Investigating multilingual vocalic space: Spectral overlap and separation in three vowel systems

Jarosław Weckwerth, Magdalena Wrembel, Nicole Rodriguez, Anna Balas

(Adam Mickiewicz University, Poznań, Poland)

The contribution aims to further our understanding of the acquisition of speech from a multilingual perspective by extending previous findings of limited studies into L3 vowel quality and quantity (e.g. Missaglia 2010, Sypiańska 2016, Kopečková et al. 2016, Kartushina and Martin 2019). In this study, we report on the first testing time of a large longitudinal project investigating L3 Norwegian from the onset of its acquisition in a formal setting in L1 Polish learners with L2 English. In two separate sessions, seventeen female students (mean age = 20) read material in the three languages, including non-words containing all the monophthongs. The durations and first three formants of the vowels were measured. We aimed to explore interactions between the three vocalic subsystems by assessing overlap between pairs of cross-linguistically adjacent vowels.

Overall, Norwegian (Fig. 3) has better spectral category separation than English (Fig. 2), and some L2 and L3 vowels cluster away from the L1 system. Interestingly, the averages for English KIT and Norwegian /y(ː)/ cluster together, and so do those for English GOOSE, FOOT and Norwegian /ʉ(ː)/, suggesting a partially merged L2/L3 system (Fig. 4), albeit there is considerable inter-speaker variability. At least some speakers use duration to distinguish between the short and long vowels of Norwegian.

Pillai scores (Nycz and Hall-Lew 2013) were computed for some vowel pairs, providing numerical confirmation of the trends apparent visually. For example, the score for English GOOSE vs. Norwegian /ʉː/ is 0.016, indicating overlap, while that for Norwegian /ʉː/ vs. /øː/ is 0.551, and for /ʉː/ vs. /yː/ is 0.315, indicating much better separation. The observed trends will be interpreted in relation to orthographic interference, proficiency level, 'foreign language effect' and high interspeaker variability. Ultimately, we hope to trace patterns of dynamic, multidirectional cross-language interactions in vowel productions of multilingual learners.

References:

Kartushina, N., Martin C.D. 2019. Third language learning affects bilinguals' production in both their native languages: A longitudinal study of dynamic changes in L1, L2 and L3 vowel production. *Journal of Phonetics* 77, 100920.

Kopečková, R., Marecka, M., Wrembel, M., & Gut, U. 2016. Interactions between three phonological subsystems of young multilinguals: The influence of language status. International Journal of Multilingualism 13 (4), 426-443.

Missaglia, F. 2010. The acquisition of L3 English vowels by infant German-Italian bilinguals, *International Journal of Multilingualism* 7(1): 58-74.

Nycz, Jennifer & Lauren Hall-Lew. 2013. Best practices in measuring vowel merger. *Proceedings of Meetings on Acoustics* 20. 60008. (166th Meeting of the Acoustical Society of America.) < https://asa.scitation.org/doi/pdf/10.1121/1.4894063>

Sypiańska, J. 2016. Multilingual acquisition of vowels in L1 Polish, L2 Danish and L3 English. *International Journal of Multilingualism* 13(4):476-495

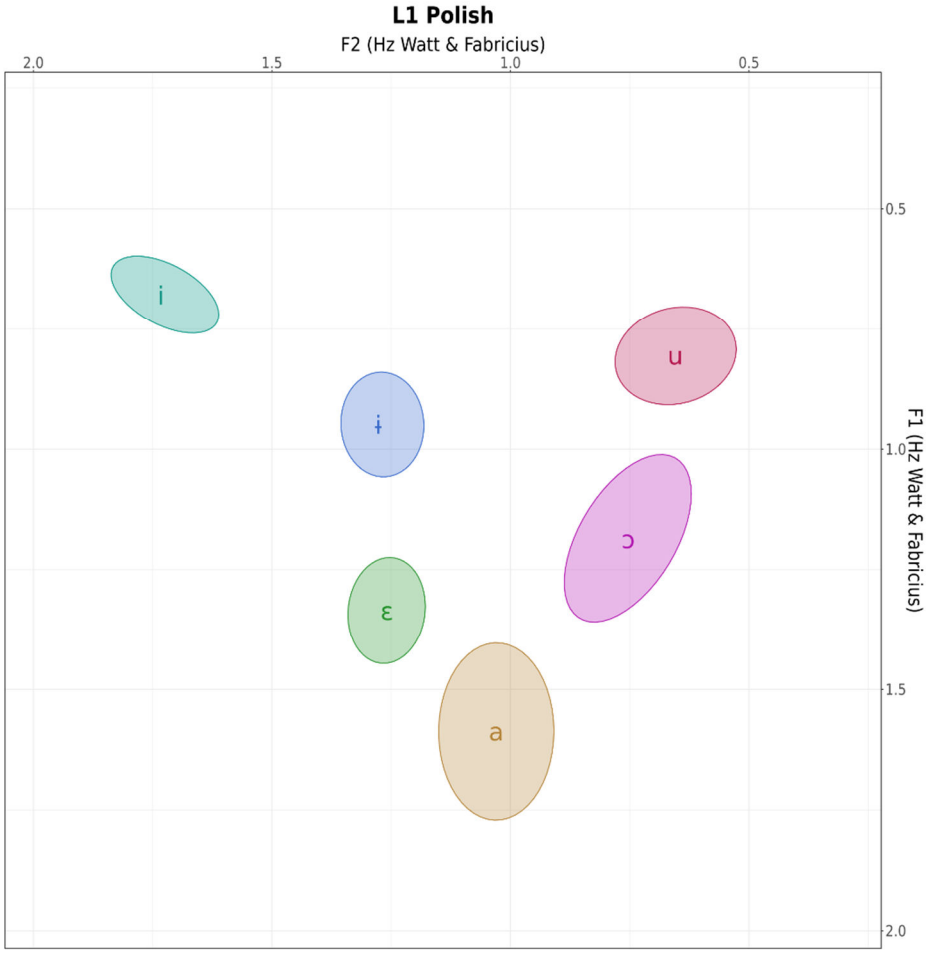

Fig. 1. L1 Polish vowels. (All graphs made using Visible Vowels: Heeringa, W. & Van de Velde, H. (2018). “Visible Vowels: a Tool for the Visualization of Vowel Variation.” In Proceedings CLARIN Annual Conference 2018, 8 - 10 October, Pisa, Italy. CLARIN ERIC.)

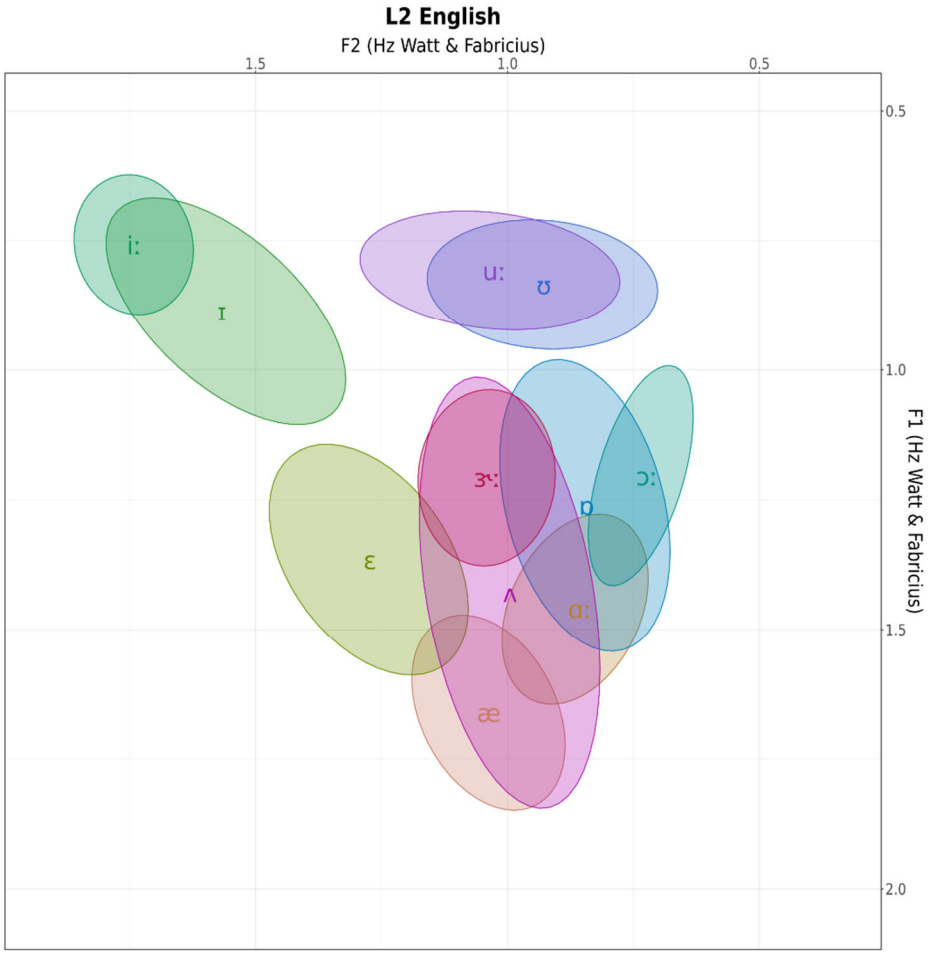

Fig. 2. L2 English vowels.

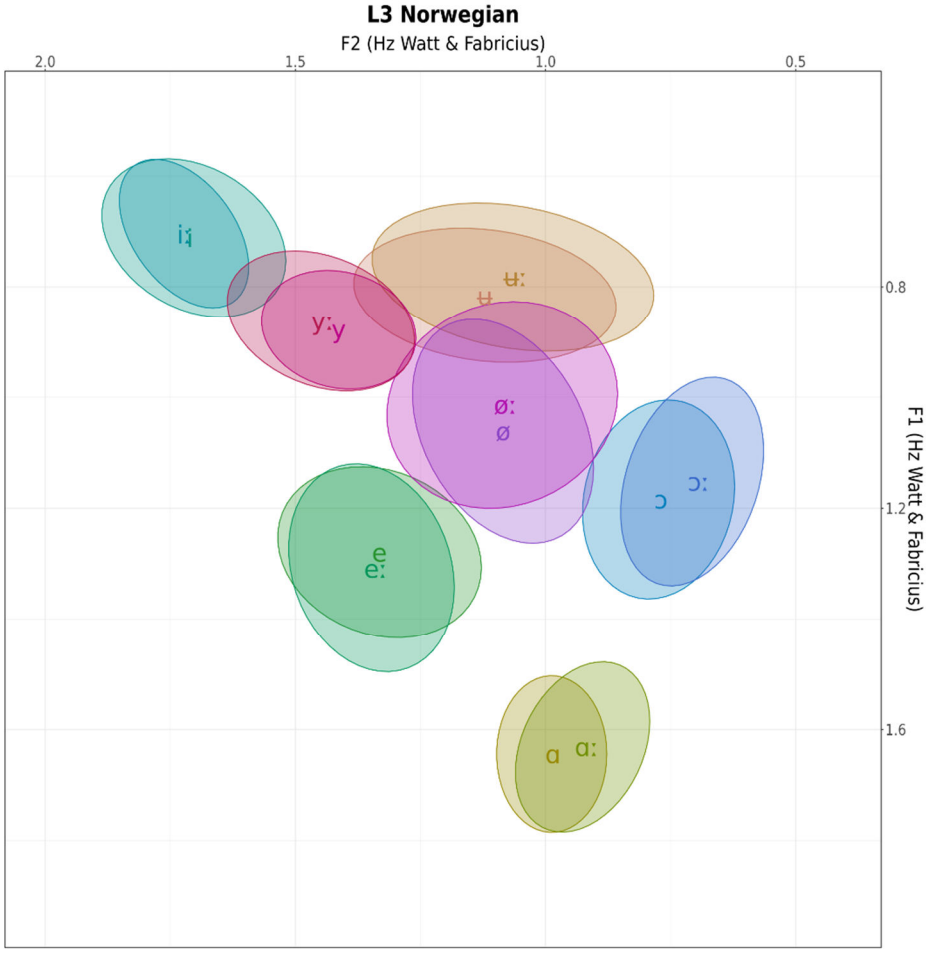

Fig. 3. L3 Norwegian vowels. /u(ː)/ disregarded due to extreme variability.

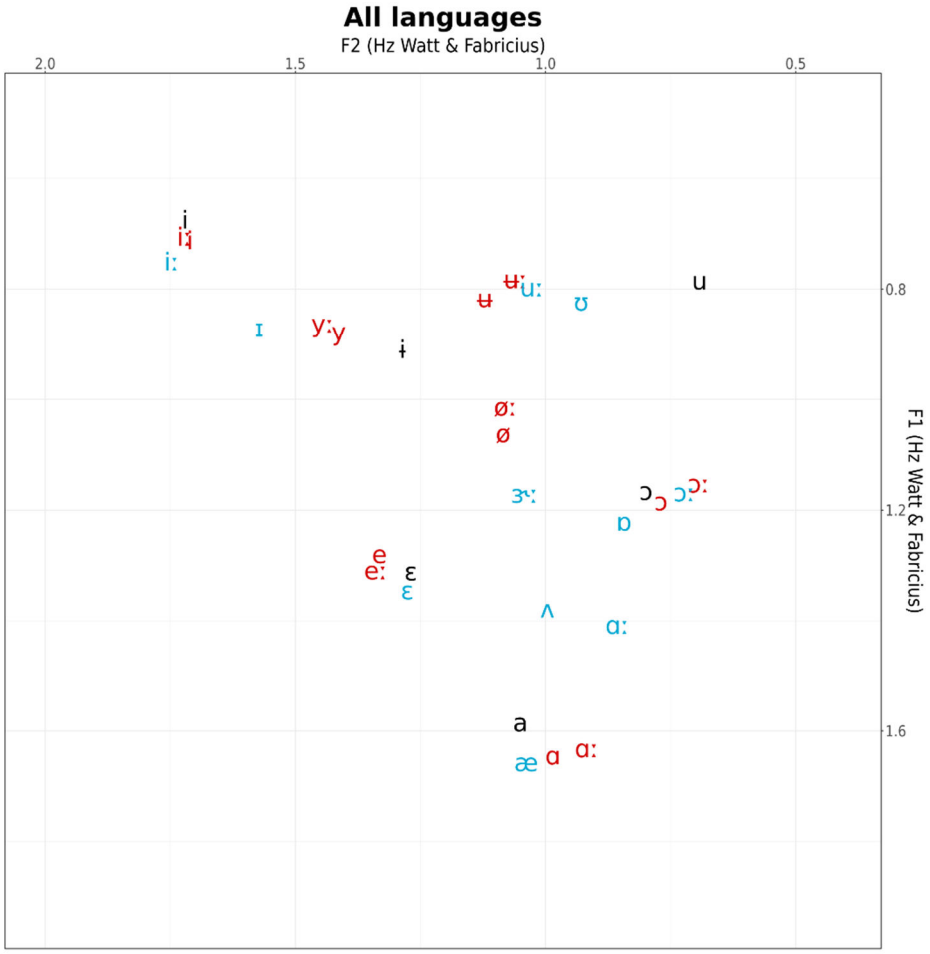

Fig. 4. Average values for all the vowels (except Norwegian /u(:)/). Polish in black, English in blue, and Norwegian in red.