



# THE EFFECT OF PHONETIC CONTEXT ON SPEAKER INFORMATION IN NASAL CONSONANTS

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## 1 INTRODUCTION

## 3 RESULTS

### Speaker characteristics

Nasals have low within- and high between-speaker variation (Rose, 2002)

### Linguistic information

- **Phonetic context:** coarticulation larger in /m/ than in /n/ (Su et al., 1974)
- **Syllabic position:** different gestural timing for onsets and codas (Byrd et al., 2009; Krakow, 1993)

### Is there a relation between speaker characteristics and linguistic information?

- What is the context-dependency of nasal consonant acoustics?
- What is the role of linguistic information in speaker classification?



### Context-dependency

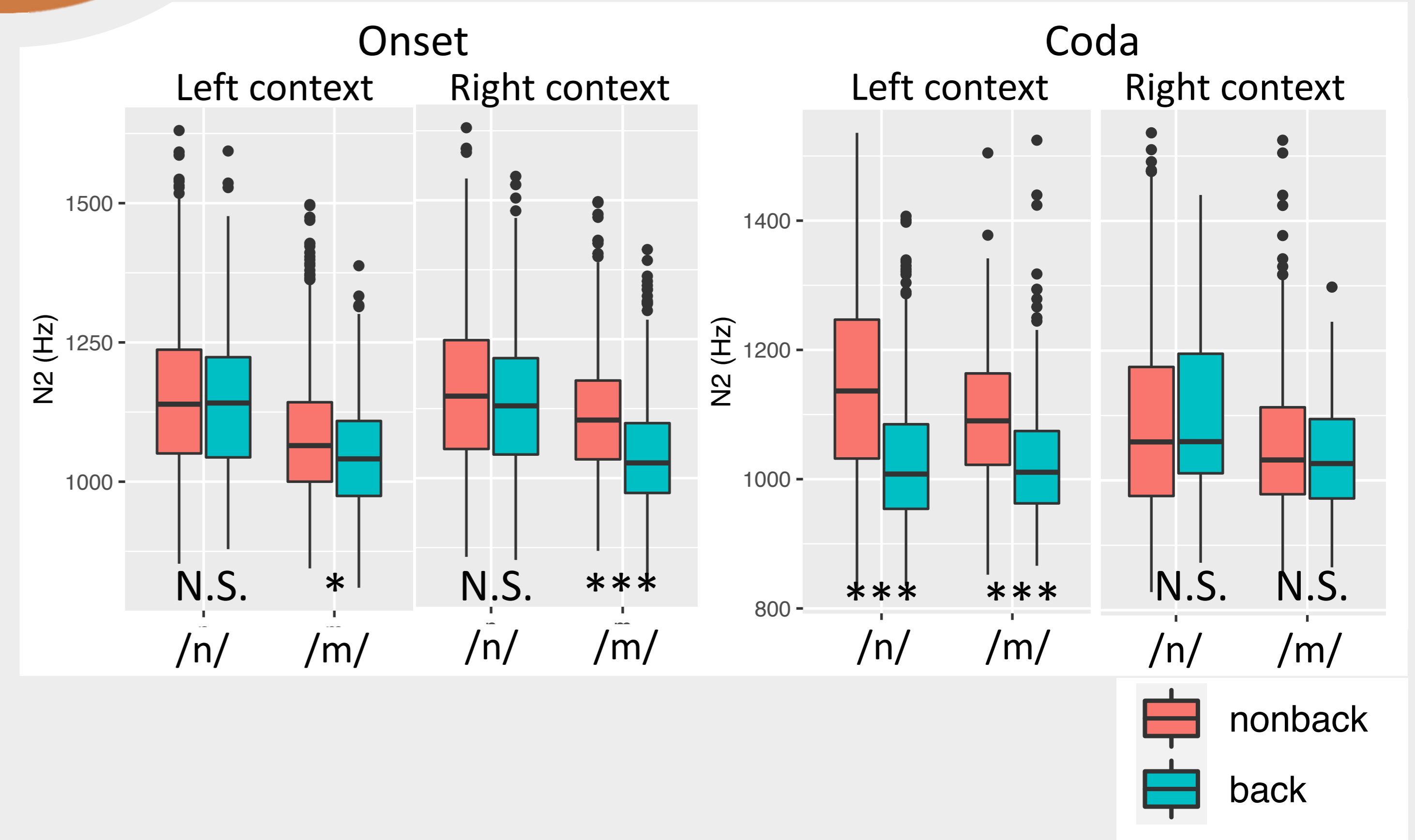
**Dur:** m > n

**BW:** m > n

**N3:** no effects

**N2:** see figure ↓

**CoG:** like N2



## 2 METHODOLOGY

### Spoken Dutch Corpus - telephone dialogues

(Oostdijk, 2012):  
/n/ and /m/, 60 adult male speakers of Standard Dutch  
→ 4,217 /n/ tokens and 3,143 /m/ tokens

### Phonetic context:

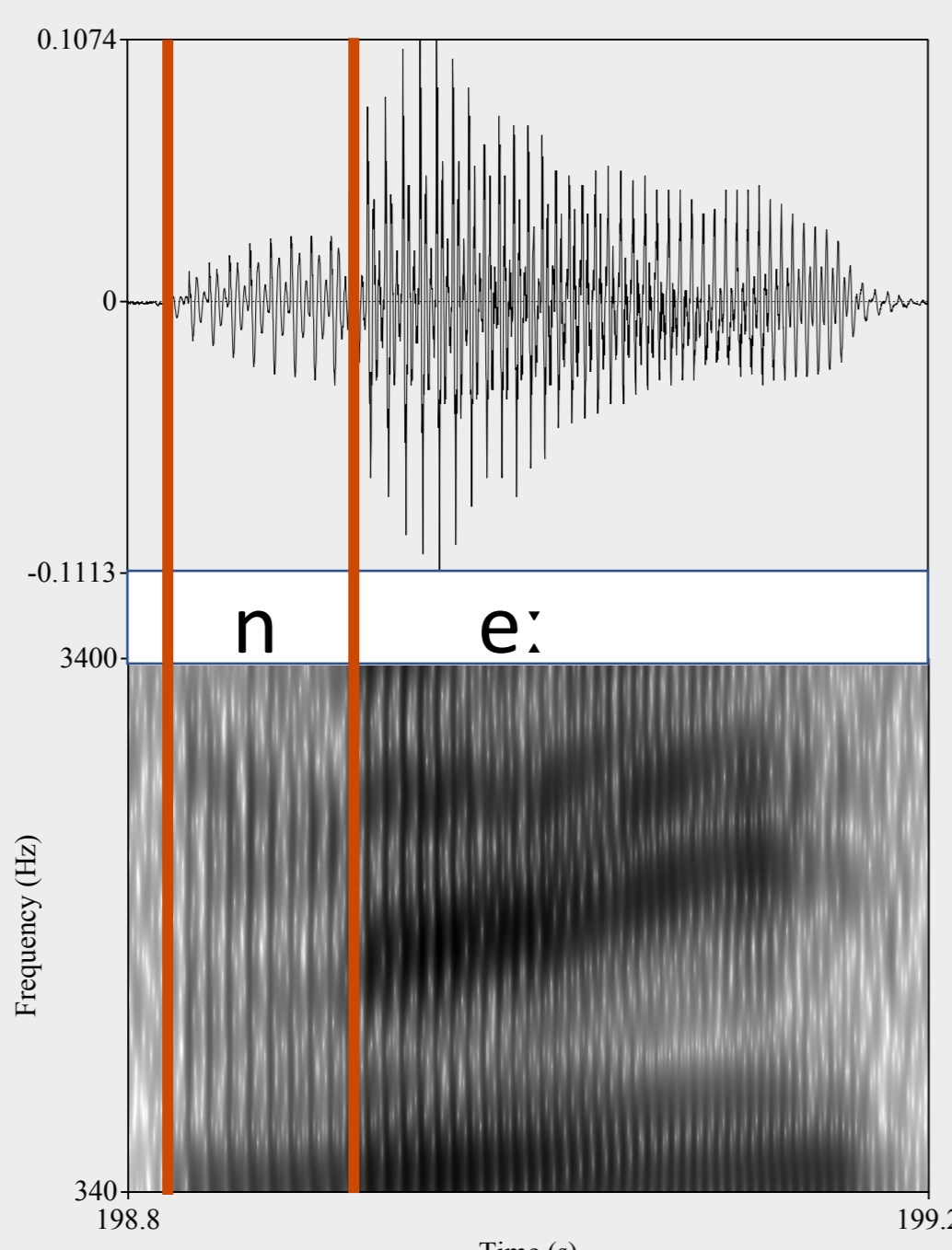
LEFT POA (non-back, back) RIGHT POA (non-back, back)

### Syllabic position:

SYLLABIC POSITION (onset, coda)

### Acoustics (340-3400 Hz band):

Duration, spectral moments (CoG, SD) and formants (N2, N3, average formant bandwidth) (Tabain et al., 2016)



### Speaker-dependency

Predictors	Speaker class. accuracy	Odds (M and range)
Acoustics only	12.3%	3.2 (0.5 – 19.5)
+ Nasal interaction	14.5%	3.8 (0.8 – 21.1)
+ Linguistic interactions	14.5%	3.7 (0.5 – 18.8)

Context	All	Onset	Coda
/n/	3.4	3.1	4.2
/m/	3.5	4.8	3.4

## 4 CONCLUSION AND DISCUSSION

### Context-dependency

- Place assimilation effects larger within the syllable
- /m/ onsets more dependent on right context, /n/ codas more dependent on left context

### Speaker-dependency

- Adding nasal information, but not context information, improves speaker classification
- Weak positive relation between context-dependency and speaker classification (between-speaker variation in timing and degree of coarticulation/reduction)

### Context-dependency: Linear mixed-effect models

- random by-speaker intercepts

### Speaker-dependency: Multinomial logistic regression

- 70/30 (training/test) split
- 10 iterations of random sampling
- LASSO:  $\lambda$  penalty at minimum mean cross-validated error

**References** Byrd, Tobin, Bresch & Narayanan (2009). Timing effects of syllable structure and stress on nasals: A real-time MRI examination. *J Phon.* 37(1), 97–110. Krakow (1993). Nonsegmental influences on velum movement patterns: Syllables, sentences, stress, and speaking rate. In *Nasals, Nasalization, and the Velum* (pp. 87–116). Academic Press. Oostdijk (2000). Corpus Gesproken Nederlands. *Ned. Taalkunde* 5. 280–284. Rose (2002). *Forensic Speaker Identification*. Sciences New York (Vol. 20025246). Su, Li & Fu (1974). Identification of speakers by use of nasal coarticulation. *JASA* 56(6). 1876–1883. Tabain, Butcher, Breen & Beare (2016). An acoustic study of nasal consonants in three Central Australian languages. *JASA* 139(2), 890–903.

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