



# Learning new inter-gestural timing patterns

How does coproduction/coarticulation help Belgian French speakers to learn how to produce Southern French nasal vowels?

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## Introduction

### General research project

- This study is part of a broader research project investigating the processes involved in the acquisition of a **new phonetic variant in L2 learning**. (Harmegnies et al. 2005, Delvaux et al., 2008a)
- Our experimental paradigms are specifically designed to attempt a better understanding of the **production/perception link** in phonetic learning.
- We also implement in the laboratory phonetic training designs based on (presumably efficient) **didactic processes** used in the classrooms.

### This study

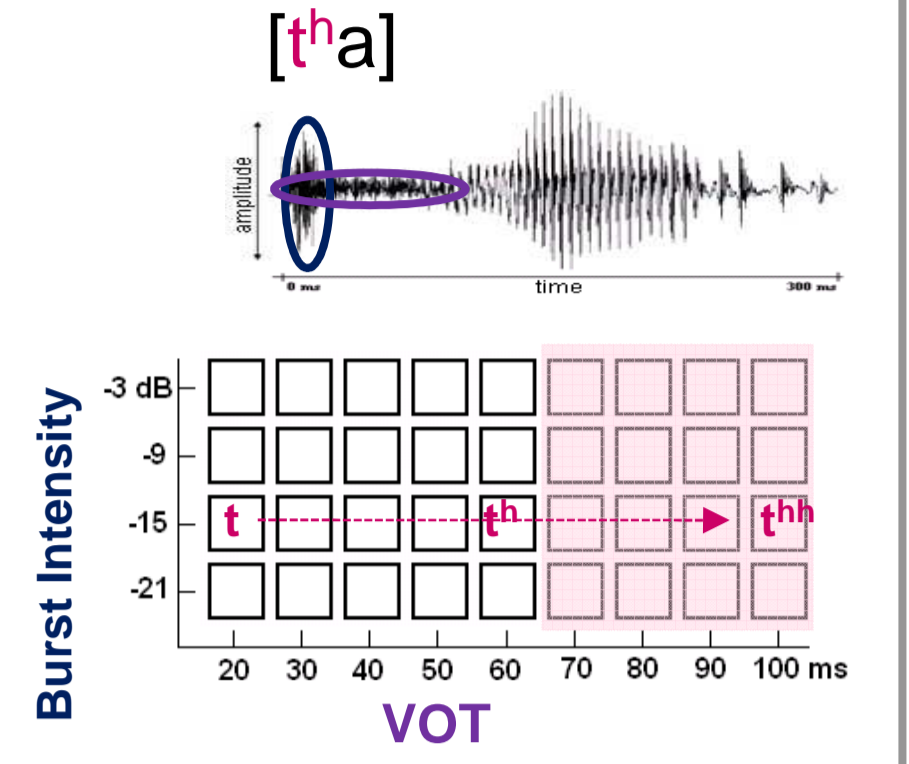
- Main working hypothesis here: the mechanisms involved in the processing of speech sounds arising from **regional variation** are partly similar to those involved in L2 learning.
- We study the acquisition of the appropriate inter-gestural timing for the production of nasal vowels from listeners of a given regiolect (R1; Belgian French) when they are exposed to the productions of a second regiolect (R2; Southern French).
- The case of **French nasal vowels** is particularly appropriate because their phonetic realization strongly differs across regiolects (Teston & Demolin, 1998; Clairet, 2008).
- We test for a potential **facilitating effect** of velar coproduction/coarticulation in the mastering of Southern French (SF)-like nasal vowels by Belgian French (BF) speakers.

## Preliminary study (1)\_ Acquisition of new phonetic control regimes in L2

(Delvaux et al., 2008a)

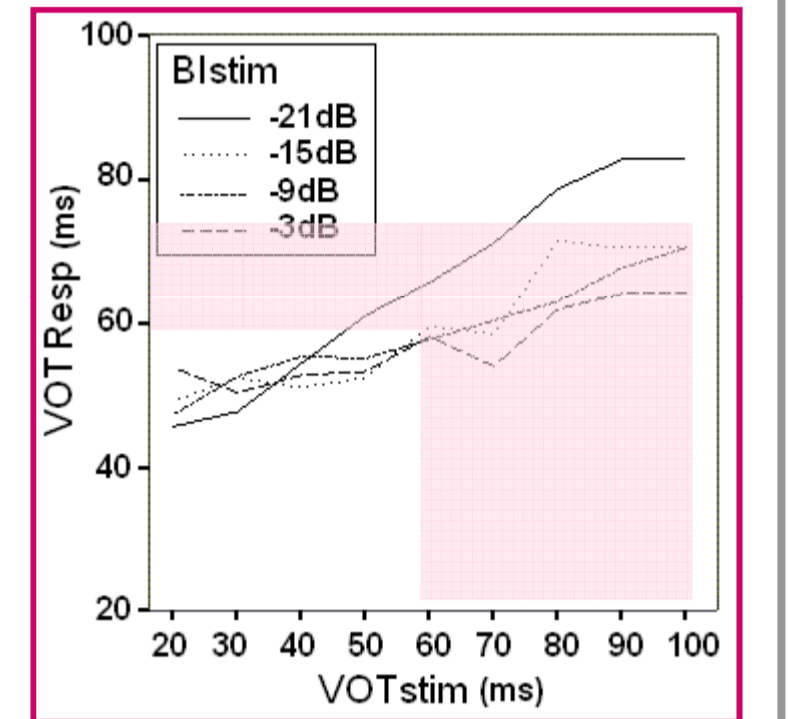
### Experimental design

- One didactic process: 'adapted pronunciation'
- French L1 English L2; 15 participants
- Phonetic target: [tʰa]
- Stimuli consist in a 2-dimensions continuum:
  - **VOT**: 9 levels ranging from 20 to 100 ms
  - **Burst intensity**: 4 levels: 1/2, 1, 2, 4 \* instantaneous amplitude
- Imitation task: 'please reproduce as faithfully as possible the word (you just heard), as if it was from a foreign language'



### Results

- As a group, speakers were **quite efficient** in the imitation task: the longer the VOT in the stimulus, the longer the VOT in the response
- A burst of reduced intensity favours longer VOT in the response
- Extra-long VOT in the stimuli trigger long VOT in the response
- Some evidence **in favor of adapted pronunciation?**
- Large inter-individual variation... to be investigated (Delvaux et al., 2008b)



## Preliminary study (2)\_ Inter-gestural timing in Belgian French (BF) vs. Southern French (SF) nasal vowels

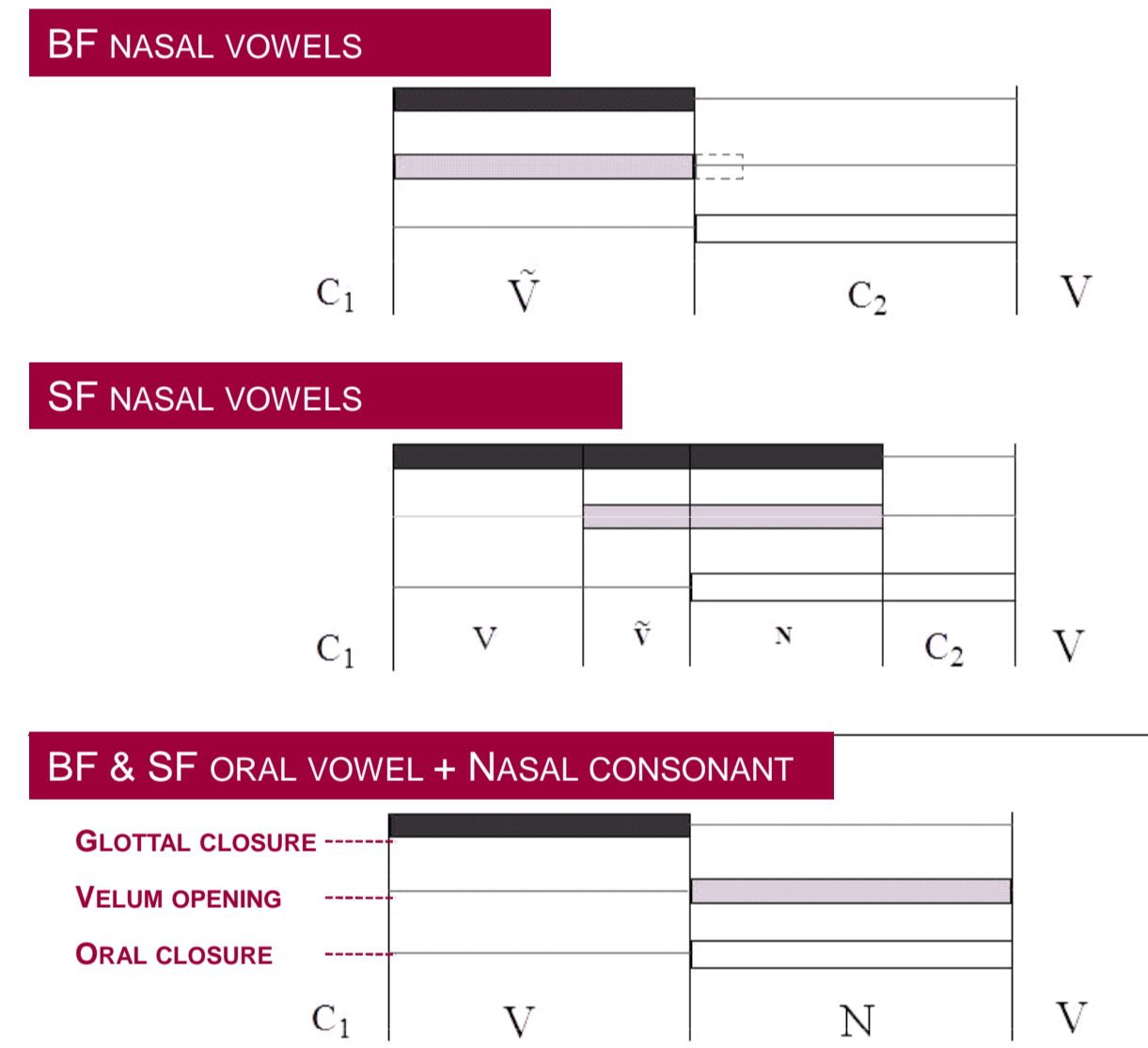
(Delvaux et al. 2010)

### General results

- 24 BF speakers (Liège, Tournai) & 24 SF speakers (Marseille, Toulouse)
- Corpus: 12 triplets made of bi-syllabic (pseudo)-words:
 

c <sub>1</sub> v.c <sub>2</sub> v	kote	sote	pope	tobe	sate	tate	rape	sape	kete	tete	pete	sete
c <sub>1</sub> v̄.c <sub>2</sub> v	kōte	sōte	pōpe	tōbe	sāte	tāte	rāpe	sāpe	kēte	tēte	pēte	sēte
c <sub>1</sub> v̄.NV	kone	sonne	pone	tone	sane	tane	rame	same	kene	tene	pene	sene
- 3 repetitions

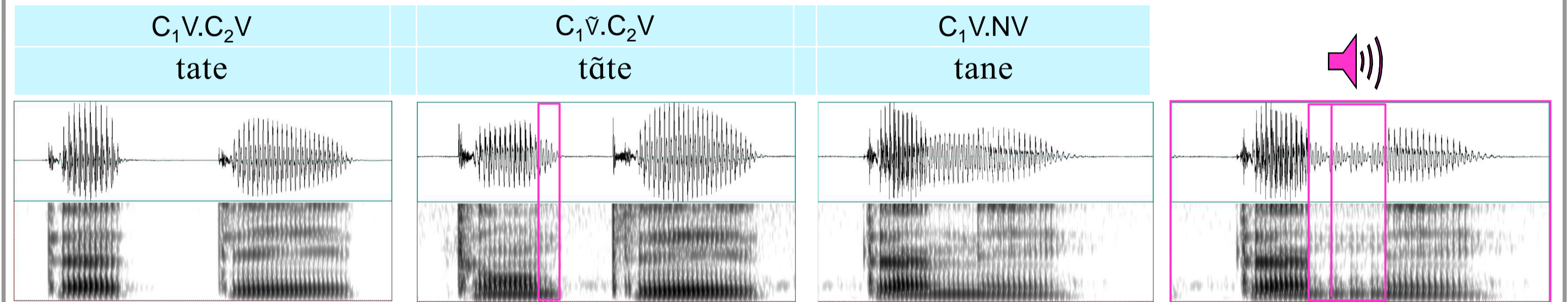
- Results suggest that the major difference between BF and SF nasal vowels lies in **the specific timing of a velum gesture of fixed duration** relatively to the glottal and oral gestures



- Mastering vowel nasalization for BF R1 / SF R2 speakers involves acquiring the appropriate motor control regimes to produce new patterns of inter-gestural timing, i.e. **desynchronizing** the velum gesture from the glottal and/or oral gestures (in /v.c<sub>[stop]</sub>/ sequences).

### Specific results

- Observation
  - In BF productions, 5 productions from 2 speakers in which there is a **short nasal appendix** (late velic rising):
    - S10 (male, 1978, employee): kēte
    - S7 (male, 1977, employee): pōpe, tōbe, sāte, tāte



- Probably **coproduction** effect
  - = coproduction of 2 conflicting gestures within a single segment
    - In back vowels /ɔ̄, ā/, the isthmus is small between the lowered velum and the raised tongue body
      - **oral closure + nasal leakage** → N stop
  - Evidence for word-final nasal coda emergence preferably in (mid-high) back vowels in French (Shosted, 2005)
- And/or maybe **coarticulation** effect??
  - = coarticulation of 2 overlapping gestures across segments
    - In v̄<sub>1</sub>c<sub>[back]</sub>, if the raised tongue body reaches the velar region before VP closure
      - **oral closure + nasal leakage** → N stop

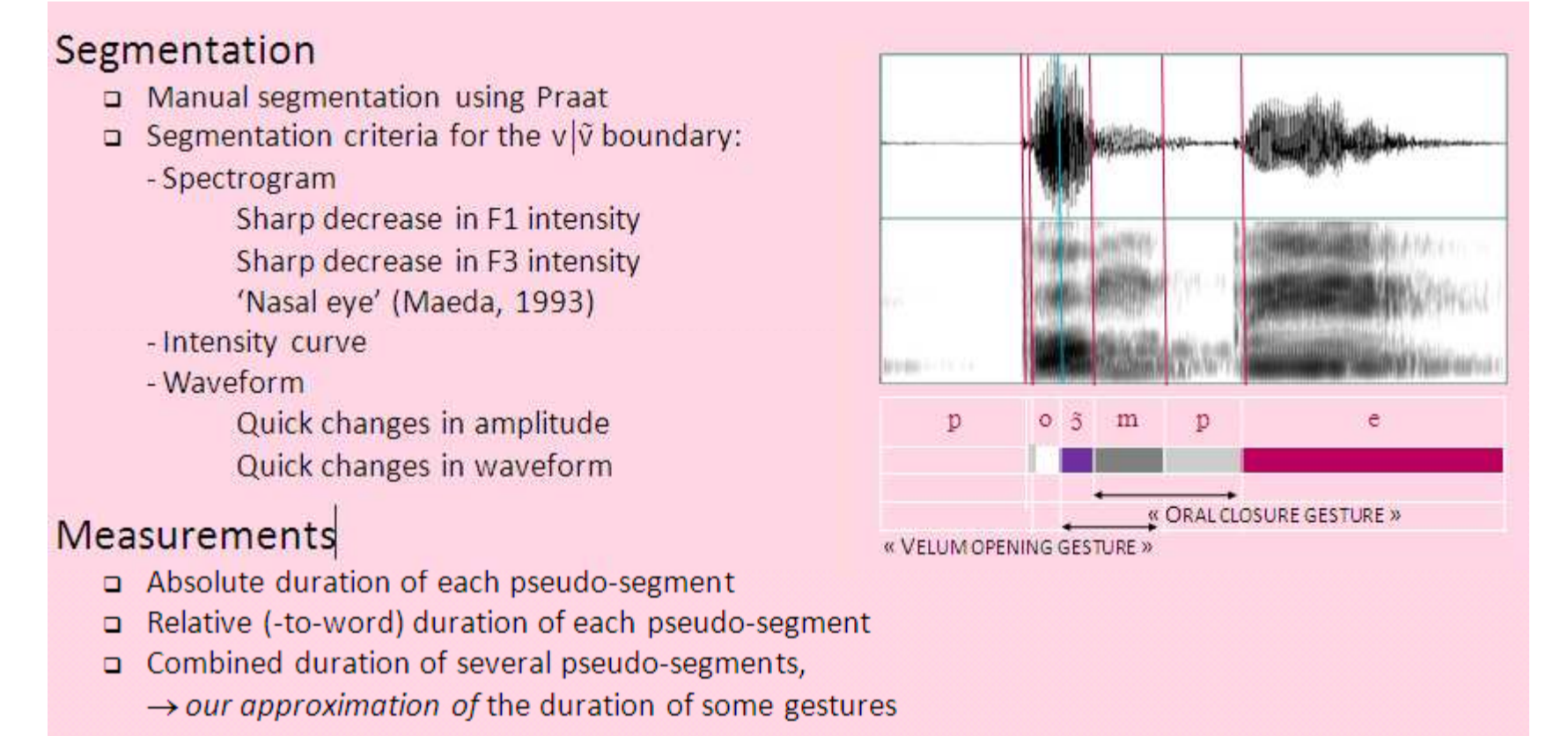
## Experiment

### Hypothesis

- Mastering SF nasal vowels for BF speakers involves **desynchronizing** the velum gesture from the other gestures, in that velum lowering is delayed relatively to the onset of AND perseveres after the offset of the vowel gesture. This desynchronization may be easier to master in (due-to-coproduction-and/or-coarticulation-effects) '**favouring conditions**', i.e. in /c<sub>[back stop]</sub>v̄<sub>[back]</sub>·c<sub>[back stop]</sub>v/ sequences, where back nasal vowels are produced in the context of back oral consonants.

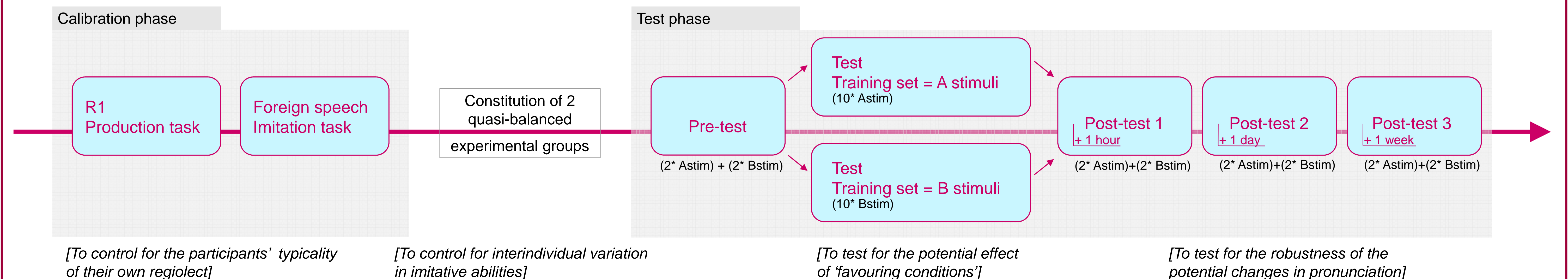
### Experimental design

- One didactic process: verbo-tonal use of coproduction/coarticulation effects
- BF R1 SF R2 speakers; 20 Belgian French speakers
- Phonetic target: SF nasal vowels /v̄/ = [v̄<sup>N</sup>]
- Main task = Imitation task: 'please reproduce as faithfully as possible the word (you just heard), as if it was from a foreign language'
  - Imitation vs. learning
  - No explicit reference to the system of Southern French, although BF speakers do have a (cliché?) representation of SF
- Size of the velum gesture and timing of the velum gesture relatively to the oral and glottal gestures is derived from acoustic measurements
- 2 sets of stimuli
  - A Training set: [+coproduction, +coarticulation] kōko, kōgo, kōku, kōgu, gōko, gōgo, gōku, gōgu
  - B Training set: [-coproduction, -coarticulation] tēte, tēde, tēti, tēdi, dēte, dēde, dēti, dēdi



(Delvaux et al. 2010)

### Experimental paradigm



[To control for the participants' typicality of their own regiolect]

[To control for interindividual variation in imitative abilities]

[To test for the potential effect of 'favouring conditions']

[To test for the robustness of the potential changes in pronunciation]

### Questions/Predictions

- Will the participants repeating the A stimuli training set perform better in the production of SF nasal vowels? **YES**.  
Will they produce a longer velum opening gesture (offset desynchronization) or a really desynchronized gesture (onset AND offset desynchronization)?
- Will better imitating individuals perform better in both experimental groups? **YES**.  
What about the size of this potential individual effect vs. the size of the potential 'favouring conditions' effect?