Light and dark /l/ in coda clusters: a four-language comparison

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The present study investigates the relationship between lateral consonant darkness and coda coordination patterns in Georgian, Romanian, Russian and American English. Within the framework of Articulatory Phonology [1] the syllable has been defined by the dichotomy of gestural timing organization between onsets and codas. Hypothetically, onsets exhibit global organization, with consonant gestures synchronically timed with the vowel nucleus, while codas exhibit local organization, with vowel-consonant gestures sequentially organized. Exceptions to local organization in codas are reported in American English [3], where clusters involving the lateral /l/ exhibit global coordination patterns. Acoustically this translates into vowel shortening in cluster tokens compared to their singleton counterpart. The authors suggest that the articulatory characteristics of the lateral trigger the global coordination patterns found in coda position [4]. We further explore this hypothesis by investigating coda coordination patterns acoustically in four languages that differ in the gestural synergies of their coda lateral consonants: English (dark /l/ [7], Russian (dark /l/ [6]), Romanian (clear /l/ [6]), Georgian (clear /l/ in front vowel contexts, dark /l/ in back vowel contexts [2,5]). Both light and dark /l/ are produced with a double gesture (tongue tip (TT) and tongue dorsum (TD)) but differ in the quality (lowering vs. retraction) and timing (earlier occurring TD gesture in dark /l/) of these gestures [7]. We postulate that coda global coordination patterns arise because the earlier occurrence of the TD gesture in dark /l/ creates gestural competition that triggers a rearrangement of gestural synergies in the coda. We therefore expect global coordination in dark /l/ coda clusters (Russian, English and Georgian after back V), but not in clear /l/ codas (Romanian and Georgian after front V).

Participants. 6 American English, 6 Romanian, 5 Russian and 5 Georgian native speakers read the target word pairs (singleton (C)CVL – cluster (C)CVLC) with varying front/back vowel contexts in their respective carrier sentences, in three randomized blocks.

Measurements. F1, F2, F3 values were extracted at the midpoint of the lateral, and a darkness degree measure (F2-F1) [7,8] was calculated for each token. Given the difficulty of separating the vowel from the dark /l/ acoustically, the duration measure considered was the vowel + lateral (VL) sequence, normalized using articulation rate. We acknowledge that other changes within the VL interval may occur, which require further careful acoustic and articulatory investigation. The duration ratio ($\text{duration}_{\text{cluster}}/\text{duration}_{\text{singleton}}$) between the cluster and the corresponding singleton tokens was used as a dependent variable. Ratios close to 1 indicate lower degrees of shortening. To compare the degrees of shortening in clusters vs. singletons we compare each language to a hypothetical language (H) which has no shortening. Data for H was generated as a normal distribution of mean=1 and standard deviation equal to the mean standard deviation of the duration ratios found in our data. To ensure that our results are not just a consequence of this standard deviation, we tested two additional standard deviations corresponding to (i) the lowest observed standard deviation in our data (for Russian) and (ii) the highest (for Georgian). Slight differences in significance levels were observed, but the overall patterns observed are the same.

Results. Different degrees of /l/ darkness are found: Russian and English have darker /l/ in coda position. English has clearer coda /l/ in a front vowel context. Romanian has clear coda /l/ in all vowel contexts. Georgian exhibits a vowel-context dependent allophony: clear /l/ after front vowels and dark /l/ after back vowels (see Fig. 1). Duration results confirm our predictions in the case of Russian, English, and Romanian: Russian and English show significantly higher degrees of shortening, while Romanian shows no differences compared to the non-shortening hypothetical language, in either front or back vowel contexts. Unexpectedly, Georgian shows the reverse pattern than predicted: significant shortening in the front vowel context (dark /l/s). This finding may be related to the lower degree of /l/ darkness in Georgian relative to Russian/English, as well as to the specific structure of the Georgian coda clusters (i.e., all clusters consist of heteromorphemic /l/ + /s/). Sibilants are known for their divergent behavior in onset clusters. Articulatory data is needed to further investigate the correlation between /l/ darkness and global coordination patterns.
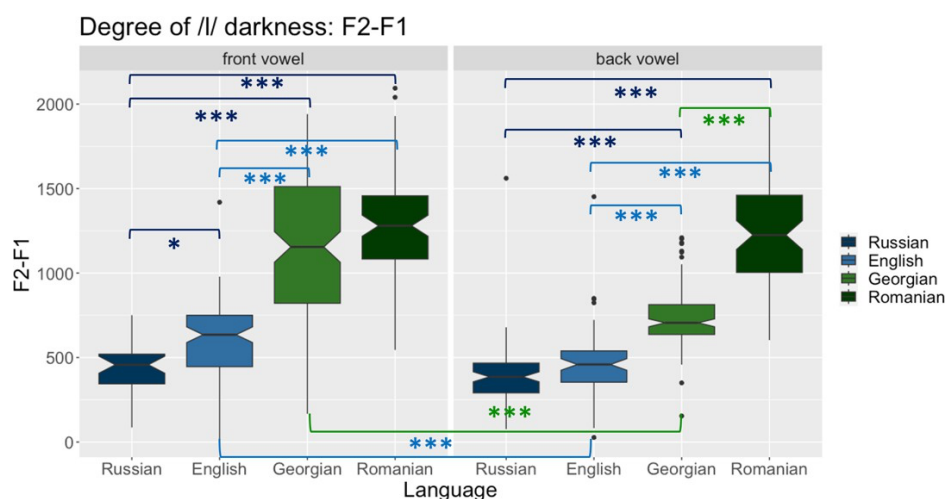
Fig. 1. Degree of coda /l/ darkness for the four tested languages based on the previous vowel context. Between language significance levels are indicated.
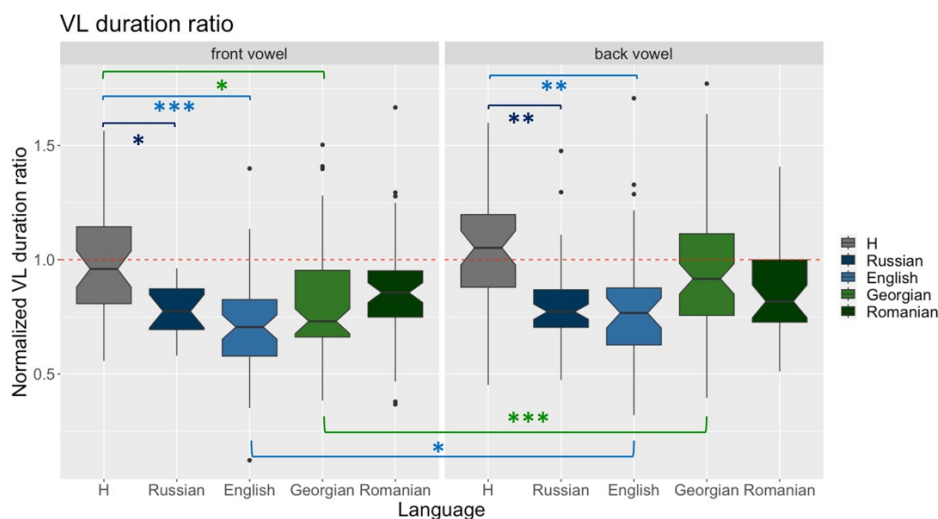

Fig. 2. Vowel + lateral duration ratios based on the previous vowel context. Significance levels in cluster vs. singleton shortening between the hypothetical no-shortening language and the four tested languages are indicated. Intra-language differences are also indicated.

References
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