

Sound change in the making –phonetics versus phonology

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Broś (2018)

Social setting as a determinant of
process application

Factor: social setting

lab vs spontaneous speech

Modality 1

aspiration/deletion

/s/ -> [h/H] /_V

/s/ -> [h] /_k

/s/ -> [∅] /_d

stop lenition

/b d g/ -> [b d g] /V(C)_

/b d g/ -> [B D G] /V_

/p t k/ -> [b d g] /V_

prensa[h]idrúlicas ‘hydraulic presses’

chocolate[h]con ‘chocolates with’

pane[∅]de ‘breads from’

pane(s)[d]e ‘breads from’

cinco[D]ulces ‘five sweets’

cinco[b]anes ‘five breads’

Modality 2

aspiration/deletion

/s/ -> [h/H] /_V

/s/ -> [∅] /_C

prensa[H]idráulicas 'hydraulic press'

chocolate[∅]con 'chocolates with'

stop lenition

/b d g/ -> [B D G] /V(C)_

/b d g/ -> [B D G] /V_

/p t k/ -> [b d g] /V_

/p t k/ -> [p t k] /V(C)_

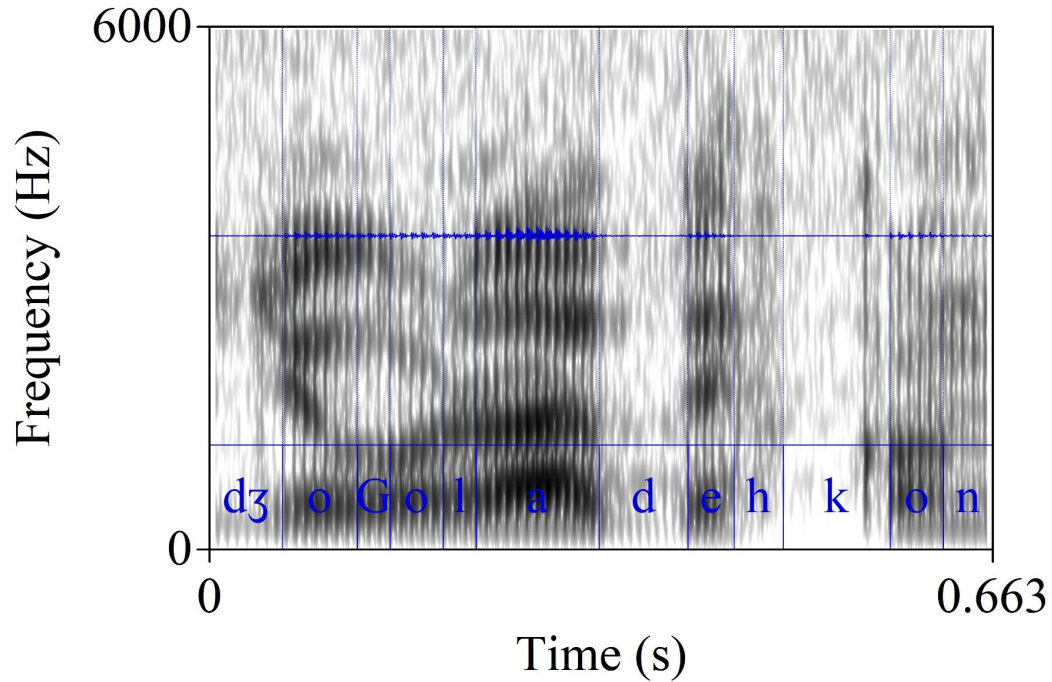
pane(s)[D]e 'breads from'

cinco[D]ulces 'five sweets'

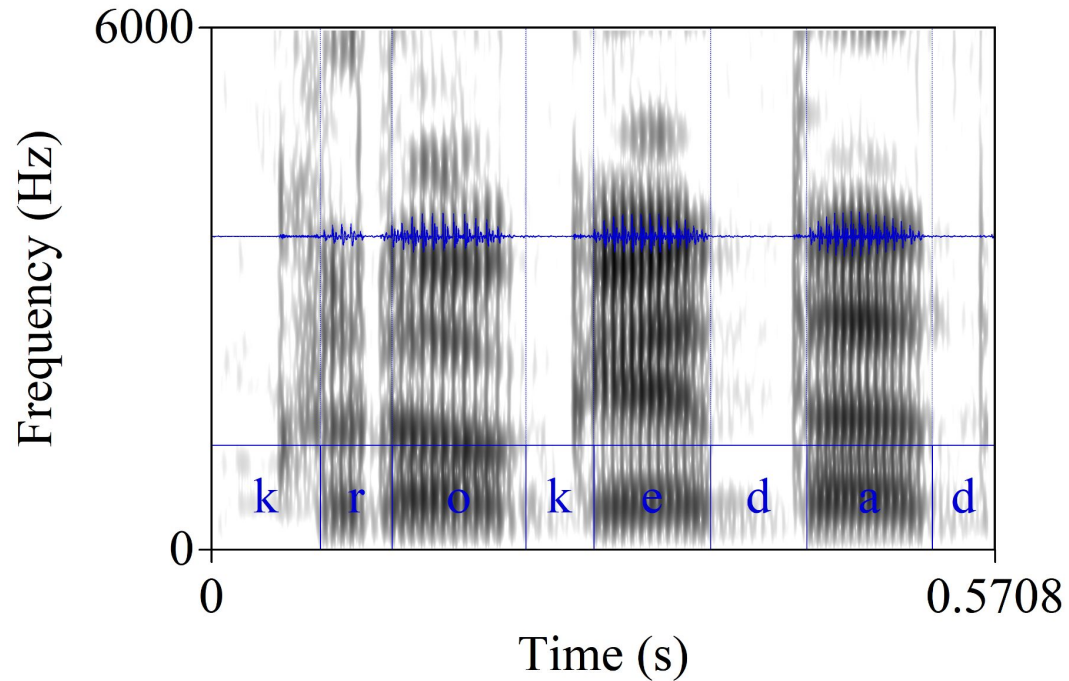
cinco[b]anes 'five breads'

chocolate(s)[k]on 'chocolates with'

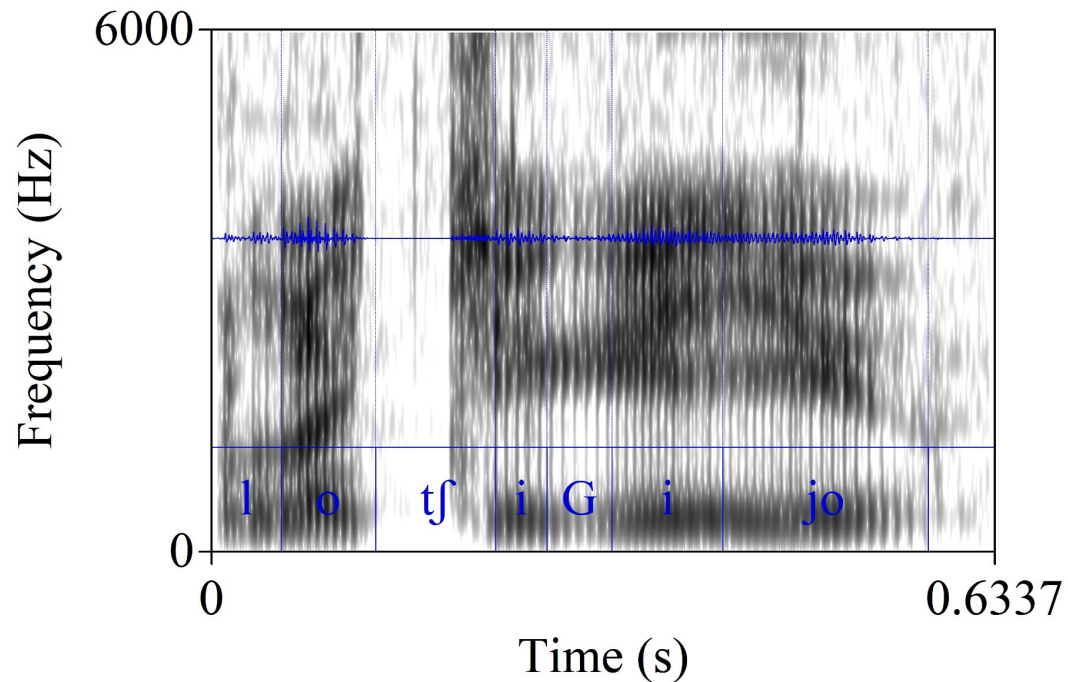
Controlled speech: *chocolates con*



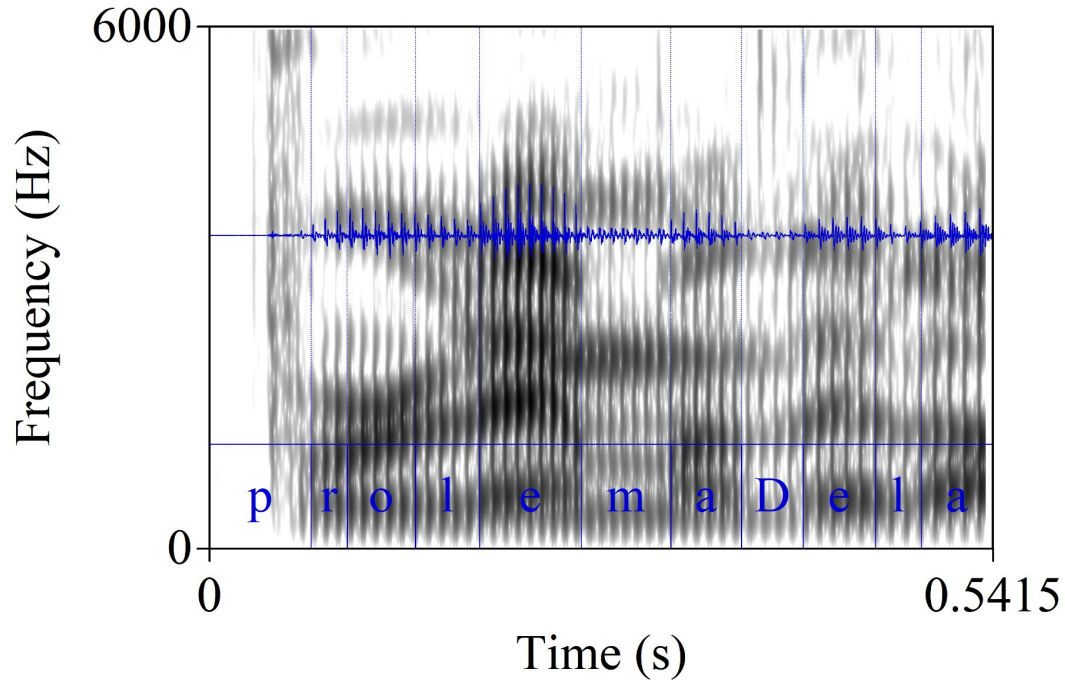
Controlled speech: *croquetas de*



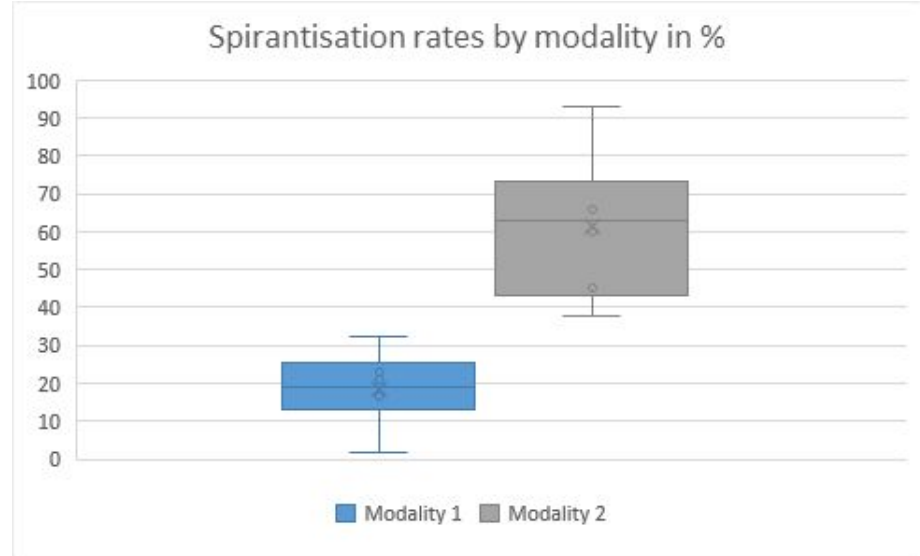
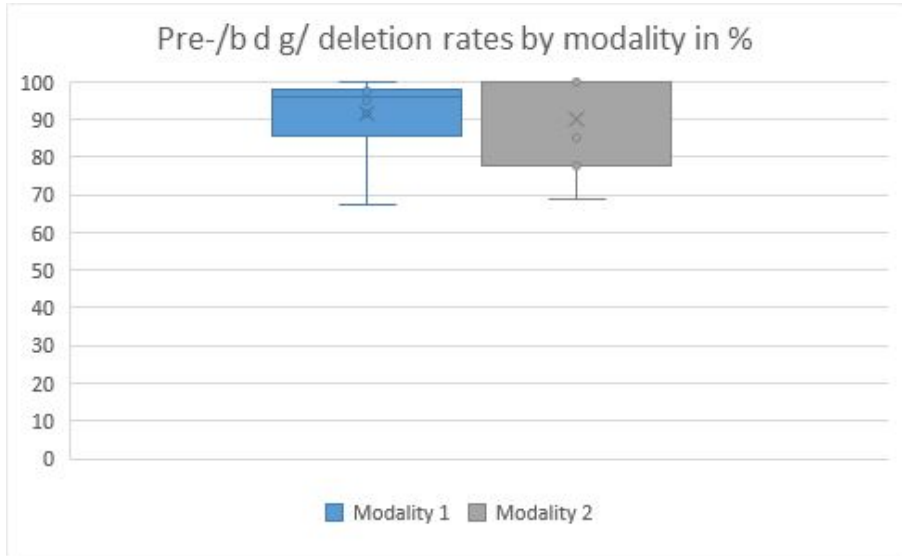
Spontaneous speech: *los chiquillos*



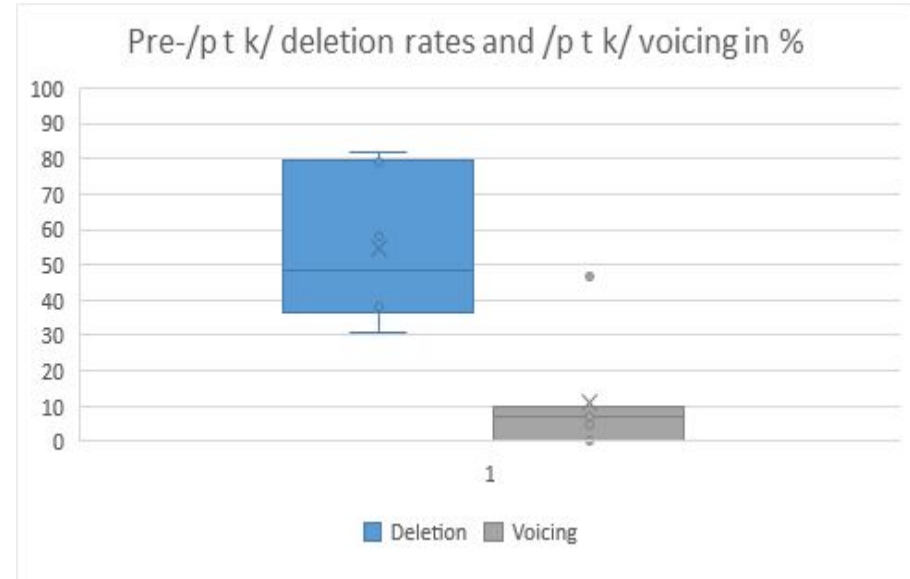
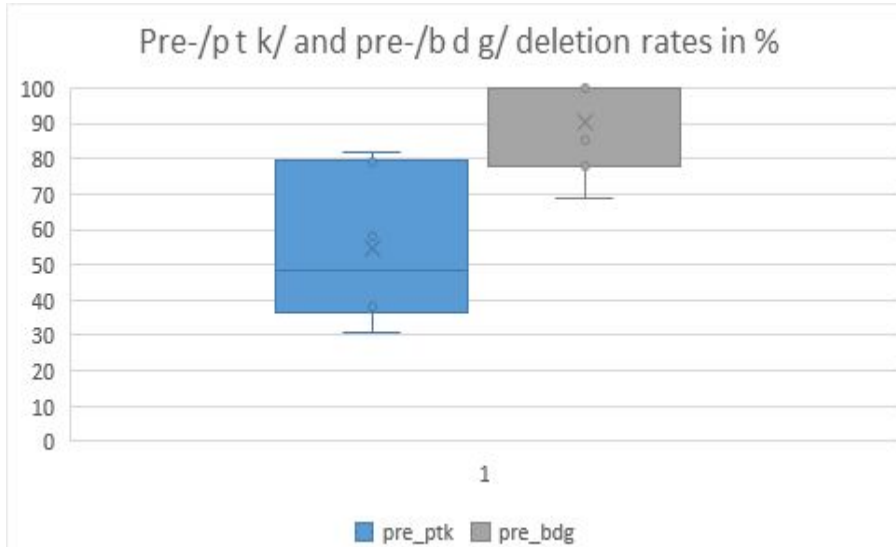
Spontaneous speech: *problemas de la*



Modality 1 vs Modality 2: /b d g/



Modality 2: /p t k/



Interim summary 1

- ❑ Individual speaker choices can be **systematic** across different social settings: **different weakening stages**
- ❑ Intra-speaker variation can be a reflection of **sound change in progress**
- ❑ Variation is situational: **co-phonologies**
- ❑ Variation should be modelled by **incorporating external factors into the grammar**
- ❑ **turbidity** for selective blocking (?)

Broś (submitted)

Using social media in
phonetic/phonological analysis

Factor: social setting

lab recordings vs social media

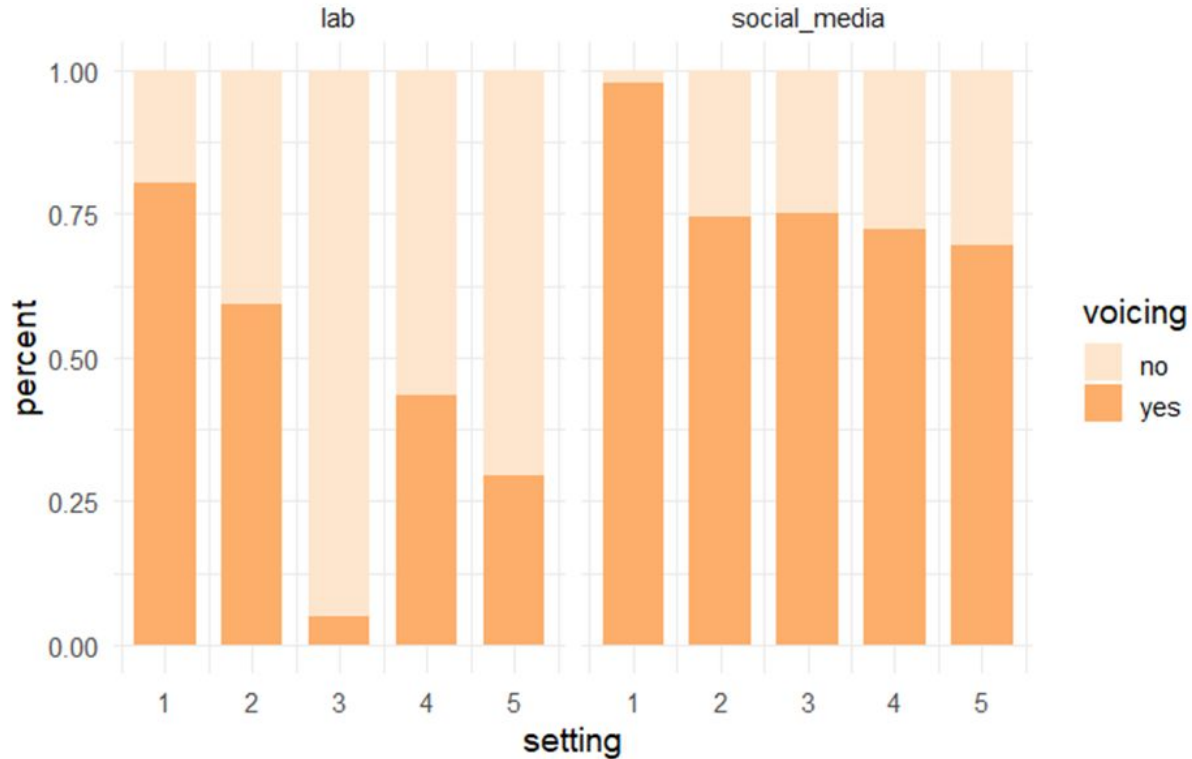
Lab data vs WhattsApp recordings

Speaker	Total recordings	Good quality recordings	Total time (s)	Sounds (social media)	Sounds (lab) ¹
Speaker 1	6	4, 5, 6	73.09	42	77
Speaker 2	2	1, 2	140.27	47	76
Speaker 3	5	1, 3, 4, 5	84.58	40	78
Speaker 4	9	1, 3, 4, 6, 9	172.59	105	78
Speaker 5	3	1, 2	84.08	59	68
Total	25	16	554.61	293	377

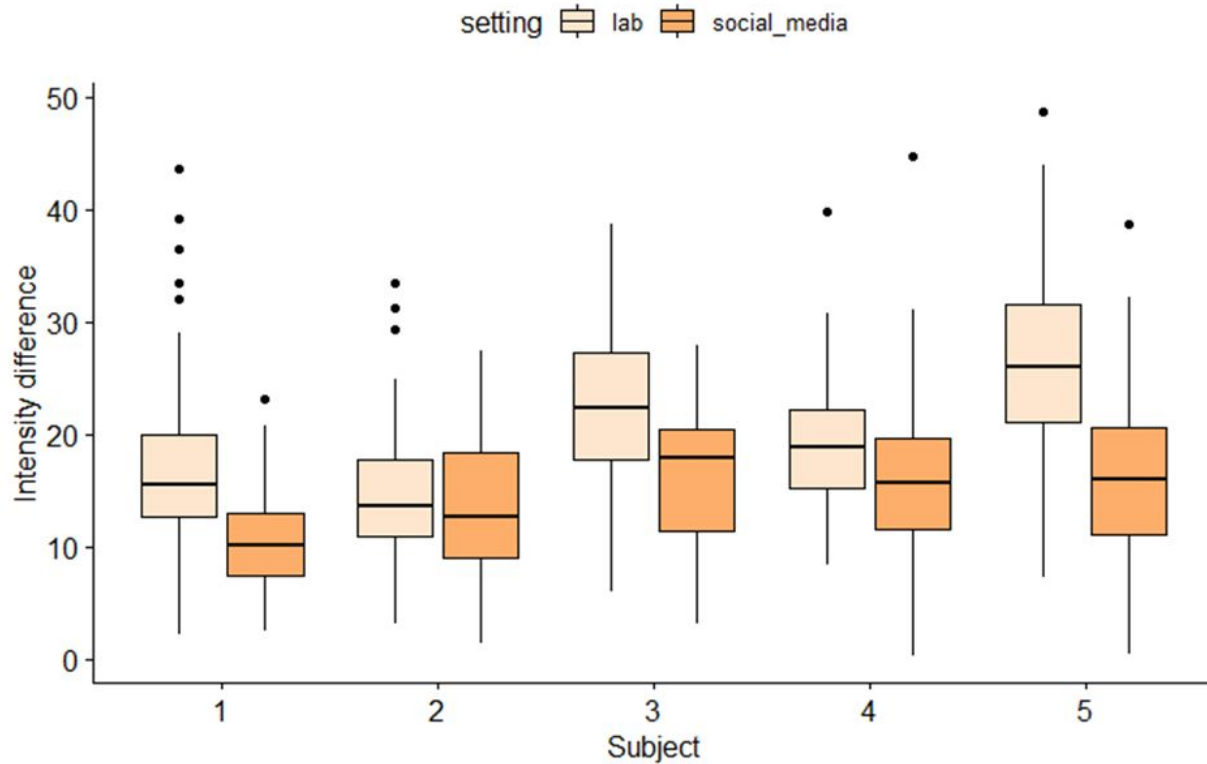
The data

- ❑ 670 observations from **5 speakers**
- ❑ target: post-vocalic /p t k/ **voicing**
- ❑ **43.8% vs 76%** sounds classified as **voiced**
- ❑ substantial **interindividual differences** between speakers in the **lab** setting but all speakers seem to be quite **uniform** in the percentage of voicing in a **naturalistic setting**

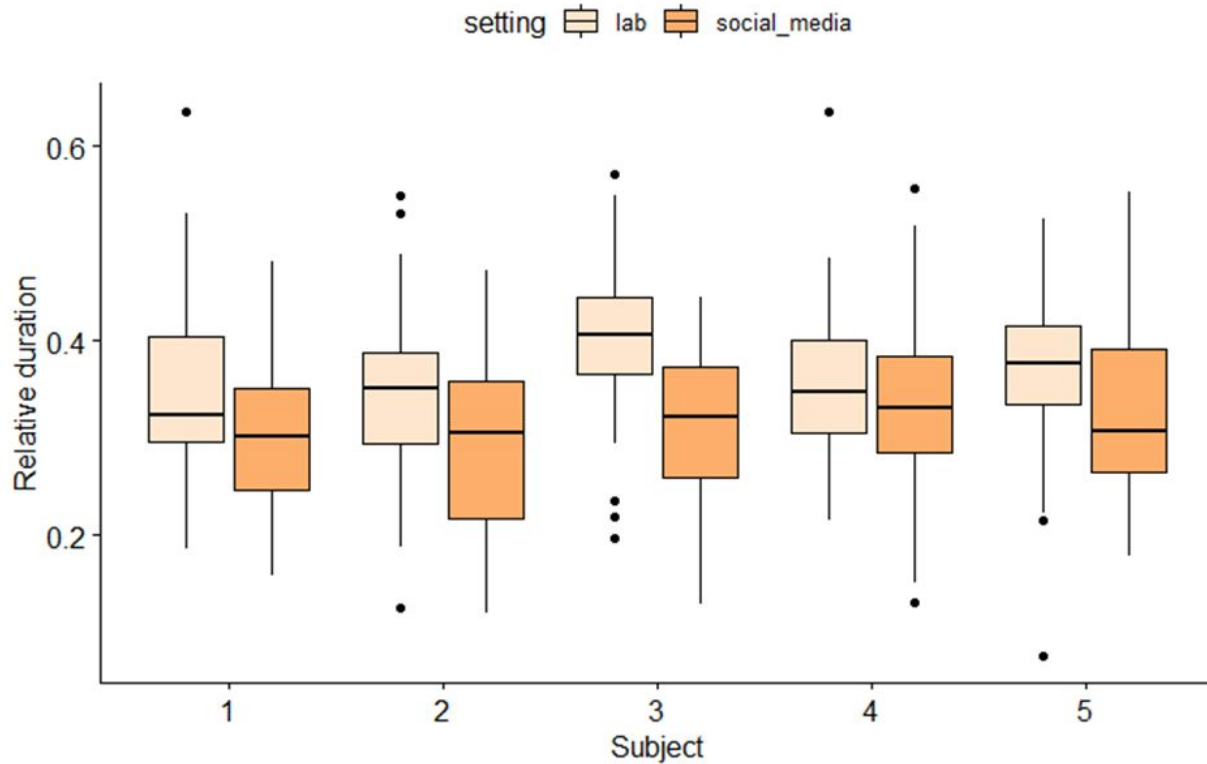
Voicing: lab setting vs the social media



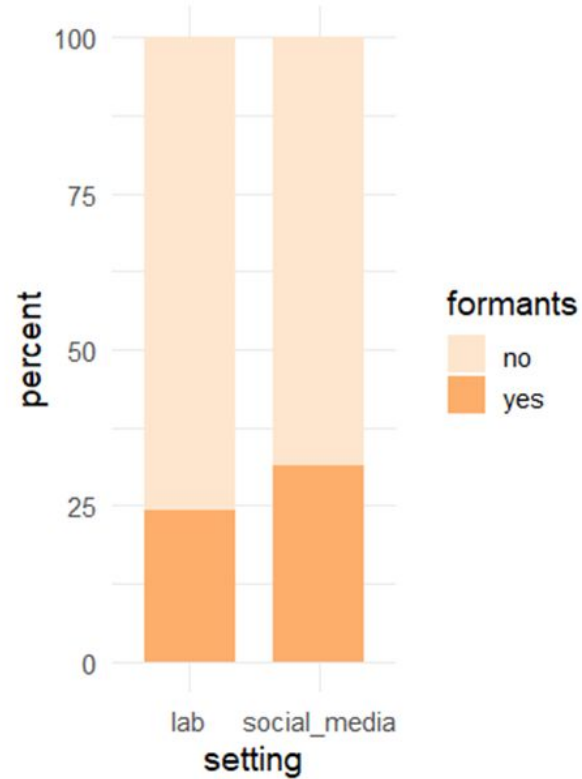
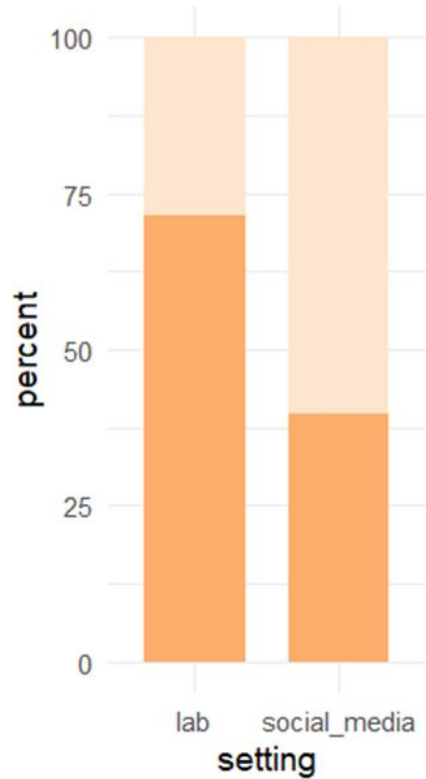
Intensity: lab setting vs the social media



Duration: lab setting vs the social media



Burst and formants



Interim summary 2

- ❑ social setting affects the **naturalness** of speech in a particular way, i.e. both **inter- and intra-speaker variation**
- ❑ speakers in the same age range speak in a similar fashion, with similar rates of lenition
- ❑ **speaker strategies** pertaining to supervised speech differ
- ❑ how we access the data affects our **generalisations**

Broś et al. (2021)

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

Factors: UR, phonology

spontaneous speech

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]	

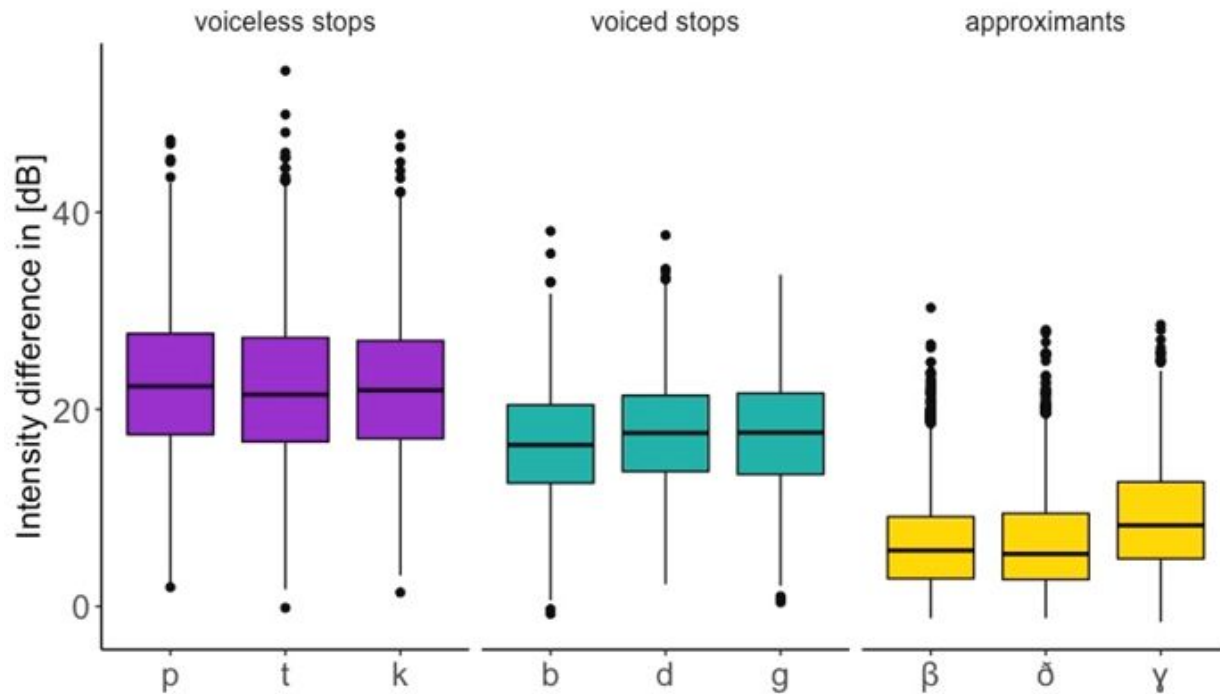
Research questions

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

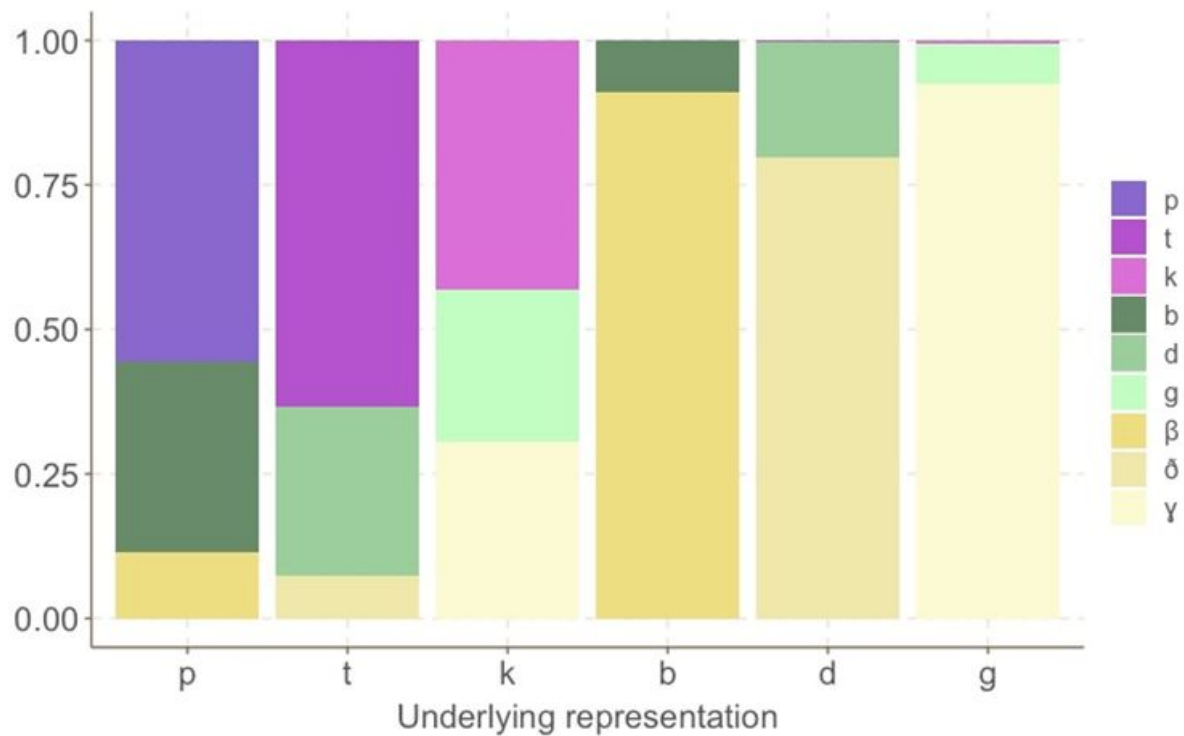
Measurements

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

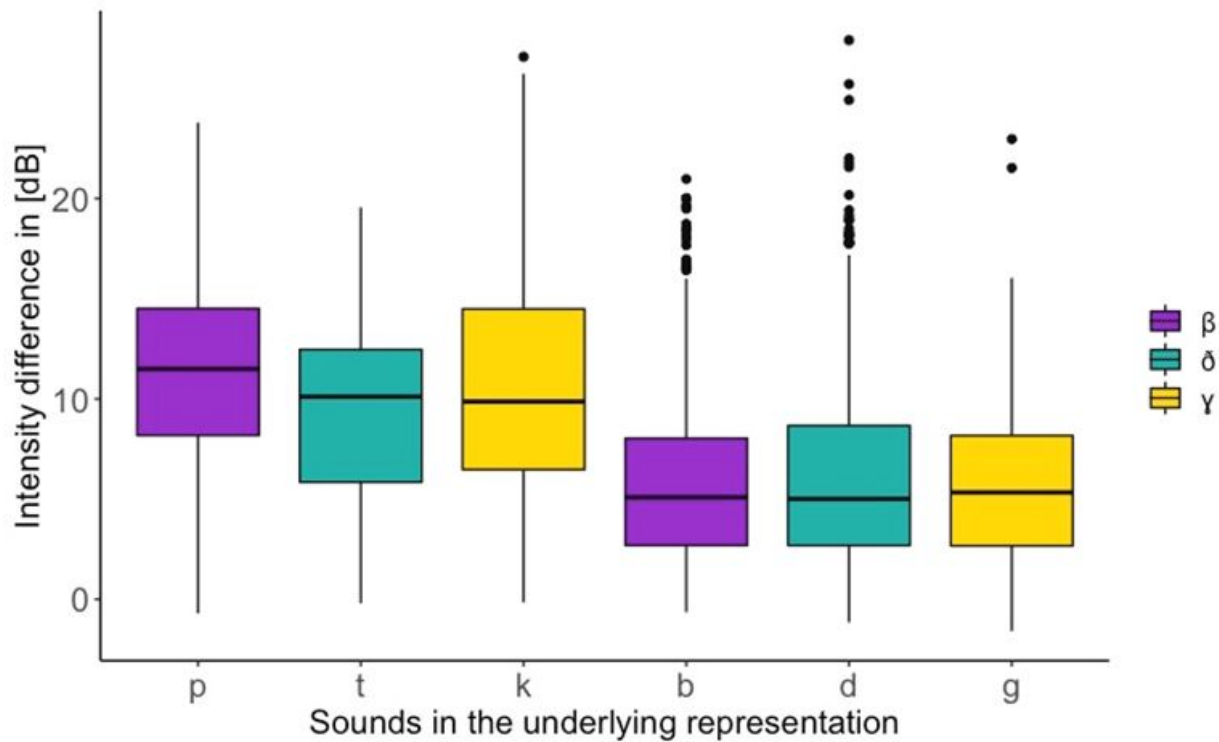
Surface differences



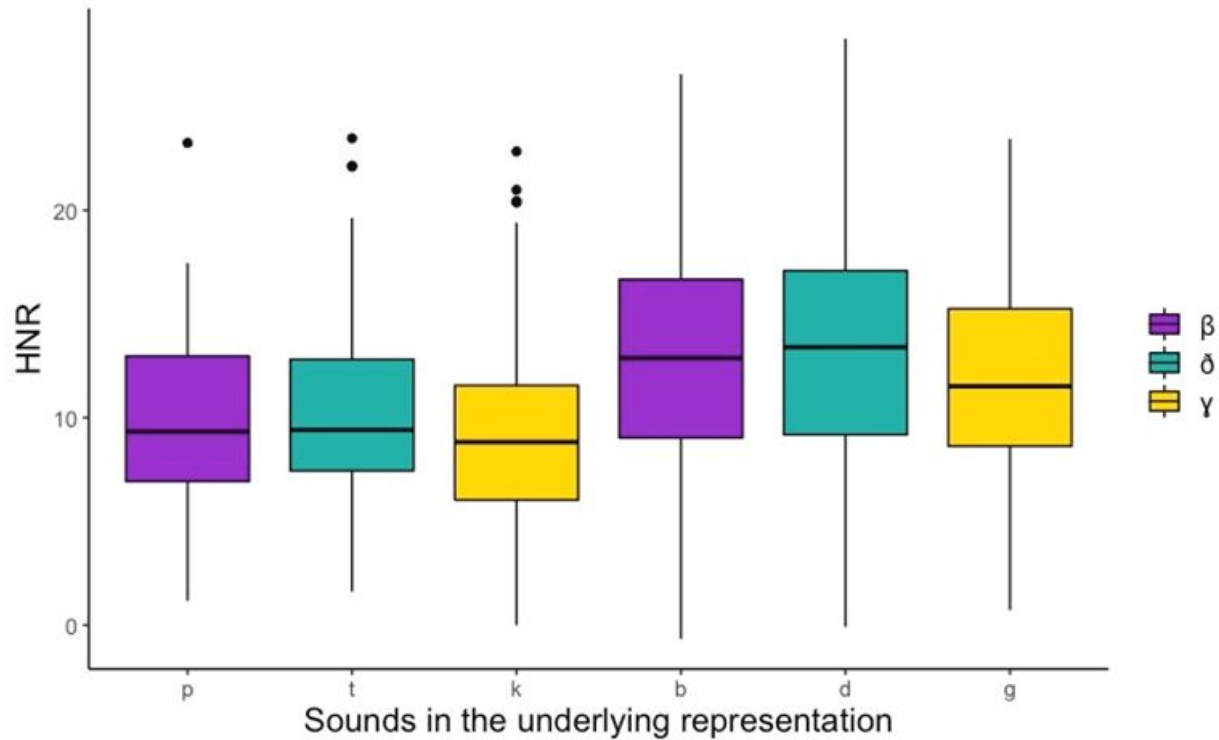
Surface differences



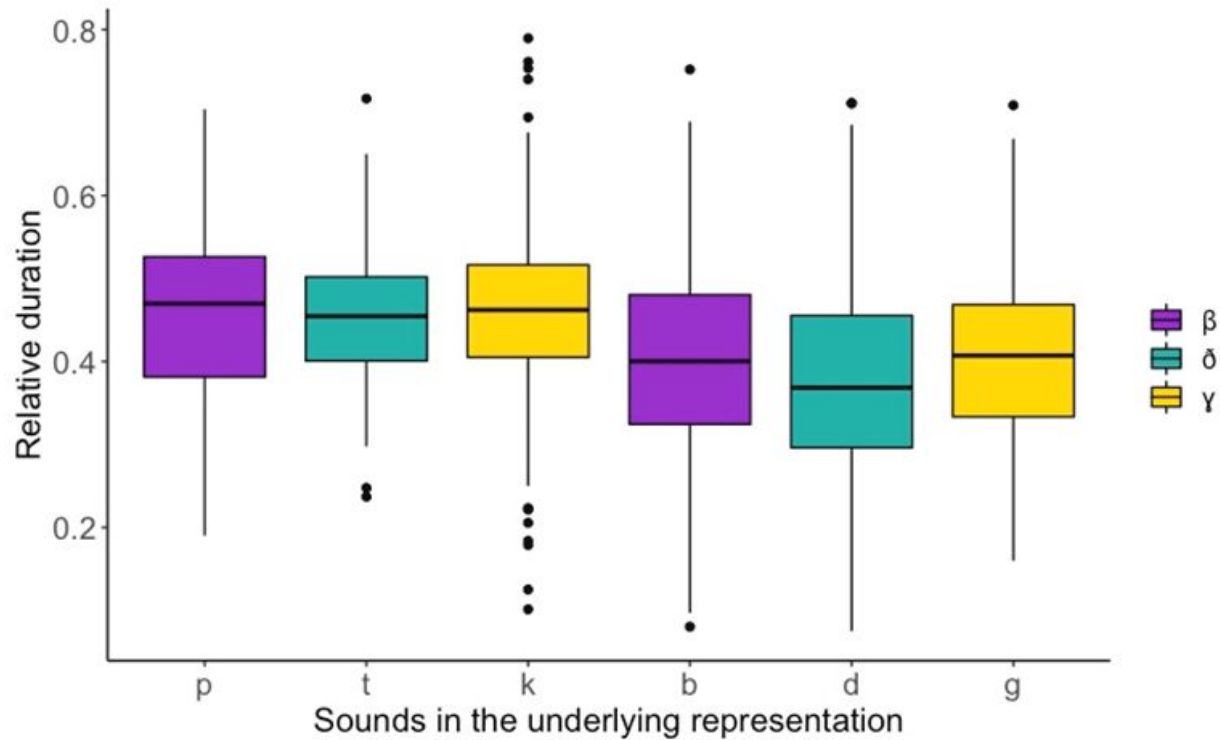
Phonemic status



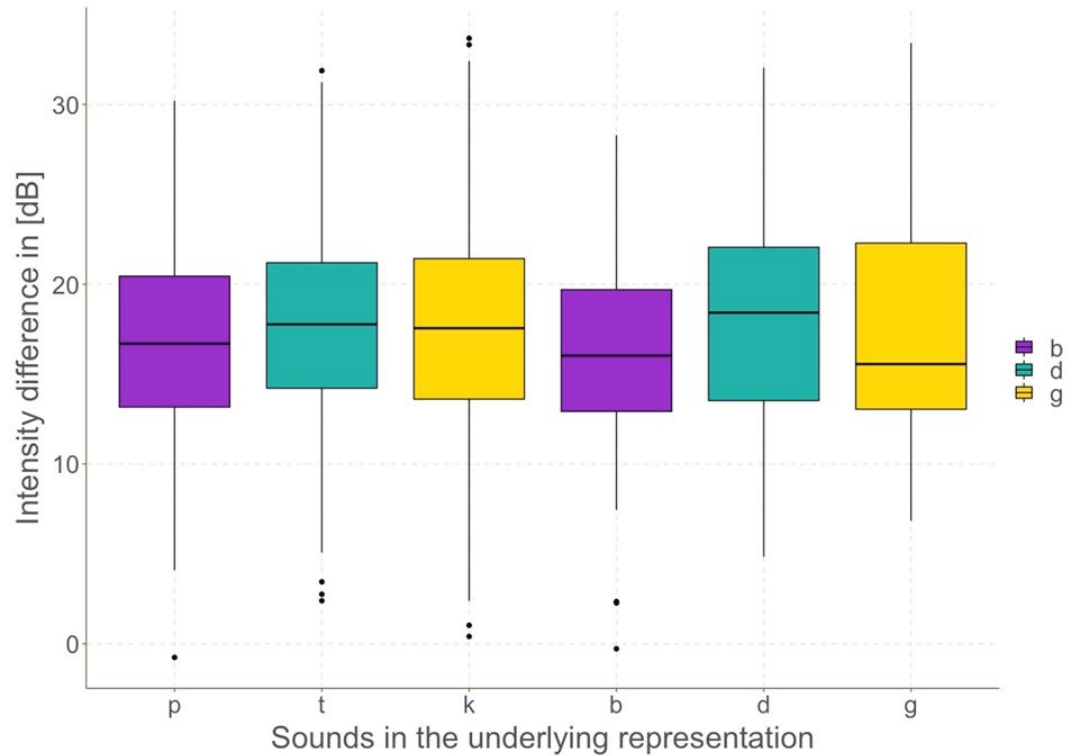
Phonemic status



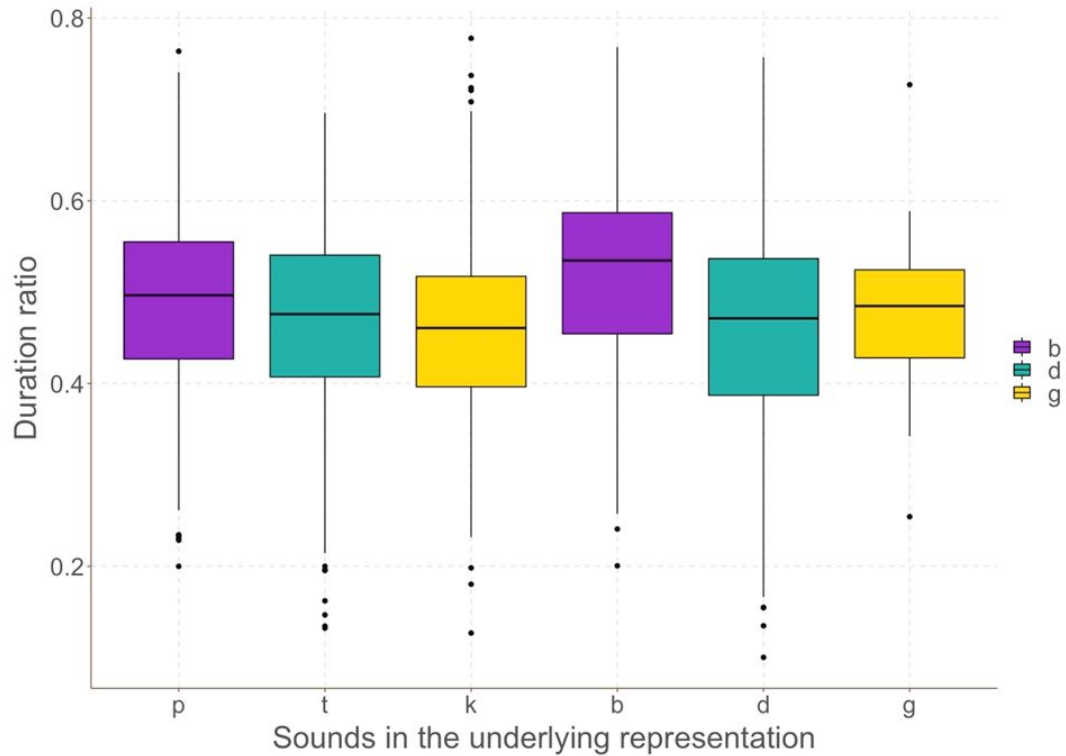
Phonemic status



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%

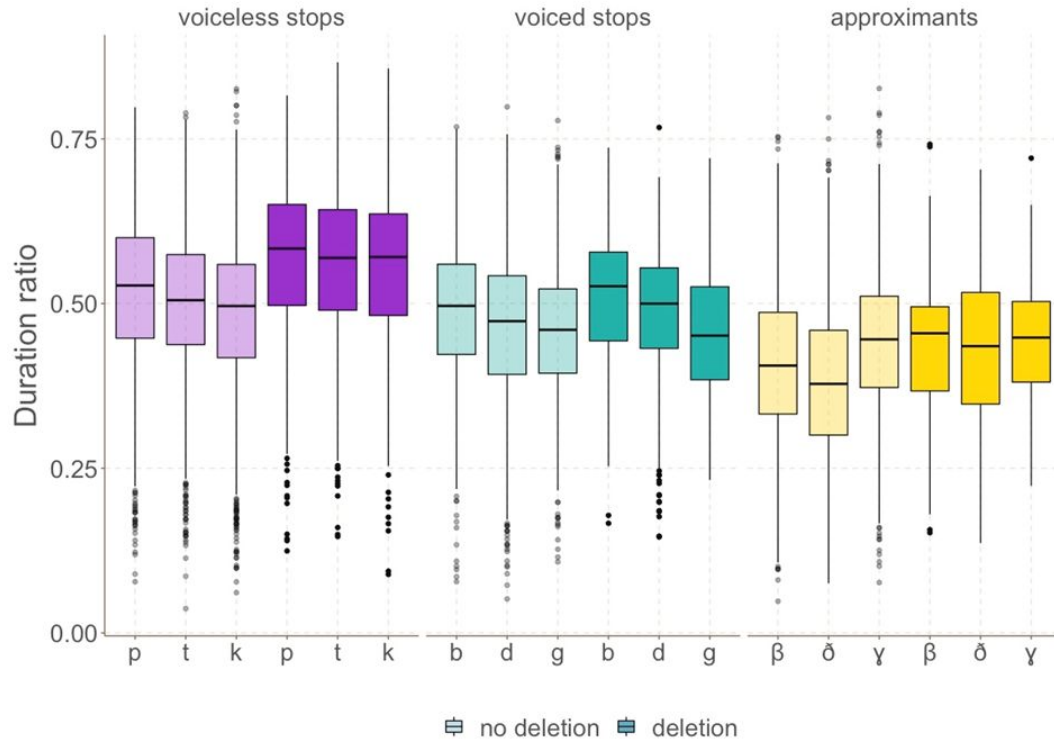
56.1% vs 42.1%

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%

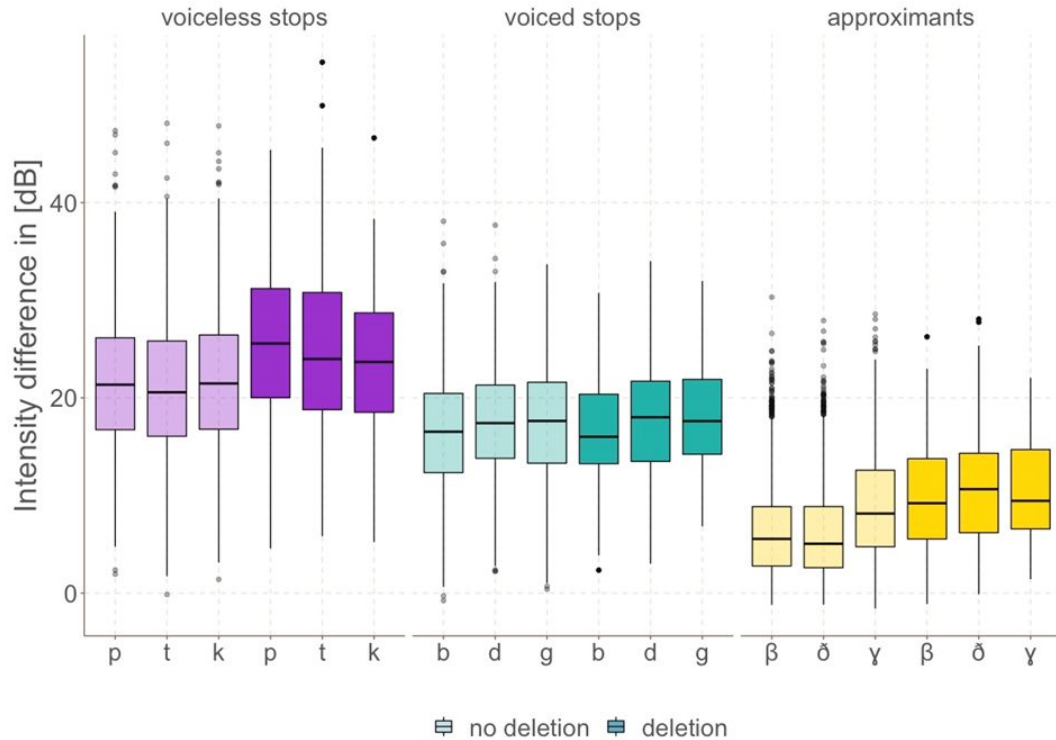
47.5% vs 52.5%

5.2% vs 94.6%

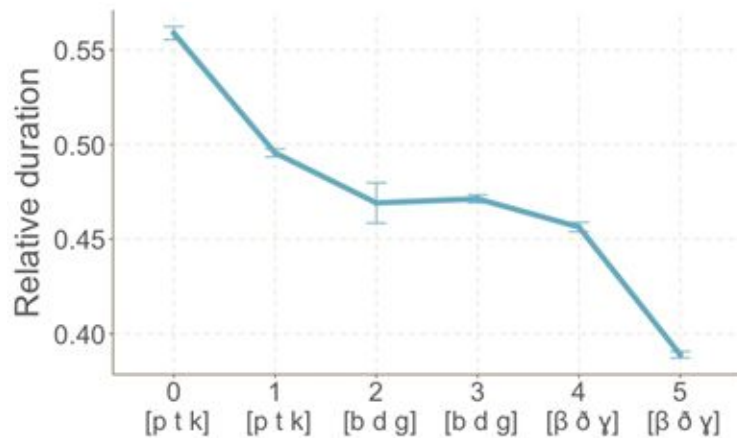
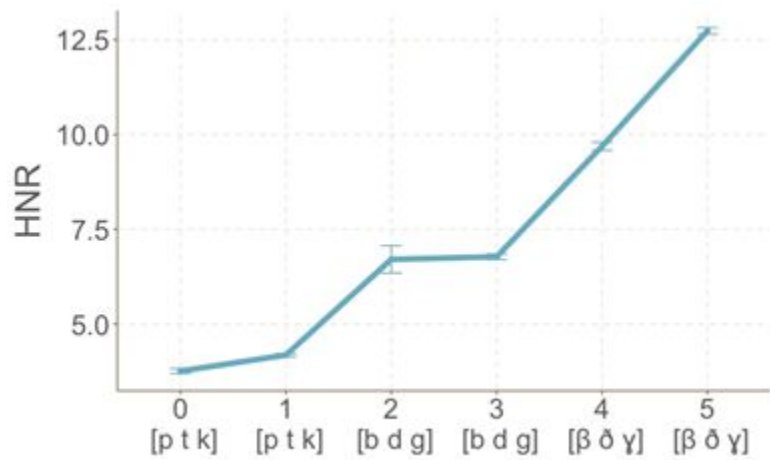
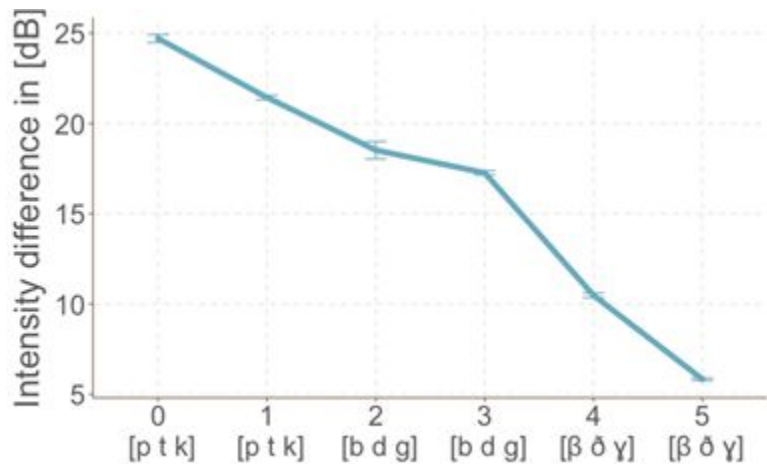
Phonological conditioning



Phonological conditioning



Scalar feature?



Interim summary 3

- ❑ 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

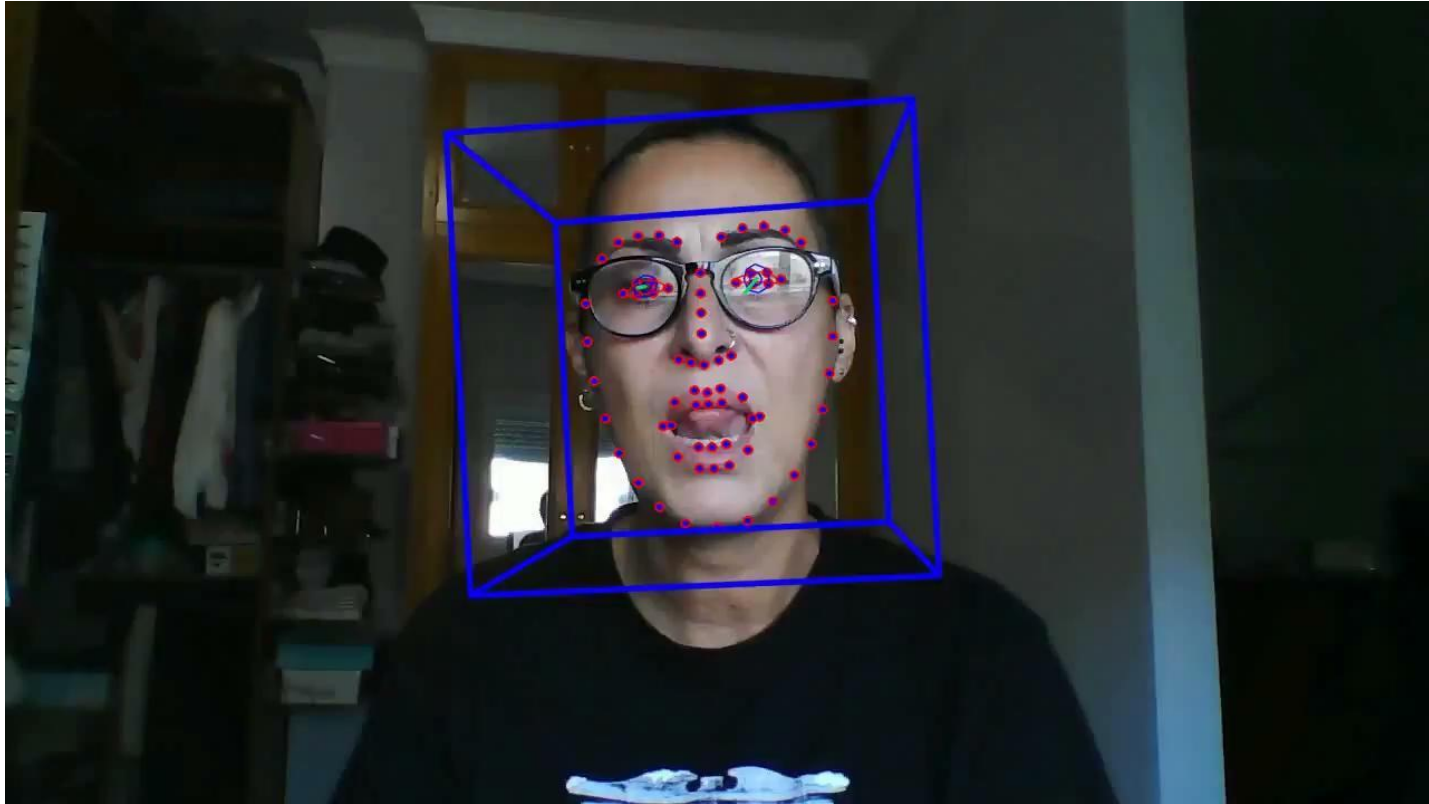
Motion capture study

in collaboration with Peter Krause

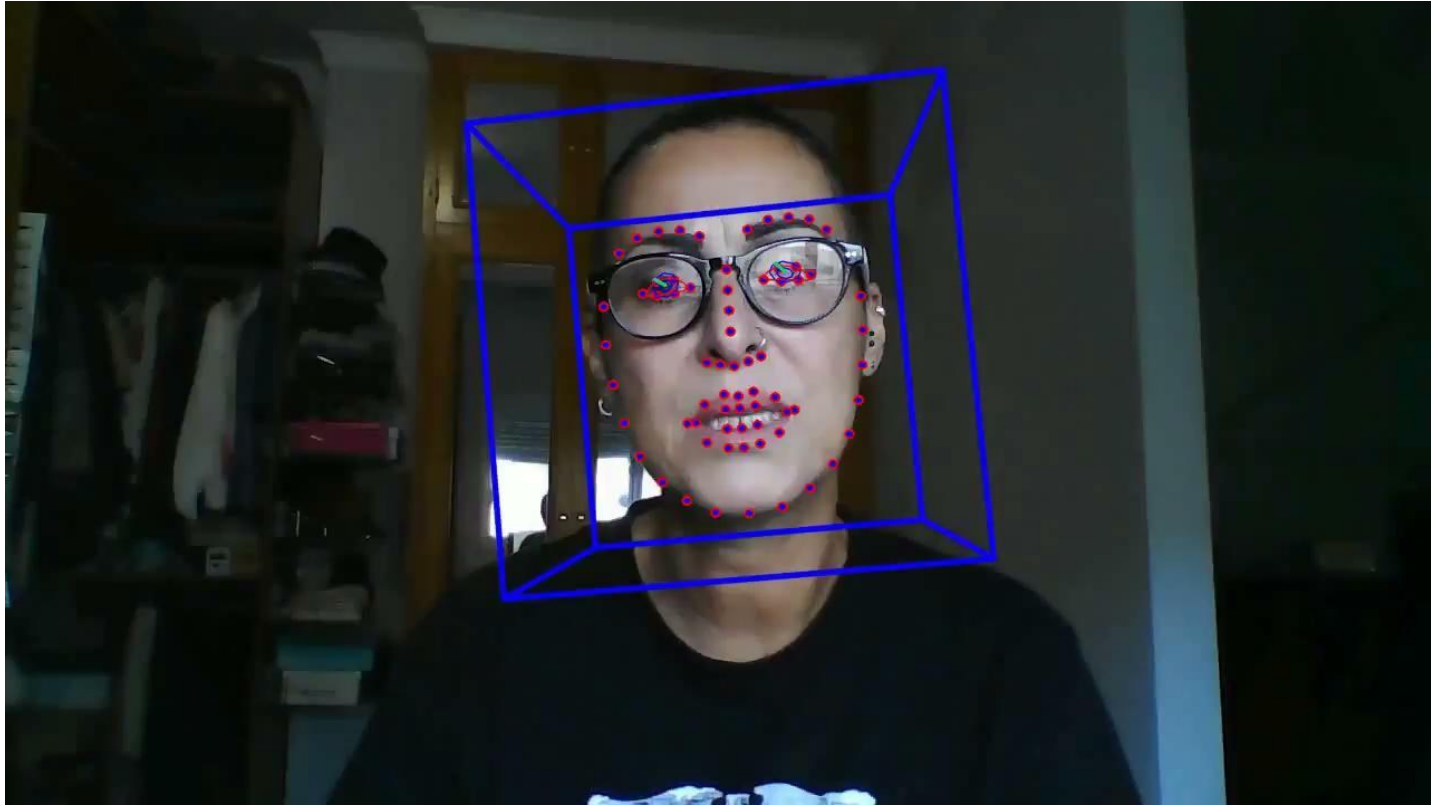
Factors tested: prosodic and phonological effects

- ❑ 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)

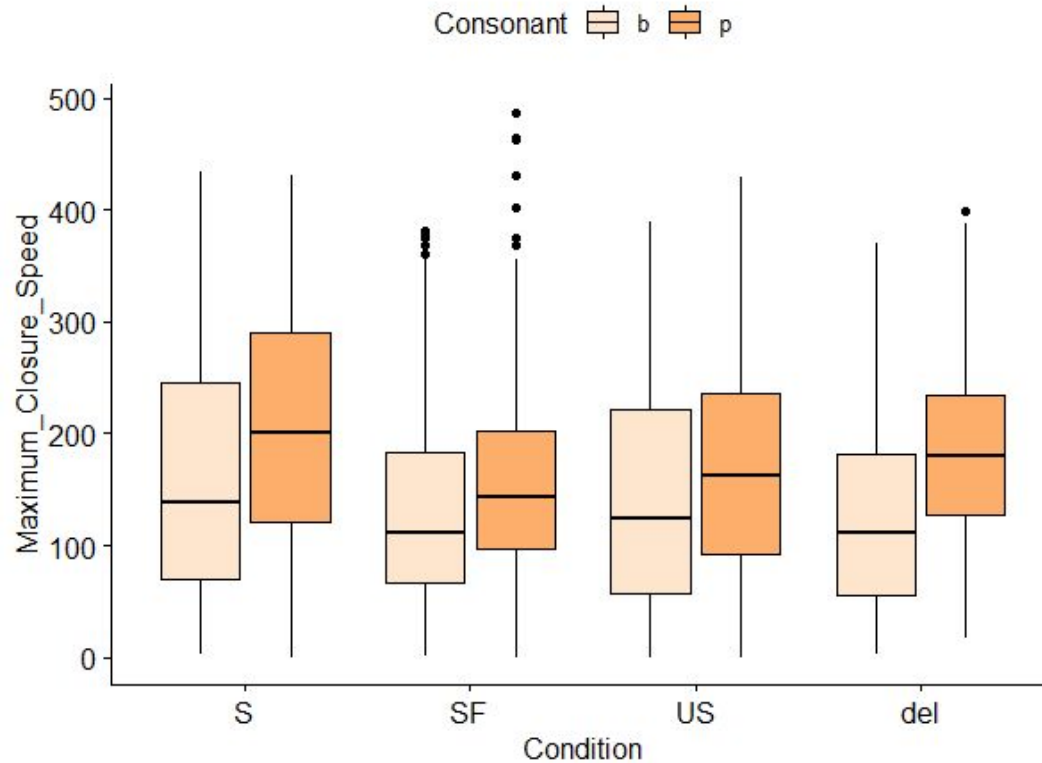
Example: /aba/



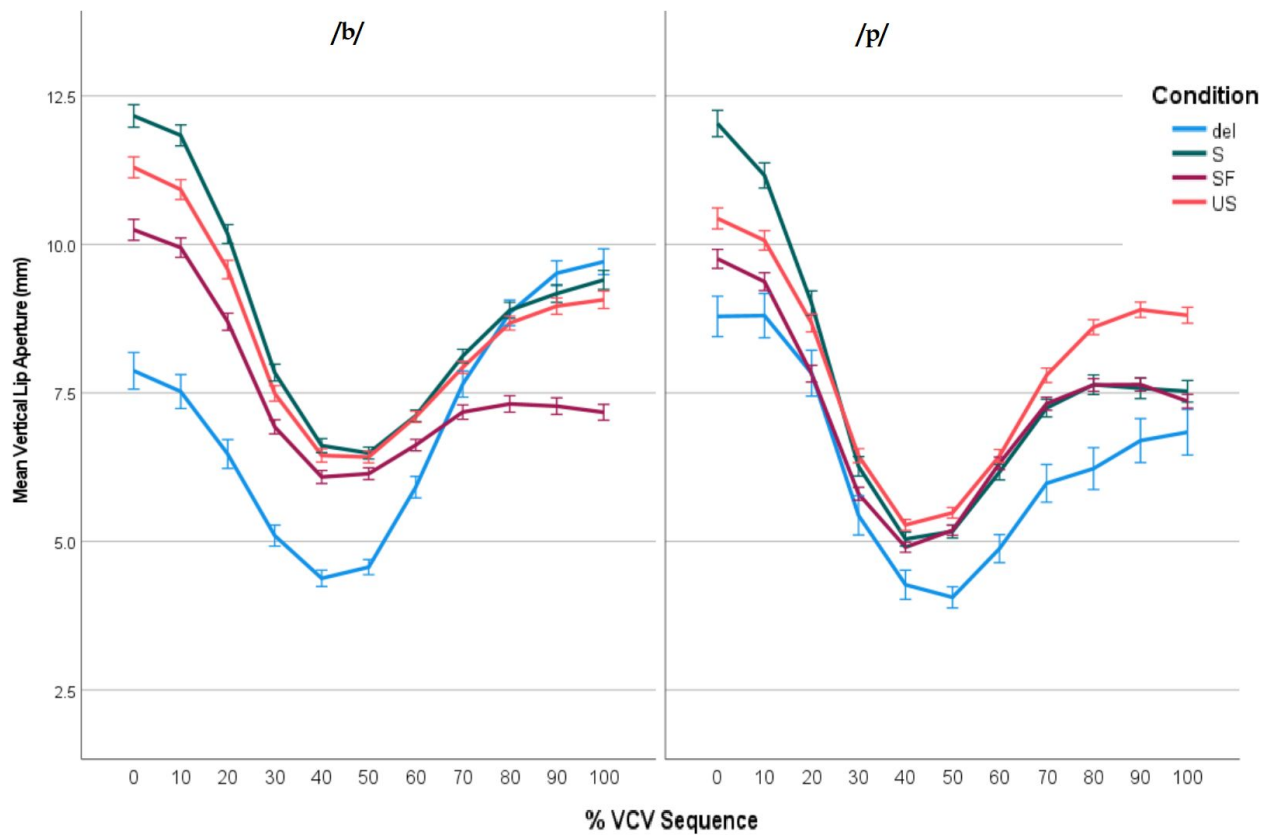
Example: /apa/



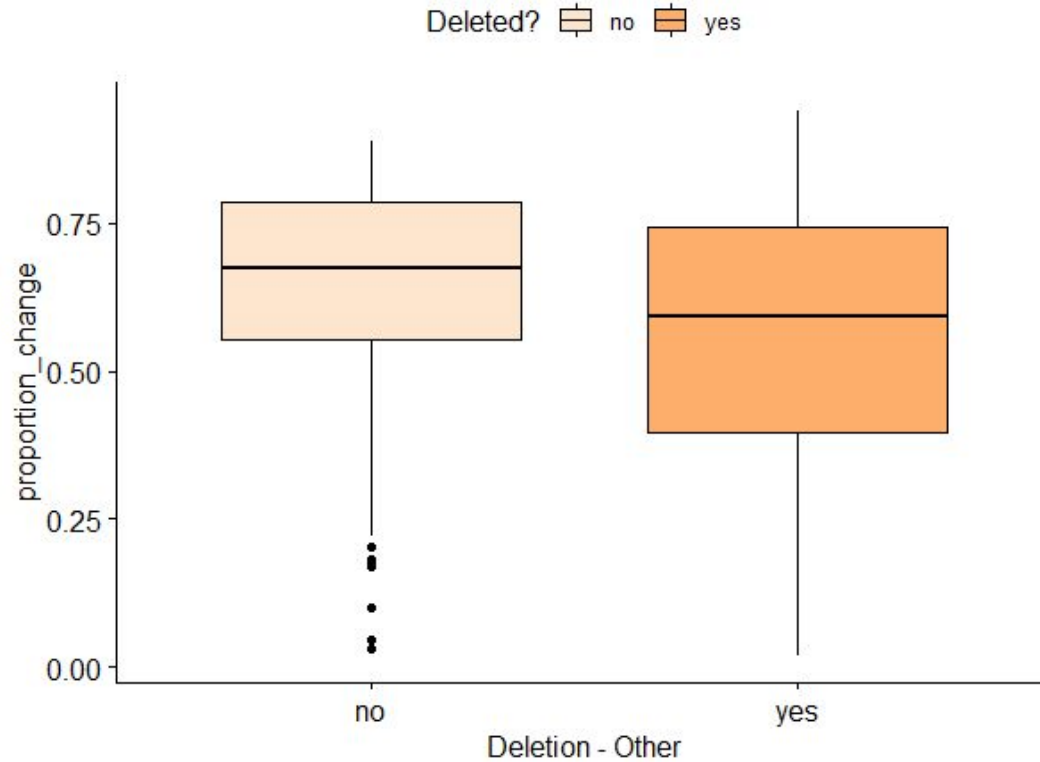
Preliminary results: max closure speed



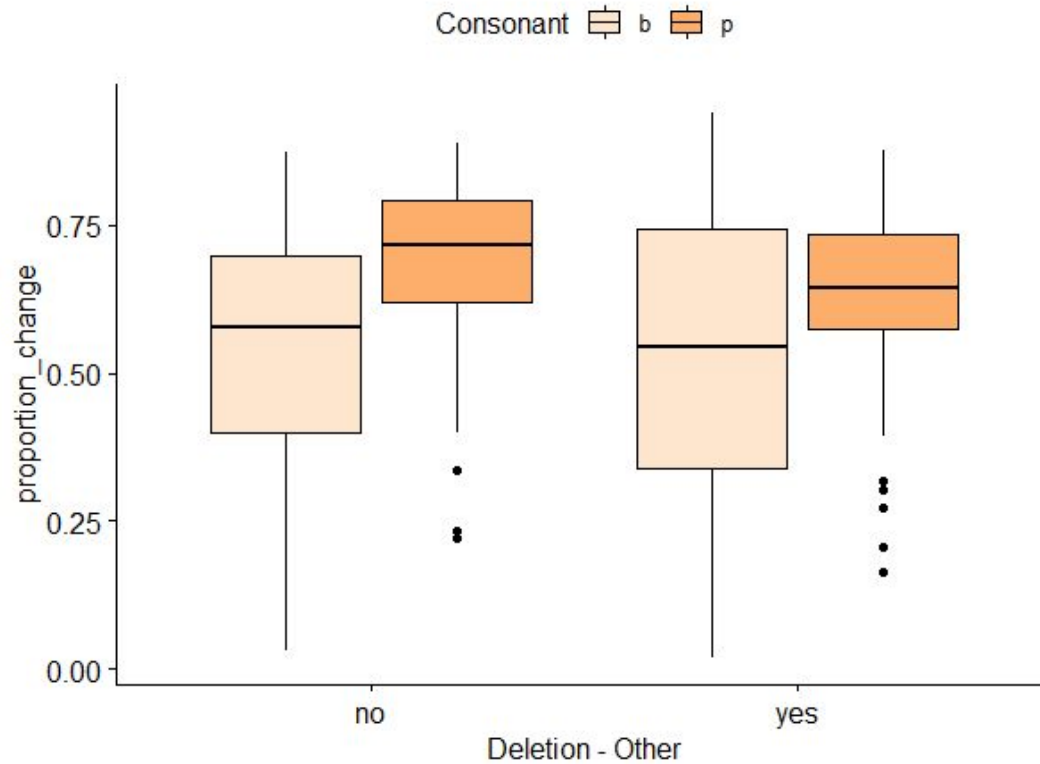
Preliminary results: mean vertical lip aperture



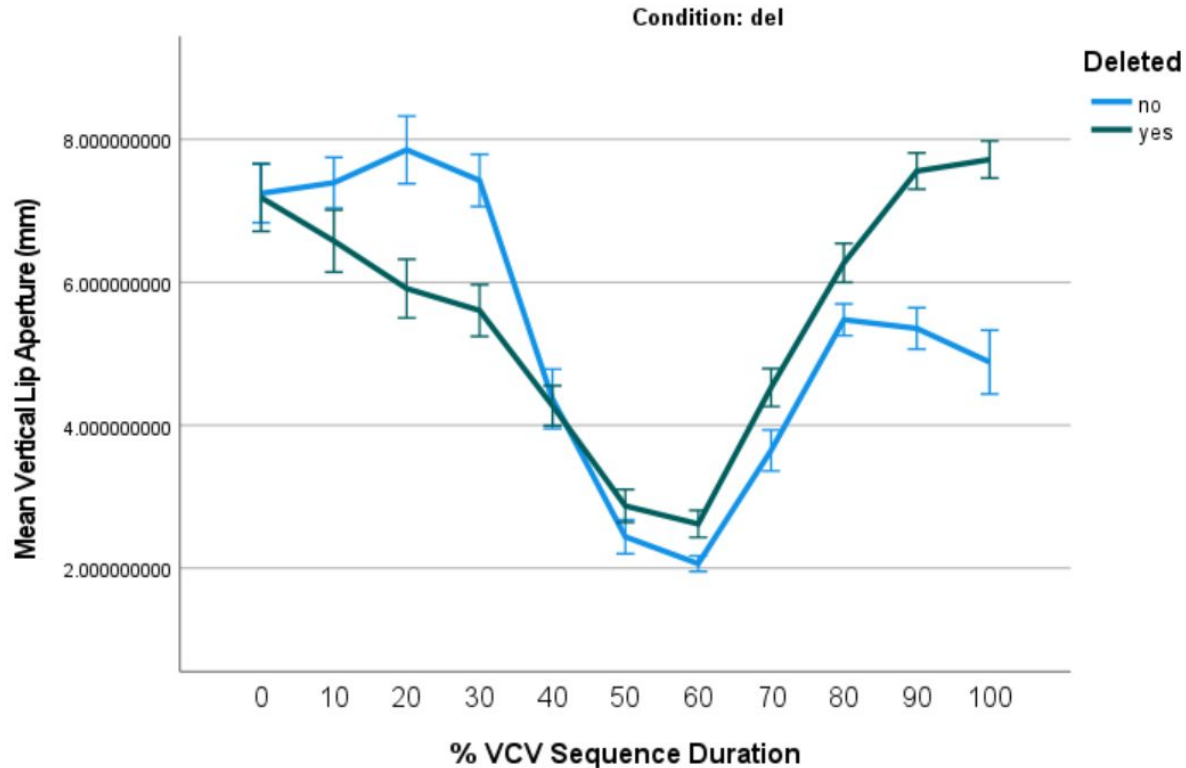
Preliminary results: change in aperture



Preliminary results: change in aperture



Preliminary results: lip aperture in deletion



Interim summary 4

- ❑ an intermediate category in deletion contexts?
- ❑ possible support for **containment** approaches in the data
- ❑ independent evidence for lenition, and **opacity**
- ❑ how to disentangle phonology from variation?

Do the data help

or not?

Too much detail vs

the trap of the incomplete picture

Compare results from the different quantitative studies mentioned

- ❑ percentages and generalisations often depend on (sub)database and type of comparisons....

How reliable is making generalisations based on auditory analysis?

my own work (2016, 2018)


Weak minimal pairs in Gran Canarian

la cama	[lagáma]	‘the bed’	la gama	[layáma]	‘the range’
cuatro	[kwádro]	‘four’	cuadro	[kwáðro]	‘painting’
paca	[pága]	‘pack/alpaca’	paga	[páyɑ]	‘pays’
grato	[grádo]	‘pleasant’	grado	[gráðo]	‘degree’
la poca	[labóka]	‘the little’	la boca	[laβóka]	‘the mouth’

Chain effects in postvocalic processes


Feeding order results in merger (unattested) *Counterfeeding order blocks merger (attested)*
 coto ‘property’ [kóto] → [kódo] → *[kóðo] coto ‘property’ [kóto] → [kóto] → [kódo]
 codo ‘elbow’ [kódo] → [kódo] → [kóðo] codo ‘elbow’ [kódo] → [kóðo] → [kóðo]

Evaluation of the sequence una prima ‘a cousin’ with constraint conjunction

/una prima/	*V [-cont, -v]	ID(cont)& ID(voice)	*[+cont] [-cont, -nas]	ID (cont)	ID (v)
a. u.na.prí.ma	*!		*		
 b. u.na.brí.ma			*		*
c. u.na.βrí.ma		*!		*	*

Blocking effects (counterfeeding)

Successful evaluation of pensar tonterías ‘thinking about silly things’

/pensar tonterías/	*V [-cont,-v]	*C]CODA	IDENT (voice)	MAX (Seg)
a. pen.sa[r _{pp}].ton.te.rí.a[s _{pu}]		*!		*
b. pen.sa[r _{pu}].don.te.ría[s _{pu}]			*!	**
 c. pen.sa[r _{pu}].ton.te.rí.a[s _{pu}]				**

The assumption: voicing is blocked, spirantisation is not

Broś & Nazarov (submitted)

Modelling opacity and variation in
Gran Canarian Spanish apocope

Factors: prosody, gender

opacity effects in spontaneous speech

Another interaction involving deletion

(1) Consonant deletion

cosas ‘things’ [‘ko.sa]

hacer ‘to do’ [a.‘se]

papel ‘paper’ [pa.‘pe]

(2) Vowel apocope

cosa ‘thing’ [‘kos]

Tenerife [te.ne.‘rif]

perfecto ‘perfect’ [per.‘fekt]

(3) Interaction

hijos ‘children’ [‘ih]

cosas ‘things’ [‘kos]

ofertas ‘offers’ [o.‘fert]

Consonant deletion:

- ❑ optional but well-established
- ❑ no prosodic restrictions,
- ❑ all speakers
- ❑ 55% phrase-internally
- ❑ 92% at phrase edges

Vowel apocope:

- ❑ strictly phrase-final process
- ❑ prosodically-defined positions
- ❑ male speakers
- ❑ 49% on average

Interaction:

fed counterfeeding opacity

perfecto → [perfekt] → * [perfek]

cosas → [kosa] → [kos] → * [ko]

Optional processes can cause complex opacity interactions

Surface distributions (averaged for 18 speakers, 391 contexts)

Input	Output	Frequency	Input	Output	Frequency
/'kosa/ 'thing'			/'kosas/ 'things'	['ko.sas]	8%
	['ko.sa]	39%		['ko.sa]	55%
	['kos]	61%		['kos]	37%

The nature of opacity

- ❑ tied directly to cyclicity , morphophonological restrictions (Kiparsky 1971, 2000; Bermúdez-Otero 1999)
- ❑ Kiparsky (2015:21) states explicitly that opacity is “a side effect of domain stratification”, at most two levels of opacity
- ❑ no opacity between optional processes: we cannot establish whether the observed opacity effect is genuine or simply a result of not applying an optional process

Is opacity a result of optionality?

Does opacity disappear if the processes in question always applied?

- ❑ For *pasos* 'steps' the probability of ['pasos] is **8%** while the probability of (transparent) ['pa] is **0%** and the probability of (opaque) ['pas] is **37%**. In vowel-final words such as *paso* 'step' the probability of (opaque) ['pas] is **61%** while (transparent) ['pa] surfaces **0%**
- ❑ Zero probability of transparent final C deletion cannot be derived from merely assuming that vowel apocope and final consonant deletion apply optionally at every derivational step: if the latter were the case, we would see at least some occurrences of such forms

Opacity - summary of the cases

deletion + apocope = underapplication

- paso(s)** deletion applies, apocope doesn't (optional, opaque)
- pas(os)** deletion applies once, apocope applies (optional, opaque)
- pasos** nothing applies (optional, opaque)
- paso** apocope underapplies (optional, opaque)
- pas(o)** apocope applies, deletion underapplies (opaque)

Opacity - summary of the cases

deletion + spirantisation = underapplication

paso [D]e

spirantisation applies transparently

paso(s) [d]e

spirantisation underapplies (opacity)

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

Opacity - summary of the cases

deletion + aspiration + voicing = overapplication

chocolate[h] con aspiration applies before a voiceless consonant (optional)

paso[H] de aspiration AND voicing apply before a voiced consonant (rare)

paso(s) de deletion applies before a consonant (optional)

paso[H] a aspiration AND voicing apply before a vowel (opaque)

General conclusions

What does working with different types of databases give us?

- ❑ helps elucidate factors affecting **sound change**
- ❑ helps get **the whole truth** about the studied processes
- ❑ helps identify **gradient vs categorical** changes (true categoricity?)
- ❑ helps identify **co-phonologies** by looking at intra-speaker differences

What does working with different types of databases give us?

- ❑ helps **disentangle phonetics from phonology** (hopefully, sometimes)
- ❑ helps look at how **variation and optionality** lead to **opacity**
- ❑ are there no other cases of **post-lexical opaque interactions** or is this gap theory-based?

In general:

It's good to have the numbers of the things you analyse!

Thank you!

Slides and publications at www.karolinabros.eu