THE IMPACT OF SPEAKING MODE ON THE PRODUCTION OF NORWEGIAN, POLISH AND ENGLISH SIBILANTS IN A MULTILINGUAL ACQUISITION CONTEXT

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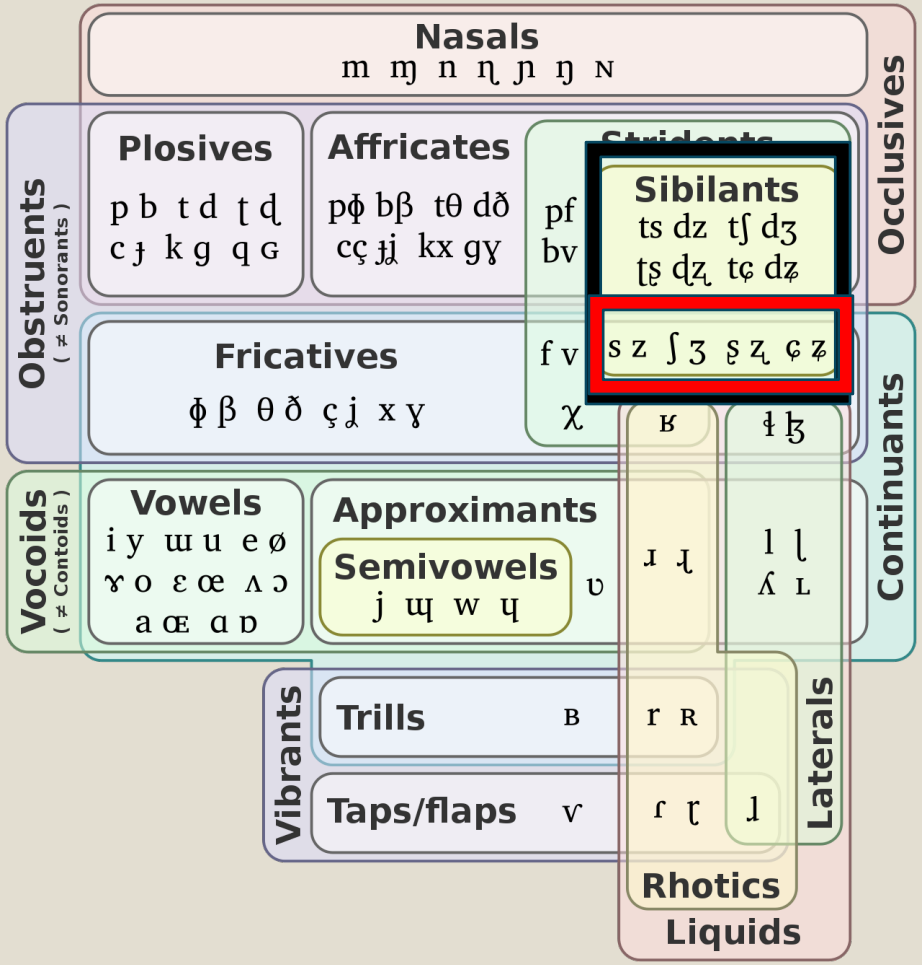
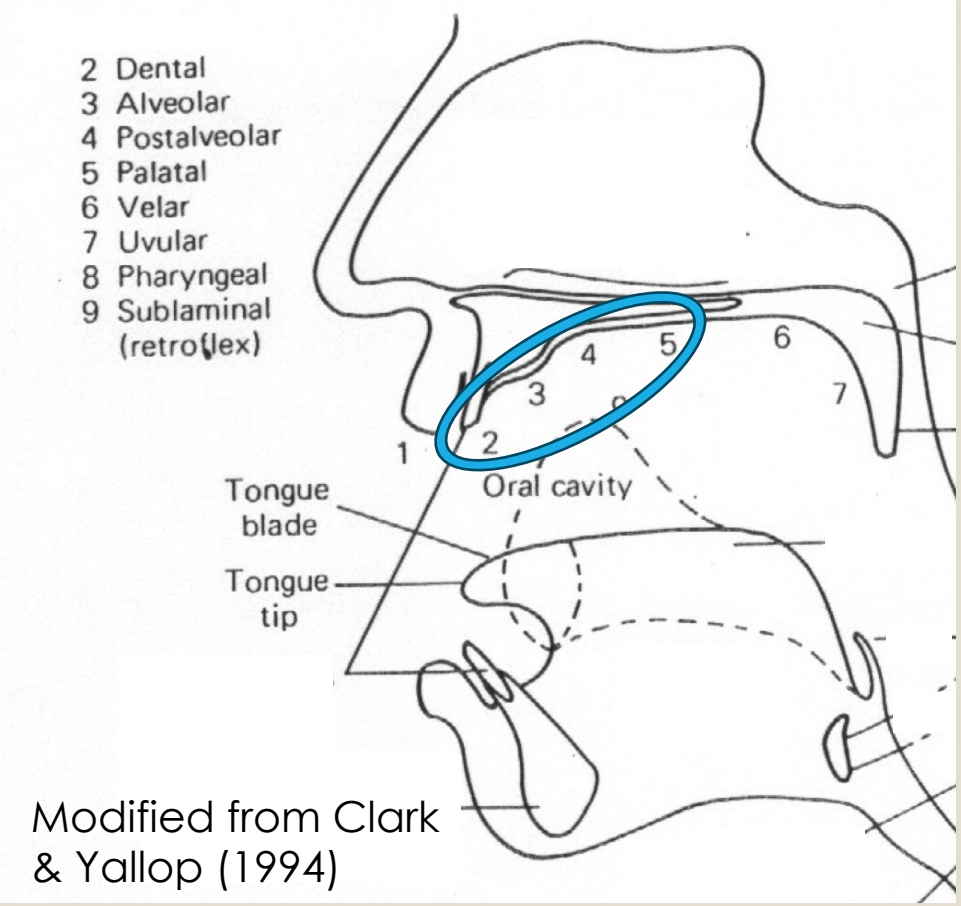
Sibilant fricatives

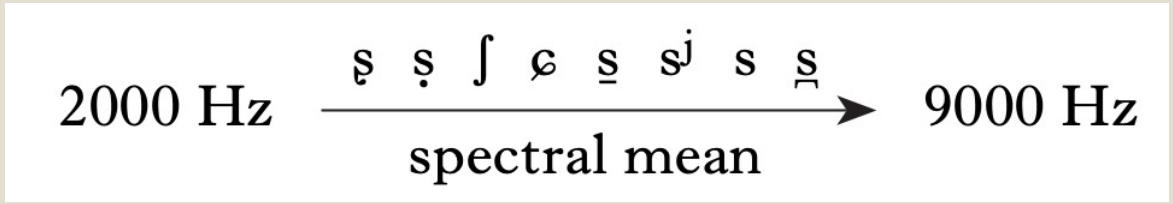


- Sibilant fricative sounds produced by the tongue tip or tongue blade
- Constricted, turbulent airstream
- Possess higher amplitude and pitch than other fricatives by directing the at the teeth.

Places (of articulation) of interest



Modified from Clark & Yallop (1994)



Schematic distribution of sibilants according to spectral mean
(from Boersma & Hamann, 2008)

Descriptions of “sibilant” inventories in Polish, Norwegian and English

- **/ʃ ~ ʂ/ in Polish:**
  - /s/, /ʃ/, /ɕ/ (in traditional representations, e.g., Jassem, 2003)
  - /s/, /ʂ/, /ɕ/ (Czaplicki, Żygis et al. 2016;)

- **/ʂ ~ ʃ/ in Norwegian:**
  - /s/, /ʂ/, /ç/ (Kristoffersen, 2000)
  - /s/, /ʃ/, /ç/ (in other sources, e.g., van Dommelen, 2019).

- **/ʃ/ in English:**
  - /s/, /ʃ/

Research Questions (Current)

Q1. Do the productions of sibilants by learners differ across speech modalities, i.e., spontaneous versus read speech?

Q2. Does cross-linguistic influence occur between the phonological systems of multilinguals as a function of modality?

Research Questions (Prior)

Q3. Do learners of Norwegian produce acoustically distinct realizations for postalveolar (/ʃ~ʂ/) sibilants across their languages?

Q4. Is Norwegian /ç/ acoustically distinct from Polish /ɕ/ in Polish learners, or is there a one-to-one mapping, as described for Polish learners of German (Morciniec & Pręd̨ota, 2005)?

Predictions

- **Q1. Does speaking mode influence sibilant production ? (COG)?**
  - P1: , **We predict <u>convergent sibilant values in spoken mode</u>**: one might expect less hypercorrectness in spontaneous rather than read speech, due to more attention on the content of the message rather than form
    - ***spontaneous speech is produced with reduced spectral space when compared with read speech*** in the L1 (Nakamura, et al., 2008) or in an L2 (Cucchiarini et al., 2002).

Predictions

- **Q2. Do we expect more CLI in spontaneous or in read speech?**
  - P2 (a) **We predict fewer examples of CLI in read speech** (which is monitored speech), whereas **spoken speech will demonstrate more instances of CLI** since there is less attentional control over the production of individual sounds.
  - P2 (b):**L1 CLI should be more prominent on L2/L3** due to L1 dominance effect (Westergaard, et al. 2017)

Participants (Learner Group)

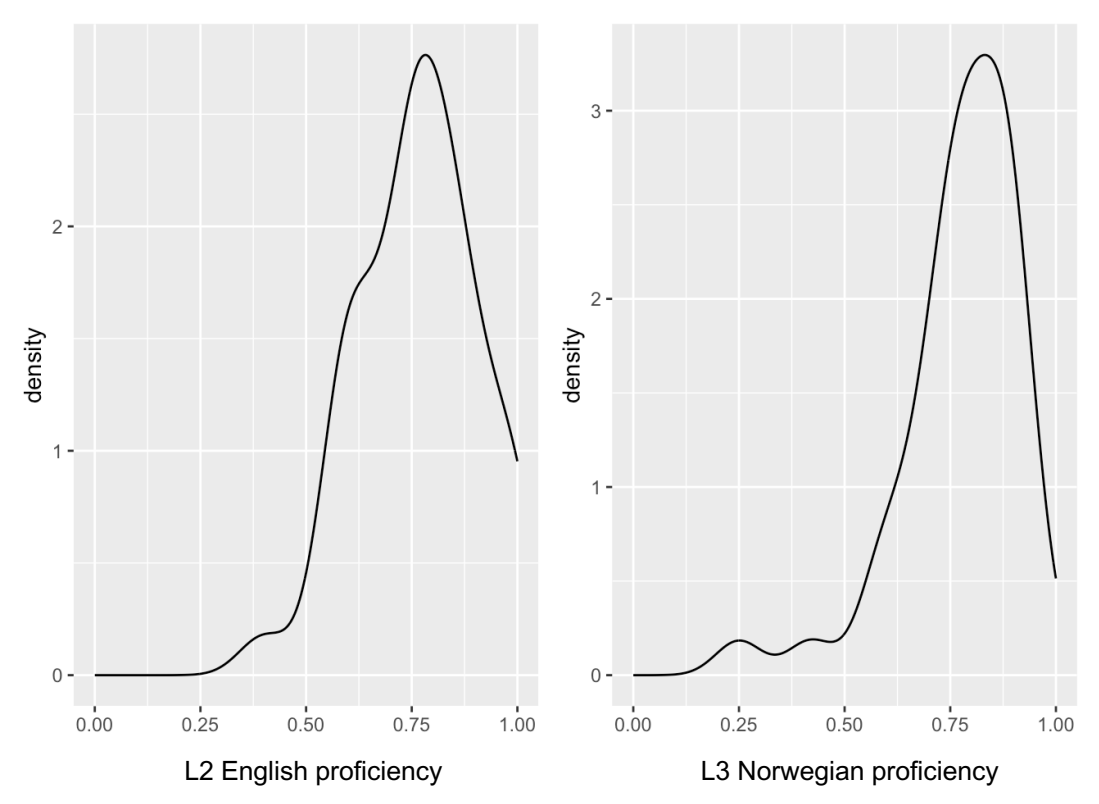
- **39 (f=35) L1 Polish, L2 English, L3 Norwegian learners** (Poznań, Szczecin)

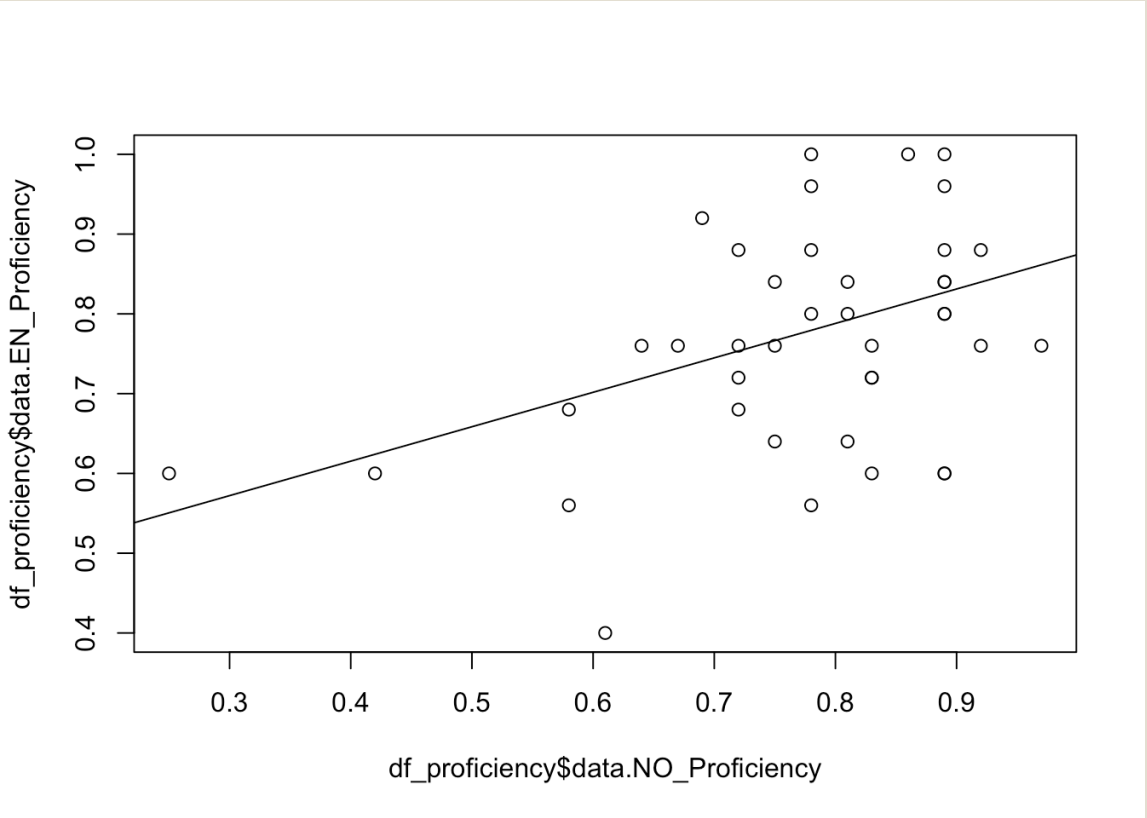
	Age
Mean	21.26
Stdev	1.94
Range	9.0
	Gender
Male	3
Female	34
Other	2
	Stage of Norwegian
Year I	17
Year 2	13
Year 3	9

Participants (Control Group)

- **10 (f = 8) out of 13 (f=9) L1 Norwegian**, L2 English **controls** (Tromsø), 2 excluded due to uvular /R/ and 1 excluded due to gaps in language proficiency tests.

L1 Polish proficiency scores in L2 English and L3 Norwegian





Methodology (Task 1: story retelling task)

- Language priming task to induce a specific language mode in L1, L2, & L3
- Video duration (~1.5 minutes) in 3 separate language blocks. (Norwegian > English > Polish)
- Immediate story retelling task after viewing
- Spontaneous responses approximately 1-2 minutes in duration

Methodology (Task 1: story retelling)

- Each language mode induced via the video retelling Task in the respective language

L3 Norwegian:
"Se denne korte videoen veldig nøye."

"Fortell med dine egne ord hva som skjedde i avsnittet du så."

L2 English:
"Watch a the movie clip very closely."

"In your own words, tell us what happened in the video you saw."

L1 Polish:
"Obejrzyj dokładnie krótki fragment kreskówki."

"Opowiedz własnymi słowami co wydarzyło się w obejrzanym przez ciebie fragmencie."

Methodology (Task 2: sentence reading)

- **20 tokens** per target phone per participant ($n_{learner}$ = 7800, $n_{control}$ = 2000)
- *20 tokens per orthographic sequence in Norwegian* (to investigate the effect of orthography on pronunciation)

	Coronal	**Postalveolar**	**Palatal**
Polish: /s/, /ʃ~ʂ/, /ɕ/	<s>,	<sz>,	<si>
English: /s/, /ʃ/	<s>,	<sh>	
Norwegian: /s/, /ʃ~ʂ/, /ç/	<s>,	<rs>,<sj>,<skj>,	<kj>

Methodology (Task 2: example tokens per phoneme)

Language	Phoneme	Word	Sentence
PL	s_1	ry**s**uje	Pisarz rysuje słowami.
PL	sz	my**sz**y	Sowy słyszą myszy z daleka.
PL	si	pro**si**	Szofer prosi o klucze do samochodu.
EN	s_2	viru**s**es	The doctor sees viruses with the microscope.
EN	sh	fi**sh**ing	Our family goes fishing twice a year.
NO	s_3	le**s**er	De leser nyheter i sosiale medier.
NO	rs	fo**rs**økte	Jeg forsøkte å reparere bilen min selv.
NO	sj	dro**sj**e	Jeg tok en drosje til flyplassen.
NO	skj	te**skj**e	Jeg vil ha en teskje sukker i kaffen min.
NO	kj	be**kj**ente	Jeg traff min gamle bekjente på gaten.

Procedure (Task 2)

- Selected **20 natural words for each phoneme** across a variety vowel contexts
  - For Norwegian **we prioritised high frequency words** that would likely be recognised by the L3 Norwegian learners
  - using a variety of resources, i.e**., high frequency lists containing the top 6000 words** , learner textbooks, etc.
- Embedded away from the edges (2 or more syllables)

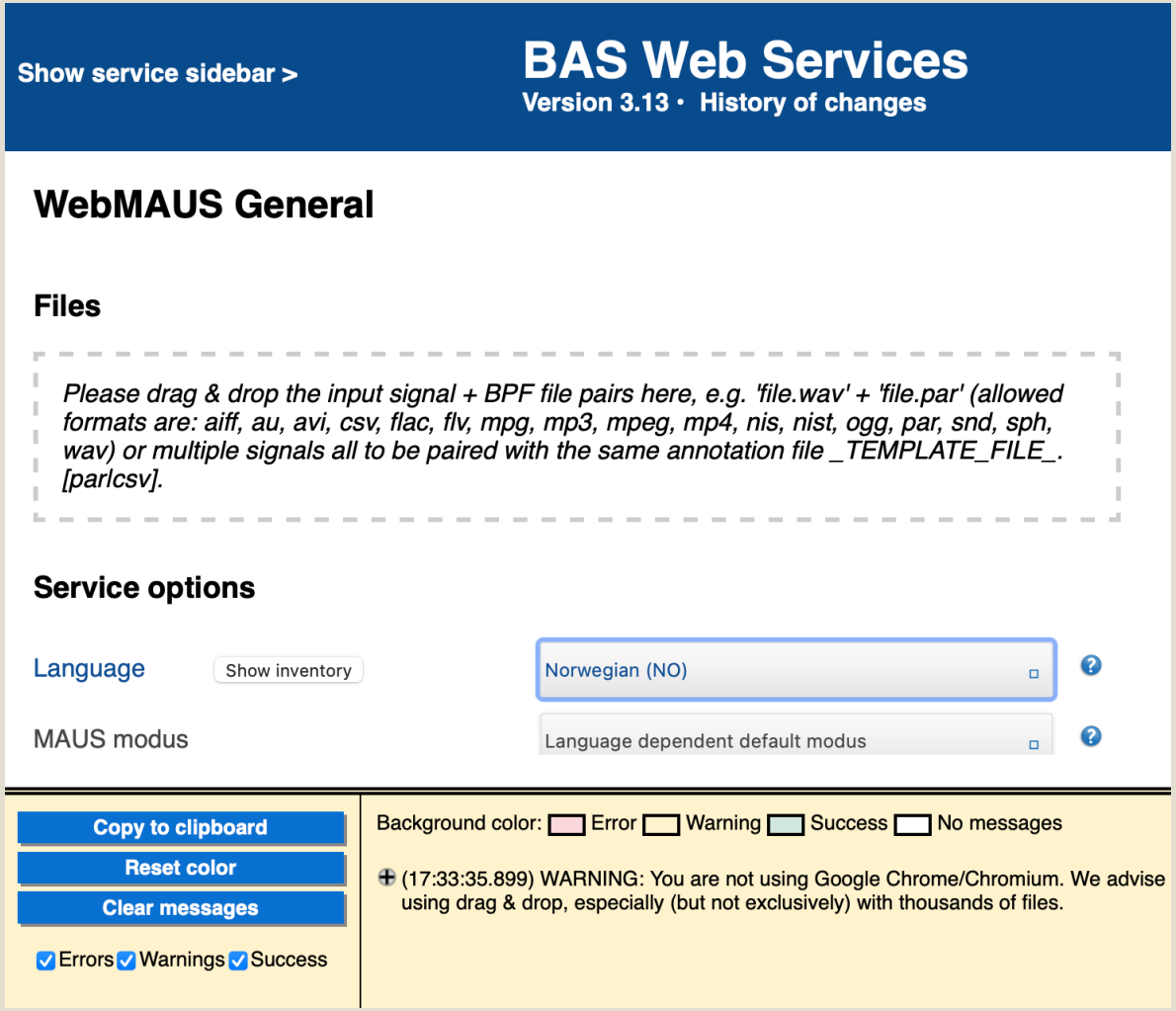
Carrier Sentences (Task 2)

- All **stimuli consisted of naturalistic sentences** in Norwegian, English and Polish
  - **Generated via ChatGPT** (ChatGPT, personal communication, March 01, 2023)
  - **Evaluated and modified by native speakers** of each respective language

Procedure (Task 2)

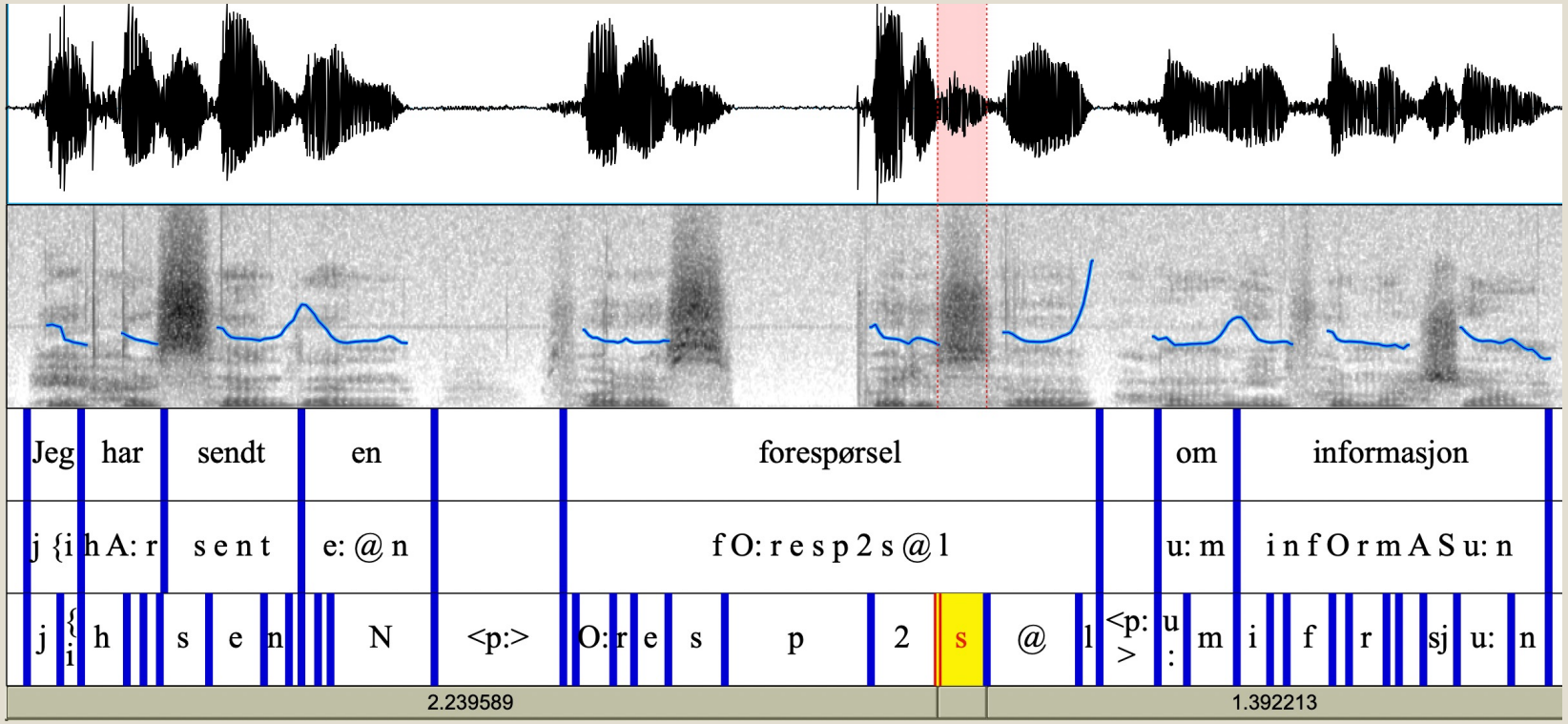
- **Stimuli were presented in 3 language blocks** (L3 Norwegian > L2 English > L1 Polish)
- Sentence lists were **randomized for each participant**
- Target sentences (Total: n=200; PL: n=60; EN: n=40; NO: n=100) were **intermixed with sentences from a VOT investigation** (Total: n=305; PL: n=120; EN: n=120; NO: n=165) as distractors.

Data Processing (annotations and force alignment)



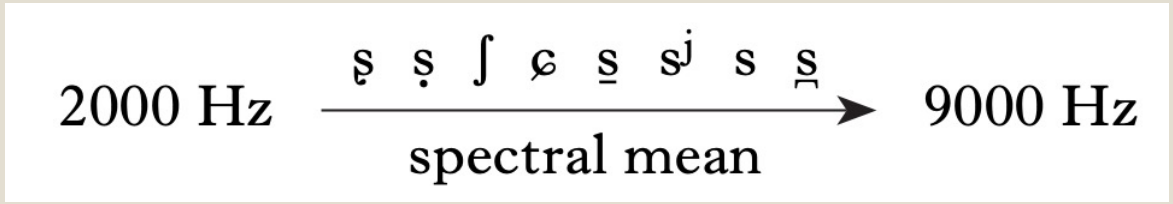
- **Force aligned participants' audio files with their corresponding text files using BAS**
- Clarin BAS Web Services: WebMAUS General **(**Kisler, Reichel, and Schiel, 2017)

Data Processing (Norwegian sample)



Assessing sibilant inventories via spectral moments

- We assessed the sibilants according to acoustic measures grounded in previous literature (Jongman, Wayland & Wong, 2000; Nirgianaki, 2014; Lee, 2020)
  - Spectral moments:
    - **Center of gravity (spectral mean)**
    - Spread (variance)
    - Skewness
    - Kurtosis



Schematic distribution of sibilants according to spectral mean
(from Boersma & Hamann, 2008)

Extracting acoustic details (Task 1+Task 2)

- **spectral moments from participants' production recordings** using a pre-existing script (2013, Christian DiCanio, Haskins Laboratories & SUNY Buffalo.)
- central 80% of fricatives were extracted
- High pass filter at 300 Hz (to exclude F0)

Speech Mode Tokens by Task

Spontaneous speech (Task 1)

Task 1: Story Retelling Task (Learner group)			
	1PL	12EN	3NO
skj/sky	0	0	1
kj	0	0	48
sj	0	0	3
rs	0	9	2
sh	0	290	3
sz	209	0	0
si	148	8	32
s	263	616	473

Read speech (Task 2)

Task 2: Reading Task (Learner group)			
	1PL	1PL2EN	1PL3NO
skj/sky	0	0	859
kj	0	0	858
sj	NA	0	1014
rs	NA	NA	897
sh	0	780	0
sz	897	0	0
si	819	NA	NA
s	897	937	1223

Analysis: Target comparisons (Task 1)

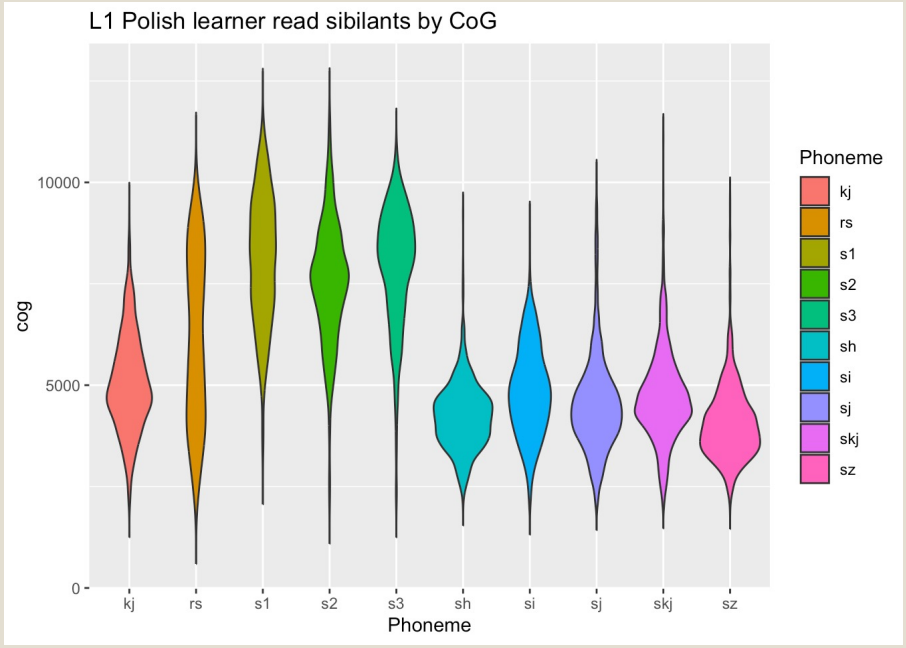
	Sound 1	Sound 2	Sound 3	Place of articulation
Within Speech Mode:	L1PL sz	L2EN sh		Postalveolar
	L1PL s1	L2EN s2	L3NO s3	Coronal
	L1PL si	L3NO kj		*Palatal
Across Speech Mode:	**Spontaneous**	**Read**		
	L1PL sz	L1PL sz		Postalveolar
	L1PL si	L1PL si		*Palatal
	L1PL s1	L1PL s1		Coronal
	L2EN sh	L2EN sh		Postalveolar
	L2EN s2	L2EN s2		Coronal
	L3NO s3	L3NO s3		Coronal
	L3NO kj	L3NO kj		Palatal

RESULTS

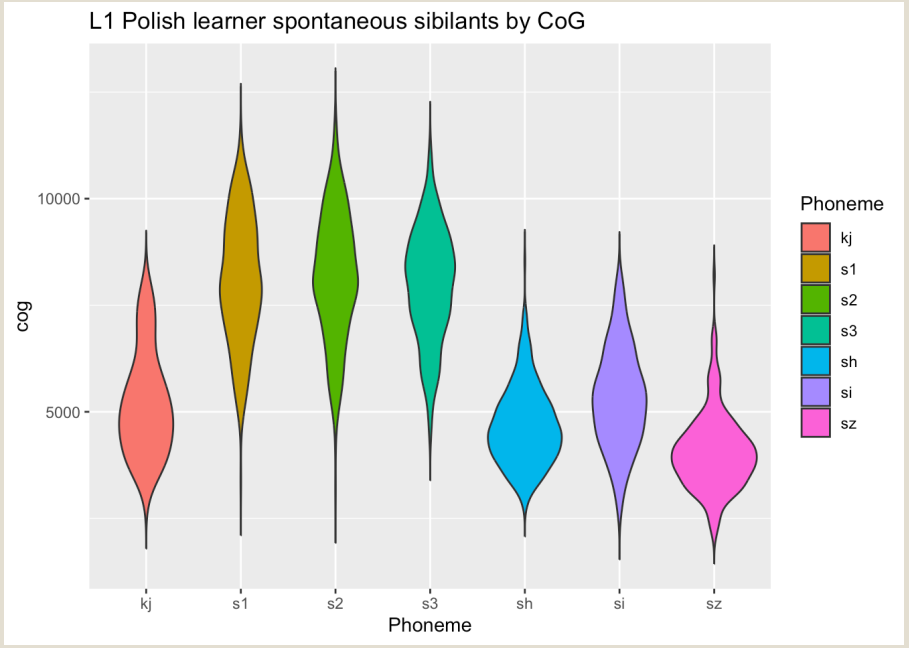
Q1. Do the productions of sibilants by learners differ across speaking mode i.e. spontaneous versus read speech? (Task 1+2)

Task 1 Results (Overview by speech mode)

Read speech

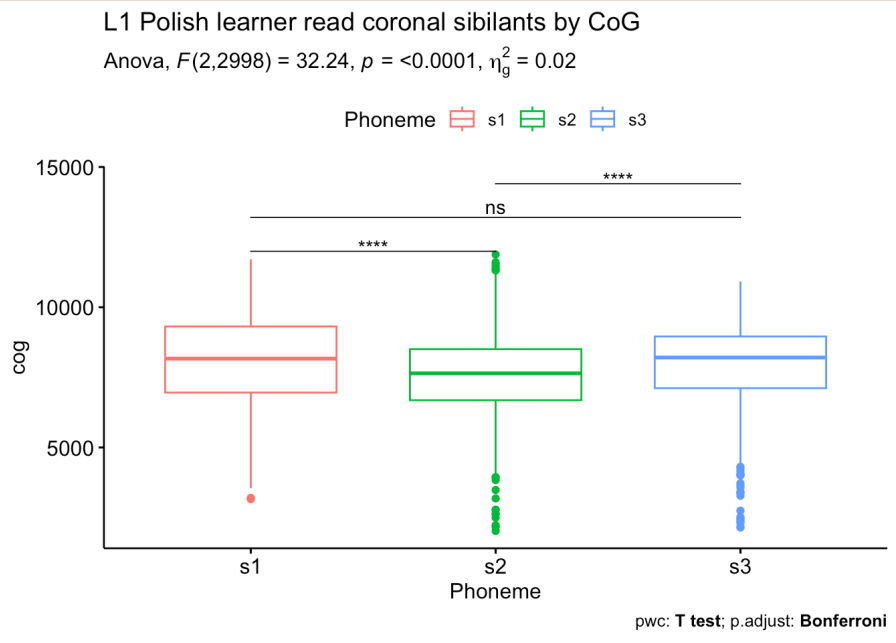


Spontaneous speech

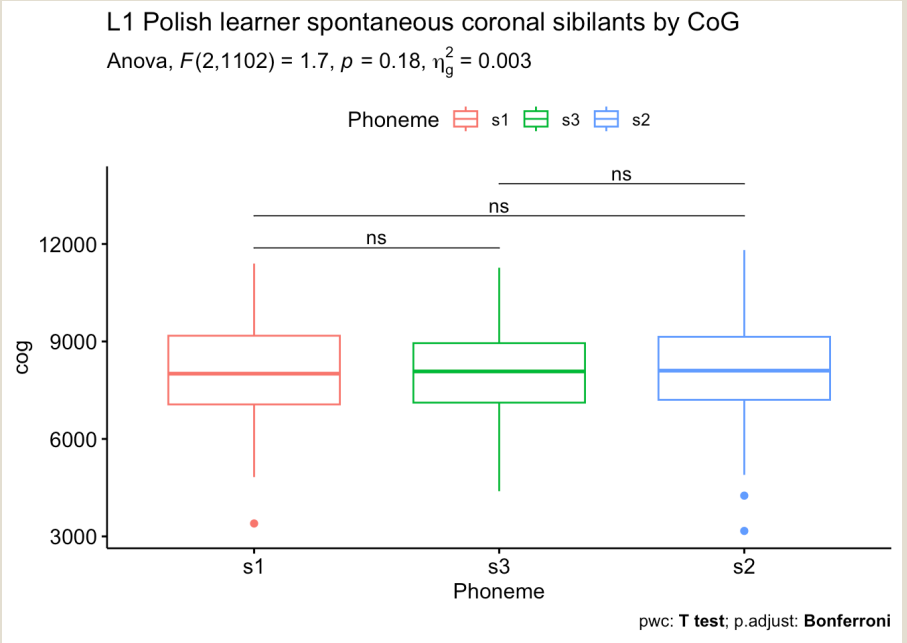


Results (Within speech mode pairwise comparisons: coronals)

Read speech

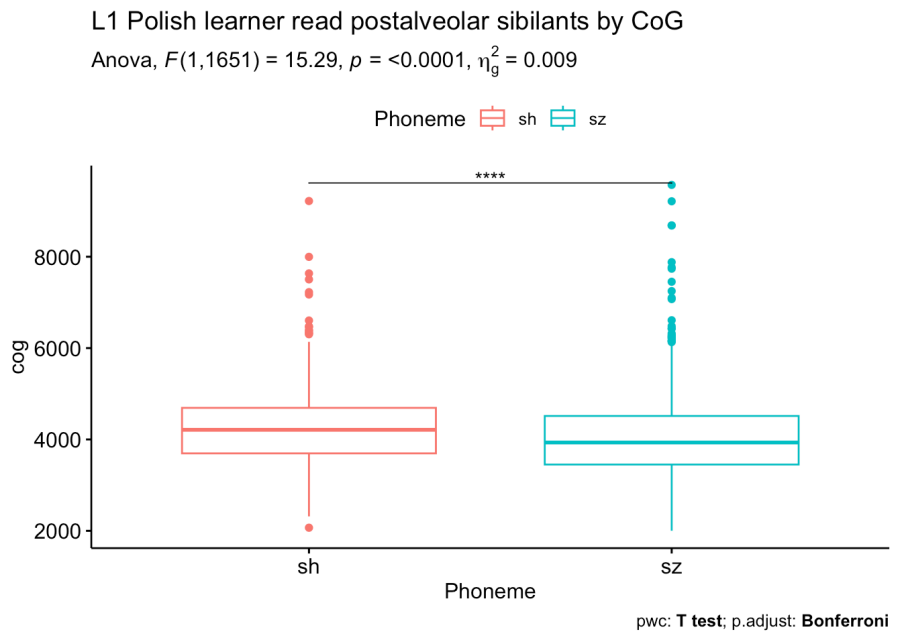


Spontaneous speech

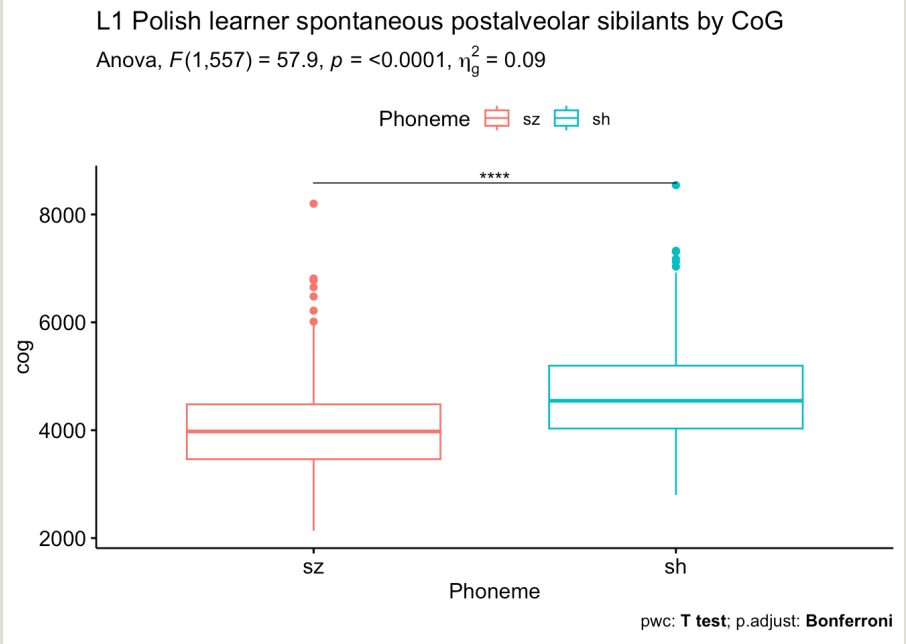


Results (Within speech mode pairwise comparisons: postalveolars)

Read speech



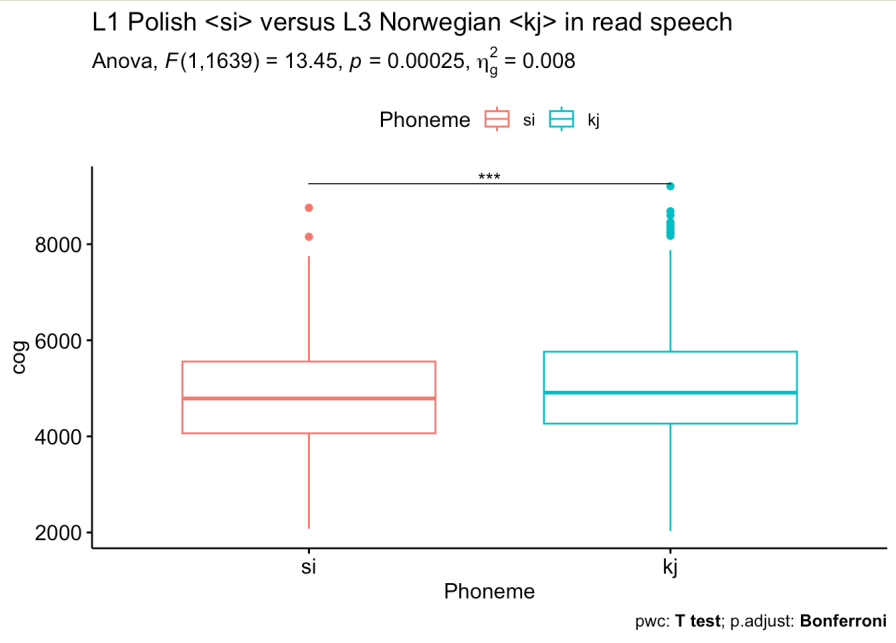
Spontaneous speech



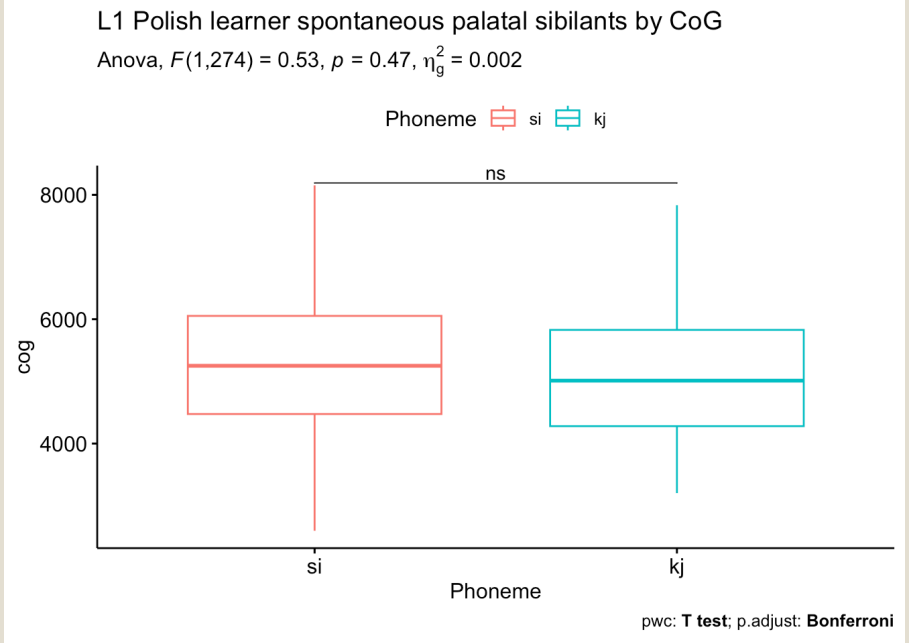
(figures flipped)

Results (Within speech mode pairwise comparisons: Palatals)

Read speech

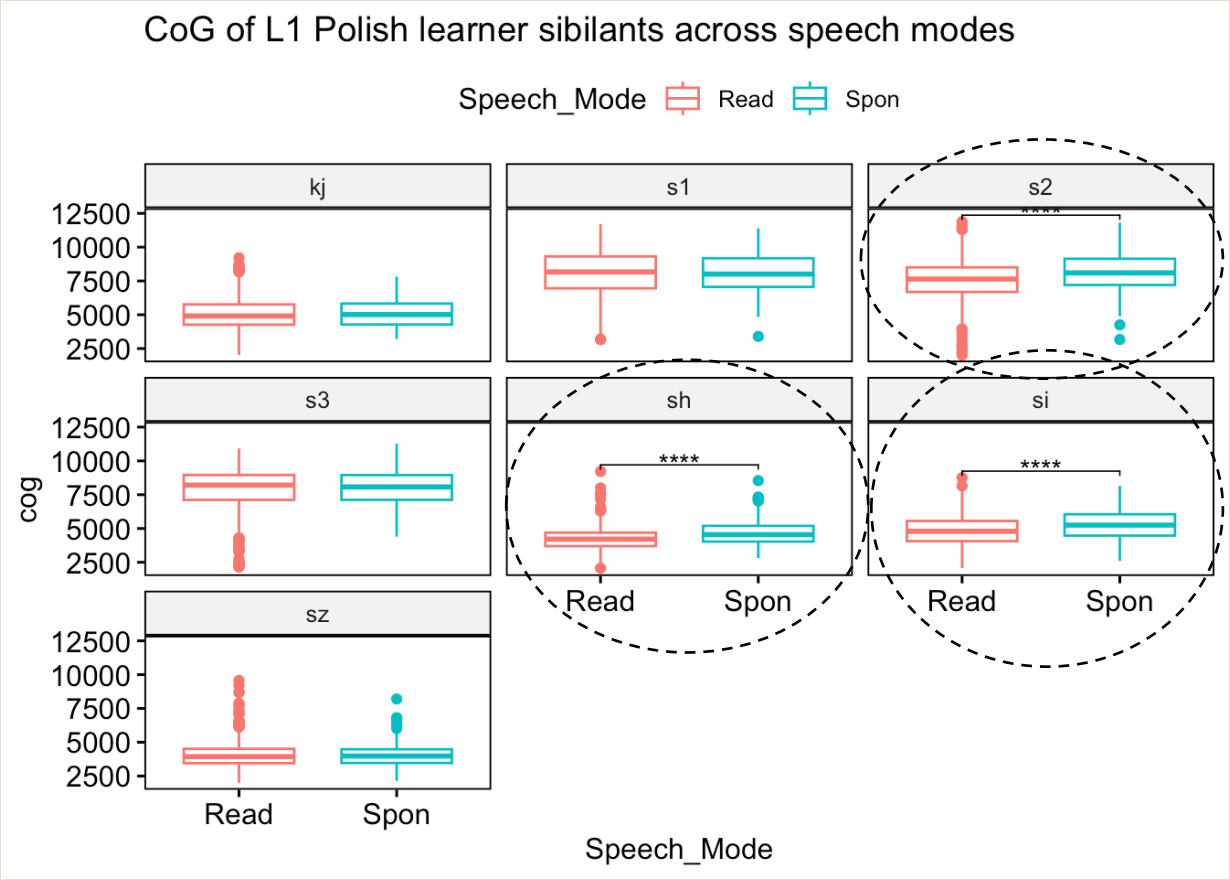


Spontaneous speech

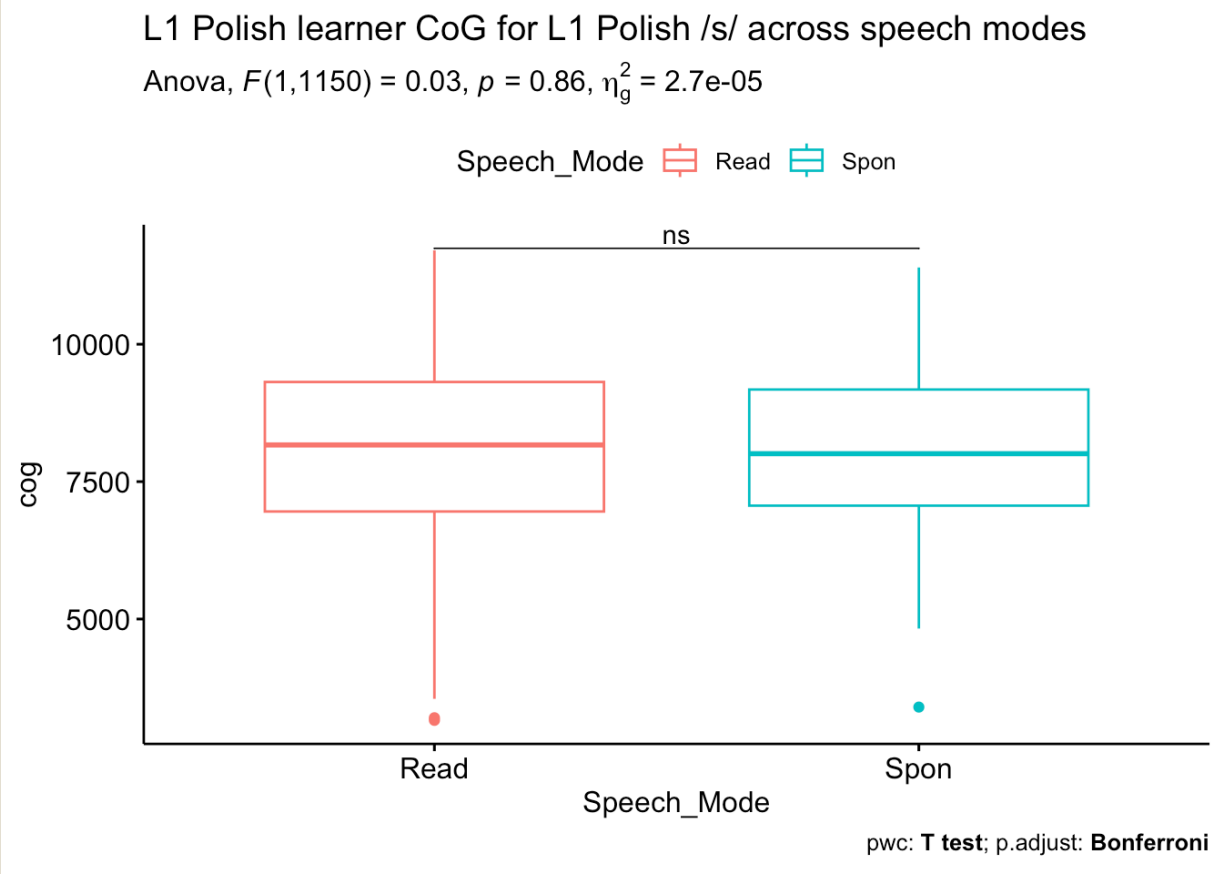


Q2. Does cross-linguistic influence occur between the phonological systems of multilinguals as a function of modality? (Task 1+2)

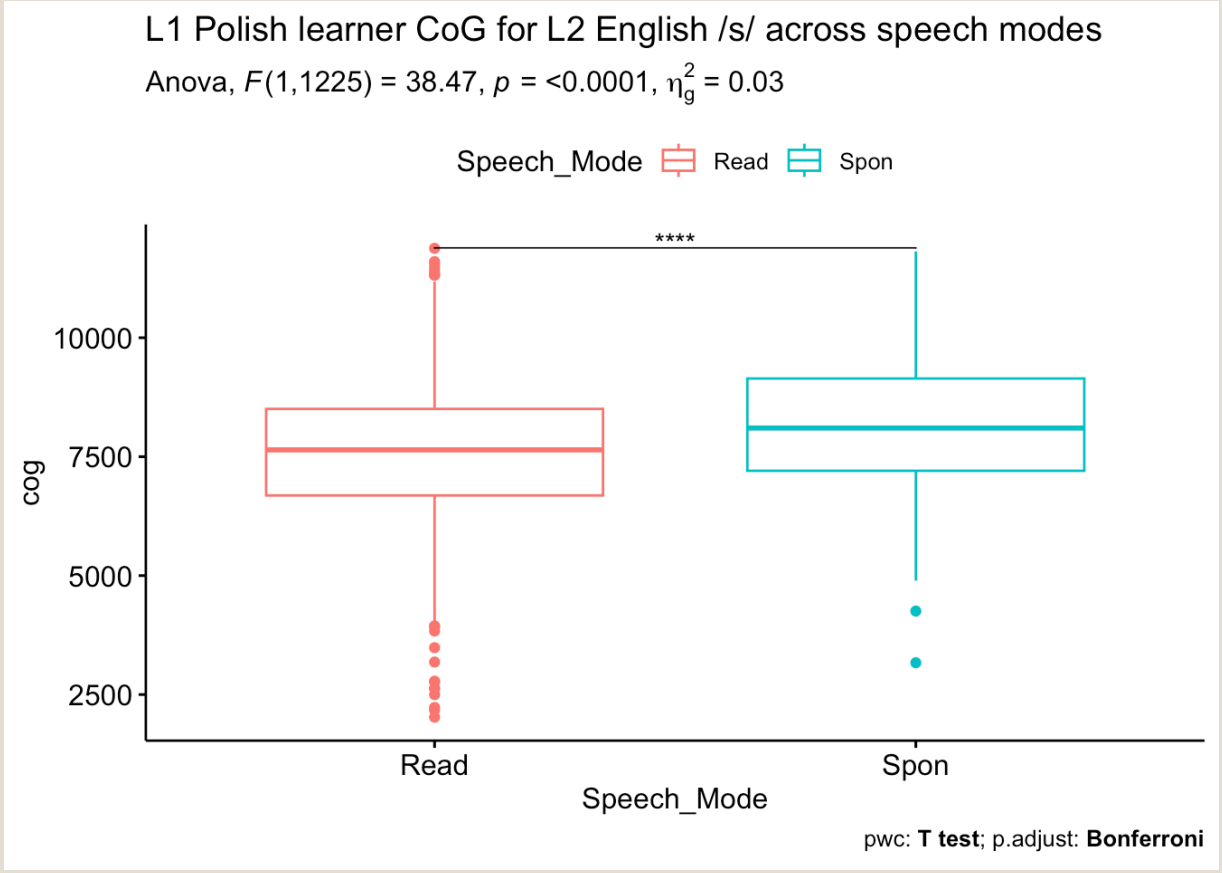
Results (Across speech mode pairwise comparisons)



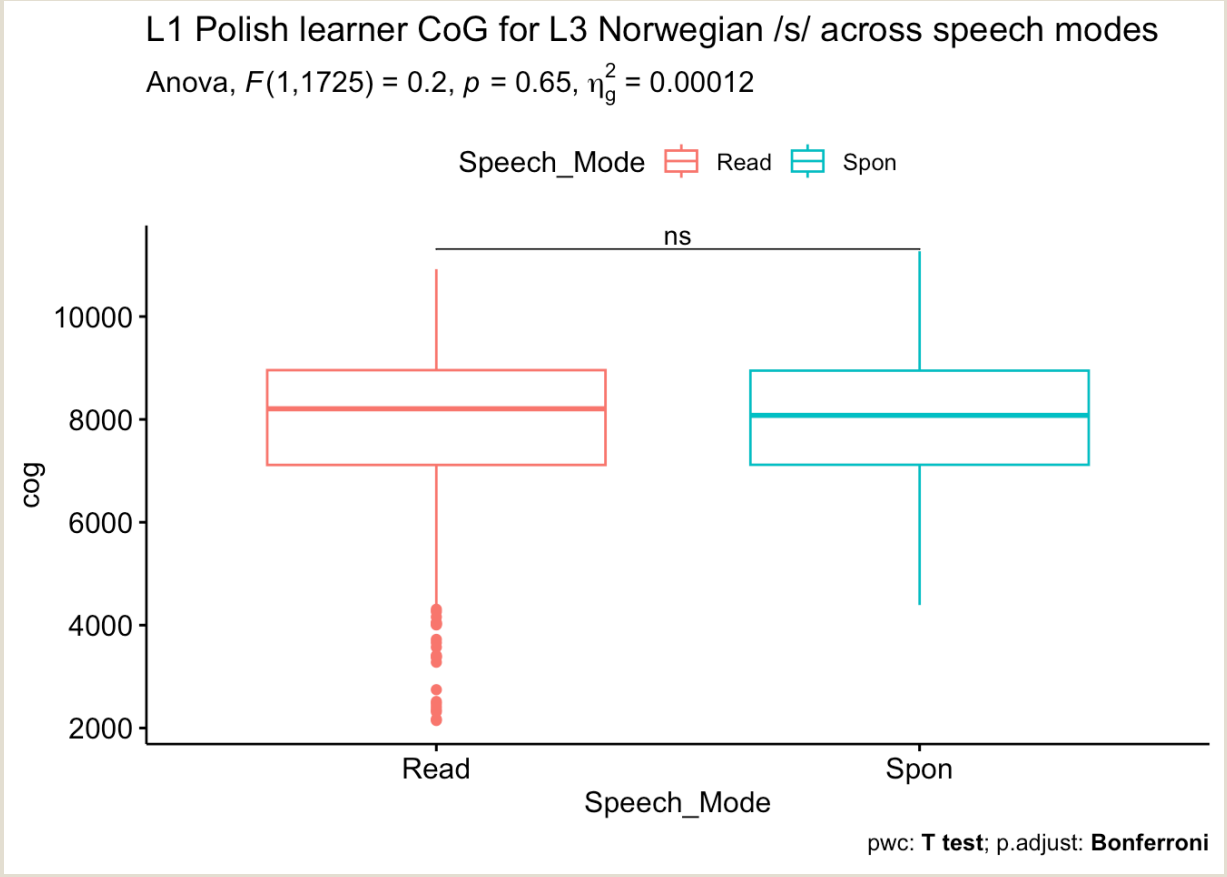
Results (Across speech mode pairwise comparisons: L1 Polish <s>)



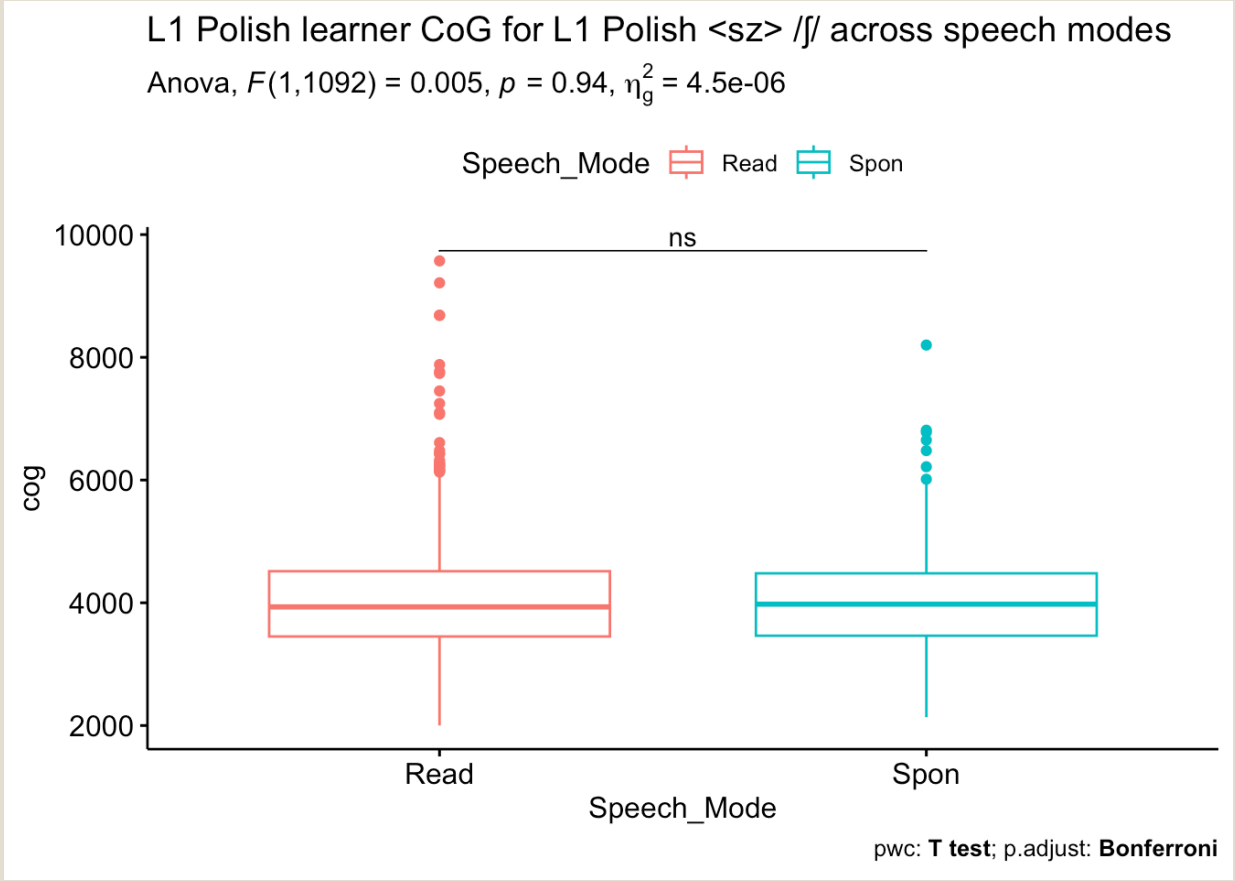
Results (Across speech mode pairwise comparisons: L2 English <s>)



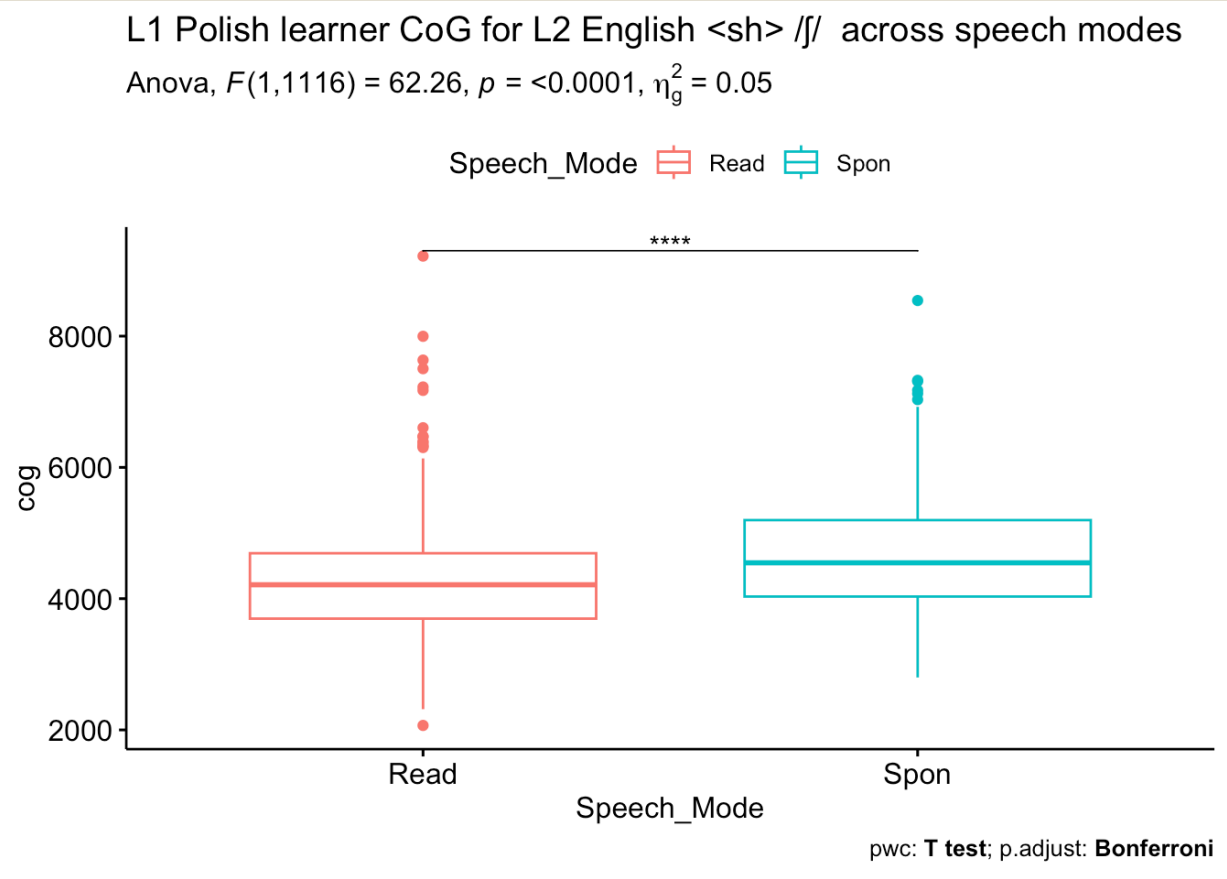
Results (Across speech mode pairwise comparisons: L3 Norwegian <s>)



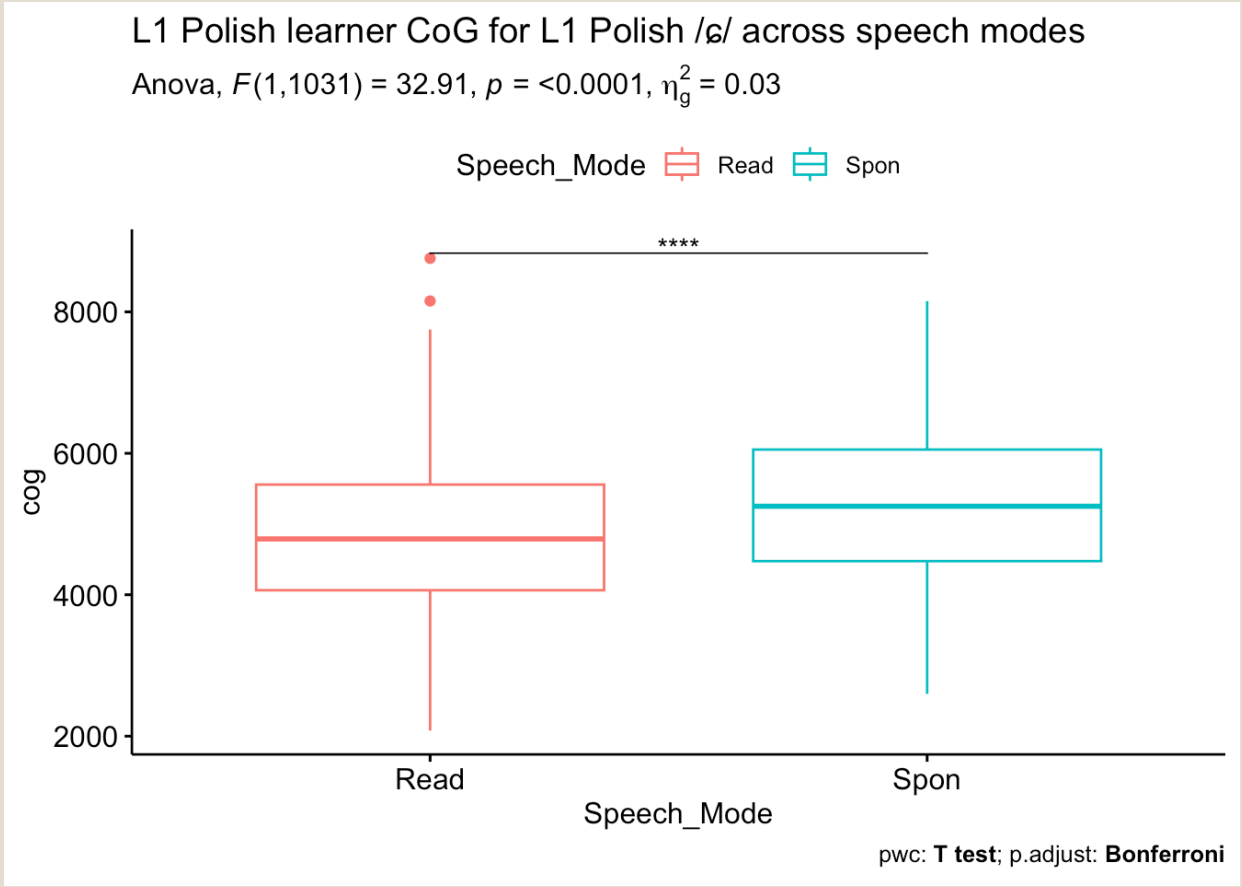
Results (Across speech mode pairwise comparisons: L1 Polish <sz>)



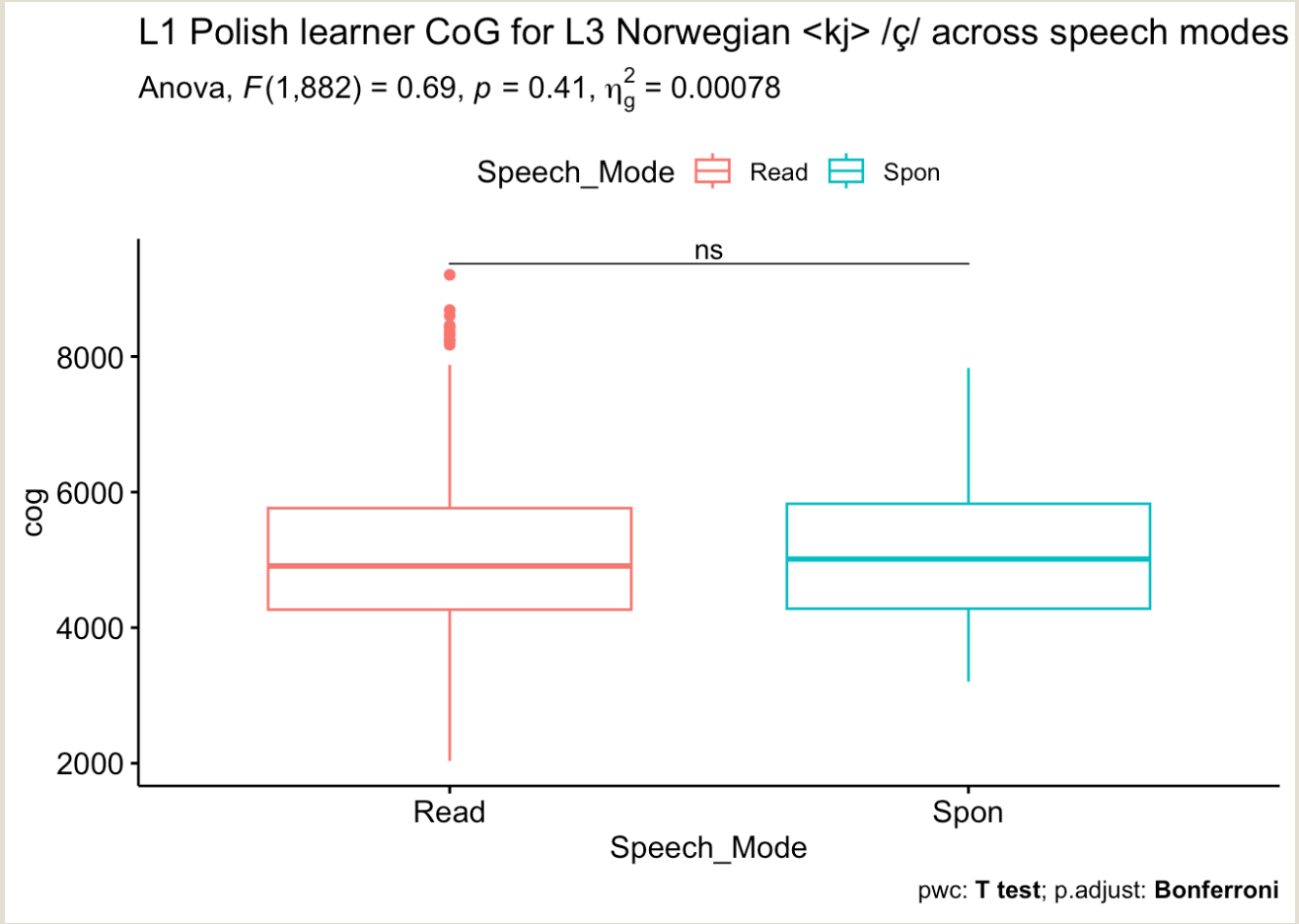
Results (Across speech mode pairwise comparisons: L2 English <sh>)



Results (Across speech mode pairwise comparisons: L1 Polish <si>)



Results (Across speech mode pairwise comparisons: L3 Norwegian <kj>)



Discussion

Q1. Do the productions of sibilants by learners differ across speech modalities i.e. spontaneous versus read speech? (Task 1+2)

- **Yes, there are differences in the production of L1, and L2 sibilants based on speech mode.** dental versus alveolar /s/ in L2 English, L2 English <sh> polish-like in read speech, English-like in spontaneous speech, alveopalatal /si/ in L1 Polish

- **There was no effect of speech mode on L3 sounds (s3, kj), but this analysis applies to a fraction of the sibilants, due to insufficient data points for <sj>, <skj>, <kj> and <rs> in the spontaneous mode.** For <kj> the lack of difference between spontaneous and read speech modes could possibly be attributed to a lack of proficiency in the foreign sound /kj/ but this needs further investigation.

- **Unexpectedly, there was a significant effect of speaking mode on L1 Polish <si> /ɕ/ (increasing CoG Hz in spontaneous speech)**
- Possibility explanations:
  - 1*) **Recheck the force alignments for <si> in the read speech*** (possible outliers could have artificially lowered the CoG)
  - 2)**There were limited lexical items** (się, ściągnąć) **and vowel contexts for /ɕ/ in spontaneous speech**
  - 3) Czaplicki et al. (2016)**: alveopalatal sibilant <si> is shifting towards palatal by young female L1 Polish speakers**, which happened to be the majority of our participants.

Czaplicki et al. (2016). Acoustic evidence of new sibilants in the pronunciation of young Polish women. *Poznan Studies in Contemporary Linguistics*, *52*(1), 1-42.

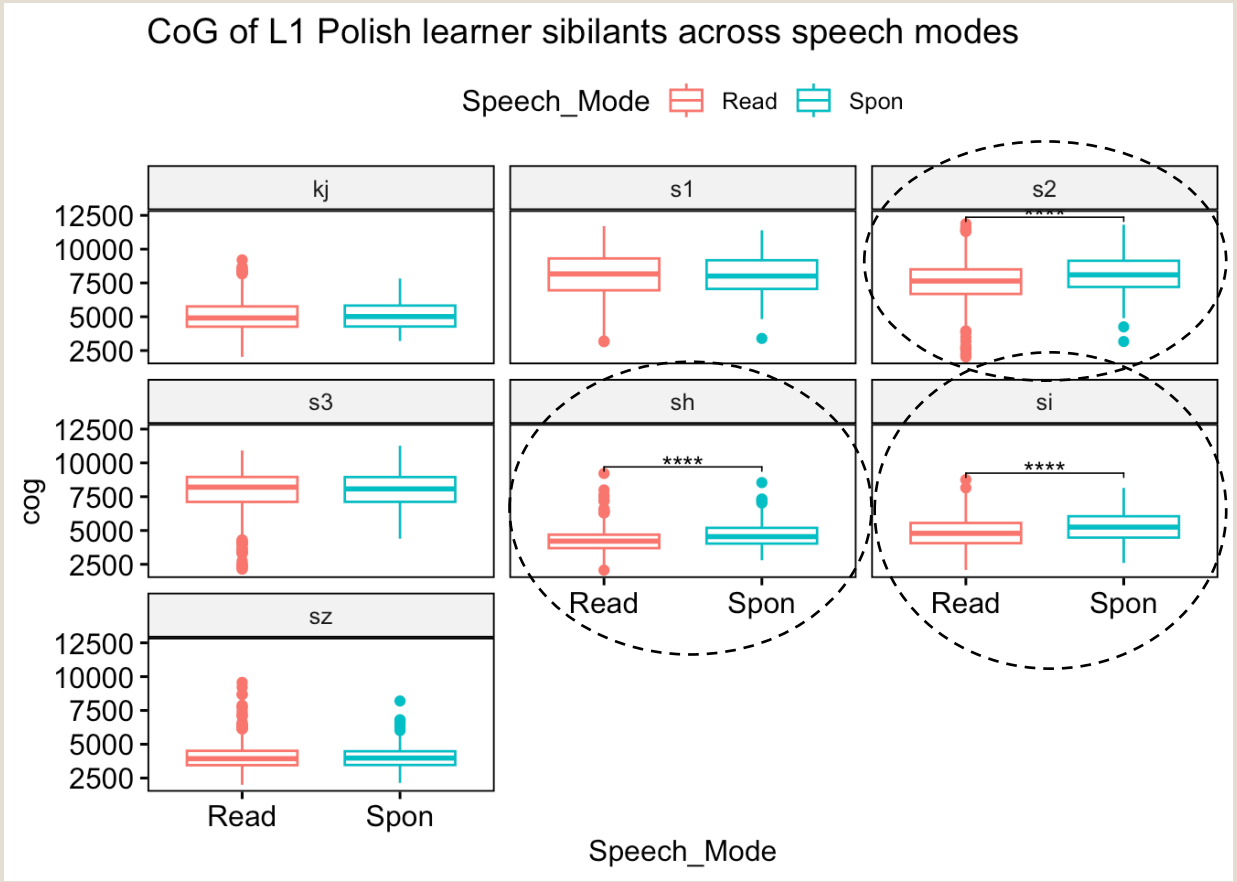
Q2. Does cross-linguistic influence occur between the phonological systems of multilinguals as a function of modality? (Task 1+2)

Discussion (across speech)

- **Yes! During spontaneous speech, there appears to be cross-linguistic influence of dental /s̪/ from L1/L3 → L2;** L2 EN /s/ is pronounced more closely to alveolar [s] in the read speech mode.

- L2 EN <sh> /ʃ/ is more similar to L1 Polish /sz/ in read speech, **L1→L2 influence in read speech;** whereas L2 <sh> less like L1 <sz> in spontaneous speech

- L1 PL <si/ś> /ɕ/ (increased CoG in spontaneous, i.e. palatal reduced cog in read speech, more alveolopalatal)
  - **L3→L1 influence of /ç/ on /ɕ/ on Polish**, OR possible phonological shift (Czaplicki et al. 2016)



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Thank you! Dziękuję! Tusen takk!