Cross-language differences in vowel inherent spectral change – evidence from Polish learners of English

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Phonetic research into vowel inherent spectral change (VISC; e.g. Nearey & Assmann 1986, Morrison & Assmann 2013; Williams & Escudero 2014) has established that formant movement over the course of the vowel is an important aspect of the English vowel system. In both British and American English, vowels nominally referred to as monophthongs show significant changes in formant frequencies over the course of their duration. As yet, research into VISC has primarily concentrated on English as an L1; spectral dynamics has for the most part remained outside of the focus of studies into L2 speech acquisition (but see Rogers et al. 2013; Jin & Liu 2013). Since languages show systematic differences in the relative degree of spectral dynamics, VISC may qualify as an additional dimension in the definition of cross-language phonetic similarity, a crucial concept for models of L2 speech (e.g. Flege 1995).

This paper will present acoustic data documenting VISC in the speech of Polish users of English. The Polish vowel system is characterized by relatively stable formant patterns, leading to a hypothesis that acquisition for Polish learners must entail mastery of native-like patterns of VISC in English. We compare students in their first year of university English-language studies with highly proficient Polish users of English, lecturers and professors employed in a university English department. Three different types of measures are included in our data: formant excursion measures (in Bark) over selected intervals of the vowel, formant slope measures over selected portions of the vowel (in Bark/100 msec), and formant stability measures of the proportion of vowel in which a formant falls within 0.5 bark of its minimum or maximum (depending on the vowel) value. The group of lecturers and professors is expected to show higher values for the excursion and slope measures. By contrast, the learner group is expected to show higher values for formant stability, indicative of purer vowel quality.

Here we report on preliminary results for long /i:/ and /æ/ in the speech of users with a British pronunciation model. Ten speakers from each participant group are analyzed producing these vowels in two contexts, with coronal codas and either labial or coronal unaspirated onsets. The vowels are divided into four intervals. One way Anovas with participant group as independent variable revealed the following significant effects (p < .05). In the case of /æ/, the more proficient group showed lower F1 stability, and greater F1 excursions and slope in the first two intervals. For /i:/, significant differences were observed for both F1 and F2 in the first two intervals for both formant excursions and formant slopes, as well as in stability over the entire vowel. Illustrations of typical realizations of the two vowels are given in Figure 1. Dots of increasing size plot the F1 and F2 values over time. Note that in both productions produced by the participant from the lecturer group (light green and purple), noticeably longer formant trajectories are recorded than in the productions by the student (red and dark green). These results provide preliminary support for the claim that VISC is an important aspect of acquisition of L2 English vowels by Polish users.
Figure 1 – Sample formant trajectories for *dad* and *deed* produced by a student and a lecturer


