

Obstruent lenition in Canary Islands Spanish - motion capture study

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Spanish spoken on Gran Canaria

Corpus:

Fieldwork with 44 native speakers
spontaneous speech, semi-structured
interviews

111,317 phones in 128 files

16,454 post-vocalic /p t k b d g/



Broś, Żygis, Sikorski, Wołłejko (2021)

Phonological contrasts and gradient effects in ongoing lenition in the Spanish of Gran Canaria

Full-fledged variation on Gran Canaria

UR	Example	voiceless stop	voiced stop	approximant	∅
/p/	<i>guapo</i> ‘pretty’	[ˈgwa.po]	[ˈgwa.bo]	[ˈgwa.β̞o]	[ˈgwa.o]
	<i>se parece</i> ‘is similar’	[se.pa.ˈre.se]	[se.ba.ˈre.se]	[se.β̞a.ˈre.se]	[se.a.ˈre.se]
	<i>después</i> ‘afterwards’	[de.ˈpwe]	[de.ˈbwe]	[de.ˈβ̞we]	
/b/	<i>cabeza</i> ‘head’			[ka.ˈβ̞esa]	[ka.ˈesa]
	<i>la vela</i> ‘the candle’		[la.ˈbe.la]	[la.ˈβ̞ela]	[la.ˈela]
	<i>las velas</i> ‘the candles’	[la.ˈpe.la]	[la.ˈbe.la]	[la.ˈβ̞ela]	

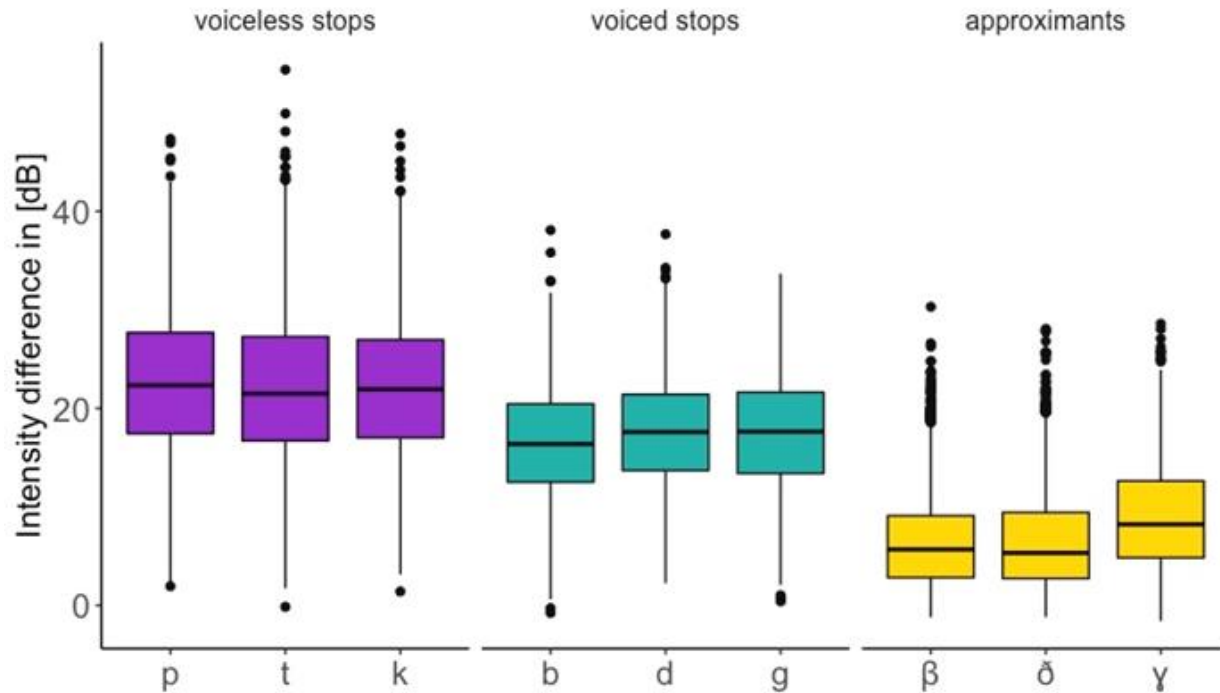
Research questions

- ❑ How systematic are the differences between surface sounds?
- ❑ Are underlying contrasts preserved?
- ❑ Which factors influence surface variation?

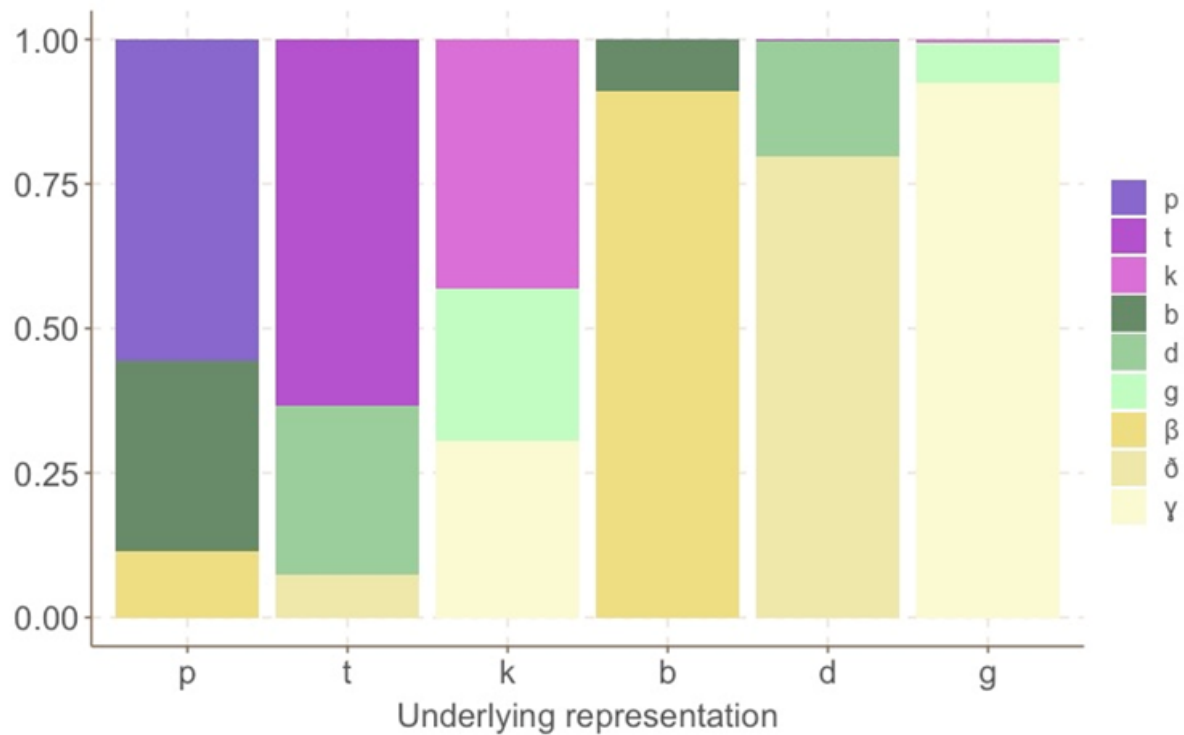
Measurements

- ❑ **intensity difference** (max intensity of the preceding vowel - min intensity of the target segment)
 - ❑ Martínez & Regueira (2008), Figueroa & Evans (2015)
- ❑ **relative sound duration** (CVC duration)
 - ❑ Dalcher (2008), modified version
- ❑ **harmonics-to-noise ratio (HNR)**
 - ❑ Bárkányi & Kiss (2010)

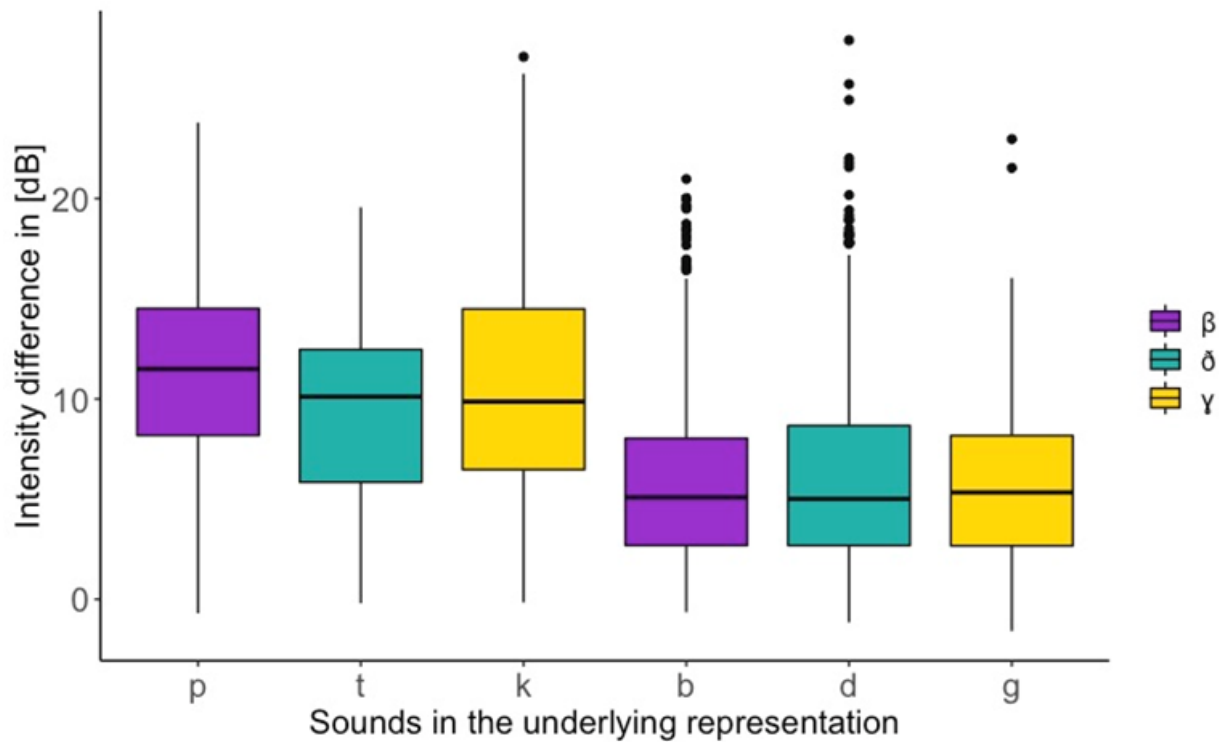
Surface differences



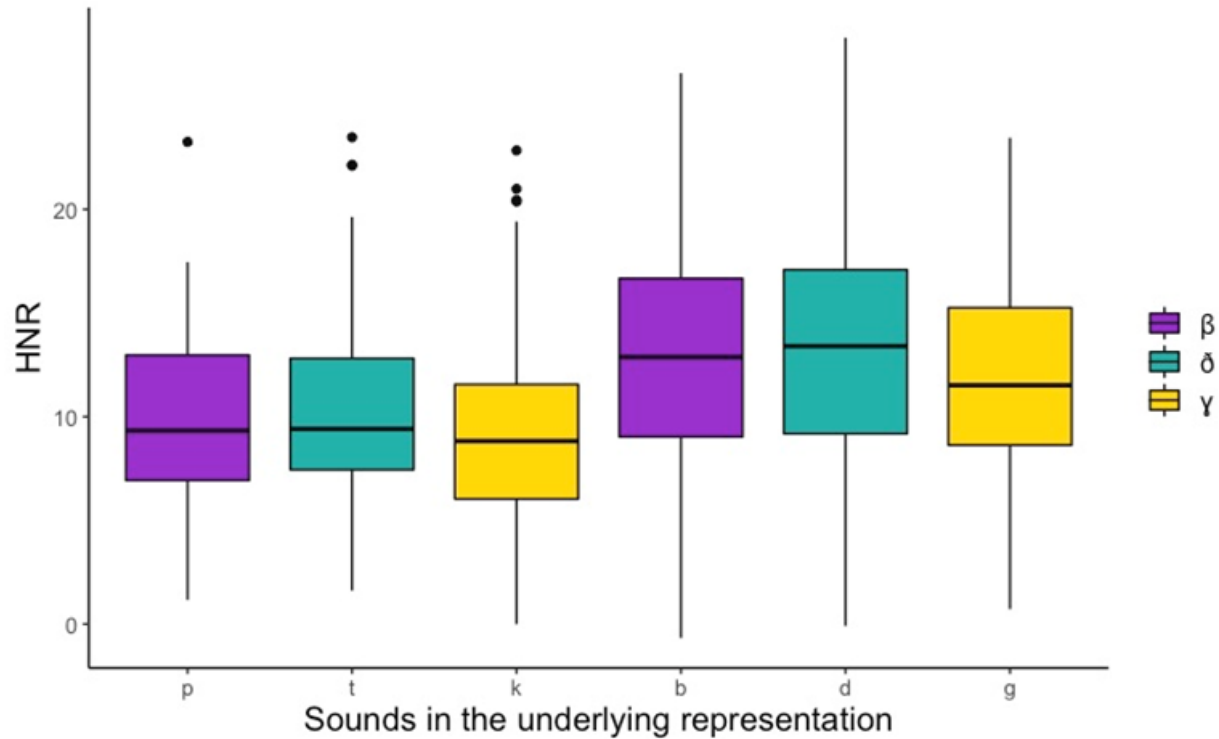
Surface differences



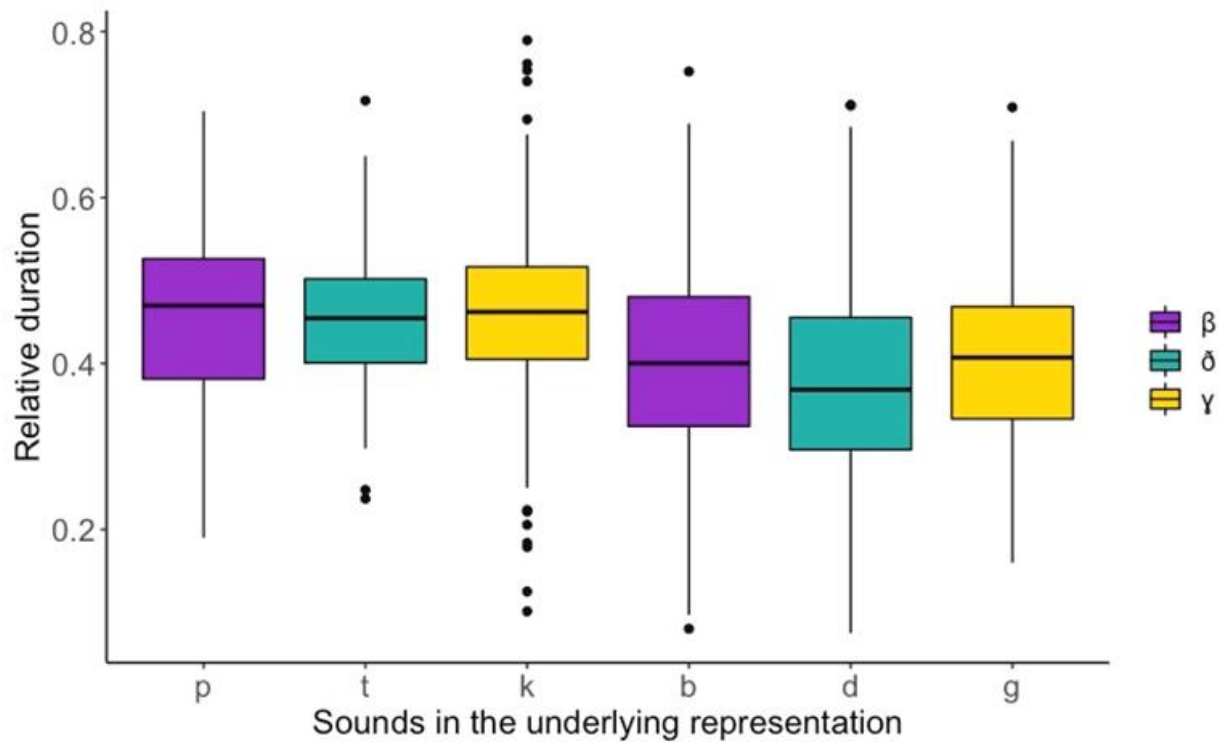
Phonemic status



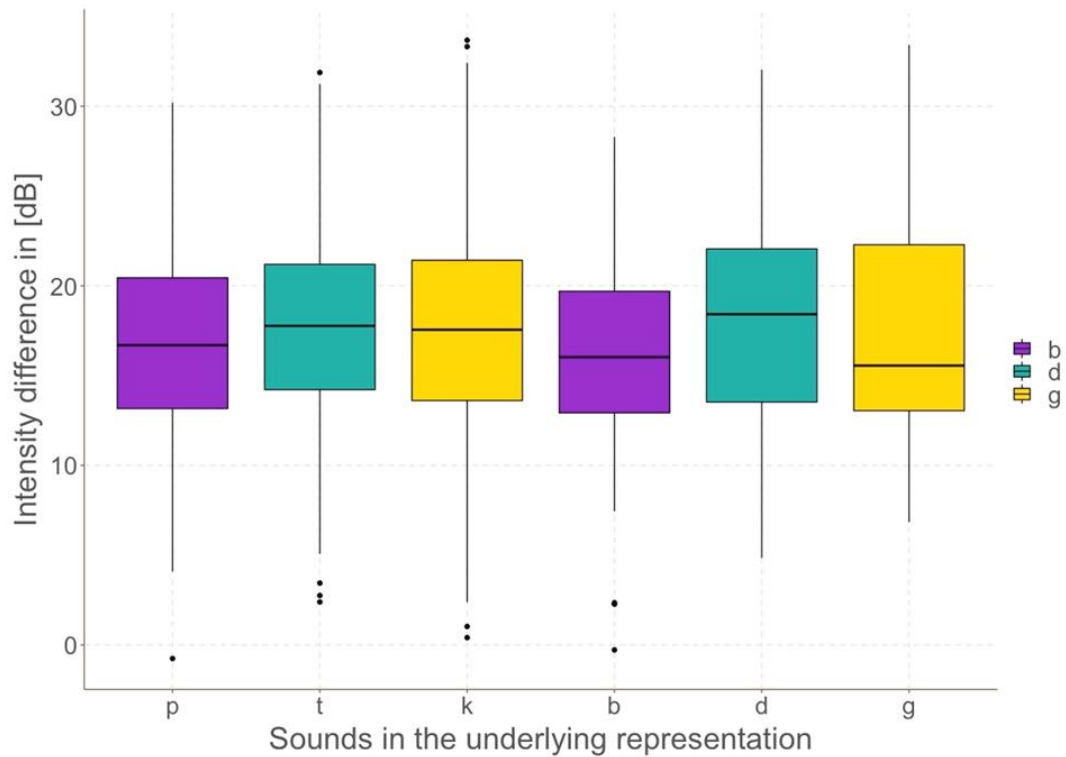
Phonemic status



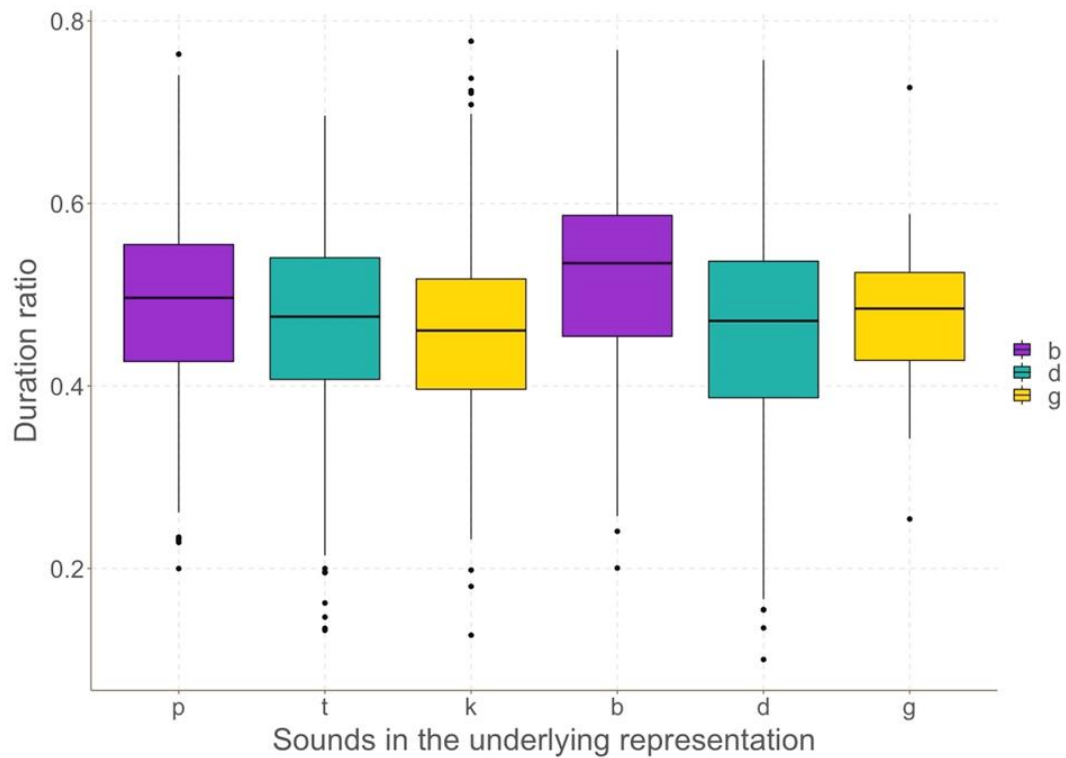
Phonemic status



Phonemic status



Phonemic status



Phonological conditioning

	/p/	/t/	/k/	/b/	/d/	/g/
post-deletion	391	642	410	186	472	46
voiceless stop	88.2%	93.8%	72.0%	0.5%	0.4%	4.3%
voiced stop	7.9%	5.3%	11.7%	62.9%	68.4%	37.0%
approximant	3.8%	0.9%	16.3%	36.6%	31.1%	58.7%

84.7% vs 15.3%

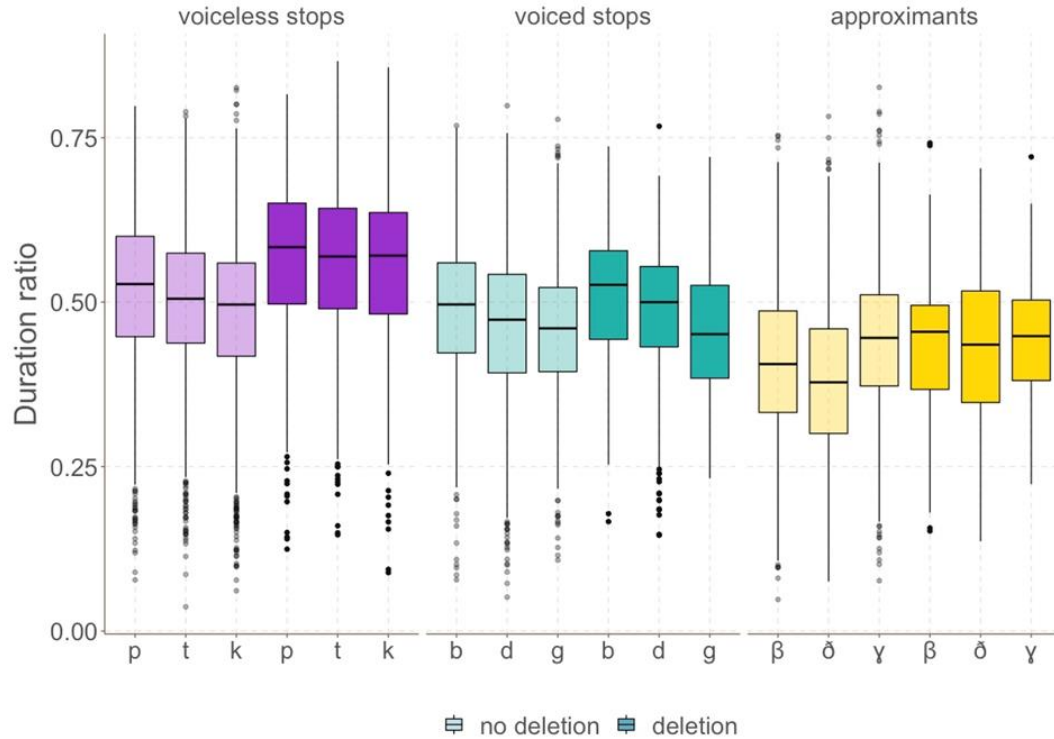
56.1% vs 42.1%

postvocalic	1769	2225	3177	1902	1854	594
voiceless stop	48.5%	54.7%	39.3%	0.0%	0.3%	0.2%
voiced stop	37.9%	35.9%	28.5%	3.4%	7.5%	4.7%
approximant	13.6%	9.4%	32.3%	96.6%	92.2%	95.1%

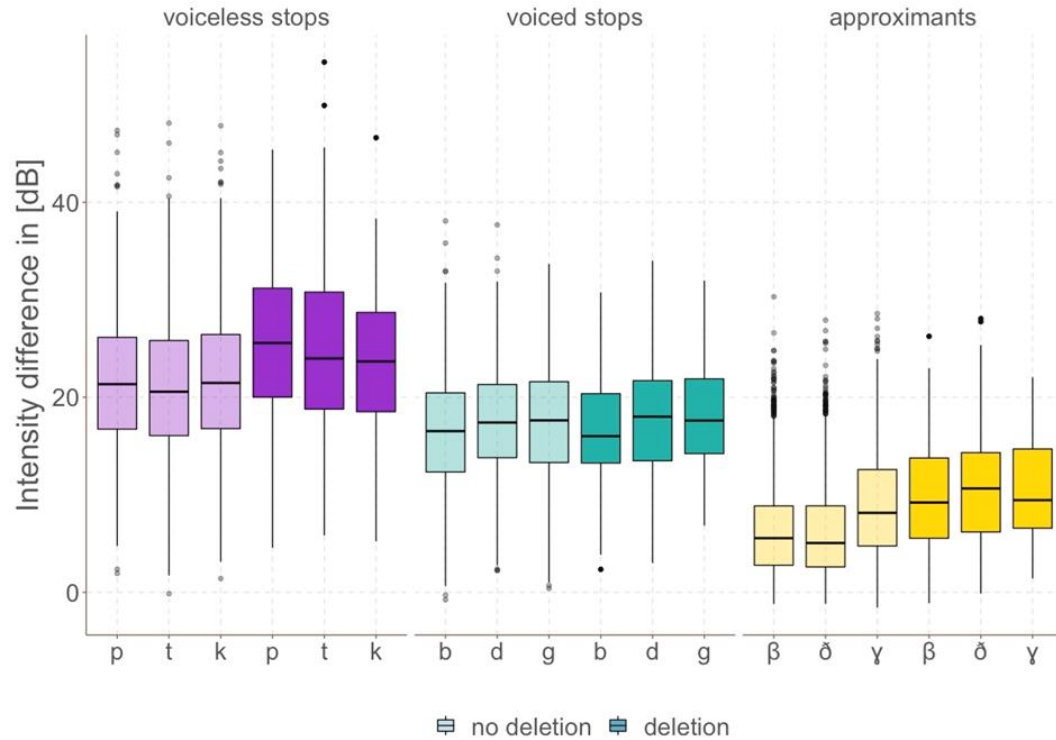
47.5% vs 52.5%

5.2% vs 94.6%

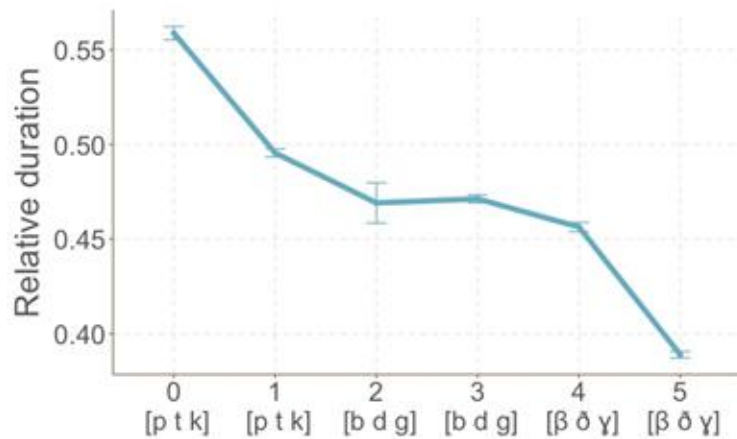
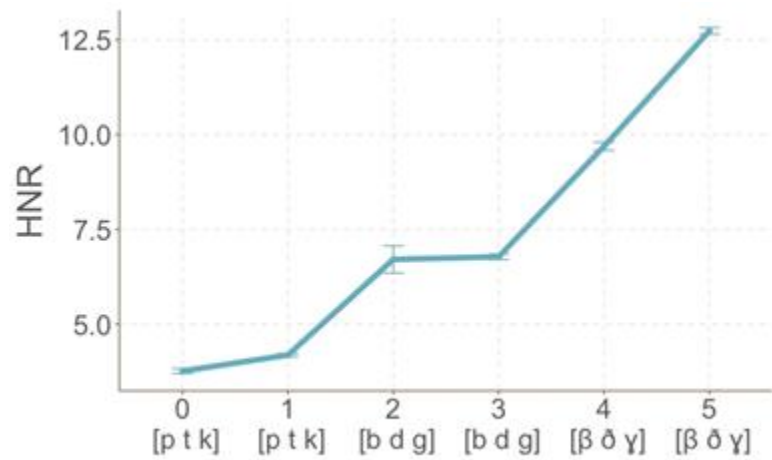
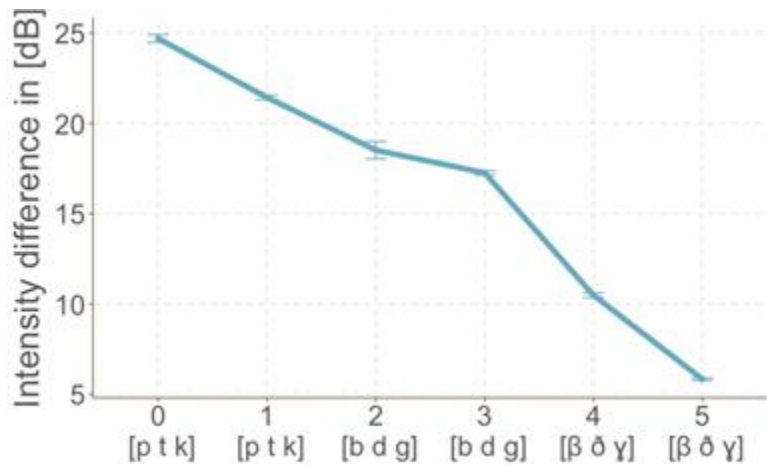
Phonological conditioning



Phonological conditioning



Scalar feature?



Interim summary

- ❑ there is a lot of **gradience** and **variability** in the data – probably in any dataset
- ❑ some degree of **categoricity** or **allophonic variation** can be identified quantitatively
- ❑ **different URs** are produced differently despite partial phonemic overlap
- ❑ surface variants depend on **phonological structure**: interaction with deletion, **opacity**
- ❑ possible indication of a **scalar feature** governing lenition

The present study

Motion capture: video recordings of 16 speakers from Gran Canaria

- ❑ Preliminary results based on data from 6/9 speakers

Factors tested: prosodic and phonological effects

- ❑ post-vocalic /p b/ tested for lip aperture and lip area measurements
- ❑ to be correlated with acoustic markers of lenition
- ❑ 376 sentences, a total of 560 target words
- ❑ Conditions:
 - ❑ stressed syllable (S)
 - ❑ unstressed syllable (US)
 - ❑ stressed syllable in focus (SF)
 - ❑ deletion context (del)

Examples of sentences used

La **barrera** estaba mal colocada y el portero no veía.

US /b/

La **paciencia** de esa mujer me tenía impresionado.

US /p/

La **banda** de música empezó el concierto con **la bamba**.

S /b/, SF /b/

La **paga** mensual es **más baja** de lo que **pensaba Paco**.

S /p/, DEL, SF /p/

La **vaca** de Juan cuesta **mucha pasta**.

/b/, SF /p/

Las Vacas Locas es una banda de música de Tenerife.

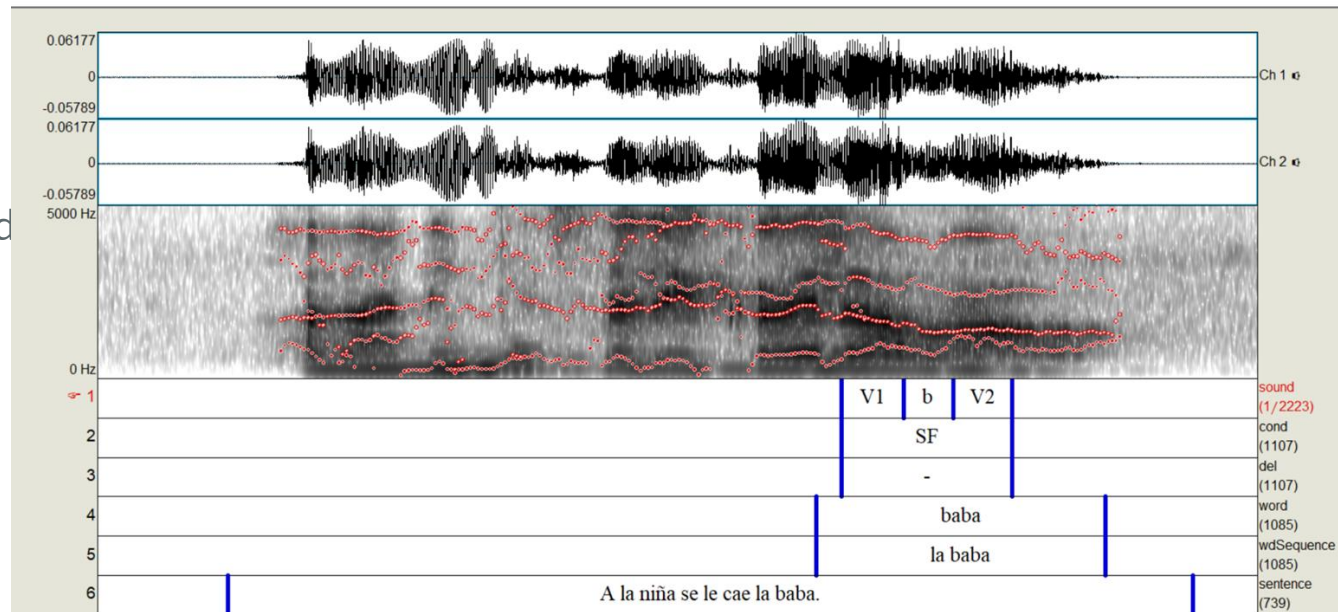
DEL /b/

Soy de Gáldar, pero vivo en **Las Palmas**.

DEL /p/

Data extraction and video output analysis

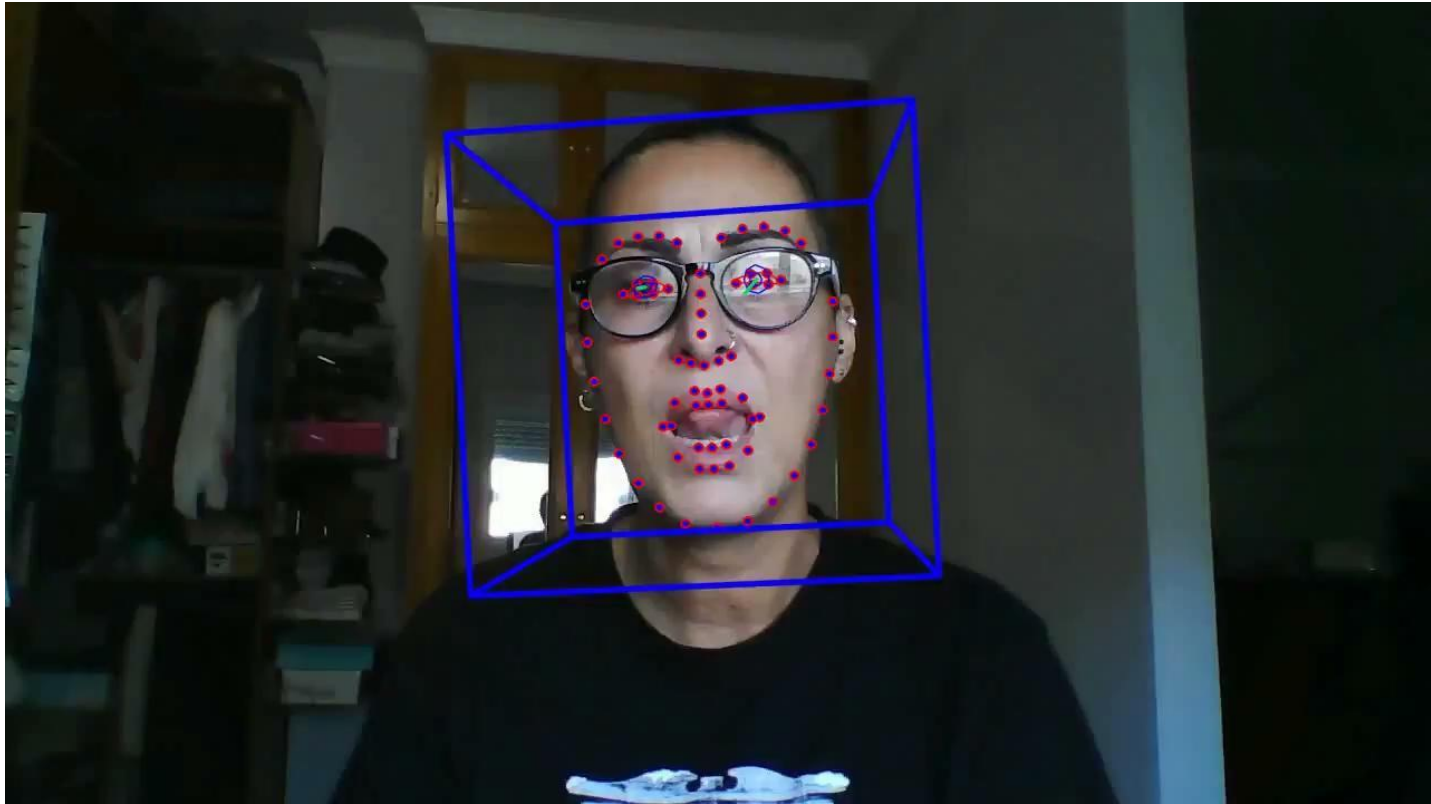
Temporal marks for the target words and their critical VCV segment sequences were annotated to Praat TextGrids



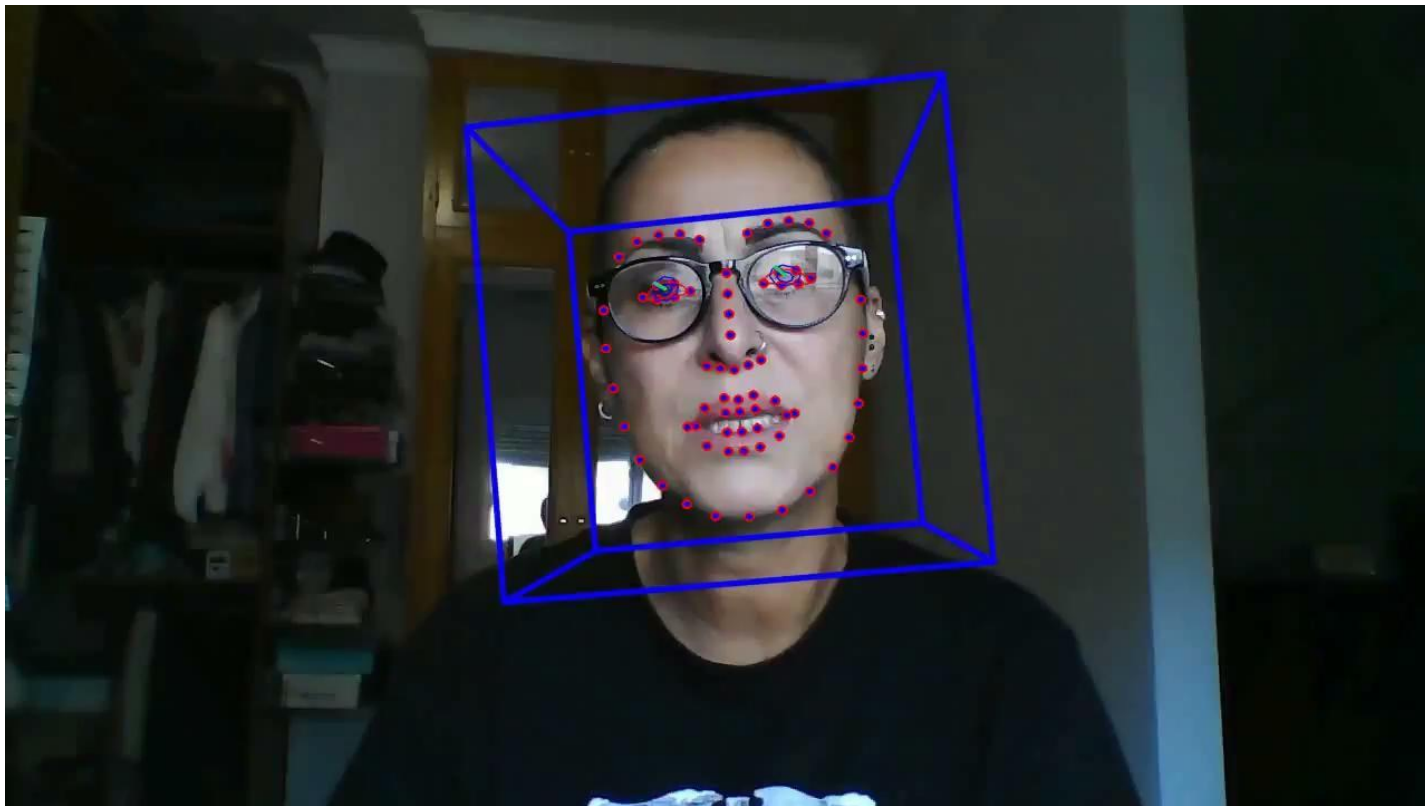
Data extraction and video output analysis

- ❑ A custom Python script used these temporal markings as the basis for splitting each participant's video into segments containing just the VCV sequences
- ❑ Each video segment was then processed through the OpenFace 2.0 face-tracking utility (Baltrušaitis et al., 2018) - see following examples

Example: /aba/

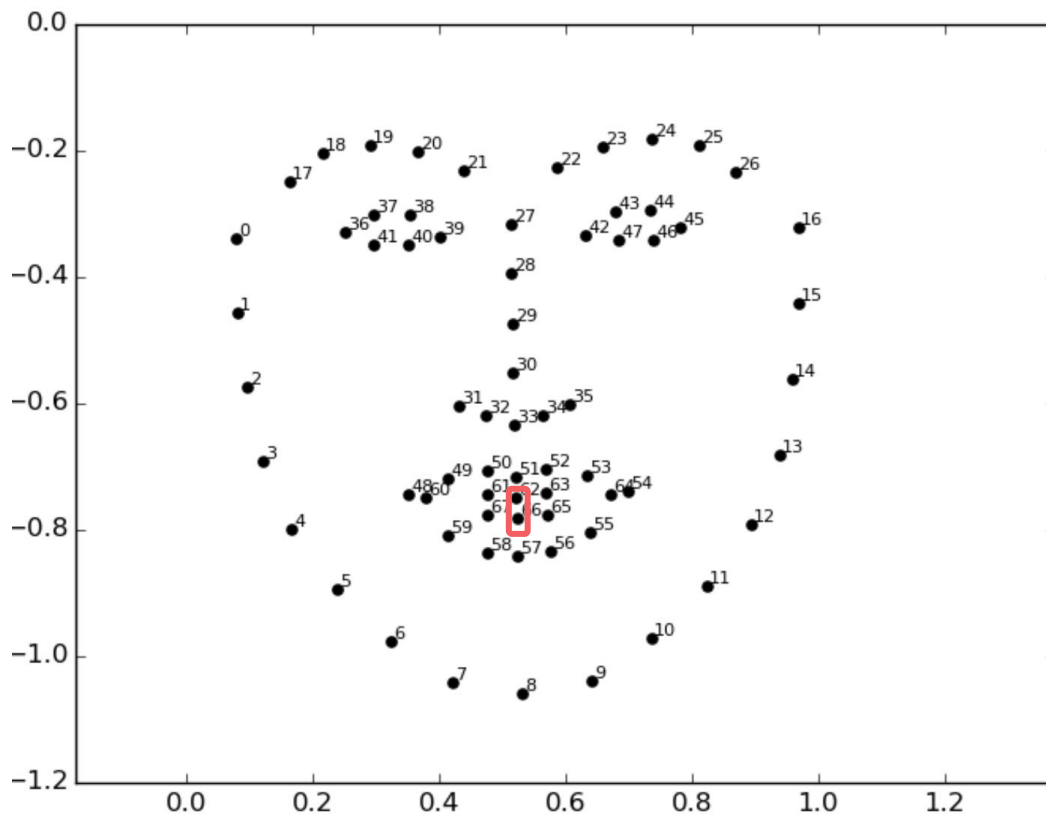


Example: /apa/



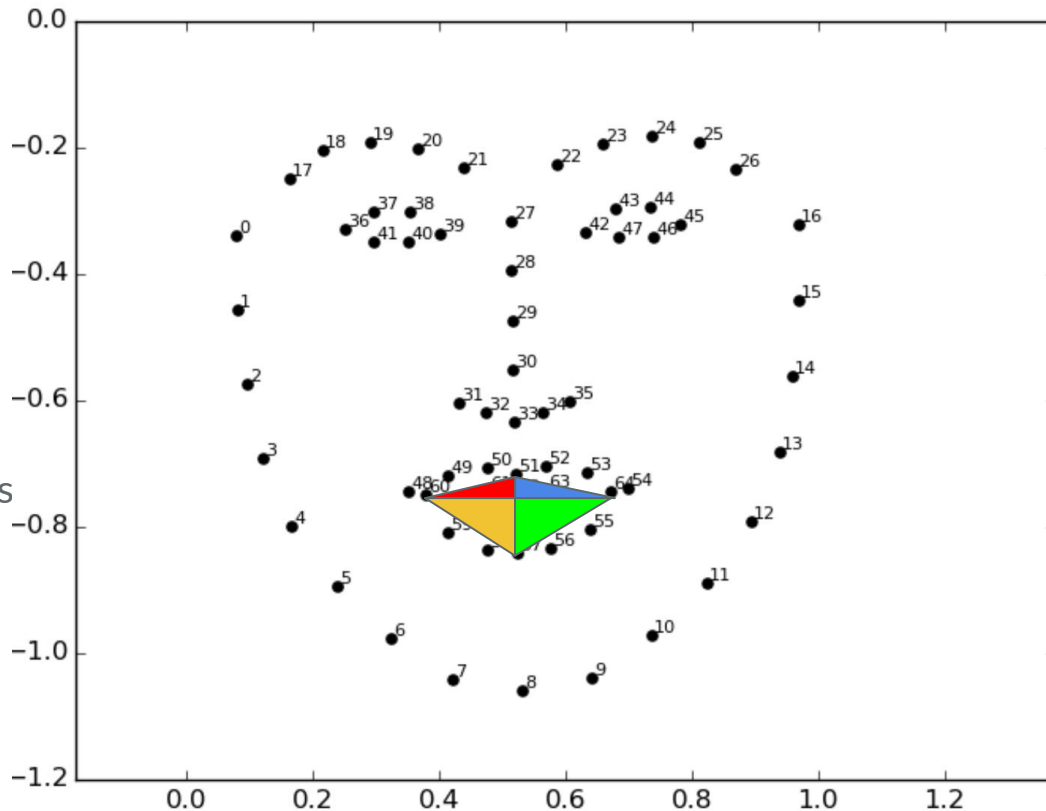
Data extraction and video output analysis

- For each frame of each trial, a custom Python script determined...
 - **Vertical Lip Aperture** - euclidean distance here



Data extraction and video output analysis

- For each frame of each trial, a custom Python script determined...
 - **Vertical Lip Aperture** - euclidean distance here
 - **Lip Area** - areas of these triangles (plus central rectangle, which here has area 0)



Key parameters

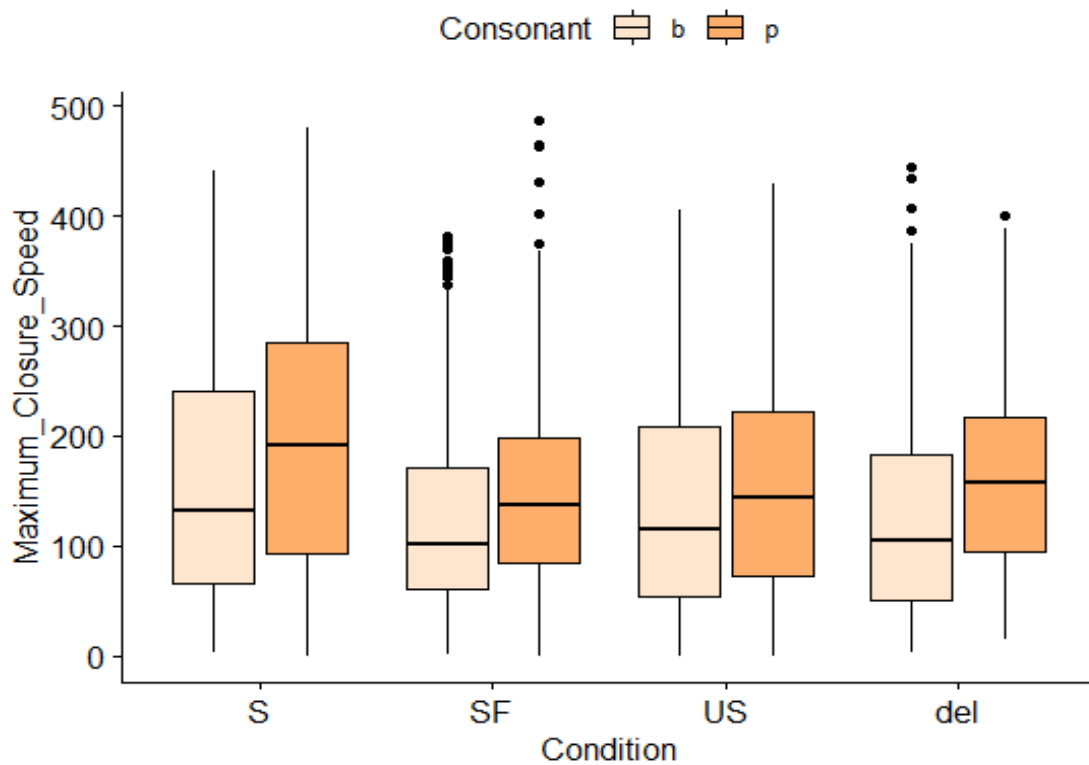
- ❑ **Maximum closure speed** - maximum absolute change in vertical lip aperture achieved (between 2 successive frames) during the closure phase
- ❑ **Change in aperture** - the difference between the maximal and minimal lip apertures observed during the closure phase
- ❑ **Vertical lip aperture trajectory**, normalized to 11 time steps via linear interpolation
- ❑ **Lip area trajectory**, normalized to 11 time steps via linear interpolation

Key parameters

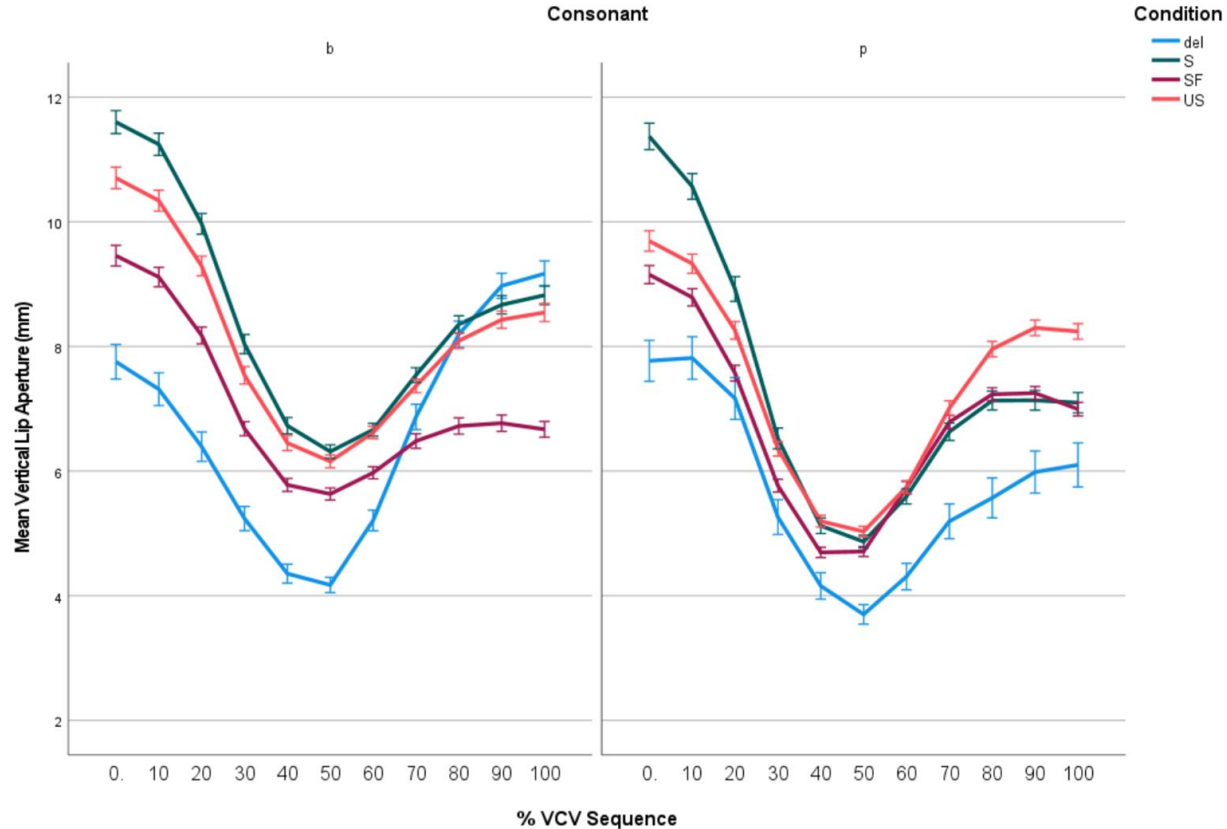
Highly correlated

- ❑ **Maximum closure speed** - maximum change in vertical lip aperture achieved (between 2 successive frames) during the closure phase
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- ❑ **Lip area trajectory**, normalized to 11 time steps via linear interpolation

Preliminary results: max closure speed

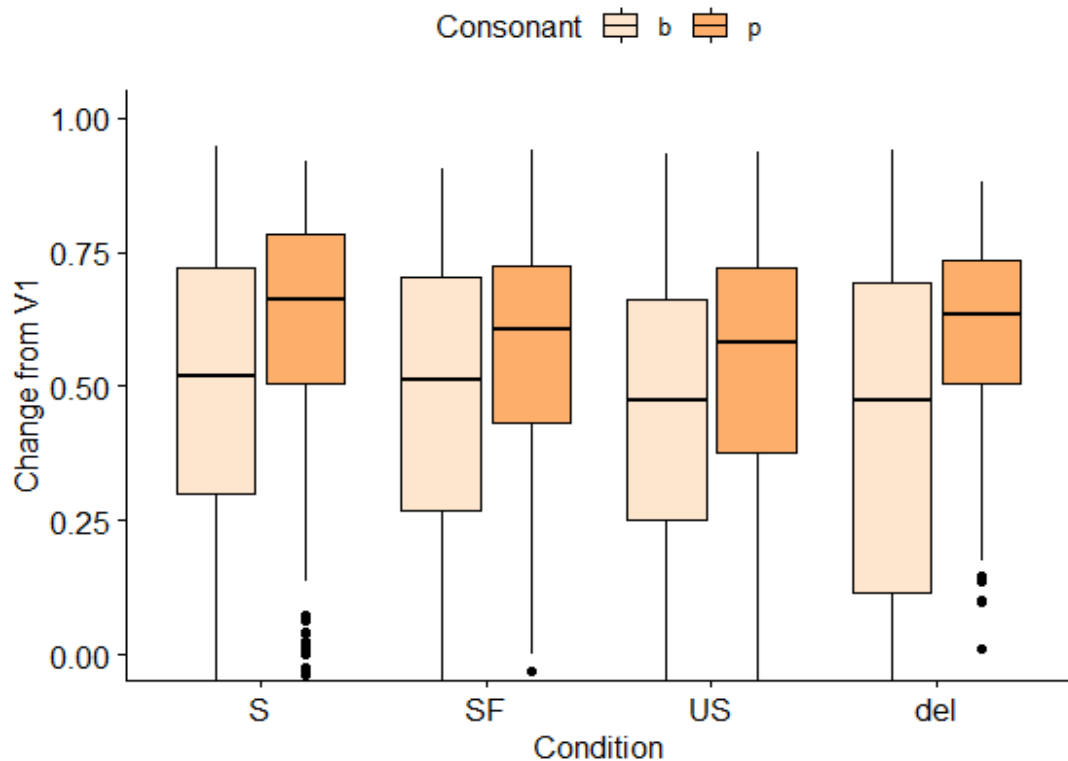


Preliminary results: mean vertical lip aperture

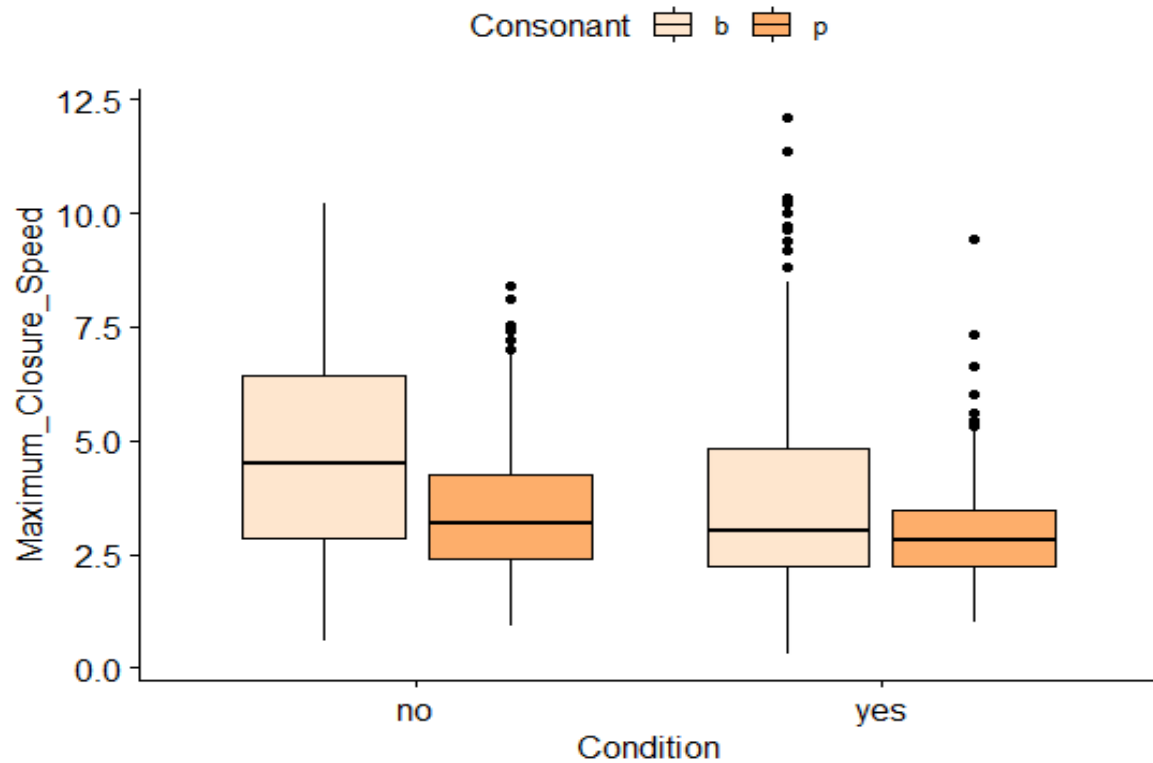


Error bars: +/- 1 SE

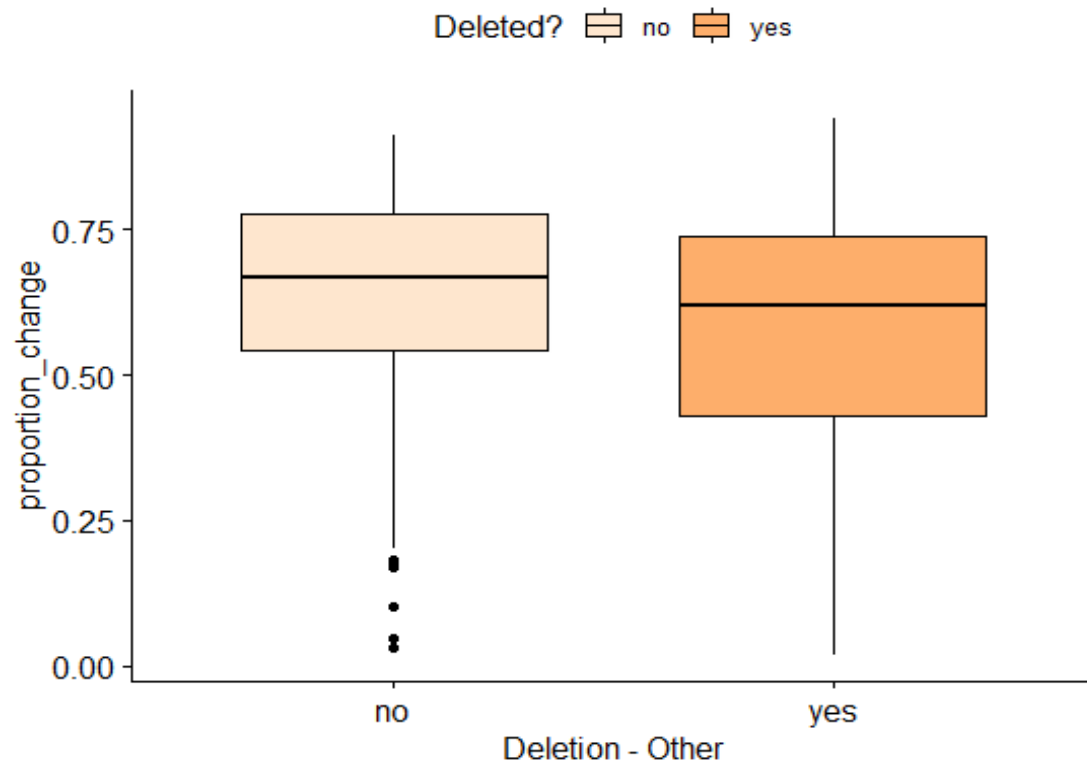
Preliminary results: change in aperture (from V1)



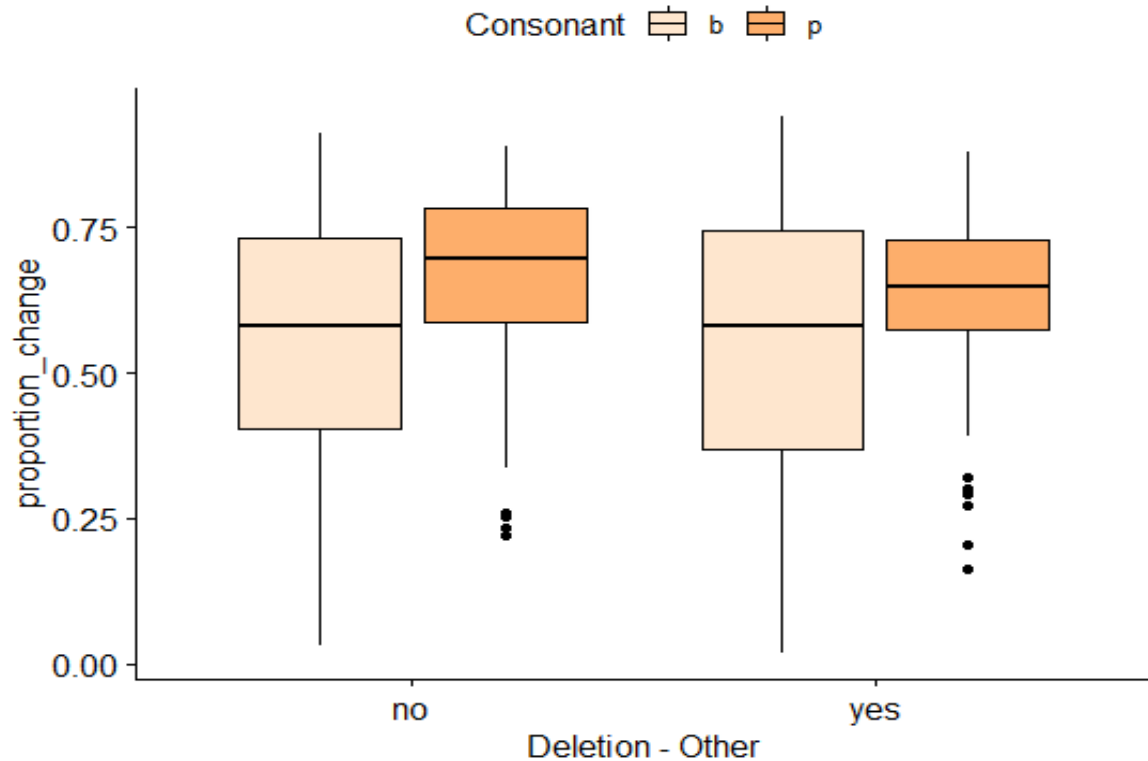
Preliminary results: max closure speed - del



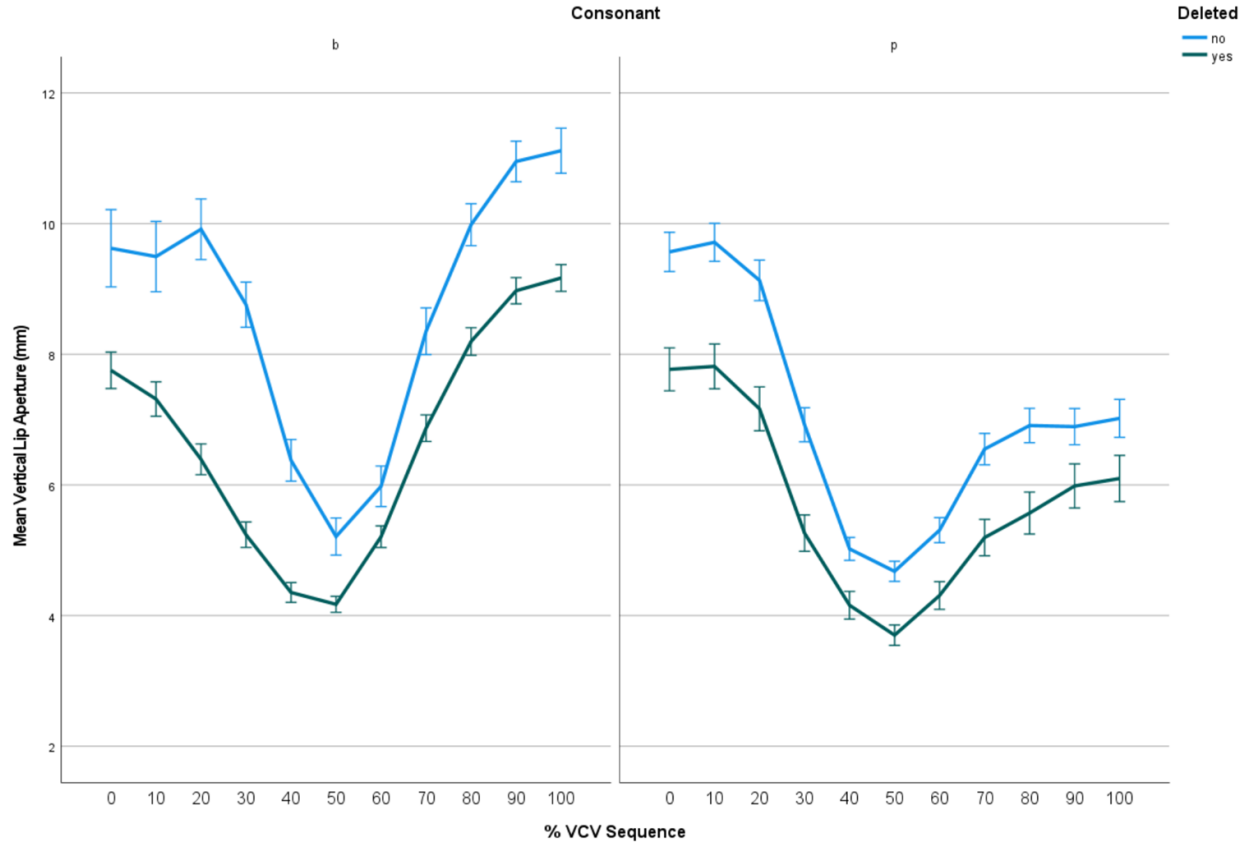
Preliminary results: change in aperture



Preliminary results: change in aperture



Preliminary results: lip aperture in deletion



Error bars: +/- 1 SE

Summary

- ❑ an **intermediate category** in deletion contexts?
- ❑ possible support for **containment** approaches in the data
- ❑ independent evidence for lenition, and **opacity**

Opacity - summary of the cases

deletion + spirantisation = underapplication

paso [D]e

spirantisation applies transparently

paso(s) [d]e
(opacity)

spirantisation underapplies

paso(s) [D]e

spirantisation applies after deletion

deletion + voicing = underapplication

chocolate [g]on

voicing applies transparently (optional)

chocolate(s) [k]on

voicing does not apply (opacity)

chocolate(s) [g]on

voicing applies after deletion

Thank you!

Slides and publications at www.karolinabros.eu