

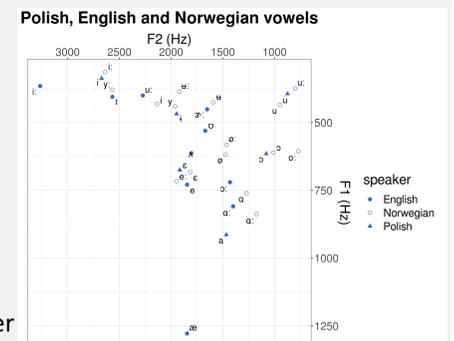


Introduction and hypotheses

- ❖ The aim: to examine the relationship between L3 Norwegian and L2 English vowel assimilation patterns to L1 Polish vowel categories and the acoustic distance between the vowels operationalized as the Euclidean distance.
- ❖ So far studies focused on L2: perceptual assimilation (Best & Tyler 2007, Tyler et al. 2014), the relationship between vowel perception and their acoustic parameters (Strange et al. 2003, Escudero et al. 2012, Alispahic et al. 2017) and perception of front rounded vowels (Gottfried 1984, Polka 1995, Strange, Bohn and Nishi 2004).
- ❖ Hypotheses for L1-L2-L3 perceptual and acoustic similarity:
 - ❖ H1: The smaller the Euclidean distance between the two vowels, the higher the likelihood of assimilating a given L2/L3 vowel to a Polish category. We expect less reliance on ED in later testing times.
 - ❖ H2: Lip rounding may influence assimilation patterns.
 - ❖ H3: The Euclidean distance predicts assimilation better in L3 than in L2.
 - ❖ H4: If we take into account the Euclidean distance, L2 vowels should be perceived as worse exemplars of L1 categories than L3 vowels.

Methods

- ❖ Languages: L1 Polish, L2 English (12.23 yrs of learning on average), L3 Norwegian (beginners).
- ❖ Three testing times after the onset of L3 Norwegian learning: T1 -- two months, T2 -- five months and T3 -- nine months.
- ❖ Participants: at T1 -- 24, mean age 19.86, at T2 and T3 -- 15.
- ❖ Tasks: assimilation of 16 Norwegian and 10 English vowels to six Polish vowel categories and goodness of fit rating, carried out in PsychoPy (Peirce et al. 2019).
- ❖ The stimuli in /dVd/ framework
- ❖ Randomised, 3x each (e.g., dād, did)
- ❖ Orthographic labels for six Polish vowel categories /i, ɨ, e, a, ɔ, u/
- ❖ Likert scale: 1 (weak fit) -- 7 (good fit)
- ❖ Euclidean distance operationalized as the distance in F1 and F2, rather than F1-F2-F3, as the model based on the former was lower by three AIC units (440 vs. 443, 7df) in the pilot study.



Results and analysis

Selected 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
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
Selected 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

H1: A negative binomial model was used to capture whether the F1-F2 Euclidean distance is related to how often a given Norwegian vowel is assimilated to a given Polish vowel. ED is negative and significant ($z = -6.751$, $Pr(>|z|) = 1.46e-11^{***}$), so the larger the Euclidean distance, the fewer assimilations are predicted.

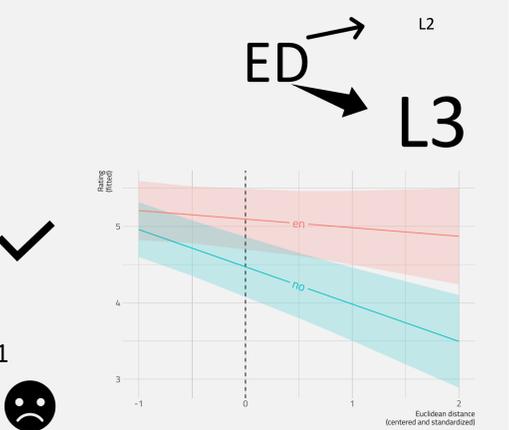
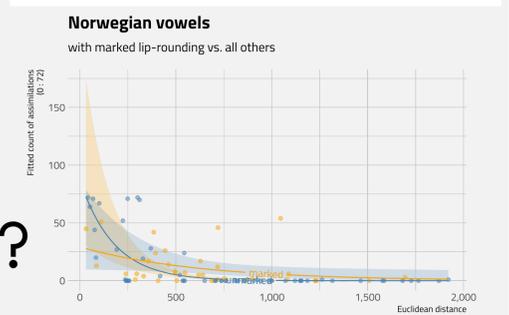
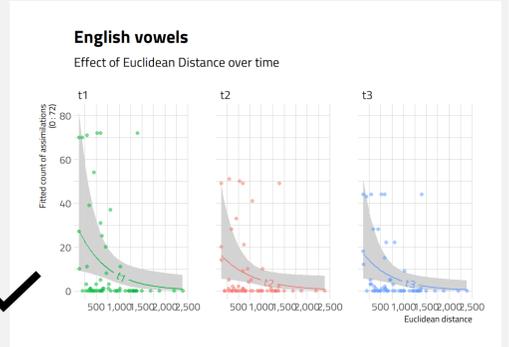
The differences between testing times are weak and not significant.

H2: The interaction ed:marked_rounding is positive and significant, but the effect of marked_rounding is not significant → hard to interpret.

H3: The influence of ED on perception in L2 and L3

The absolute value of the coefficient is larger in Norwegian ($ed_z = -1.706004$) than in English ($ed_z = -0.6104734$), which suggests that there is a stronger effect of the Euclidean distance in L3 than in L2. Interpretation: assimilations in the better-known L2 have stabilized taking into account other factors/features.

H4: L3 vowels are worse exemplars of L1 categories than L2 vowels.



Discussion

- ❖ The conclusion for L3 phonology is that perceptual targets are largely modulated by the Euclidean distance, but they are influenced by other phonetic features and these factors/factor combinations need further investigation.
- ❖ There is some indication that marked lip rounding may influence assimilation patterns, but no indication that vowel length plays a role.
- ❖ ED influences perception more in L3 Norwegian than in L2 English.
- ❖ The perceptuo-acoustic similarity patterns are not substantially restructured during the first year of L3 learning.
- ❖ With regard to the comparison of goodness of fit ratings, in the present language combination, L3 Norwegian has more marked vowels than the L2 English. Languages with comparable vowel inventories/less marked vowels should be examined (e.g. L1 Polish, L2 English, L3 Spanish?).
- ❖ Future research should also investigate the relationship between L2 and L3 vowel assimilation and production development (cf. Wrembel et al. 2022).
- ❖ Cluster dendrograms: 5 groups for L2 English, 2 groups for L3 Norwegian.
- ❖ Factors determining perceptual and acoustic similarity:
 - Euclidean distance (+), language status: L2 vs. L3 (+), lip rounding (+/-), testing time (-)

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Acknowledgements

Research presented on this poster has been a result of a project: OPUS-19-HS (UMO-2020/37/B/HS2/00617) CLIMAD "Cross-linguistic influence in multilingualism across domains: Phonology and syntax" financed by the National Science Centre, Poland.

