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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The present study investigates the acoustics of L2 English and L3 Norwegian voiceless sibilants produced by L1 Polish multilinguals. Our investigation is part of a larger project examining the effects of cross-linguistic influence and multilingualism in various linguistic domains. Polish has a three-part voiceless sibilant system usually symbolized as /s/, /ʂ/, /ɕ/ in current literature such as Czaplicki et al. (2016; but with /ʃ/ instead of /ʂ/ in more traditional representations, such as Jassem, 2003). English has a more usual two-part system with /s/ and /ʃ/. Norwegian has a three-part system reminiscent of German (/s/, /ʂ/, /ç/ in Kristoffersen, 2000; but /ʃ/ for /ʂ/ in other sources, e.g., van Dommelen, 2019).

Our main research questions were: (1a) Do learners have one, two or three categories for their /ʃ~ʂ/ across the three languages? (1b) Does transfer occur between the phonological systems of the three languages? (2) Is Norwegian /ç/ distinct from Polish /ɕ/, or is there a one-to-one mapping, as reported for Polish learners of German (Morciniec & Prędota, 2005)? In addition to these main questions, we also investigated the acoustics of /s/ across the three languages, as well as the influence of spelling (with three different spellings for Norwegian /ʃ/), vowel context, and proficiency in both English and Norwegian.

We predicted multiple levels of phonological transfer in sibilants produced by Polish learners of Norwegian. Assuming that the L1 Polish sibilant <sz> is retroflex ([ʂ]), we expected forward transfer during L3 production of Norwegian <rs> ([ʂ]). At higher Norwegian proficiency, participants were predicted to display reduced amounts of 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.

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/). Sentence lists were randomized for each participant and target sentences were intermixed with sentences from a VOT investigation as distractors. 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 the sibilants according to 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 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 impacted patterns of cross- linguistic influence pertaining to retroflexion in the sibilant phonemes of Polish, Norwegian and English.