Adam Mickiewicz University, Poznań
Faculty of English

Embracing complex linguistic landscape: L3 vs. L2 phonological acquisition

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ACCENTS 2022

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Introduction

- Complex linguistic landscape in the modern world -> wider perspective in language acquisition research, beyond SLA (e.g. De Angelis 2007)
- A growing body of studies into the acquisition of third language (L3) phonology (Wrembel & Cabrelli Amaro 2018)

- This contribution aims:
  - To compare bilingual and trilingual phonetics and phonology
  - To identify their common features and points of departure for L3 phonology (Gut and Wrembel, forthcoming)
  - To illustrate with new insights into the acquisition of L2 & L3 speech

Outline

- Overview of L2 vs. L3 phonological acquisition
  - dynamic cross-linguistic influence
  - (potential) multilingual advantage
- Project findings
  - Production study
  - Perception study
  - Processing study (ERP)
- Way forward

Multilingual acquisition

- Multilingual language acquisition - recognised as an independent field, quantitatively and qualitatively different from SLA (e.g., De Angelis, 2007)
- L3 / Ln learners possess knowledge of at least two languages stored in their mind, and non-native language learning strategies
  - e.g., Clyne, Rossi Hunt, & Isaakidis, 2004; Cook, 1995; Fouser, 2001; Hufeisen, 2001; Ó Laoire, 2005
- "Multilinguals possess a configuration of linguistic competencies that is distinct from that of bilinguals and monolinguals" (Cenoz and Genesee 1998: 19)

Comparing bilingual and trilingual speech

- Research comparing speech perception and production by bilingual and trilingual/multilingual speakers
  - e.g., Geiss et al., 2021; Domene Moreno, 2021; Amengual, Meredith, & Panelli, 2019; Gabriel, Krause, & Dittmers, 2018; Antoniou et al., 2015; Enomoto, 1994
- Differences:
  - broadened phonetic repertoire
  - type and direction of cross-linguistic influence
  - speakers' metalinguistic (phonological) awareness
  - perceptual sensitivity
  - facilitation in learning subsequent / new phonologies
    - e.g. Gut 2010, Wrembel 2015

Cross-linguistic Influence (CLI)

- Differences in the number of potential directions (CLI in L3 > CLI in L2)

L1⇔L2, L1⇔L3, L2⇔L3 …

- Interaction of two non-native languages 'lateral CLI' (Jarvis & Pavlenko, 2008)
- SLA: L1-based transfer (one-to-one)
- TLA: multidirectional & complex CLI

- L1-based CLI in L3 (due to neuro-motor routines)
- L2-based CLI in L3:
  - voice onset time (VOT) (Wunder, 2011, Wrembel 2012)
  - stops (Cabrelli & Pichan, 2021), rhotics (Patience, 2018)
  - vowel reduction and speech rhythm (Gut, 2010; Gabriel et al., 2015)

Cross-linguistic Influence (CLI)

- Combined L1 & L2 CLI
  - Production: L1-L2 hybrid values in L3 VOT (Cardoso & Collins 2010, Dittmers et al., 2018, Wrembel 2015)
  - Perception: L1 German, L2 English, L3 Polish trilinguals assimilate L3 vowel sounds to both L1 and L2 categories (Wrembel, Marecka and Kopečková 2019)
- Mixed CLI - Archibald (2022) L1 Arabic, L2 French, L3 English
  - CLI from L2 French for L3 English vowels;
  - CLI from L1 Arabic for L3 English consonants
- Structure-dependent CLI - Domene Moreno (2021): German-Turkish heritage speakers learning L3 English
  - perception of vowel length and laterals; production of voiced coda consonants: Turkish-based CLI
  - production of initial consonant clusters and vowel length: German-based CLI

Phonological Awareness

- Differences in the level of (meta)phonological awareness
  - > tacit and explicit knowledge about the target and background language phonologies
- Offline methods - SLA
  - questionnaires, diaries, retrospective reports
    - Osborne 2003, Kennedy & Trofimovich 2010
- Online methods - SLA / TLA
  - Delayed mimicry paradigm - Mora et al. 2014, Kopečková et al., 2021
    - PhonA operationalised as mimicry of L2 and L3 accented speech
  - TAPs - introspective and retrospective oral protocols TAPs (Wrembel, 2015; Kopečková, 2018)

Phonological Awareness

- Relationship between phonological awareness and fine-grained speech production attested in L2 & L3 learners
- L3 learners outperform L2 learners at the levels of conscious analyses and verbalisation (Herdina & Jessner, 2002; Jessner, 2014)
- L3 learners - more complex cross-linguistic awareness and a wider range of manifestations of metalinguistic awareness
- BUT there is need for comparative studies into phonological awareness juxtaposing L2 and L3 learners directly

Enhanced Perceptual Sensitivity

- L3 learners tend to outperform L2 learners in target language phonetic discrimination e.g., Antoniou et al., 2015; Enomoto, 1994; Onishi, 2016
- Kopečková (2014) higher perceptual sensitivity
  - young Polish-English bilingual learners tend to be less sensitive to the differences between Polish and English vowels than their multilingual peers
- Onishi (2016) 'global advantage in phonological perception':
  - the more proficient L3 learners were in their L2 phonology, the more sensitive they became in the discrimination of non-native speech.
- Wrembel et al. (2019) - perception of vowels and sibilants in L1 German, L2 English and L3 Polish young learners
  - beginner L3 learners formed new L3 categories

Enhanced Perceptual Sensitivity

- BUT also contradictory or mixed results
- No significant differences between monolinguals and bilinguals in discriminating novel speech sound contrasts.
  - e.g., Patihis, Oh, & Mogilner (2015)

Facilitation in learning new phonologies

- Hypothesised that L3/Ln learners should have a general advantage in acquiring new phonological systems due to:
  - previous speech learning experience
  - enlarged phonetic/phonological repertoire
- Dittmers et al. (2018) and Gabriel et al. (2018) - production of VOT in the voiceless stops /p,t,k/ in L2/L3 French
  - German-dominant heritage speakers of Turkish and Russian > more targer-like than L1 German monolingually-raised speakers
- Geiss et al. (2021) - VOT values in L2/L3 English
  - German-dominant speakers with heritage Italian and English as L3 > L1 Italian learners of L2 English
- Domene Moreno (2021) - bilingual Turkish/German learners
  - No negative transfer of final devoicing rule to L3 English > monolingually raised German learners, (transfer final obstruent devoicing from L1 to L2 English)

Facilitation in learning new phonologies

- Amengual (2021) examined VOT in English, Japanese, and Spanish /k/ in three different groups;
  - two groups of English-Japanese bilinguals in a mirror L1/L2 design,
  - a trilingual group with L1 Spanish, L2 English and L3 Japanese.
- Results:
  - both bilingual and trilingual participants able to differentiate VOT in the three languages
  - acquired language-specific timing properties in English, Japanese and Spanish
  - however, bilinguals' VOT productions in L2 converged more on L1 VOT
  - trilingual group - a greater degree of differentiation between their VOT values in L1 Spanish, L2 English and L3 Japanese

Facilitation in learning new phonologies

- Contradictory results: no advantage for L3 learners
  - Gabriel et al. (2016) - perception and production of L3 French voiceless stops in L1 German monolinguals vs. bilingual Germans with Mandarin as heritage language
  - Grünke and Gabriel (2022) - the German/Turkish bilinguals did not outperform the monolingually raised German speakers in production of L3 French intonation

- Trilingual advantage found in some studies might not reflect a general advantage in phonological acquisition
- Rather: L3/Ln learners can benefit from specific phonological properties of their background languages

Interim summary

- Different methodology required for studying L3/Ln phonological acquisition
  - data collection in all of a multilingual's languages
  - consideration of the impact of language mode during data collection (e.g. Amengual, 2021)
  - Wide range of multilingual learner groups

- For more -> Gut & Wrembel (forthcoming) "Comparing Bilingual and Trilingual Phonetics and Phonology" in CUP Handbook of Bilingual Phonetics and Phonology (ed. Amengual 2023)

INSIGHTS FROM L3 PROJECTS

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Introduction

- Part of a larger project investigating multilingual acquisition in L1 Polish – L2 English – L3 Norwegian learners
  - *Cross-linguistic influence in multilingualism across domains: Phonology and syntax* (CLIMAD)
- Longitudinal design (T1, T2, T3)
- Aim: exploration of cross-linguistic interactions in multilinguals' vowel systems

Study design: participants

- L1 Polish, L2 English (B1/B2), L3 Norwegian (A1)

- 24 participants at T1 (17 at T3), aged 20
- 1st-year students in Norwegian modern language BA programmes
  - University of Szczecin
  - Poznań College of Modern Languages (WSJO)
- Participant profiles:
  - Language History Questionnaire LHQ (Zhang et al. 2014)

Study design: time points

- Three data collection times (T1, T2, T3)
  - T1 in November 2021
  - T2 in March 2022
  - T3 in June 2022
- Three sessions
  - speech production
  - speech perception
  - grammaticality judgements
- Fieldwork mode
- L3 vs. L1, L2 language blocks (different days)

June 2021

Pilot study:
- remote recordings, perception study, grammaticality judgements
- 16 participants
- recordings of control speakers (remote)

T1 November 2021

Study:
- on-site recordings, perception study, grammaticality judgements

- 24 participants with L1 Polish - L2 English - L3 Norwegian

T2 March 2022

- production, perception, grammaticality judgements

- Control Norwegian participants

T3 June 2022

-

- Data collection
- Drop outs

-

Exploring spectral overlap in L1 Polish, L2 English and L3 Norwegian vowels

Jarosław Weckwerth, Magdalena Wrembel, Anna Balas, Kamil Kaźmierski - **New Sounds 2022**

PRODUCTION STUDY

Production study design: tasks

- Several tasks
- Here, reading of sentences and isolated words to elicit all the vowel phonemes in the 3 languages
- Real and nonce words in (dVd, dVt) in a carrier sentence and in isolation, e.g.
  - There is the same vowel in “god” and “dod”
- Three language blocks (L1, L2, L3)

Processing and measurement

- Forced alignment (WebMAUS, Kisler et al. 2017)
- Target vowel boundaries manually corrected by four phoneticians
- Measurements:
  - Averages of the first three formants, in the central portion (30–70%) of each vowel
  - Vowel durations

Research questions

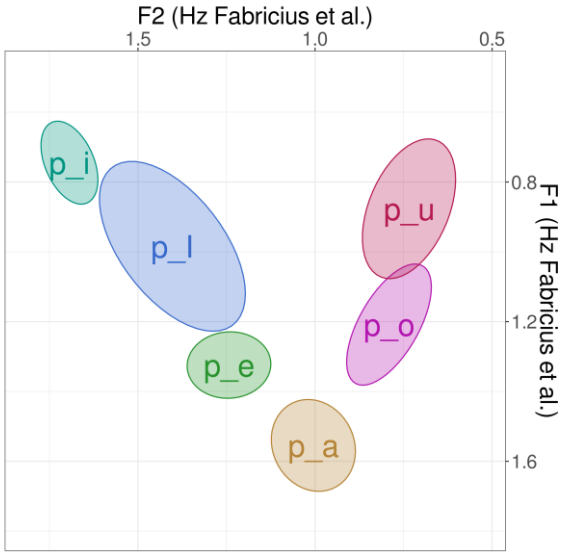
- What are the interactions between the three vocalic subsystems in multilingual learners?
- Are new categories formed in L3?
- What are the sources and directions of CLI?
  - Do the L1 and L2 have a facilitative/non-facilitative influence on the L3?
- Are the L1/L2/L3 systems stable over time?
  - Does category overlap change?
  - Does category compactness change?

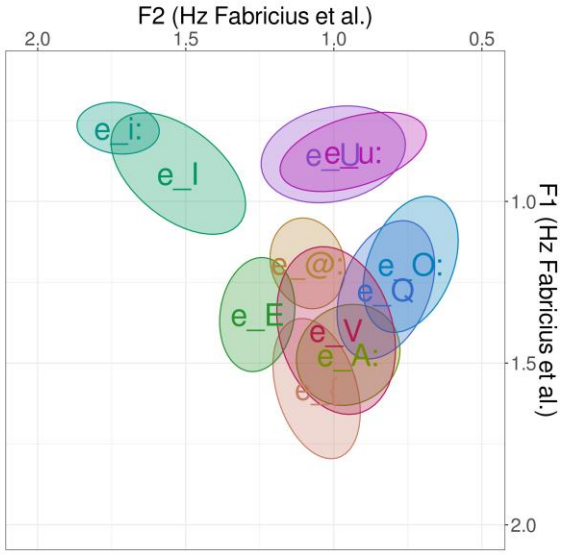
Measures

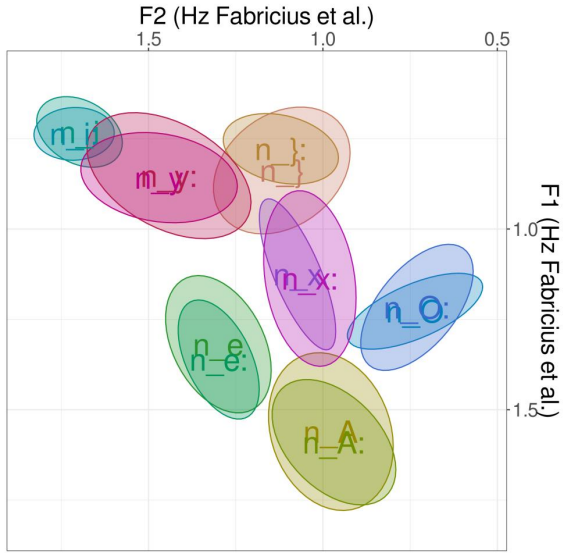
- Does category overlap change?
  - Pillai scores (Nycz & Hall Lew 2013)
  - Mixed effects models for F1 and F2 (Nycz & Hall Lew 2013)
- Does category compactness change?
  - SD?

Results

- L1 Polish L2 English L3 Norwegian



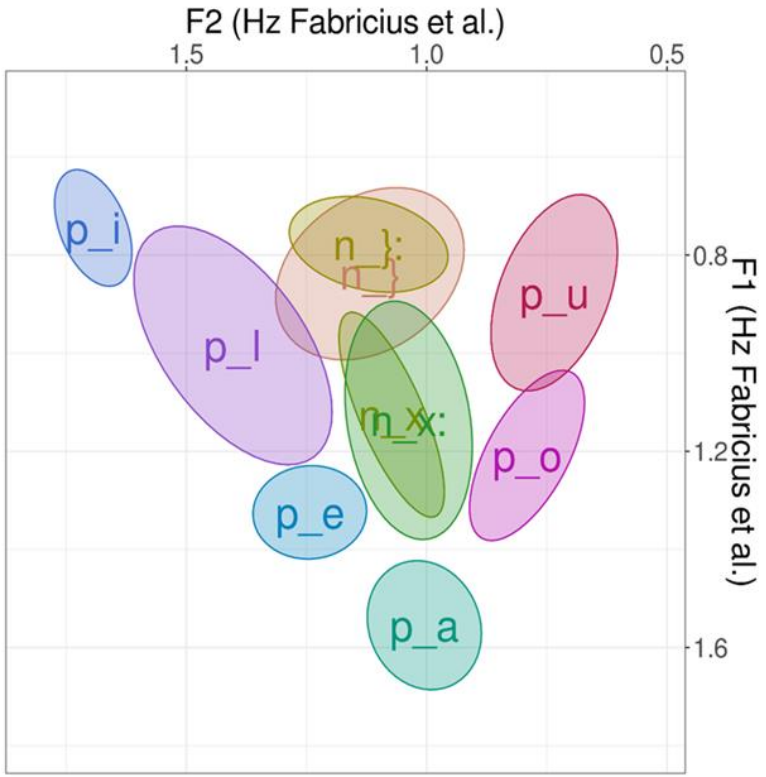




- Additional L2 and L3 spectral categories found in areas unoccupied by L1 vowels
- Some differentiation between L2 and L3

Results: estimating spectral overlap between vowel categories

Norwegian /ʉ(ː)/ /ø(ː)/ separate from Polish



Pillai score measures (0 – 1)

- GUD vs. pl /ɨ/: 0.69
- GUD vs. pl /u/: 0.75
- LØP vs. pl /ɛ/: 0.45
- LØP vs. pl /ɔ/: 0.58
- GUD vs. GOOSE: 0.21
- GOOSE vs. pl /u/: 0.33
- the higher the value, the greater the difference between the two distributions

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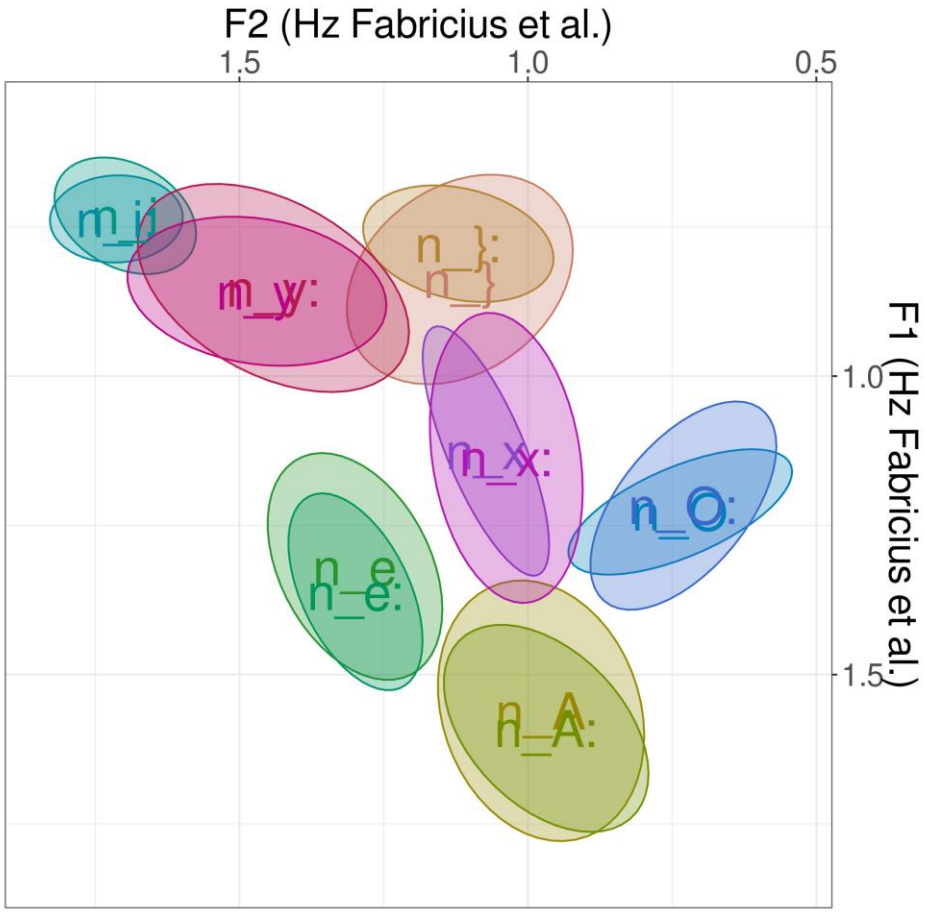
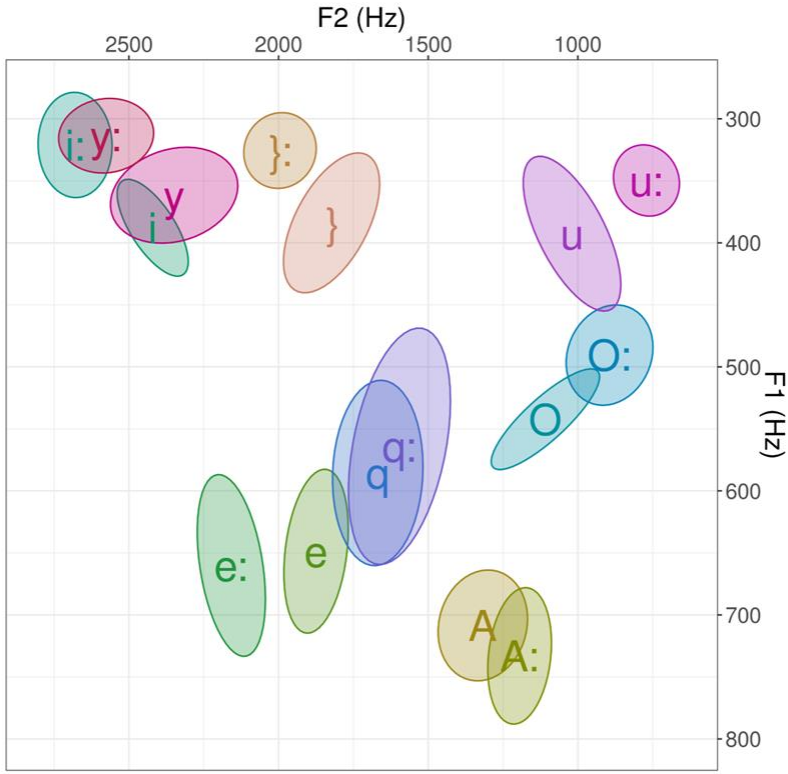
Norwegian categories

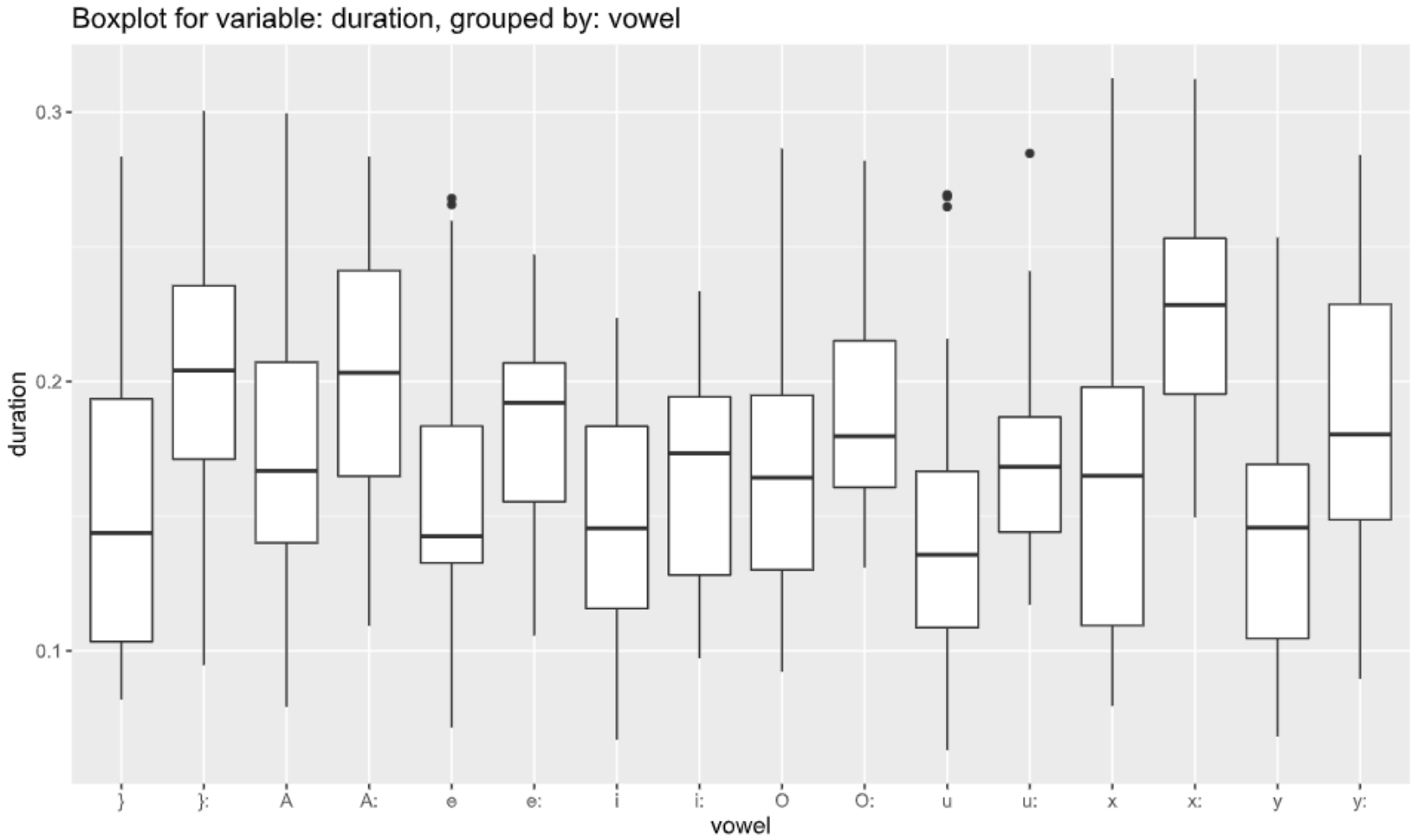




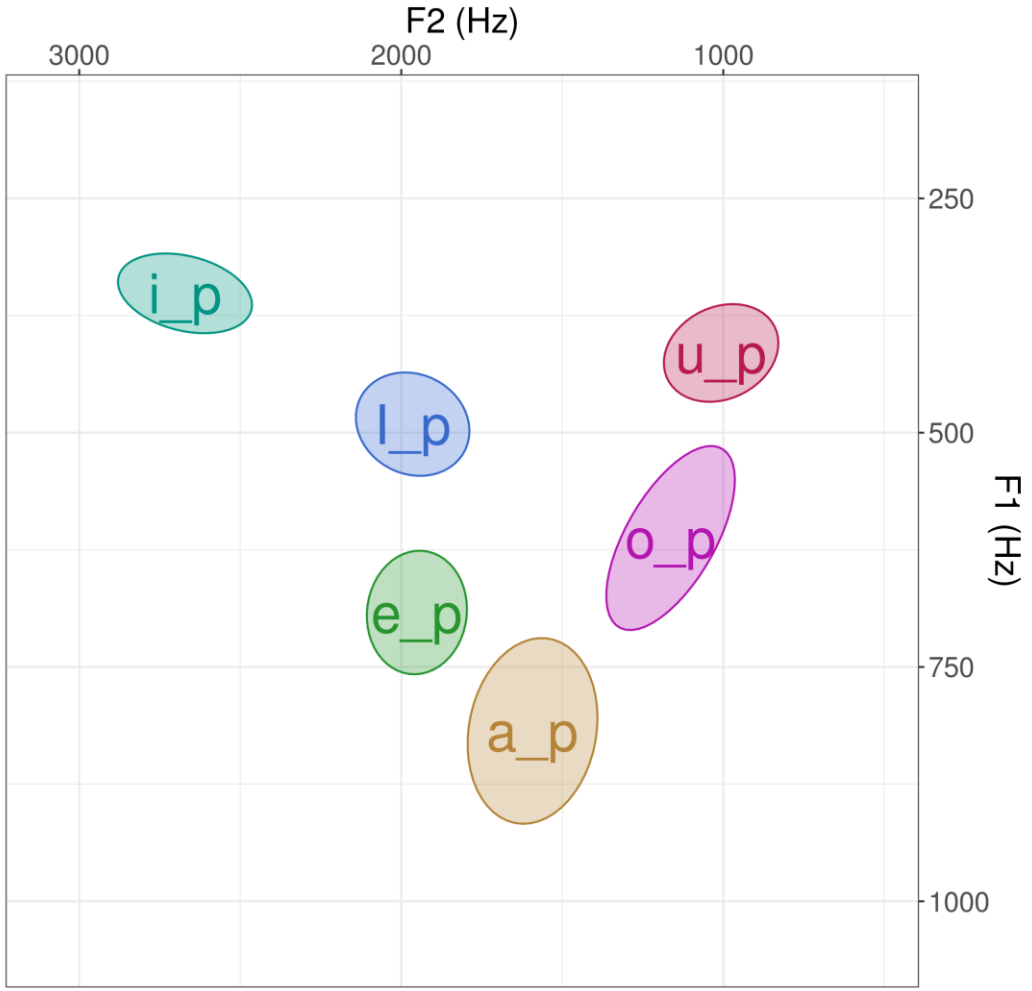
Pillai scores (long vs. short)

- TID vs. MITT: 0.002
- STED vs. BEST: 0.015
- DAG vs. TAKK: 0.005
- RÅD vs. FÅTT: 0.003
- BOK vs. BORT: 0.05
- GUD vs. SLUTT: 0.082
- LYS vs. SYND: 0.005
- LØP vs. SØNN: 0.015

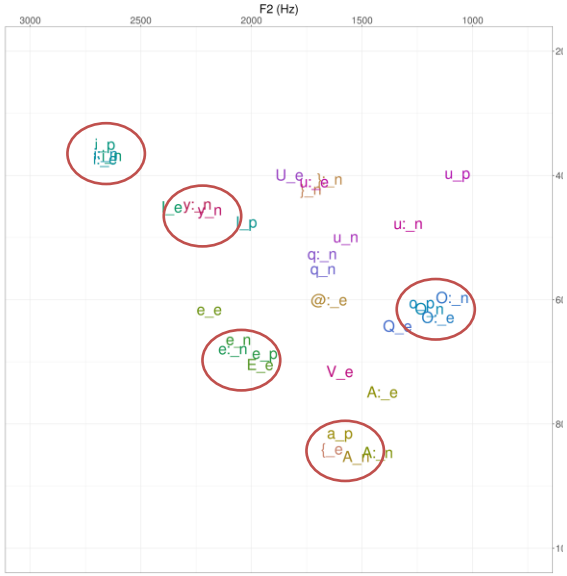
Duration averages for Norwegian

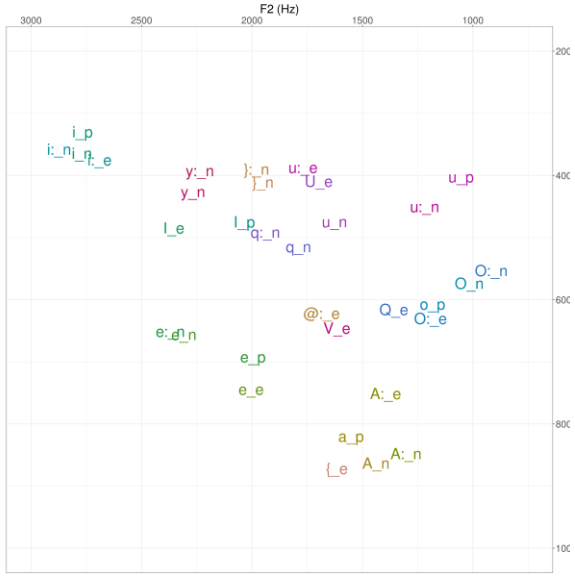


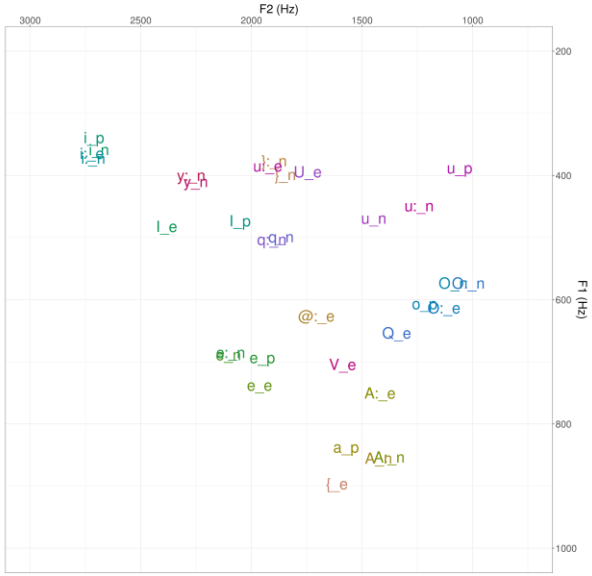
Polish at T1



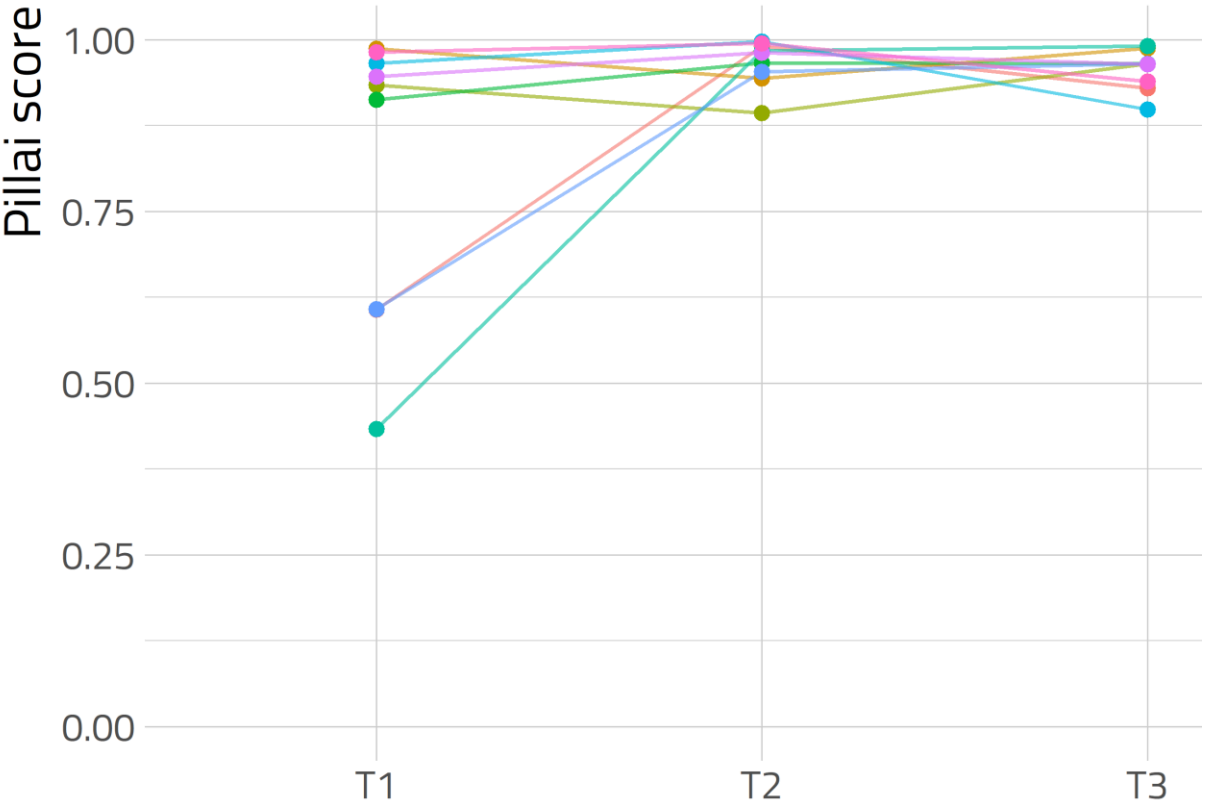
All systems at T1, T2 and T3

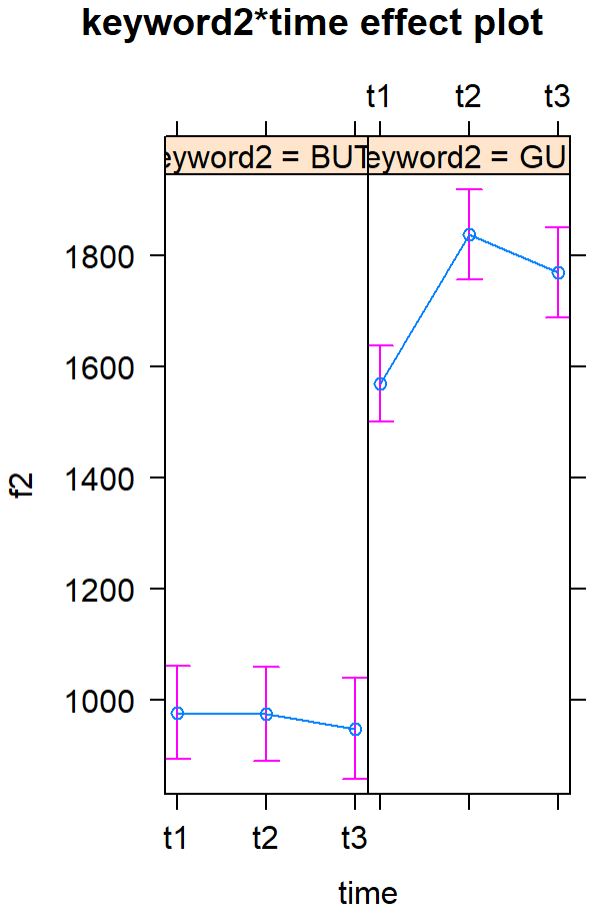




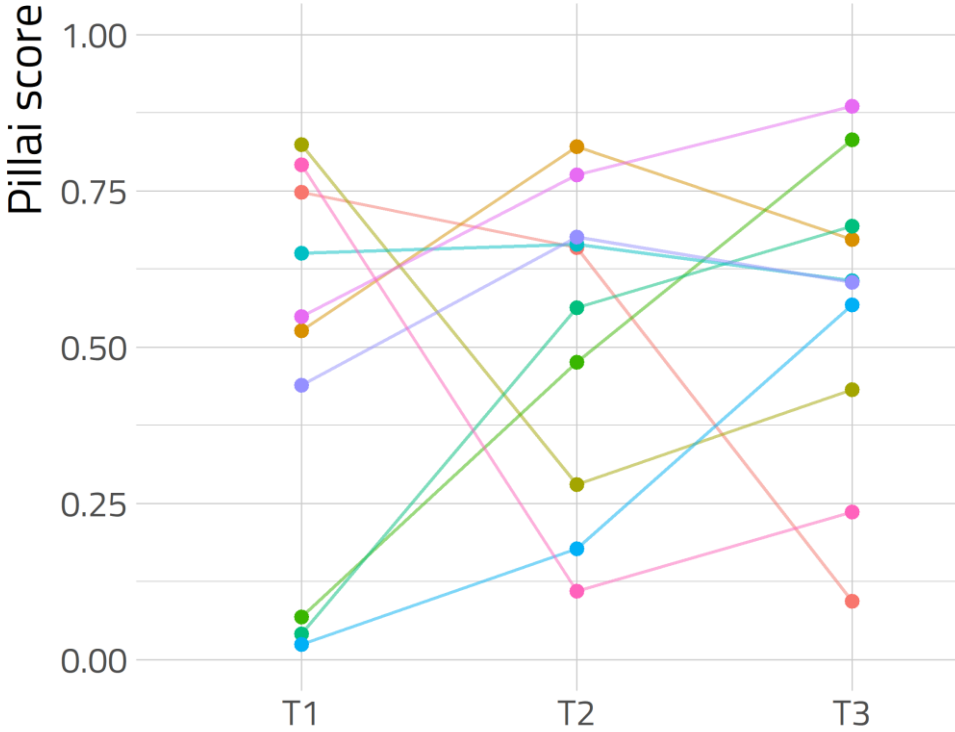


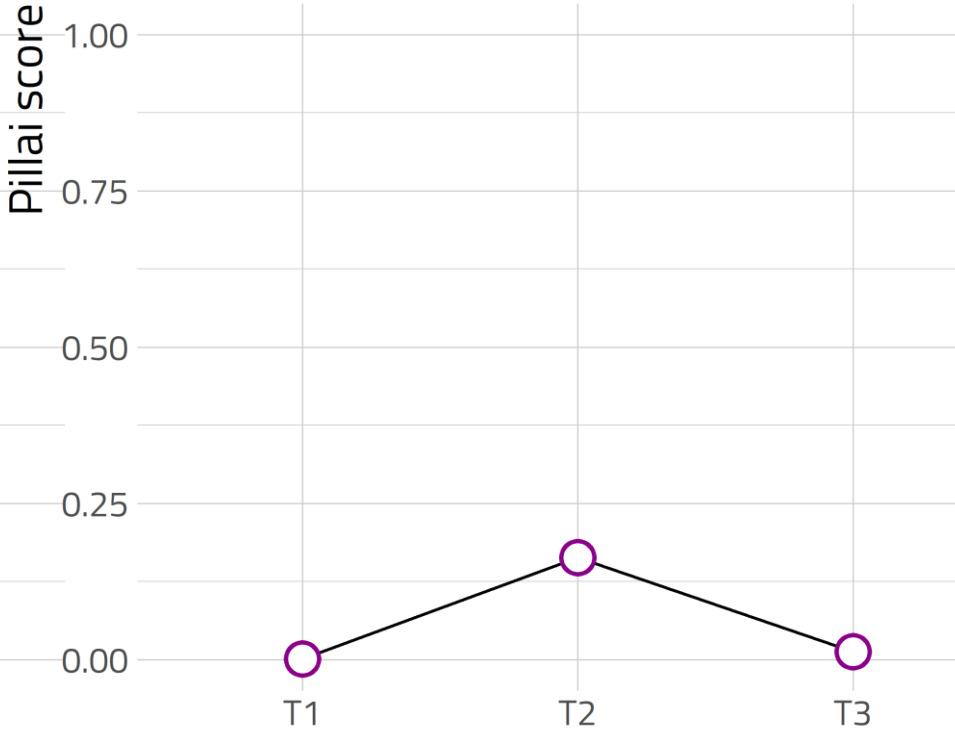
Nor /ʉ(ː)/ vs. Pol /u/ at T1, T2, T3



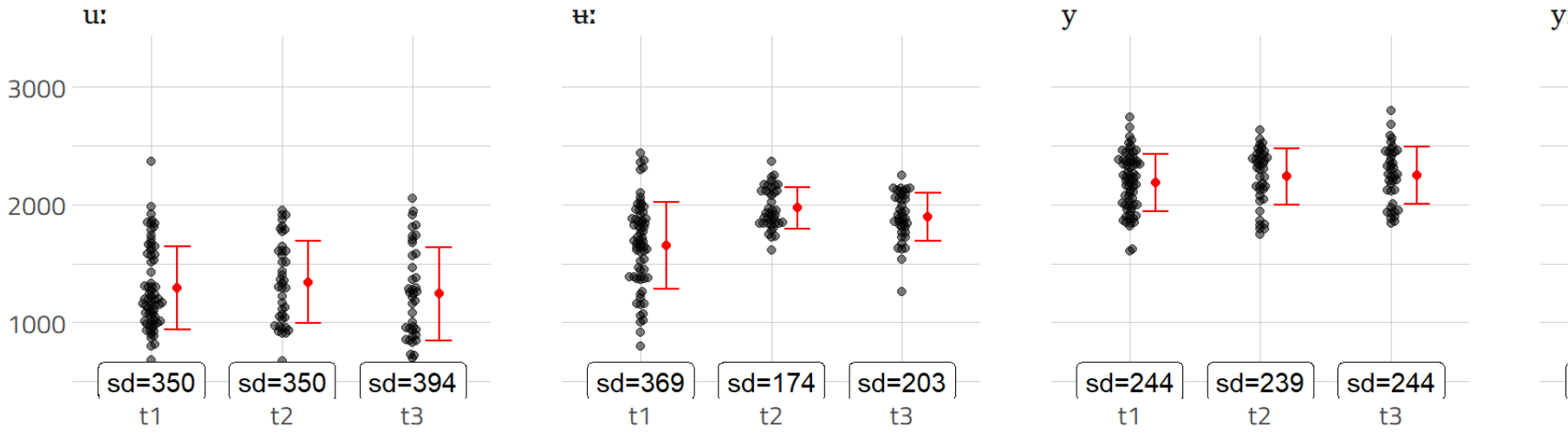


Nor /ʉ(ː)/ vs. GOOSE at T1, T2, T3

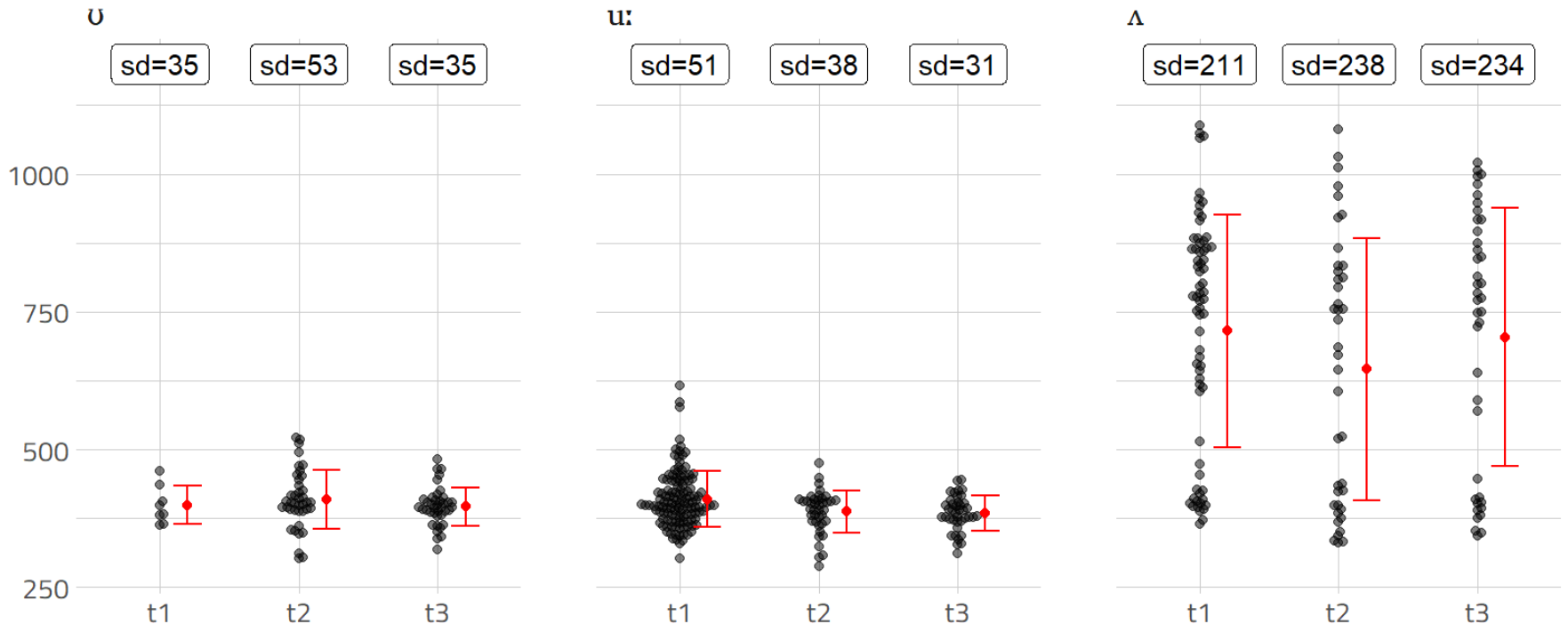




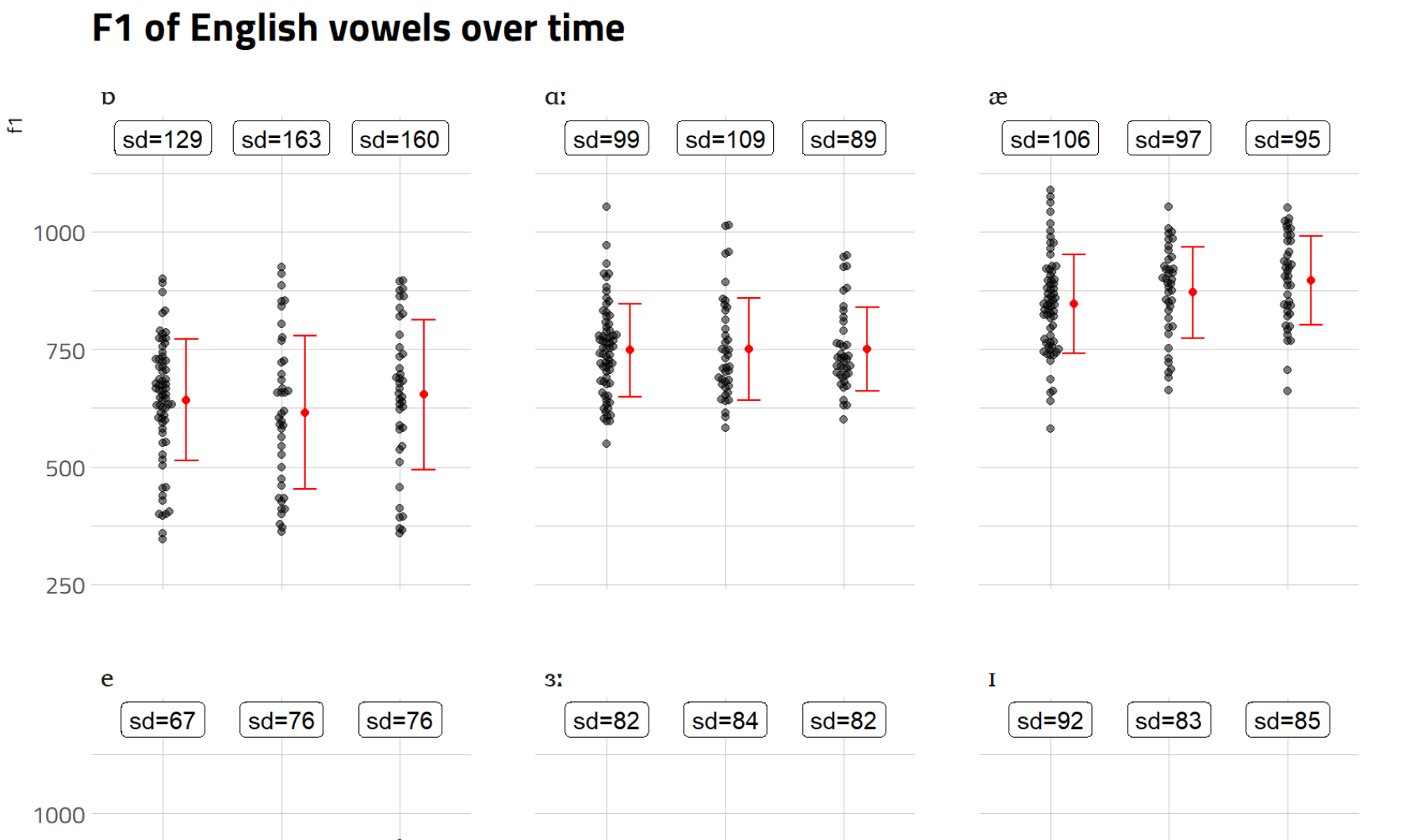
L3 GUD: descreased diffusion T1-T3



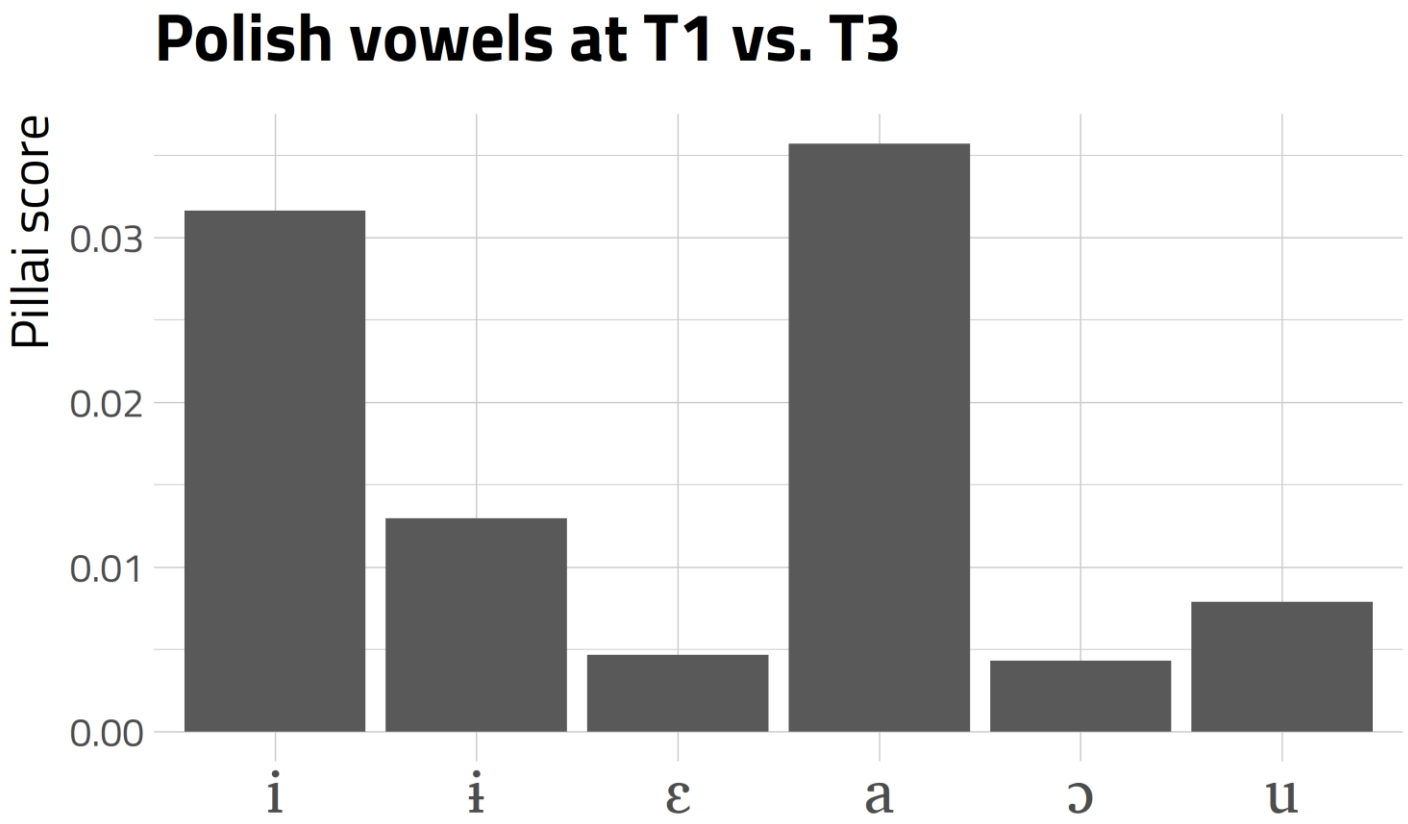
L2 STRUT: L3-to-L2 interference?



L2 LOT: dialectal variation?



Polish categories over time



Discussion

- Multilingual learners try to keep their vocalic systems apart
  - > new phonological categories formed in L3 Norwegian
  - > L2 English less stable, subject to variability
  - > L1 Polish remains stable
- There are interactions between the three vocalic subsystems in multilingual learners?
  - > prevailingly L1>L3, but some L2>L3

- Phonological development over time in L3 Norwegian

Discussion: CLI sources and directions

- CLI from L1/L2 -> L3
  - Individual variability in Nor BOK
    - Realized as [o] via Polish orthography
    - Realized as [ʉ] based on GOOSE?
- Reverse CLI from L3 -> L2
  - STRUT F1 very diffuse as a result of interference from Norwegian (!) orthography
- NO reverse CLI L2/L3 -> L1

Discussion: CLI sources and directions

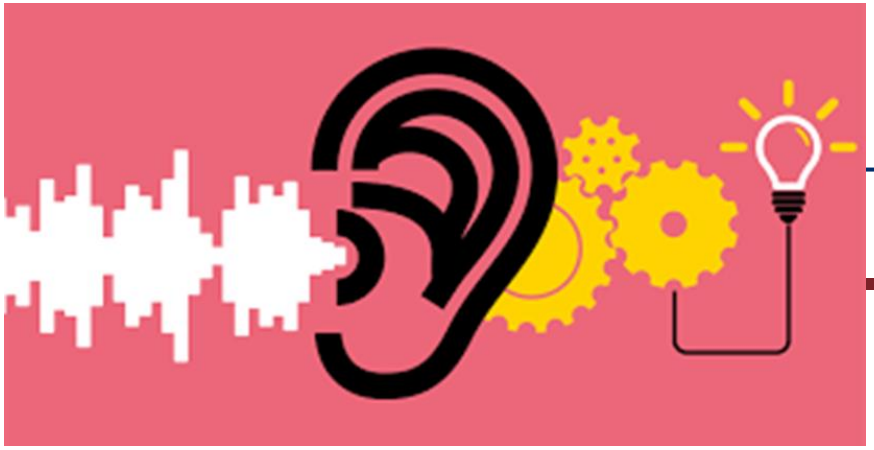
- Evidence of facilitative CLI from L2 -> L3:
  - GUD and pl /u/ increase separation
  - GUD starts and continues in overlap with GOOSE

Discussion: Are the systems stable?

- L1 categories stable spectrally
- Some L3 categories change over time
  - GUD, SLUTT increase in F2
- Some L2 categories change over time
  - GOOSE increases in F2

Interim summary

- Interference from orthography
- Dialectal differences complicate the picture
  - more for L2 English than L3 Norwegian
- In L3 Norwegian duration trumps spectral effects
- Developmental trajectory to be continued (T4, T5)
- Identified patterns will be subject to more in-depth analysis



Perception in L2 and L3: The relationship between English and Norwegian vowel assimilation patterns and the Euclidean distances

Anna Balas, Magdalena Wrembel, Jarosław Weckwerth, Kamil Kaźmierski, Zuzanna Cal, Karolina Rataj - **SLE 2022**

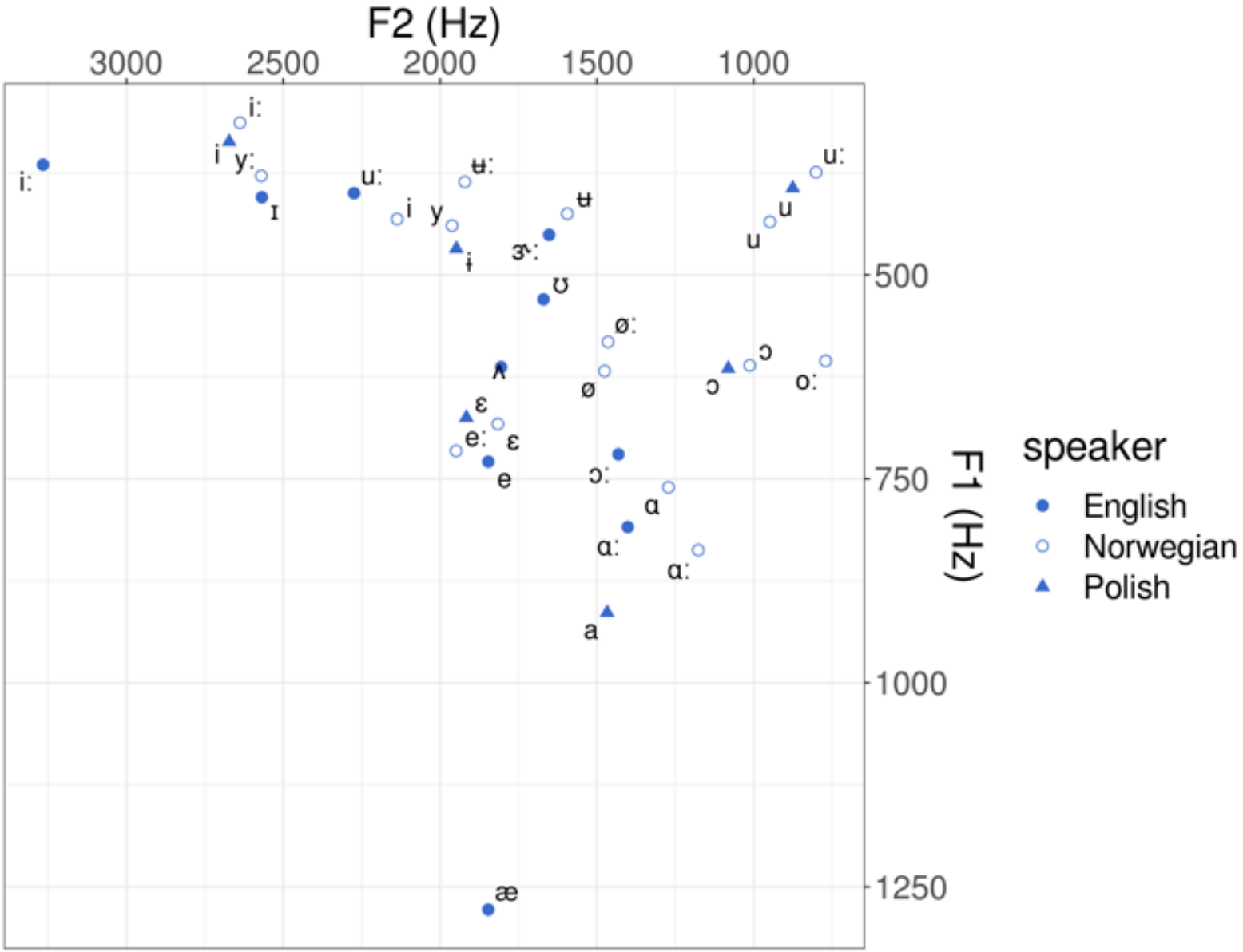
PERCEPTION STUDY

Aim & rationale

- To explore the **relationship between L2 and L3 perception** and acoustic similarity
- To examine **perceptual assimilation patterns** for L3 Norwegian and L2 English vowel assimilated to L1 Polish vowel categories
- To compare the relationship **between perceptual patterns and acoustic distance** between the vowels operationalized as Euclidean distance

- So far studies focused on
  - L2 perceptual assimilation (Best & Tyler 2007, Tyler et al. 2014),
  - relationship between vowel perception and their acoustic parameters (Strange et al. 2003, Escudero et al. 2012, Alispahic et. al. 2017)
- **No previous such studies on L3 nor comparing L2 and L3**

Polish, English and Norwegian vowels



Hypotheses

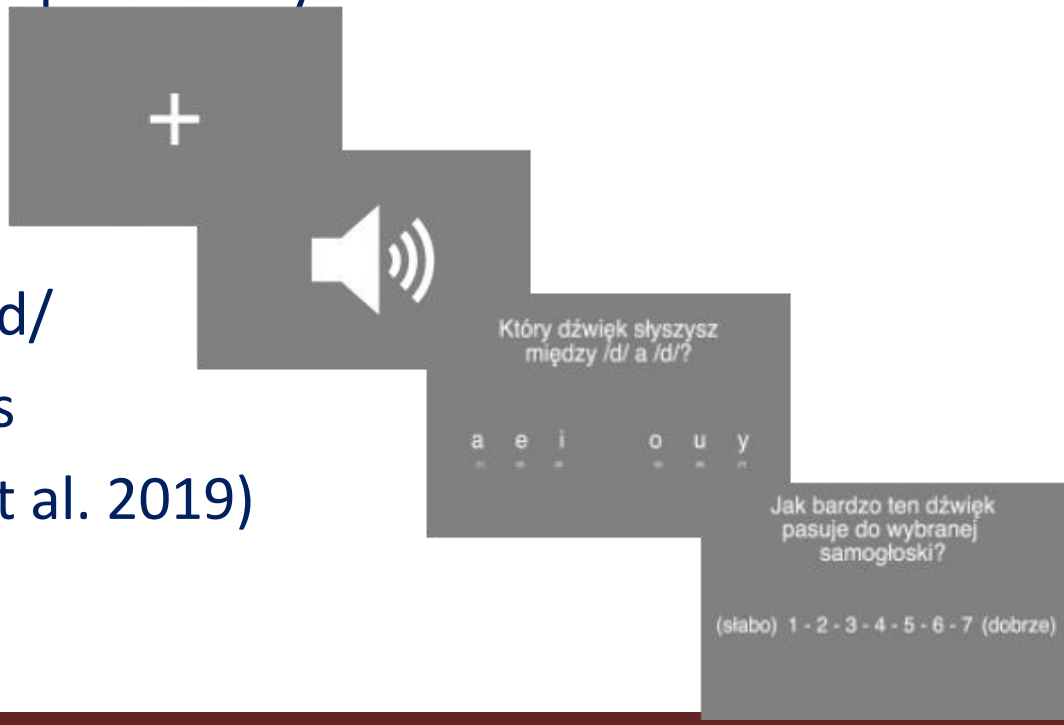
- H1: The smaller the Euclidean distance between two vowels, the higher the likelihood of assimilating a given L2 English/L3 Norwegian vowel to an L1 Polish vowel category.
- H2: Lip rounding may influence assimilation patterns.
- H3: The Euclidean distance predicts assimilation better in L3 than L2.
- H4: If we take into account the Euclidean distance, L2 vowels should be perceived as worse exemplars of L1 categories than L3 vowels.

Methodology

- Participants N=24 L1 Polish
  - Mean age: 19.86
  - 17 females, 7 males
- L2 English
  - Advanced, mean of language learning: 12.23 yrs
- L3 Norwegian
  - Beginner: 2 months of intensive instruction
  - Instructed setting

Methodology

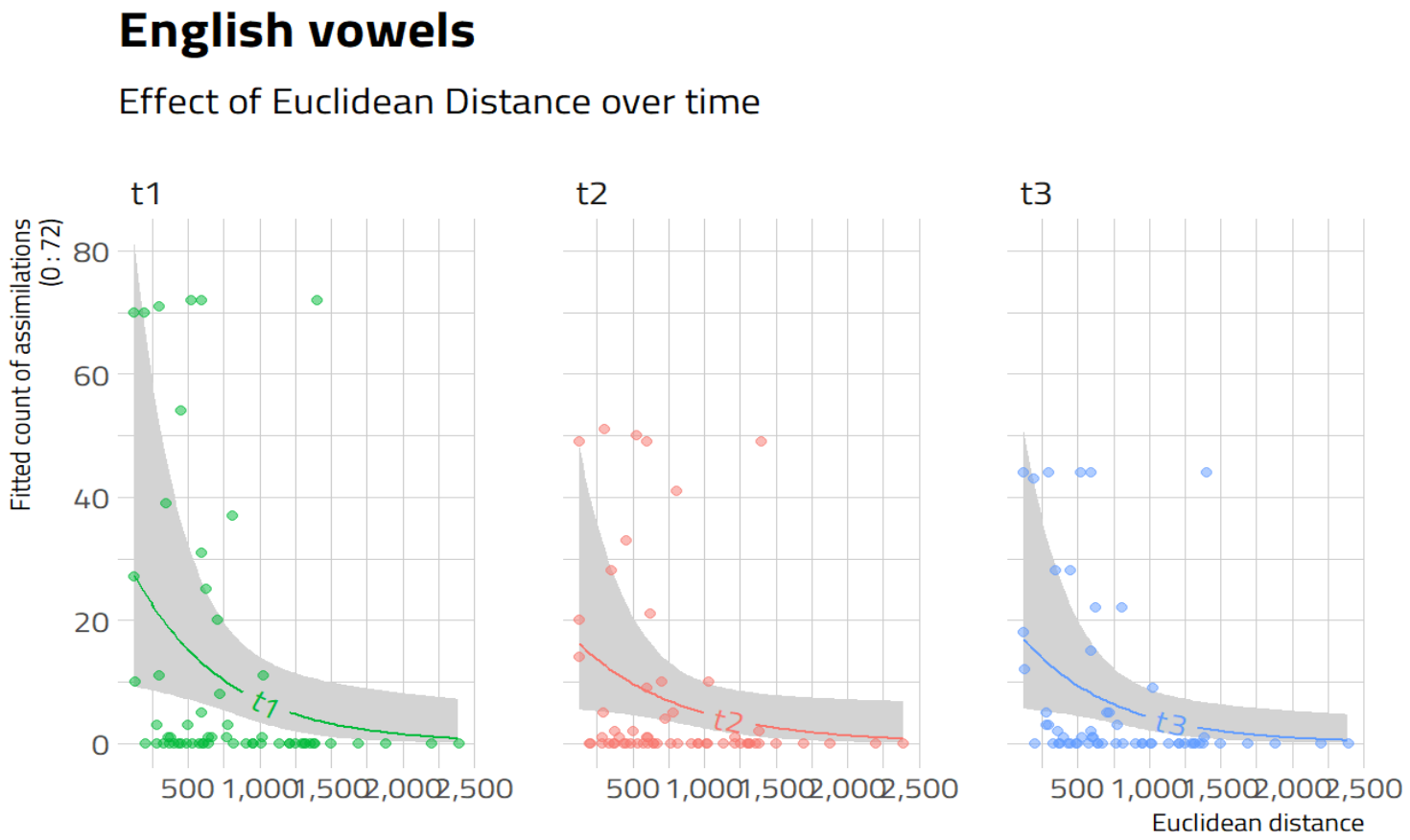
- Perceptual assimilation task
  - 10 English and 16 Norwegian monophthongs to six Polish vowel categories (orthographic labels)
- Two language blocks, on separate days
- Goodness of fit ratings
  - Likert scale from 1 to 7
  - 1 (weak fit) -- 7 (good fit)
- Stimuli: embedded in /dVd/
- Randomised, 3 repetitions
- Run in PsychoPy (Peirce et al. 2019)



Results

NORWEGIAN stimuli	Polish vowel labels <i>	<y>	<e>	<a>	<o>	<u>
TID /i:/	100% 5.77					
FIN /i/	33.33% 5	37.5% 5.41	26.39% 5.21			1.38% 3
STED /e/		88.89% 5.14		6.94% 5.6	1.39% 2	
LYS /y:/	70.83% 4.59	23.61% 5	1.39% 1			4.17% 4.33
SYND /y/	16.66% 5.25	62.5% 4.64	8.33% 5.17		2.78% 5	8.33% 2.33
LØP /ø:/		9.72% 3.57	19.44% 5.14	5.56% 3.75	58.33% 4.45	6.94% 3.2
SØNN /ø/		11.11% 3.25	36.11% 4.35	8.33% 5	33.33% 4.29	6.94% 3.2
ROM /u/					72.22% 5.08	27.78% 4.9
GUD /ʉ:/	2.78% 7	18.06% 4.23	1.39% 1		1.39% 1	75% 4.72
SLUTT /ʉ/	1.39% 3	23.61% 4.11			9.72% 5	63.89% 4.65
ENGLISH stimuli						
FLEECE	100% 5.8					
KIT	37.5% 5.03	34.72% 5.84	27.78% 6.15			
DRESS		98.61% 6.03		1.39% 5		
GOOSE						100% 5.15
FOOT	1.39% 7	4.17% 4.67			43.06% 4.61	51.39% 3.86

Results: Euclidian distance & assimilations

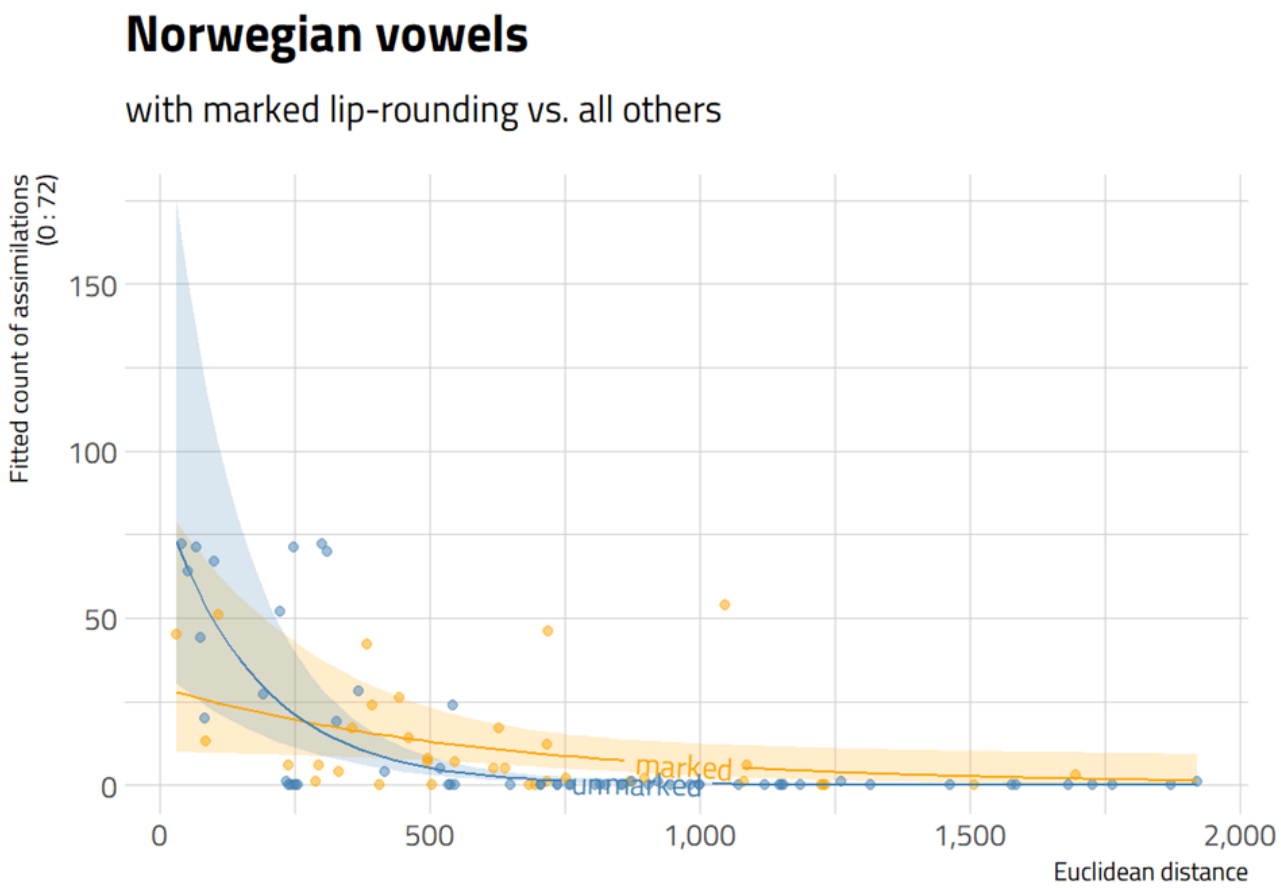


Discussion

- A negative binomial model to capture whether F1-F2 Euclidean distance is related to how often a given L2 Eng / L3 Nor vowel is assimilated to a given L1 Polish vowel
  - ED is negative and significant (z = -6.751, Pr(>|z|) = 1.46e-11***) for L2 & L3
  - T1 – the strongest effect in both L2 and L3

- H1: The larger the Euclidean distance, the fewer assimilations predicted

Results: influence of lip rounding on assimilation rates



Discussion

- H2 predicted that Euclidean distance may have a weaker effect on assimilation rates for vowels with more marked lip rounding, i.e. high and central front rounded vowels.
- The interaction ed:marked_rounding is positive and significant, but the effect of marked_rounding is not significant -> hard to interpret.
- Unmarked vowels have higher predicted assimilation rates

- H2: Lip rounding may influence assimilation patterns

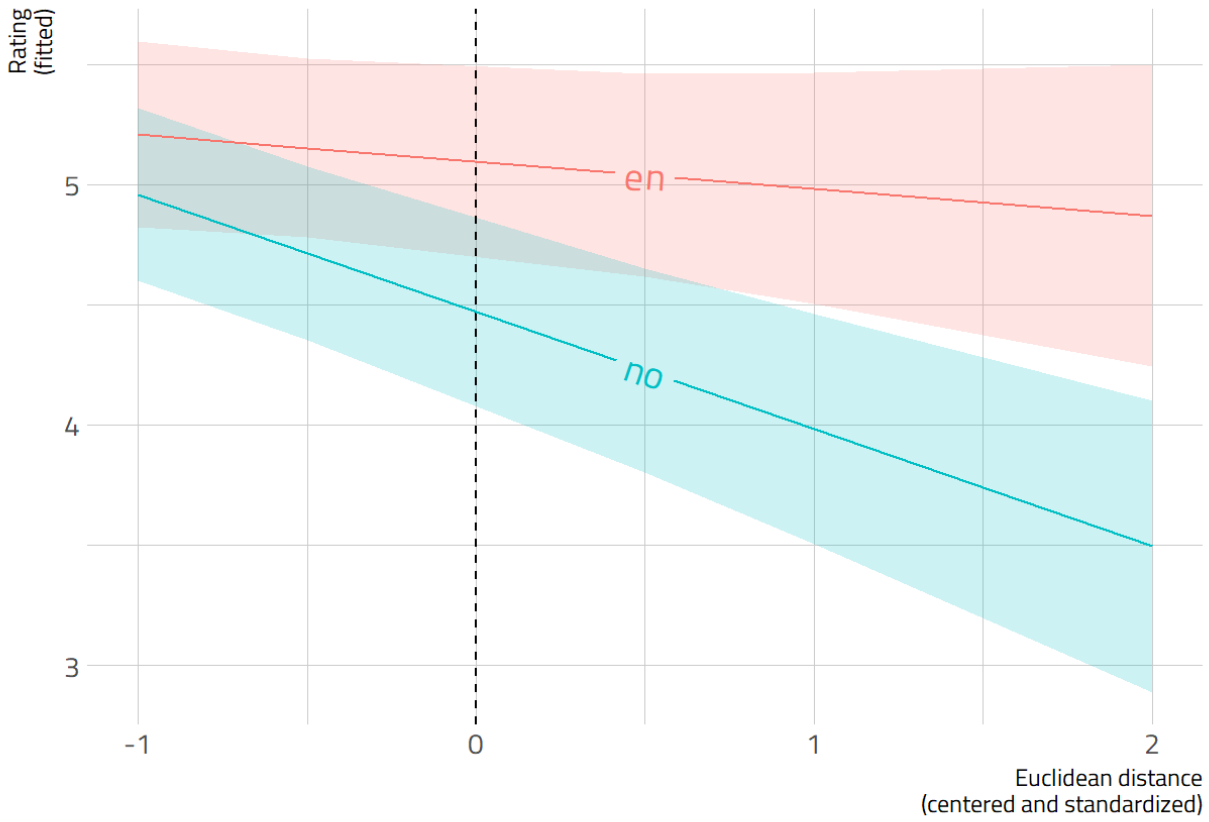
?

Discussion

- Stronger effect of the ED L3 than L2
  - coefficient in Nor ed_z = -1.7 > Eng ed_z= - 0.61,
  - assimilations in the better-known L2 have stabilized

- H3: The Euclidean distance predicts assimilation better in L3 than L2 ✓

Results: L2 or L3 vowels as better exemplars of L1?



Discussion

- Mixed effects linear model of Liker rating as a function of ED, language and their interaction; by-participant random intercept.
- Larger Euclidean distance means lower goodness of fit ratings in both languages.
- Significant effect of language: L2 English vowels are rated higher than L3 Norwegian vowels.
- H4: If we take into account the Euclidean distance, L2 vowels should be perceived as worse exemplars of L1 categories than L3 vowels. NO!

Interim summary

- The smaller the Euclidean distance between two vowels, the higher the likelihood of assimilating a given non-native vowel to a native category.
- There is some indication that marked lip rounding may influence assimilation patterns
- There is a stronger effect of ED in L3 than in L2.
- The perceptuo-acoustic similarity patterns restructured over time; the strongest effect of ED at T1.
- L2 English vowels seem more similar to L1 Polish vowels than L3 Norwegian vowels.

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Cross-linguistic influence in vowel processing in multilinguals

Hanna Kędzierska, Karolina Rataj, Anna Balas, Zuzanna Cal and Magdalena Wrembel

ERP STUDY

10 YEARS WA Faculty of English at AMU

EEG study

- Aim: to examine non-native phonological contrasts perception and processing in L2 and L3
- RQ: Will phonological contrasts be equally easy to detect and process in L2 and L3/Ln?
- Predictions: We predict the MMN to be stronger in native when compared with non-native speech (Jakobyet al., 2011; Liang & Chen, 2022; Näätänenet al., 1997; Song & Iverson, 2018).
  - BUT the scale of the MMN effect in L2 vs. L3/Ln impossible to predict

-> NO previous studies which would focus on such a comparison.

EEG study

Procedure

600 /i/ 60 /ɛ/

600 /ɪ/ 60 /ʊ/

600 /i/ 60 /ʏ/

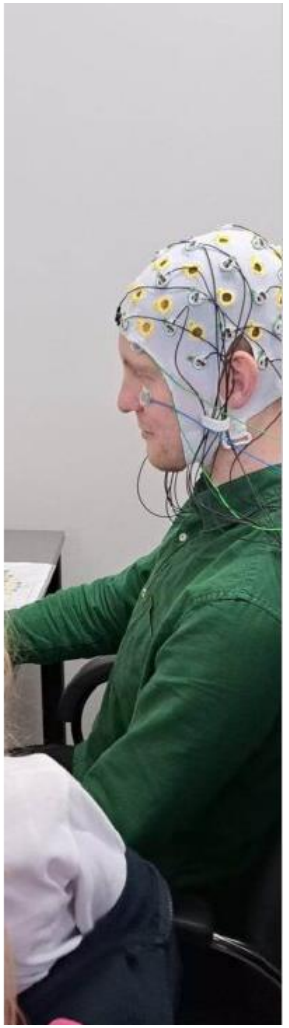
gating task: to assess the participants' speech-specific capabilities, which have been demonstrated to affect non-native phoneme discrimination (Díaz et al., 2016)

consent, surveys

the ERP preparation

ERP stimuli presentation during cartoon watching

gating task, proficiency tests



EEG study

- Oddball paradigm (standard & deviant stimuli)
- Three language blocks
  - Polish /ɨ/-/ɛ/ contrast mainly manifested in height
  - English /ɪ/-/ʊ/ contrast mainly manifested in backness
  - Norwegian /i/-/ʏ/ contrast mainly manifested in roundness
- Vowels synthesized with the aid of PRAAT (Boersma, 2001)

- Mismatch negativity (MMN) component
  - index of listeners' sensitivity to phoneme constrasts at a pre-attentional level (Näätänen et al., 1997)
  - P300 – memory processing

Way forward

- To further pursue theoretical refinement
- To triangulate different methodologies
- To investigate features that pattern differently across languages
- To expand across-domains studies
- To extend neurolinguistic studies to L3 phonology

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Thanks to the project team ☺

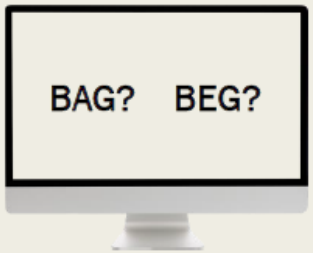
Thank you!

EEG study

- Gating task:
  - After the alineation point identification, the words were divided into other gates (i.e., fragments) by adding or subtracting 10 ms from the alineation point, e.g.:

Word	AP	Duration	G1	G2	G3	G4	G5	G6	G7	G8	G9	G10
beg	0,108	0,4463	0,088	0,098	0,108	0,118	0,128	0,138	0,148	0,158	0,168	whole

  - The two members of the minimal pairs (e.g., BAG and BEG) were displayed on the computer screen.



EEG study

Result analysis

Gating task

- We will take into account the answers satisfying **the following criteria**: (**a**) the decision concerning the selected word cannot be changed afterwards, (**b**) the level of confidence needs to be assessed as at least 4 in a 7-point Likert scale.
- In order to compare the results with those achieved by native speakers of English, the same gating task is being conducted independently on **a group of native English speakers** via Pavlovia.

ERPs

- We will analyse mean amplitudes of the ERP epochs time-locked to the onset of investigated phonemes.
- Statistical analyses will be performed in three main time windows, defined for the **MMN**, for the **P3b** and for the **LDN**.
- We plan to consider the following factors: **language** (L1 vs. L2 vs. L3) × **deviancy** (standard vs. deviant) × **brain region** (frontal vs. parietal).