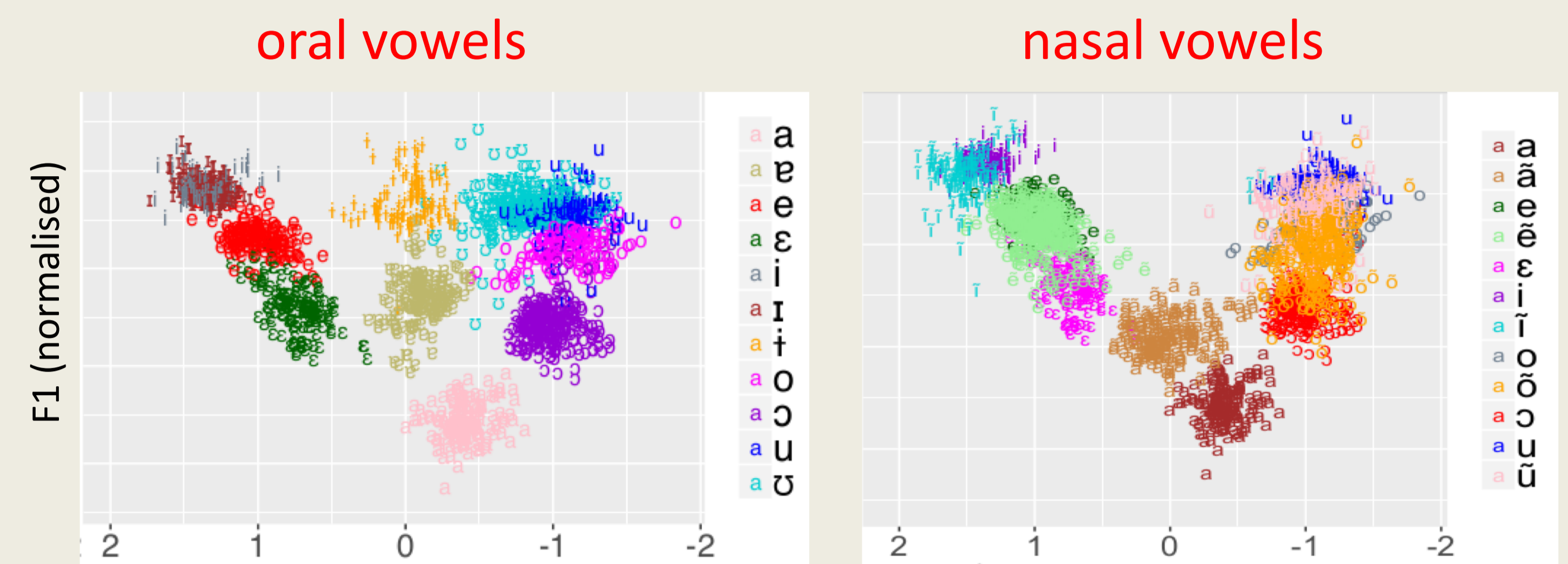
Articulatory study

- Materials:** *Diga| ouvi| leio* 'Say| I heard| I read' TW *baixinho|depois* 'gentle, after') TW = *pato panto mato manto*
- Speakers:** 25 speakers (acoustics)
- RT-MRI:** 3 Tesla Siemens Prisma Fit MRI System equipped with a 64-channel head coil (Niebergall et al. 2013, Frahm et al. 2014).
- Low-flip angle gradient-echo sequence with radial encodings and a high degree of data undersampling
- Synchronous audio recorded by means of an optical microphone (Dual Channel-FOMRI, Optoacoustics).
- Frame selection criteria:** Based on the audio annotations; *Identification of target and consonantal context (pre and post target) image frames



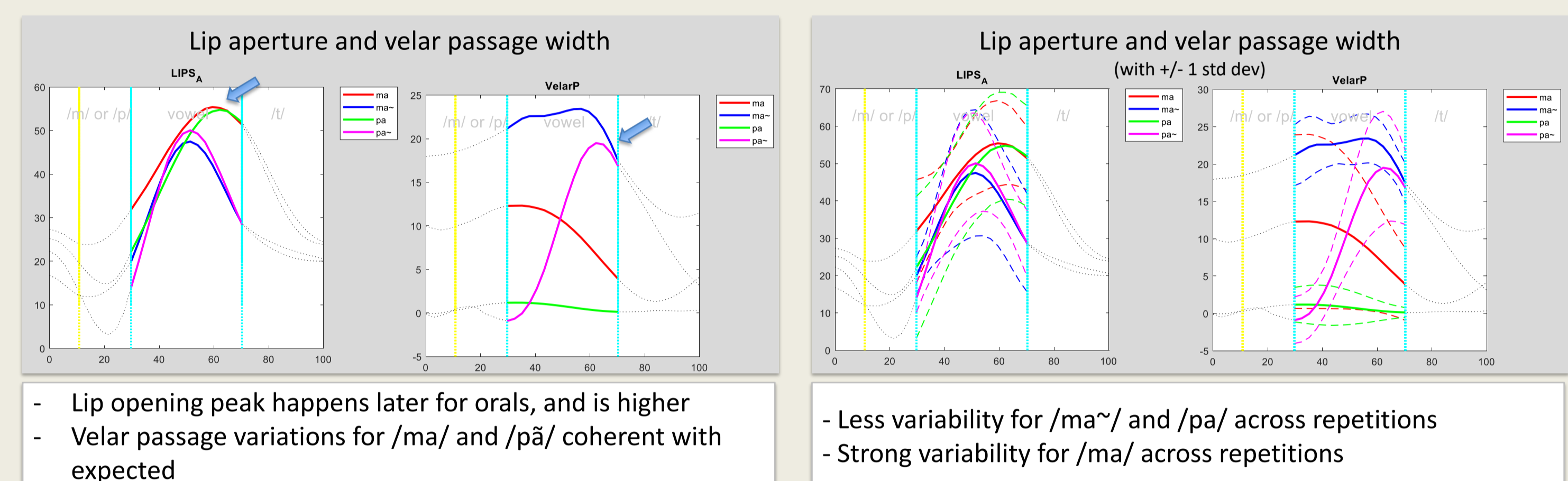
- Articulatory Variables:** Vocal tract contours for the selected data were processed to extract LIP APERTURE and VELOPHARYNGEAL PASSAGE width, over time
- Time normalization:** Multiple repetitions for each sound and context are considered
- All repetitions for all contexts for a particular vowel are time aligned, with pre-target, target, and post-target treated independently
- The result is a set of repetitions with the same number of frames to represent context and target
- Overall Plots:** The multiple repetitions for each context are considered to compute an average curve

Acoustic data

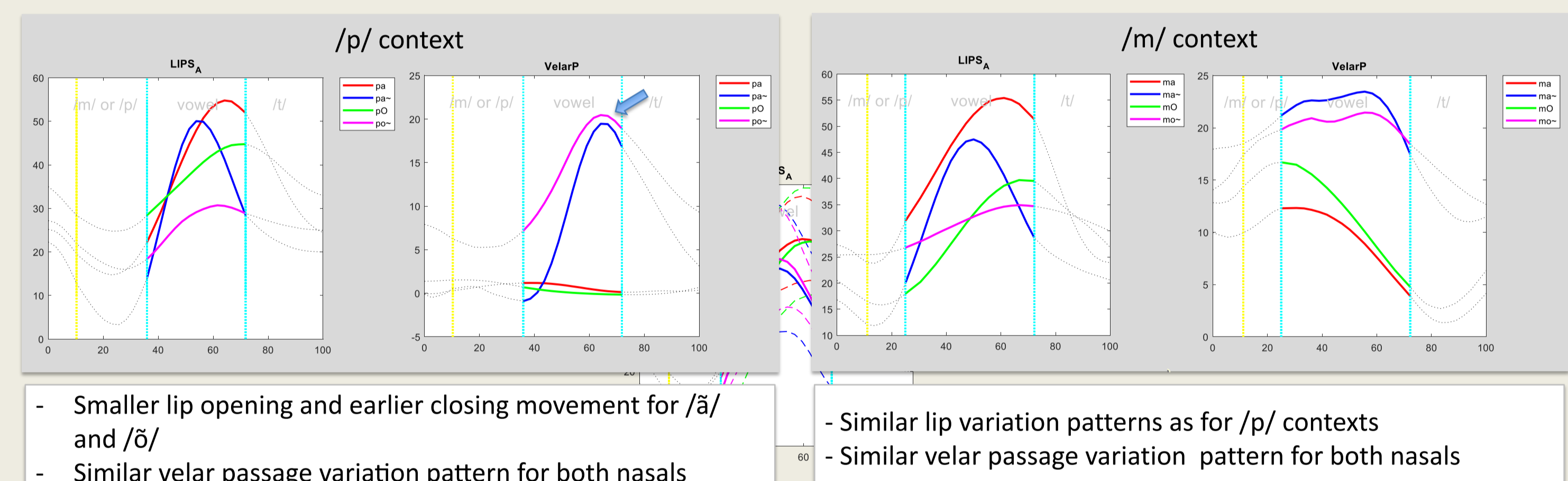


Illustrative Articulatory Behaviour from RT-MRI data

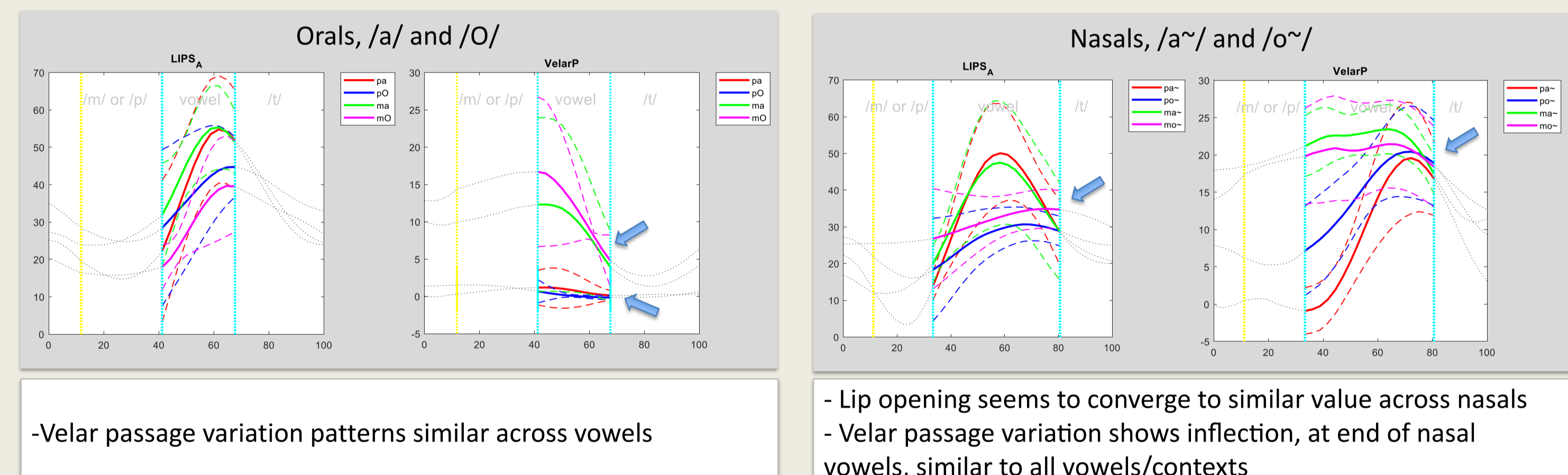
1) /a/ and /a~/, all contexts



2) /a/, /a~/, /o/, /o~/, in /p/ or /m/ context



3) Orals or nasals, all contexts



Conclusion & Further Work

- Timing pattern between oral and nasal; convergence in the velum closing movement
- Greater lip aperture for oral than nasal vowels related with more peripheral oral vowels
- Coherent velar passage variation across vowels
- a good grasp of the articulatory behaviour regarding the considered variables.
- These need to be further developed with considerations regarding the oro-velar passage and a quantitative assessment of different velar movement stages

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