

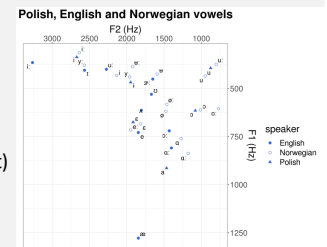
Anna Balas, Magdalena Wrembel, Kamil Kazmierski and Jaroslaw Weckwerth

## 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 – 15, at T3 – 14.
- ❖ 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
- ❖ Three times each (e.g., dād, did)
- ❖ Randomised
- ❖ Orthographic labels for six Polish vowel categories /i, i, e, a, ɔ, u/
- ❖ Likert scale: 1 (weak fit) – 7 (good fit)

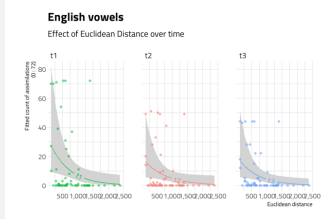


## Results and analysis

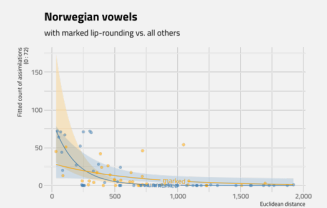
NORWEGIAN stimuli	Polish vowel labels					
	<i>	<y>	<e>	<a>	<o>	<u>
TID /i:/	100% 5.77					
FIN /i/	33.33% 5	37.5% 5.41	26.39% 5.21			1.38% 3
STED /e/		88.89% 5.14		6.94% 5.6	1.39% 2	
LYS /y:/	70.83% 4.59	23.61% 5	1.39% 1			4.17% 4.33
SYND /y/	16.66% 5.25	62.5% 4.64	8.33% 5.17		2.78% 5	8.33% 2.33
LØP /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

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. ✓

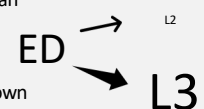
T1 – the strongest effect in both Ls.



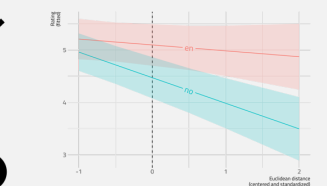
H2: The interaction ed:marked\_rounding is positive and significant, but the effect of marked\_rounding is not significant -> hard to interpret. ?



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.
- ❖ Experience with the language plays a role.
- ❖ The perceptuo-acoustic similarity patterns are restructured during the first year of L3 learning. The effect of the ED was the strongest at T1.
- ❖ The effect of the Euclidean distance is stronger for L3 than for the L2.
- ❖ 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 Norwegian).
- ❖ Future research should also investigate the relationship between L2 and L3 vowel assimilation and production development (cf. Wrembel et al. 2022).

## References

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