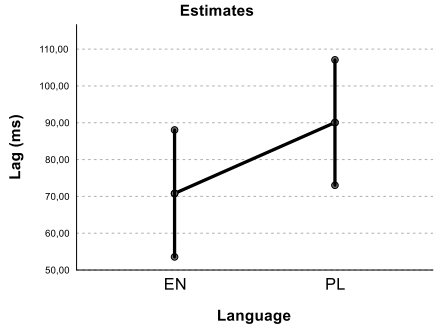
The phonology of initial cluster coordination – a cross-language articulographic study

Geoff Schwartz, UAM Poznań
Anne Hermes, Laboratoire de Phonétique et Phonologie/UMR 7018, CNRS/Sorbonne Nouvelle
Radek Święciński, Amsterdam University of Applied Sciences

This paper will present articulatory data from 5 Polish-English bilinguals – L1 speakers of Polish with C2-level proficiency and native-like pronunciation in English – speaking in both of their languages. The goal of the study is to examine the 'same' initial consonant clusters in the two languages (e.g. Polish *blok* vs. English *block*) to see if we can observe language-based differences in the gestural timing between the initial consonants C_1C_2 (i.e. target-to-target lags). Articulatory studies of English complex onsets have described relatively tight coordination of word-initial consonant sequences (Tilsen et al. 2012), while Hermes et al. (2017) observed relatively large target-to-target lags in word-initial consonant clusters in Polish. In our data, speakers produced larger C_1C_2-lags in Polish compared to English. These results will be discussed within the Onset Prominence framework (OP; Schwartz 2016, 2018), which posits cross-language structural differences in rising sonority clusters, and makes predictions about C_1C_2-lags.

Articulatory recordings were made with the electromagnetic articulograph (AG 501). Speakers produced two repetitions of 24 pairs of C_1C_2-initial target words in each language, all with stop-sonorant clusters /pr, bl, pl…/. The items were placed in a pseudo-randomized order, and embedded in carrier phrases (Polish: '*Powiedziała ___ jeszcze raz'*. English: *'We say ____ again*'). There was a pause between the L1-Polish and L2-English recordings in order to mitigate possible effects of language mixing. Articulatory data were annotated using the EMU WebApp (Winkelmann & Raess 2014), and extracted using R. We identified the gestural targets for the initial consonants by analysing the vertical movement of the primary articulators (e.g. tongue tip /l/, tongue body for /k/, lower lip for /p,b/). Here we present results of target-to-target lags, with language (L1 Polish or L2 English) as the main predictor variable. A linear mixed effects model with speaker and item as random factors revealed a significant effect of language – Polish lags were estimated by the model to be 19.3 ms longer than English lags (t = 3.75, p < .001), as illustrated in the Figure 1.

Figure 1
Lag estimates (in ms) of linear model as a function of language



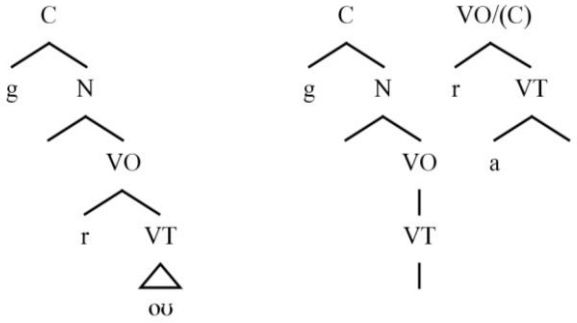
Our results are compatible with an interpretation that stop-sonorant onsets have different structural properties in the two languages, despite the fact that the clusters are the 'same'

according to segmental transcription and sonority sequencing. Larger lags in Polish reflect phonological evidence on the question of whether onset clusters may bear a prosodic function. CCV-shaped Polish words may be inflected normally: *gra-grze* /gzɛ/ – 'game (nom.-loc.)', but CV-shaped words may not, and are often pronounced as enclitics. These facts suggest that in Polish, C_1 in initial clusters may indeed contribute to prosodic minimality, and is not joined with C_2 into a single 'complex' onset constituent. These results also raise questions about anchor-based heuristics used in EMA studies of syllable structure (e.g. Shaw et al. 2009). In Polish and English, c-center to anchor measures suggest 'complex' onsets (Hermes et al. 2017) in both languages, while in Polish the longer lags do not support the claim for complex onsets.

The Onset Prominence framework (OP; Schwartz 2016, 2018) allows for two different structural configurations for rising sonority onset clusters. These configurations are shown in Figure 2. In Polish *gra* (Fig. 2, right), an *adjoined* cluster places C_1 into a separate constituent from C_2. Since the /g/ in Polish /gr/ is separated from the /r/, the representations capture both the prosodic function of the /g/ and the larger articulatory lag relative to the 'same' cluster in English. In English *grow* (Fig. 2, left), the *absorbed* cluster is contained in a single iteration of the OP structural hierarchy, so the lag between consonants is shorter, and the initial cluster plays no role in English structural well-formedness. It is unclear how traditional representations of the syllable can capture this cross-language structural difference in so-called 'branching' onsets.

Figure 2

OP configurations for English (left) and Polish rising sonority onset clusters



References:

Hermes, A., Mücke, D & Auris, B. 2017. The variability of syllable patterns in Tashlhiyt Berber & Polish. *Journal of Phonetics* 64, 127-144.

Schwartz, G. 2016. On the evolution of prosodic boundaries – parameter settings for Polish and English. *Lingua* 171, 37-73.

Schwartz, G. 2018. Towards a typology of consonant synchronicity. Talk given at the Representing Phonotactics session, LabPhon 16, University of Lisbon.

Tilsen, S., Zec D, Bjorndahl, C., Butler, B., L Esperance, M. J., Fisher, A., Heimisdottir, L., Renwick, M., Sanker, C. 2012. A cross-linguistic investigation of articulatory coordination in word-initial consonant clusters. *Cornell Working Papers in Phonetics and Phonology*.

Shaw, J. A., Gafos, A., Hoole, P., & Zeroual, C. 2009. Syllabification in Moroccan Arabic: Evidence from patterns of temporal stability in articulation. *Phonology* 26. 187–215.

Winkelmann, R., & Raess, G. 2014. Introducing a web application for labeling, visualizing speech and correcting derived speech signals. In *LREC* (pp. 4129-4133).