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Acquisition of speech from a multilingual perspective

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Outline

- Dynamic nature of multilingualism
- Introduction to L3 phonological acquisition
- Methodological & theoretical challenges
- New research insights
- Project results and way forward

Introduction

- Complex linguistic landscape of today
  - Multilingualism as a norm
- Multilingual acquisition - a dynamic and diversified process

- New insights into language learning beyond investigations into the first (L1) and second language (L2) (Flynn et al. 2004)

- A growing body of studies into the acquisition of third language (L3) phonetics & phonology (Wrembel & Cabrelli Amaro 2018)

Dynamics of multilingualism

- All languages in multilinguals' repertoire constitute **dynamic systems undergoing continuous change** (Kroll et al. 2012, Sorace 2020)

- **Cross-language interactions** persistent from the very onset of multiple language learning (Kroll 2020)
  - in different linguistic domains i.e. lexis, grammar, and phonetics/phonology

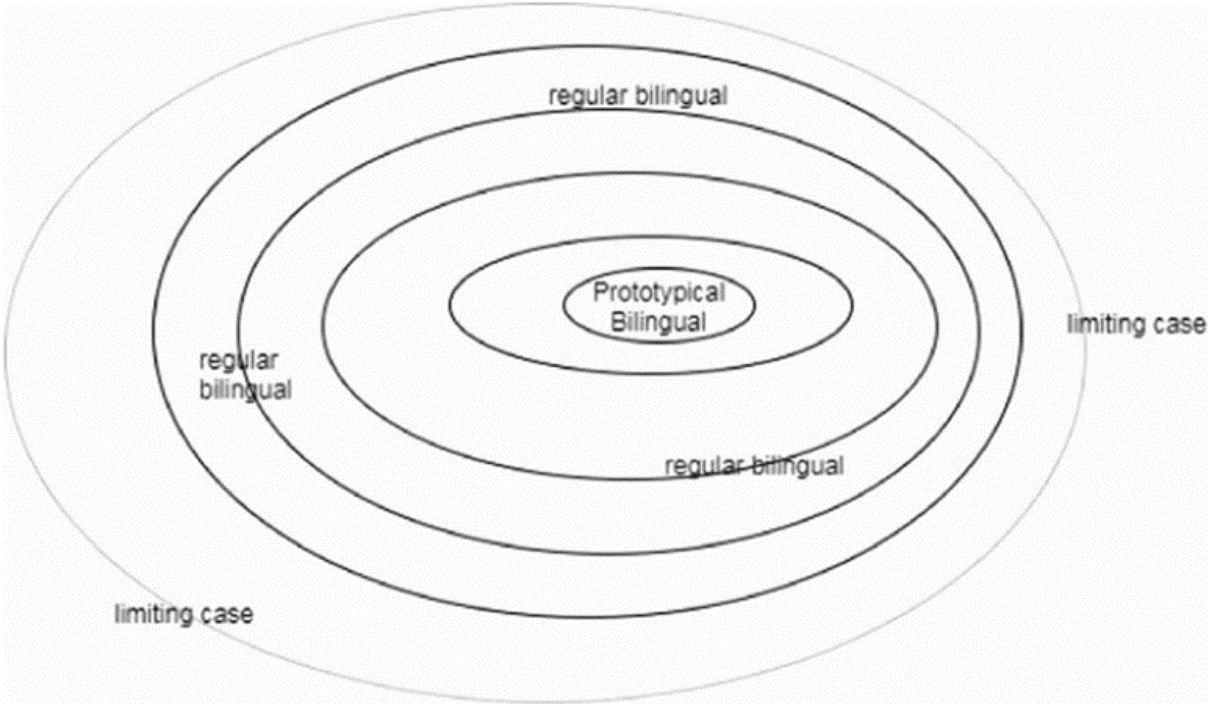
- **Reconfiguration** of cognitive network -> e.g. convergence between L1 and L2/Ln (Sorace 2020)

Dynamics of multilingualism

- L1 phonetic drift from the onset of L2 learning (Chang 2012)
- ”L1 takes a hit” - L1 performance on a lexical decision task altered even after brief exposure to L2/Ln (Kroll 2020)
- Passive language exposure in multilingual environment facilitates new language learning (Bice and Kroll 2015)
  - vowel harmony in an unfamiliar language in uni- vs. multilingual environment (Southern California > Pennsylvania) ERP study

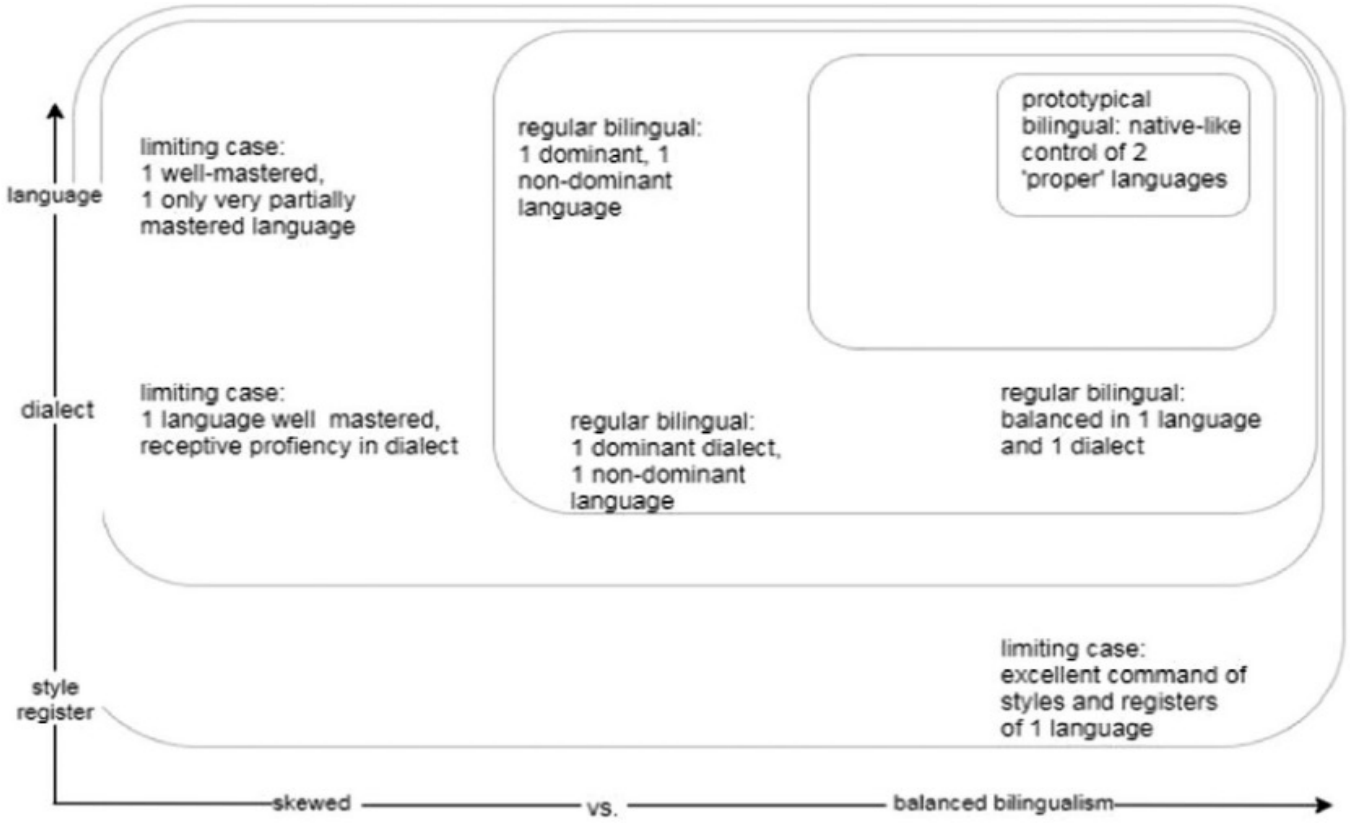
Conceptualising bi-/multilingualism

- Not a categorical variable (Luk & Bialystok, 2013)
- A natural category - Berthele (2021):
  - radiality, gradient membership, fuzzy boundaries



Conceptualising bi-/multilingualism

- Natural category of bi/multilingualism along two dimensions:
  - balance
  - language status (Berthele 2021: 86)



Comparing bilingual and trilingual speech

- Traditionally: conflating bi- & multilingualism
- Evidence for distinctness (neuro-, psycholinguistics)
- Quantitative differences
- Qualitative differences
- Extended interactions between languages
- Prior linguistic knowledge
- More extensive previous learning experience
- Increased metalinguistic awareness
- Enhanced language learning strategies

(De Angelis, 2019)

Comparing bilingual and trilingual speech

- Cross-linguistic Influence (CLI)
- Enhanced perceptual sensitivity
- Facilitation in learning new phonologies
  - Increased metalinguistic awareness
  - Trilingual advantage (potential)

Cross-linguistic Influence (CLI)

- Quantitative differences
- SLA: L1-based transfer (one-to-one)
- TLA: multidirectional & complex CLI

  L1⇔L2, L1⇔L3, L2⇔L3 …

- Qualitative differences
- L1-based CLI in L2/L3 (due to established neuro-motor routines)
- L2-based CLI in L3 (interaction of two non-native languages, 'foreign language effect', 'lateral CLI' (Jarvis & Pavlenko, 2008)

Cross-linguistic Influence (CLI)

- Combined L1 & L2 CLI
  - L1-L2 hybrid values in L3 VOT (e.g. Cardoso & Collins 2010, Dittmers et al., 2018, Wrembel 2015 for L3 French)

- 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

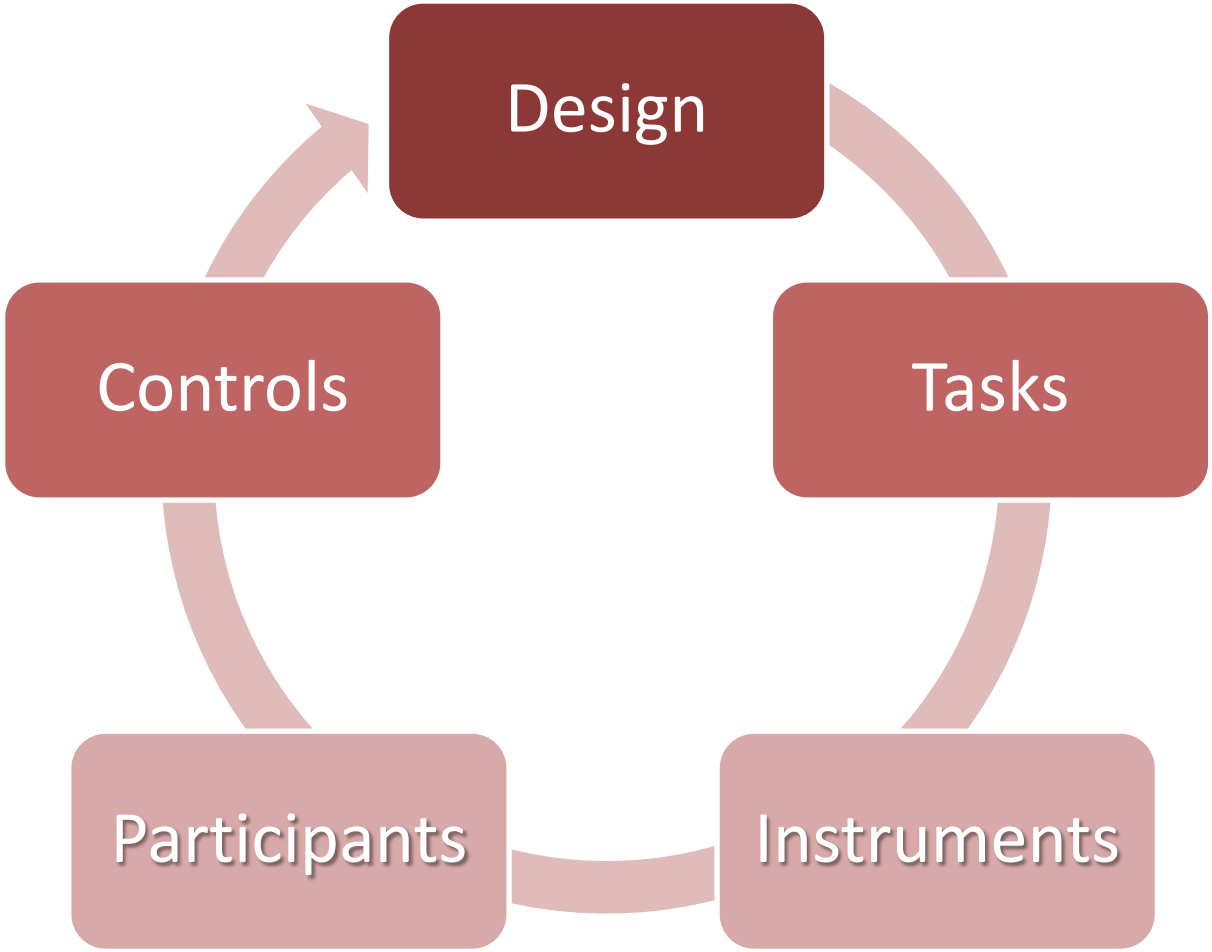
- Structure-dependent CLI - Domene Moreno (2021): German-Turkish heritage speakers learning L3 English
  - perception of vowel length and laterals: Turkish-based CLI
  - production of consonant clusters and vowel length: German-based CLI

Facilitation in learning new phonologies

- Trilingual advantage found in some studies might not reflect a general advantage in phonological acquisition
  - Antoniou et al., 2015; Enomoto, 1994; Onishi, 2016
- Rather: L3/Ln learners can benefit from specific phonological properties of their background languages

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

Methodological considerations



Methodological challenges: Language status

- L1 / L2 / L3 /Ln

- Chronology of acquisition
- Dominance and use
- -> potential dominance shift

Methodological challenges: Design

- Focus: outcome of L3 acquisition -> process
  - cross-sectional vs. longitudinal
    - several testing times
    - dense data collection

- Types of L3 learners
  - Foreign language learners (late sequential)
    - Emerging multilinguals
    - Initial state vs. more advanced L3 learners
  - Active bi/multilingual (early, simultaneous) + L3
  - Heritage speakers L1/L2 -> 2L1s + L3

Methodological challenges: Tasks

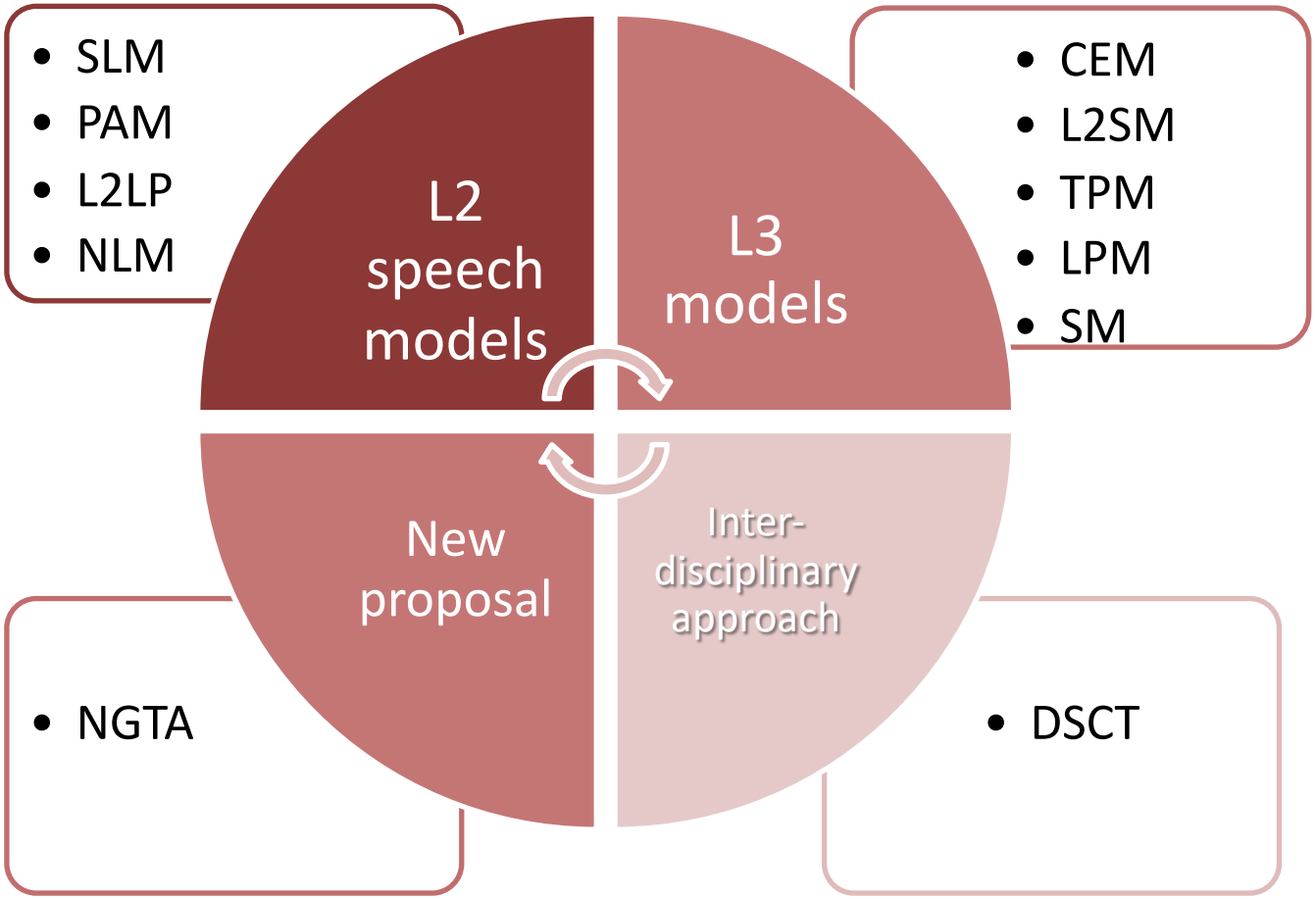
- Tasks and procedures
  - Speech sample elicitation in all (3 or more) languages (!)
  - Degree of control vs. ecological validity
  - Perceptual paradigms - for separate languages or cross-linguistic

- Language modes in testing
  - Induced monolingual (separate testing days)
  - Encouraged multilingual (favouring CLI, code-switching)

Methodological challenges: Controls

- Comparison groups
  - Monolingual controls?
  - Bilingual control groups
    - e.g. Llama & Lopez-Morelos 2016, Hopp & Schmid 2013
  - Mirror-design groups
    - L1 **X**, L2 **Y**, L3 Z vs. L1 **Y**, L2 **X**, L3 Z
    - L1 **X**, L2 Y, L3 **Z** vs. L1 **Z**, L2 Y, L3 **X**
      - e.g. Gut, Wrembel, Kopečková, Balas 2019
  - Same group over time

Theoretical frameworks



Third language (L3) acquisition models

- Cumulative Enhancement Model Flynn et al., 2004
  - All previously learnt languages may influence subsequently acquired languages (if facilitative)
- L2 Status Factor Model Bardel & Falk 2007
  - L2 influence prevails over L1, Psycho & neurolinguistically motivated, greater cognitive similarity of L3 and L2 (not L1)
- Typological Primacy Model Rothman 2011, 2015
  - Typology determines source of CLI, Holistic transfer from L1 or L2
- Linguistic Proximity Model Westergaard et al. 2017, 2019
  - CLI from L1 and/or L2 based on structural similarity
  - property-by-property transfer
- Scalpel Model Slabakova 2017
  - In line with LPM + cognitive and experiential factors

INSIGHTS FROM L3 PROJECTS

FAR study
Perception study
Processing study (ERP)

10 YEARS WA
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CLIMAD study design

- Three data collection times (T1, T2, T3)
  - T1 in November 2021
  - T2 in March 2022
  - T3 in June 2022
- Three sessions
  - speech production (vowels, VOT, sibilants/retroflexes)
  - speech perception (as above)
  - grammaticality judgements (syntactic features)
- Fieldwork mode
- L3 vs. L1, L2 language blocks (different days)

INVESTIGATING PREDICTORS OF FOREIGN ACCENTEDNESS IN L3 ACQUISITION

Magdalena Wrembel, Kamil Kaźmierski, Nicole Rodriguez, Katarzyna Dziubalska-Kołaczyk, Zuzanna Cal and **Jarosław Weckwerth**

FAR STUDY

10 YEARS WA
Faculty of English at AMU

Study design: participants

- **Speakers (N=24)**
  - L1 Polish, L2 English, L3 Norwegian
  - aged 21
  - 8 weeks of intense initial exposure to the L3 in a formal setting
- **Raters (N=30)**
  - 18 Norwegian native speakers
  - 12 highly proficient L2 speakers of Norwegian
  - some phonetic training
  - moderate to considerable previous experience with foreign-accented speech in Norwegian.

Study design: speech samples

- Excerpts from *The North Wind and the Sun*
- Read in L3 Norwegian
- 48 words long
- 30 samples
  - 24 L3 learners
  - 6 Norwegian controls
  - presented to the raters in a randomized order

Online rating survey in Qualtrics

Rate the following speech sample according to the questions below, feel free to use the whole scale:

Q1: How much of a foreign accent does this speaker have?
1 = No foreign accent | 9 = Strong foreign accent

Q2: How comprehensible is this speech sample to you?
1 = Very comprehensible | 9 = Not comprehensible at all

	1	2	3	4	5	6	7	8	9
How much of a foreign accent does this speaker have?	○	○	○	○	○	○	○	○	○
How comprehensible is this speech sample to you?	○	○	○	○	○	○	○	○	○

Measures

- **L3 Proficiency**: Norwegian placement test
- **Amount/frequency of L3 use**: a composite score based on self-declared answers in LHQ
- **Oral reading fluency**: number of words per minute (wpm)
- **Fine-grained phonetic performance**: VOT durations in /p, t, k/ in word list reading in L3
- **Profile**: Language History Questionnaire (Li et al. 2006)
- **Rating parameters** (on a 9-point scale):
  - degree of foreign accentedness
  - comprehensibility

Research questions

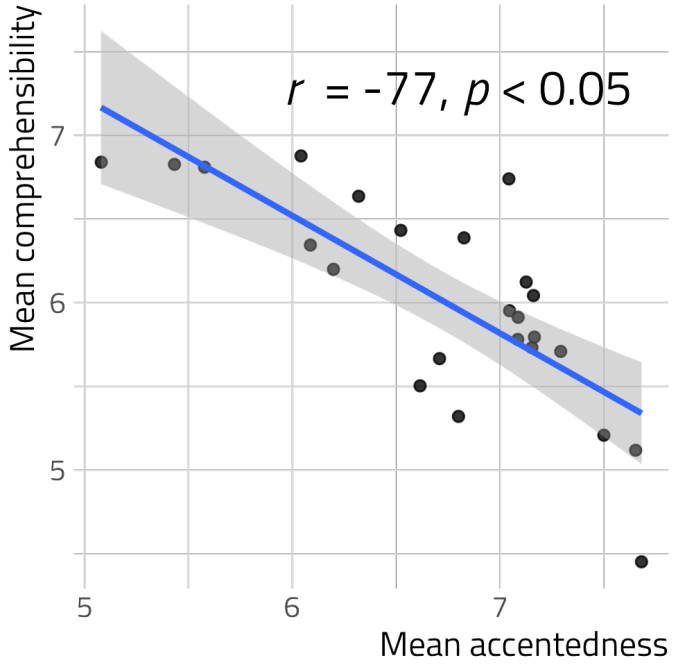
- **RQ1:** Do the rating parameters (accentedness and comprehensibility) correlate?
- **RQ2:** Does perceived global accent correlate with the learners' proficiency level, oral fluency and fine-grained phonetic performance in the L3?
- **RQ3:** Does perceived comprehensibility correlate with the learners' proficiency level, oral fluency and fine-grained phonetic performance in L3 Norwegian?

Results

Parameters	Experimental group M (SD)	Control group M (SD)
Accentedness (1–9)	6.72 (1.8)	1.5 (1.5)
Comprehensibility (1–9)	6.03 (2.3)	7.8 (2.7)
Oral fluency (wpm)	0.05 (0.01)	–
VOT /p/ (ms)	44 (14)	–
VOT /t/ (ms)	62 (15)	–
VOT /k/ (ms)	74 (18)	–
Norwegian use (hrs/week)	4.2 (4.6)	–

Results: Accentedness vs. comprehensibility

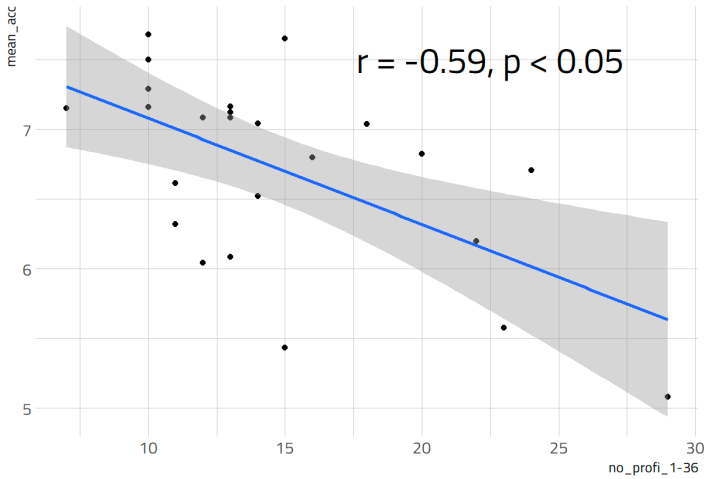
- Significant correlation between Accentedness and Comprehensibility
- The stronger the accent, the lower the comprehensibility
- **RQ1 – YES**

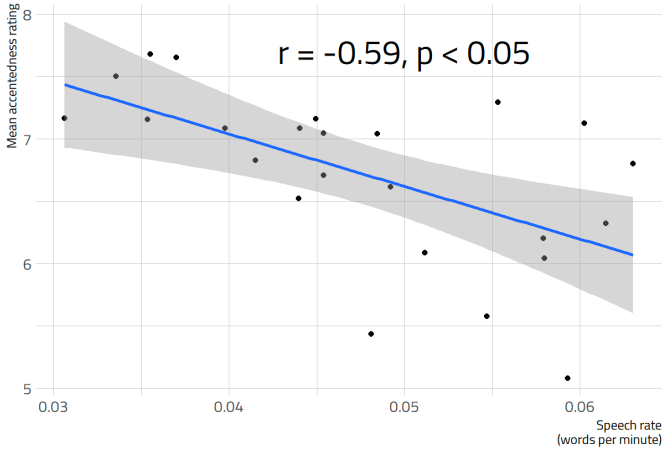


Results: Accentedness vs. factors

- Accentedness and L3 Proficiency
- **No** correlations between perceived foreign accent and VOT measures

- Accentedness and Oral Fluency
- The higher the speech rate, the less accented it is perceived to be
- RQ 2 -> partially yes

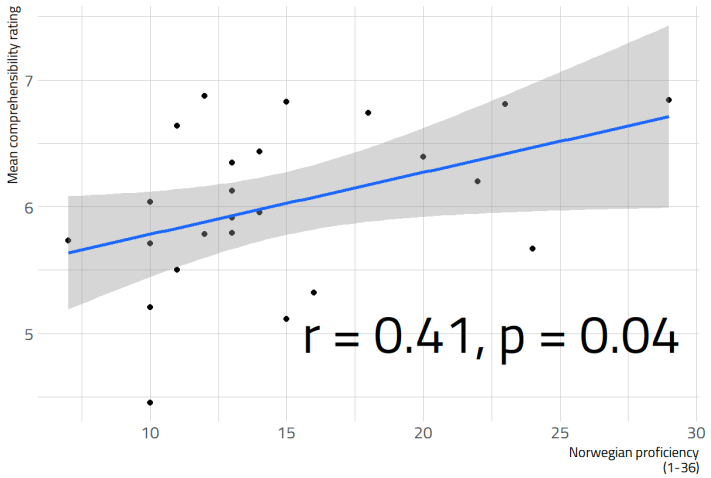


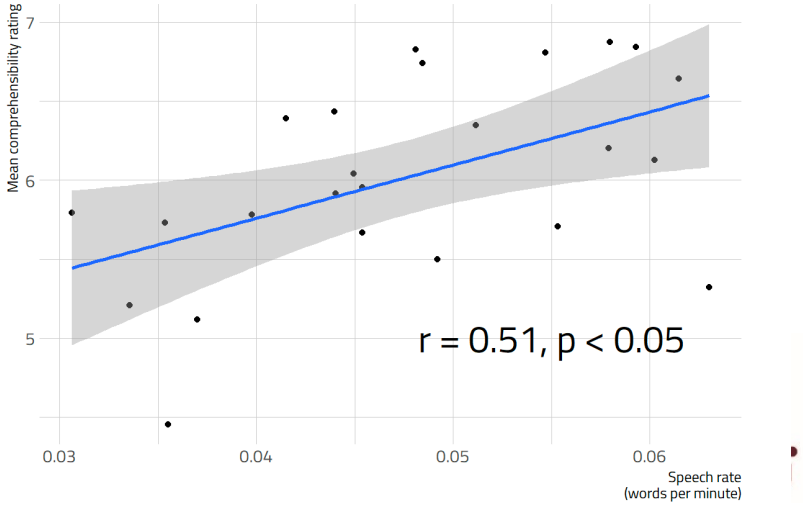


Results: Comprehensibility vs. factors

- Comprehensibility and L3 Proficiency
- **No** correlations between perceived Comprehensibility and VOT measures

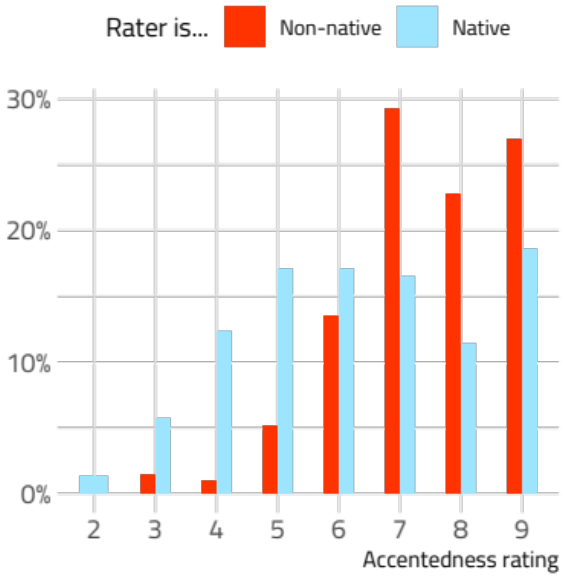
- Comprehensibility and Oral Fluency
- The higher the speech rate, the higher the comprehensibility rating
- RQ 3 -> partially yes





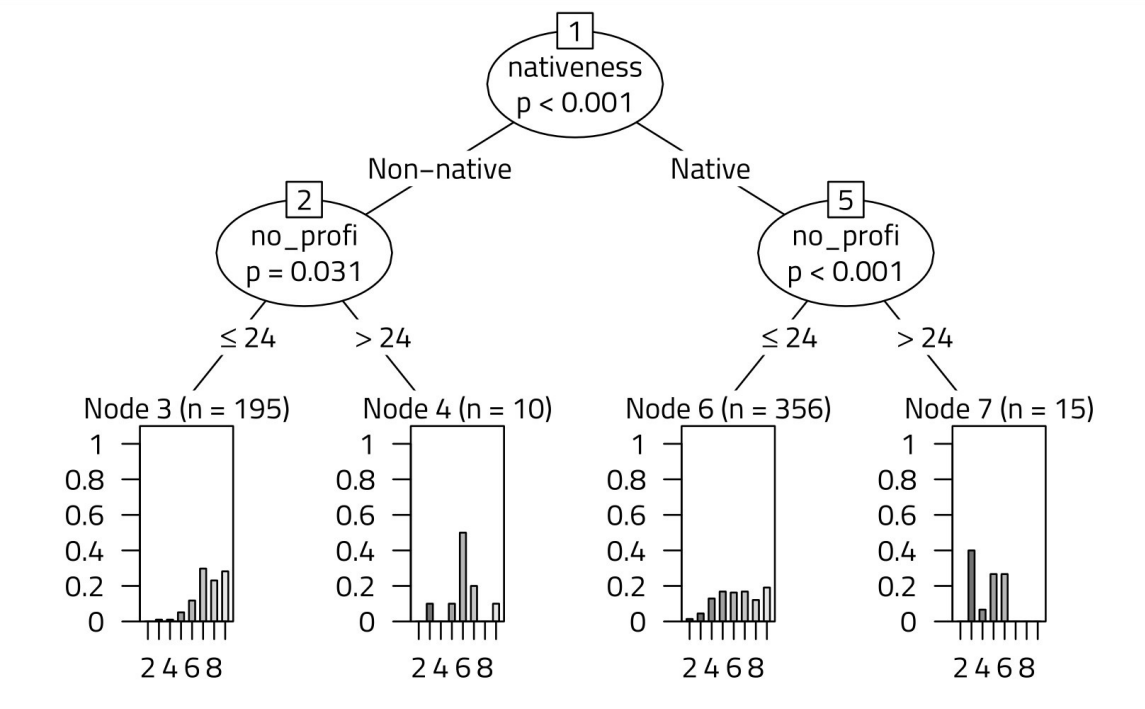
Results: rater variables

- **Native vs. non-native speaker status** significant for Accentedness but not Comprehensibility
- Mixed-effects ordinal logistic regression model: Accentedness as a function of Nativeness of Rater, with Norwegian Proficiency as control, and by-speaker and by-rater random intercepts
- **Interrater reliability**: Cronbach's alpha for Accentedness $\alpha = 0.89$; for Comprehensibility $\alpha = 0.87$



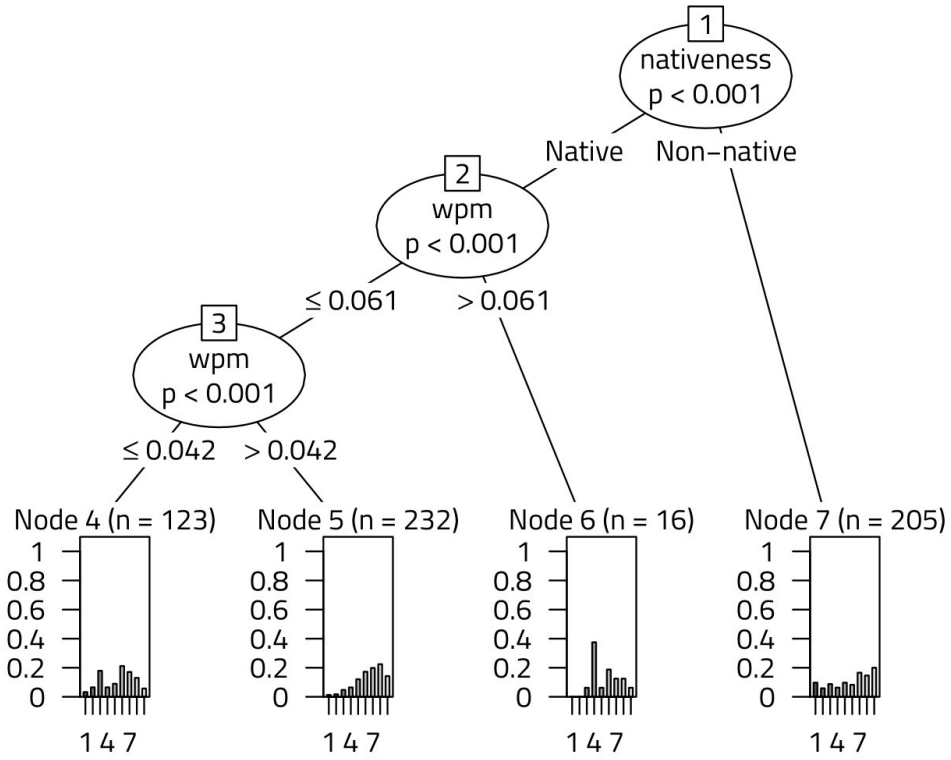
Results: importance of predictors for Accentedness

- A random forest analysis



Results: predictors for Comprehensibility

- Conditional importance of predictors for Comprehensibility



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

PERCEPTION STUDY

10 YEARS WA Faculty of English at AMU

Aim & rationale

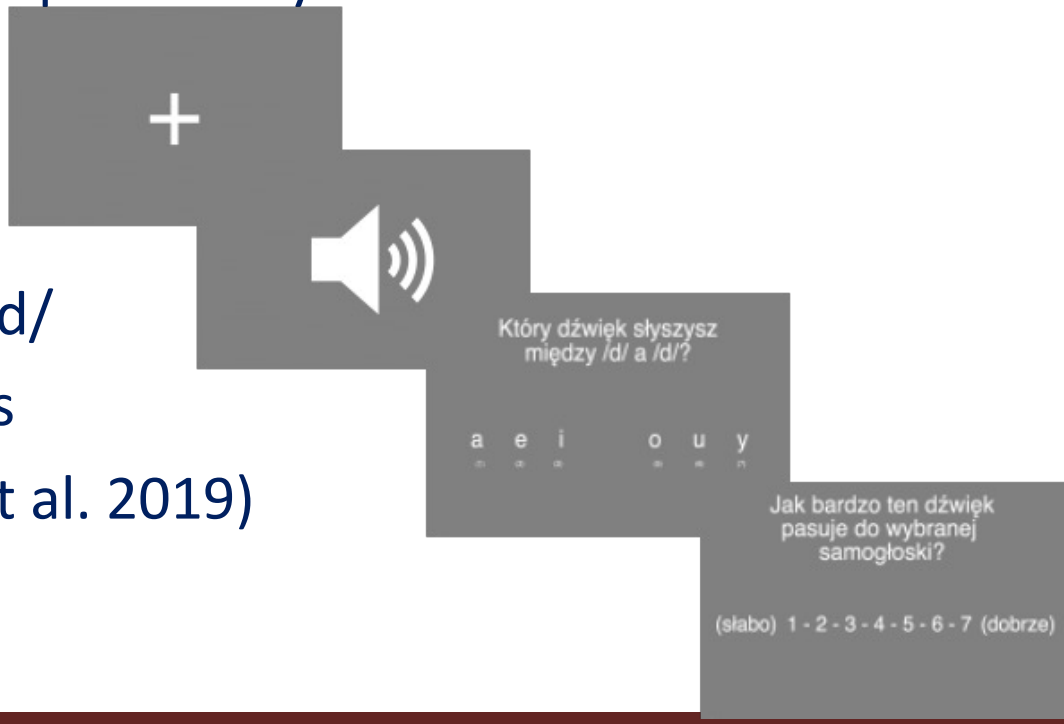
- To explore the **relationship between L2 and L3 perception** and acoustic **distance** between the vowels operationalized as Euclidean distance
- To examine **perceptual assimilation patterns** for L3 Norwegian and L2 English vowel assimilated to L1 Polish vowel categories
- So far studies focused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

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: The Euclidean distance predicts assimilation better in L3 than L2.
- H3: If we take into account the Euclidean distance, L2 vowels should be perceived as worse exemplars of L1 categories than L3 vowels.

Methodology

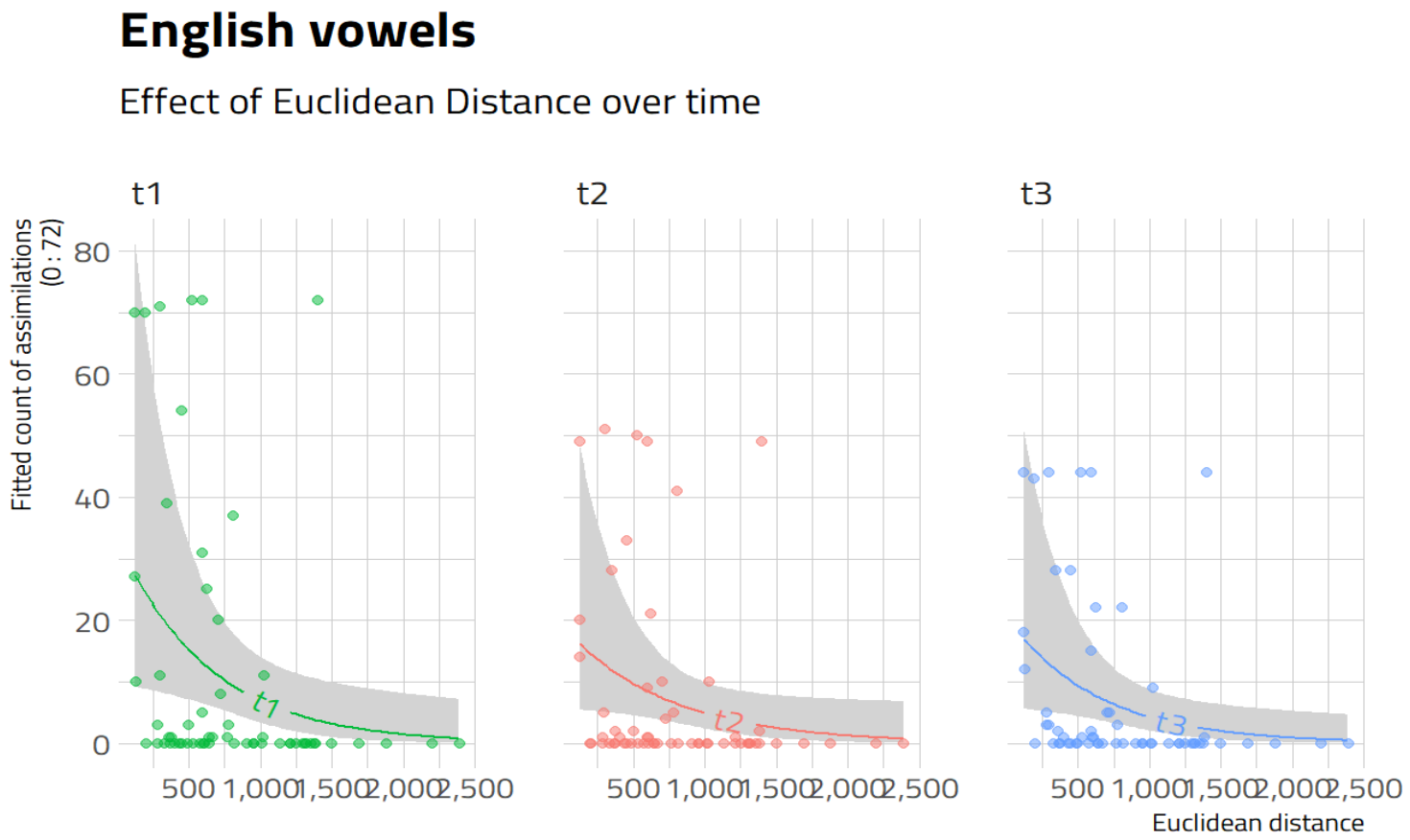
- Perceptual assimilation task
  - 10 English and 16 Norwegian monophthongs to six Polish vowel categories (orthographic labels)
- Two language blocks, on separate days
- Goodness of fit ratings
  - Likert scale from 1 to 7
  - 1 (weak fit) -- 7 (good fit)
- Stimuli: embedded in /dVd/
- Randomised, 3 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: H1

- 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

Discussion: H2

- 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 English have stabilized
- H2: The Euclidean distance predicts assimilation better in L3 than L2

Discussion: H3

- Mixed effects linear model of **Liker rating** as a function of ED, language (L2, L3) 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 as better exemplars of L1 categories than L3 Norwegian vowels
- H3: 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 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 English and L3 Norwegian?
- 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/

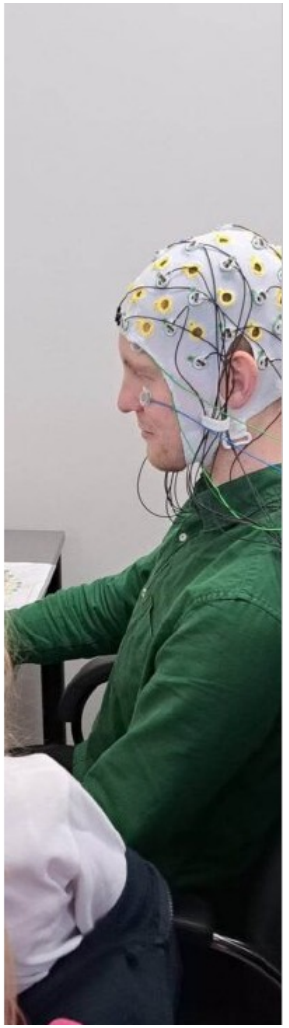
gating task: to assess the participants' speech-specific capabilities, which have been demonstrated to affect non-native phoneme discrimination (Díaz et al., 2016)

consent, surveys

the ERP preparation

ERP stimuli presentation during cartoon watching

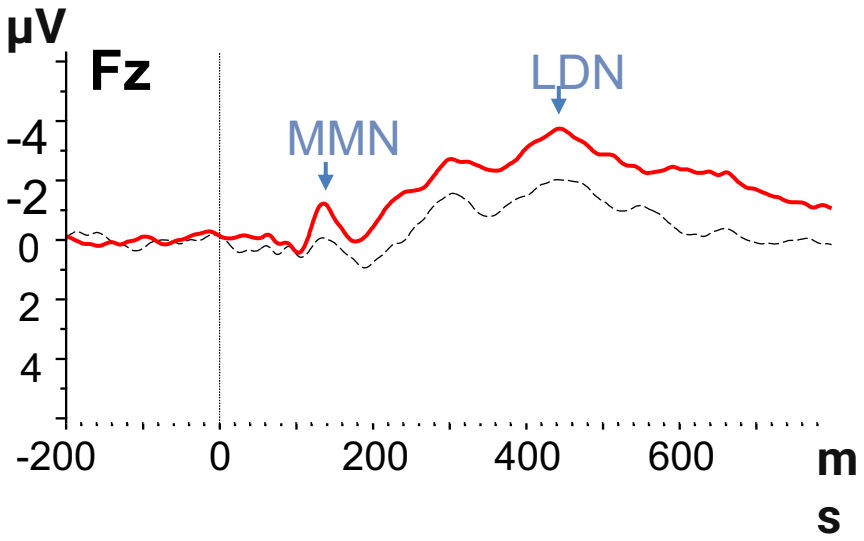
gating task, proficiency tests



Oddball paradigm

Oddball:

a sequence of frequently occurring standard stimuli interrupted by the occasional appearance of deviant stimuli)



MMN:

a negative-going wave deflection of frontocentral distribution with a peak at around 150-250 milliseconds from change onset.

P300 and LDN:

often following the MMN. **P300** is associated with switch of attention, **LDN** involves additional cortical resources to extract the difference.

Experimental stimuli

Polish: /ɨ/-/ɛ/ **English:** /ɪ/-/ʊ/ **Norwegian:** /ɨ/-/ʏ/

We used possibly similar standard sounds in Polish, English and Norwegian.

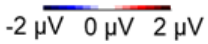
The deviant sound were selected to be language-specific with approximately comparable distance from the standard one.

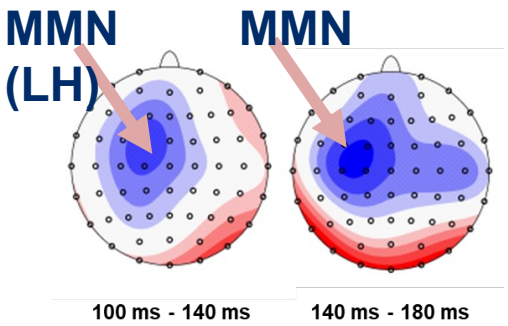
Vowel	F1	F2	F3	ED
/ɨ/	468	1948	2821	231
/ɛ/	675	1916	2722	
/ɪ/	394	1828	2882	483
/ʊ/	390	1345	2896	
/ɨ/	357	1917	2587	161
/ʏ/	313	2015	2708	

EEG study

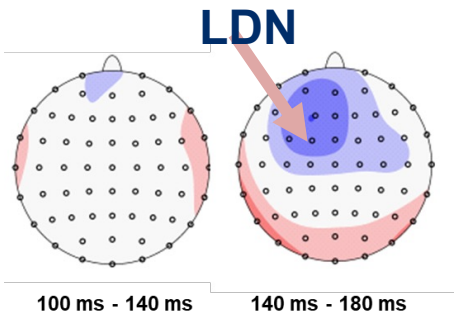
- 2 groups – diverse acquisition settings
  - Formal learners in Poland (N=24)
  - Naturalistic learners in Norway (N=21)

ERP results: MMN

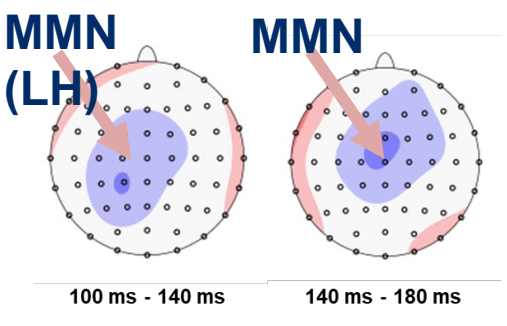




L1 POLISH



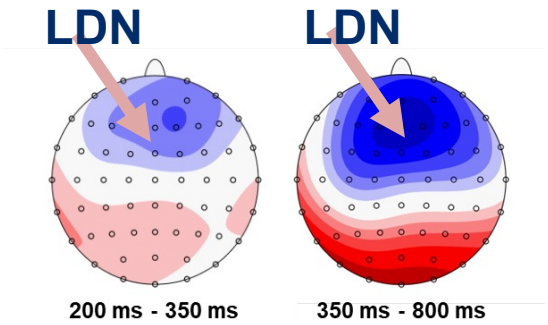
L2 ENGLISH

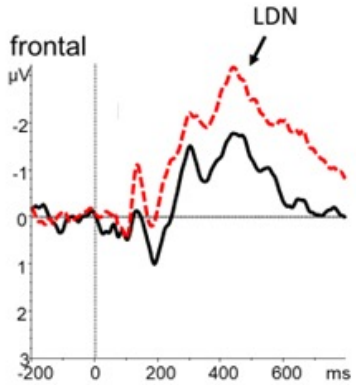


L3/L*n* NORWEGIAN

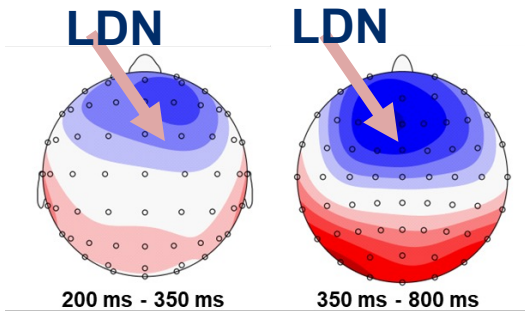
ERP results: LDN

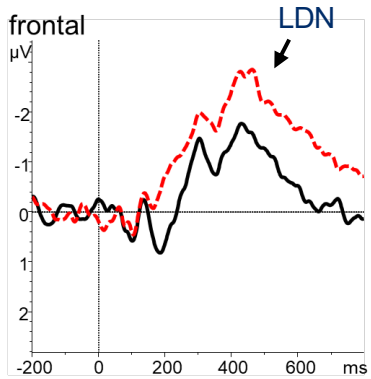
-2 μV 0 μV 2 μV



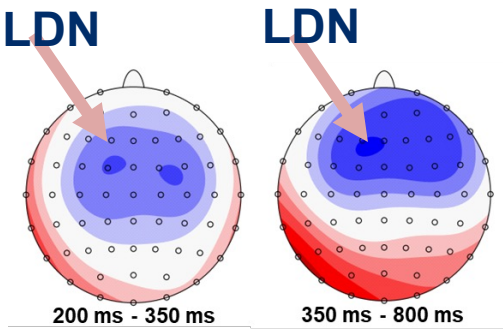


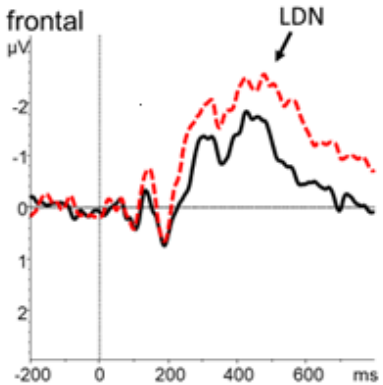
L1 POLISH





L2 ENGLISH





L3/L*n* NORWEGIAN

Discussion: prediction testing

- Will phonological contrasts be equally easy to detect and process in **native and non-native** langauges?
- MMN response was deficient for non-native languages (L2 English, L3/L*n* Norwegian) compared to L1 Polish -> **in accordance with our hypothesis** and previous studies

- Will any significant distinctions emerge in **L3/Ln as opposed to L1 and L2**?
- MMN emerged in L3/L*n* Norwegian but not in L2 English
- **LDN less pronounced in L3/L*n* Norwegian** when compared with L1 Polish (but not with L2 English)

Interrim summary

- We have **replicated previous findings** concerning the impaired phonemic perception in non-native languages
  - But the study extended beyond L2 to L3
  - Diverse acquisition settings: formal vs. naturalistic
- Foreign language status as **L2 or L3/L*n* modulates auditory language processing**
- Results suggest the relevance of **language proficiency and dominance** as factors influencing phonemic perception mechanisms
  - correlation between the MMN magnitude in Norwegian and L3/L*n* proficiency level, $r(21) = 0.65$, $p = .02$.

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 develop multilingual speech corpus

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Thank you!

10 YEARS WA
Faculty of English at AMU

Polish, English and Norwegian vowels