Cross-linguistic influence and sibilant production: An acoustic analysis of voiceless retroflex and non-retroflex sibilants produced by L1 Polish, L2 English, L3 Norwegian learners

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Abstract (433 words)
Polish and Norwegian are phonologically distinct languages, but their overlapping sibilant inventories contain sounds that have been labeled by some scholars as acoustically retroflex (Żygis & Hamann, 2003; Żygis, Pape, & Czaplicki, 2012). The aim of this experiment was to describe the spectral characteristics of sibilant inventories in Polish, Norwegian and English (as a non-retroflex language), by examining the cross-linguistic influences of these languages on sibilants produced by multilingual speakers with varying levels of Norwegian proficiency. Our investigation is a part of a larger project (CLIMAD) examining the effects of cross-linguistic influence and multilingualism in various linguistic domains.
We predicted that multiple levels of phonological transfer would be observed in sibilants produced by multilingual learners of Norwegian. Assuming that the L1 Polish sibilant <sz> is retroflex, we expected facilitative forward transfer during L3 production of retroflex sibilants in Norwegian. Identical spectral means for <sz> in L1 Polish and <rs> in L3 Norwegian would support this hypothesis. At higher levels of Norwegian proficiency, participants were predicted to display reduced amounts of spectral transfer from L1 Polish sibilants into L3 Norwegian. If the spectral means of L1 Polish <sz> and L3 Norwegian <rs> differ significantly for highly proficient learners of Norwegian, then that finding would weaken the more recent interpretation of Polish <sz> as a retroflex sibilant.
The participants included 40 (f=35) L1 Polish, L2 English, L3 Norwegian learners who were recorded reading naturalistic sentences in Norwegian, Polish and English (n=840 tokens per sibilant per language, i.e., (Polish: [s], [ʃ~ʂ], [ɕ]; English: [s], [ʃ]; Norwegian: [s], [ʃ~ʂ], [ç~ʂ~ɕ]). Sibilant sentences were presented in tandem with sentences from a VOT investigation as distractors. Sentence lists were randomized for each participant. The stimuli were presented in 3 separate language blocks, with each language mode induced via the Peppa (video watching and retelling) task in the respective language.
Our analysis will use generalized linear mixed effects modeling to quantify the spectral similarity of sibilant inventories both within and across languages. We will assess sibilants according to multiple acoustic measures grounded in previous literature (Jongman, Wayland & Wong, 2000; Nirgianaki, 2014; Lee, 2020), i.e., spectral mean, spectral peaks, and spectral moments (spectral center of gravity, spread, skewness and kurtosis). We will consider multiple factors of L2/L3 proficiency and use in Norwegian and English, obtained via several language background questionnaires and proficiency tests. Results of the analysis will determine whether learner proficiency in Norwegian had an impact on retroflexion of sibilant phonemes in Polish and Norwegian, as well as on the spectral similarity of L1 Polish <sz>, L2 English <sh>, and L3 Norwegian <rs> within the speech production of multilinguals.

Keywords:
Cross-linguistic influence, speech production, voiceless sibilants, Polish, Norwegian

References

Jongman, A., Wayland, R., & Wong, S. (2000). Acoustic characteristics of English fricatives. *The Journal of the Acoustical Society of America*, *108*(3), 1252-1263.

Lee, S., & Lee, S. (2020). Spectral analysis of English fricatives/s/and/ʃ/produced by people with profound hearing loss. *Clinical Archives of Communication Disorders*, *5*(3), 147-153.

Nirgianaki, E. (2014). Acoustic characteristics of Greek fricatives. *The Journal of the Acoustical Society of America*, *135*(5), 2964-2976.

Żygis, M., & Hamann, S. (2003). Perceptual and acoustic cues of Polish coronal fricatives. In *Proceedings of the 15th International Conference of Phonetic Sciences* (pp. 395-398).

Żygis, M., Pape, D., & Czaplicki, B. (2012). Dynamics of sibilant systems: Standard Polish and its dialects. *Phonetik & Phonologie 8 Friedrich-Schiller-Universität Jena*, 8.