



# Within-speaker consistency across languages: The realization of [m] in L1 Dutch and L2 English

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## 1 INTRODUCTION

### Multilingual forensic speaker comparisons

IAFPA's Code of Practice: "Members should exercise particular caution with cross-language comparisons"

Are there language-independent speech characteristics?

### Bilabial nasal

- **Speaker-specific:** low within- and high between-speaker variation because of rigid nasal cavity [1]
- **Language-specific:** gestural timing, tongue position, lip tension may differ across languages [2]

### Are multilingual speakers consistent in their production of [m] across languages?

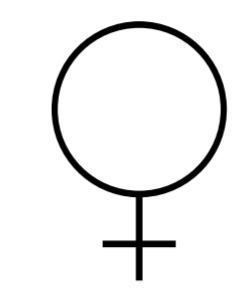
Previous study: N2 somewhat language-dependent [3]

What about context effects?

## 2 METHOD

### Speakers

N = 53



M<sub>age</sub>

18.4 (0.8)

### Recordings

- D-LUCEA database [4]
- Semi-spontaneous informal monologues (2 minutes)

### Hand-segmented tokens

	#	Dutch	English	Total	Range
Total		1,759	1,322	3,081	
By-speaker mean		33	25	58	28 – 112

### Measurements

- N1, N2, N3 (Hz)

### Linear mixed-effects models

- Language: Dutch (L1), English (L2)
- Left and right context
- Random slopes

silence  
front  
mid  
back

## 3 RESULTS

### Language only included in N2 model

Reference level = Dutch, silences on the left (l) and right (r)

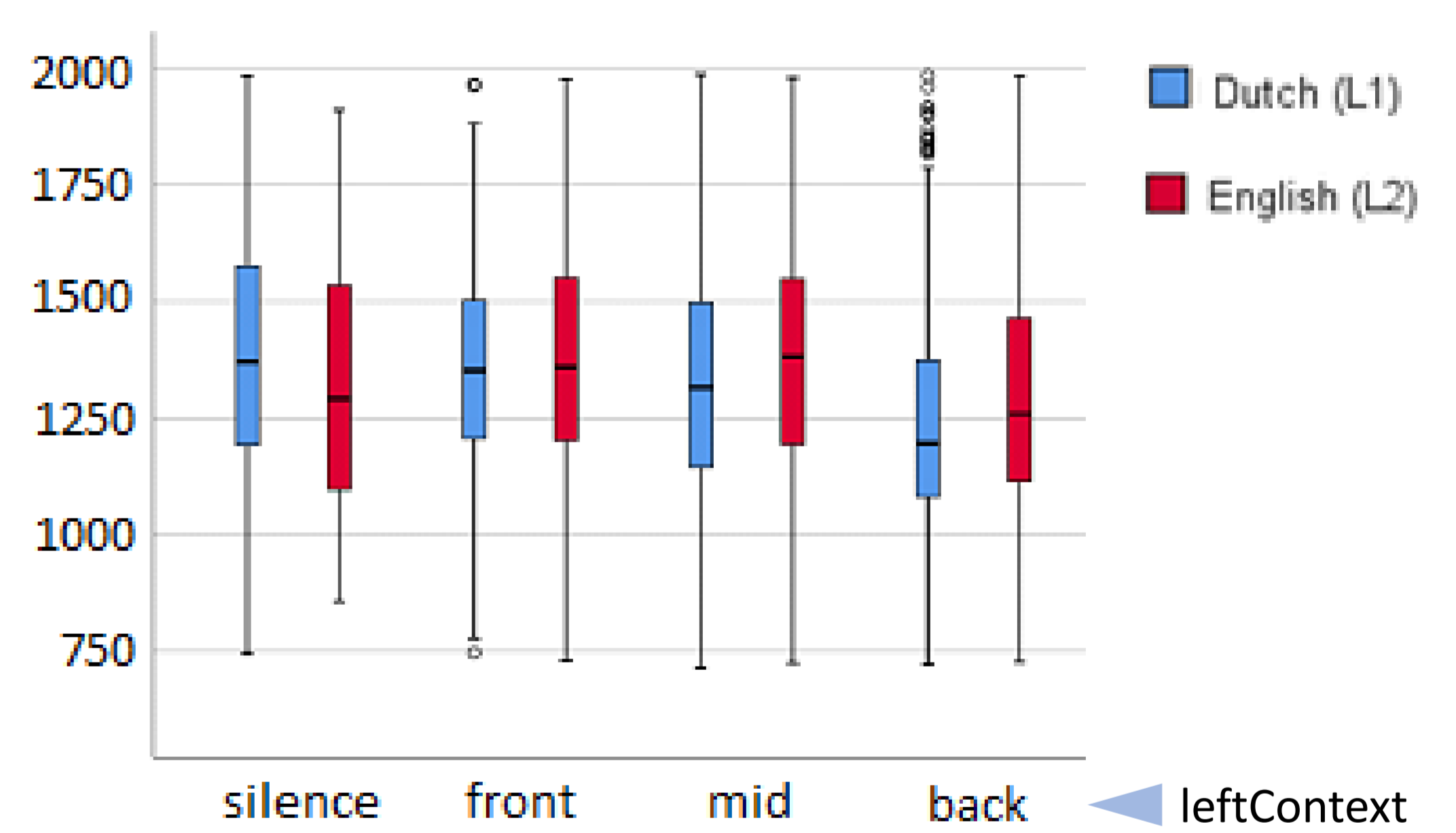
N1 model				N2 model			
		Est.	SE			Est.	SE
Intercept		293	7	Intercept		1,398	93
leftContext	front	14	4	rContext	back	-297	110
	mid	25	4	langEng*rContext	back	357	146
	back	7	5	langEng*lContext	mid	409	154
rightContext	front	20	4	langEng*lContext	back	271	132
	mid	16	4	rContext*lContext	back	-263	121
	back	10	4	back	back		
				LangEng*rContext*lContext	back	-427	178
				back	front		
N3 model							
		Est.	SE				
Intercept		2,507	21	langEng*rContext*lContext	front	-362	161
leftContext	front	-44	16	front	mid		
	mid	-56	16	langEng*rContext*lContext	back	-526	179
	back	-23	16	back	mid		
					langEng*rContext*lContext	back	-442
				back	back		

### N2 model utterly complex

- Three-way interactions
- Random by-speaker slopes for Language, leftContext, and rightContext

### Language not included as main effect

Only relevant in certain contexts?



## 4 CONCLUSION

### Language-independent?

- [m] seems to be largely language-independent
- N2 may be language-dependent (for some speakers)
- Context affects [m] acoustics and language-dependency
- The question remains how it can contribute to multilingual forensic speaker comparisons [5]

## 5 FUTURE WORK

- **Speaker-specificity:** How speaker-specific is [m] in the L1 and in the L2?
- **Strength of evidence:** How well can we discriminate speakers based on [m] in a cross-language context?
- **Other segments:** What about other segments (e.g. [s])? For *uh* and *um* across languages (and time), see package by Meike de Boer, Hugo Quené, and Willemijn Heeren

## REFERENCES

[1] Rose, P. (2002). Forensic speaker identification. In: J. Robertson (Ed.), *Taylor & Francis Forensic Science Series*. London: Taylor & Francis (pp. 125-173). [2] Stevens, K. N. (1998). *Acoustic phonetics*. Cambridge: The MIT Press. (pp. 487-512). [3] De Boer, M., & Heeren, W. (2021). Language-dependency of /m/ in L1 Dutch and L2 English, *XVII AISV*, 57-58. [4] Orr, R., & Quené, H. (2017). D-LUCEA: Curation of the UCU Accent Project data. In J. Odijk & A. van Hessen (Eds.), *CLARIN in the Low Countries* (pp. 177-190). [5] Smorenburg, L., & Heeren, W. (2021). Acoustic and speaker variation in Dutch /n/ and /m/ as a function of phonetic context and syllabic position, *J. Acoust. Soc. Am.*, 150(2), 979-989.

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