

A kinematic study of the syllable-foot interaction in Estonian

Argyro Katsika^a, Eva Liina Asu^b, Matthew Gordon^a, Pärtel Lippus^b, Anton Malmi^b

^a*Department of Linguistics, UC Santa Barbara, CA, USA*

^b*Institute of Estonian and General Linguistics, University of Tartu, Estonia*

Estonian is known for possessing a ternary distinction (short, long and overlong) in phonemic length that is operative at multiple prosodic levels, including the segment, syllable, and foot (e.g. Lehiste 1960). Although the three-way length distinction is phonologically limited to stressed syllables, unstressed syllables play a vital role at the level of the foot: Estonian feet are trochaic, and the duration of the unstressed vowel in a foot is inversely correlated with the length of its stressed syllable. Vowels and consonants each participate in a two-way orthogonal length contrast between short and long that yields the four combinatorial possibilities of VC, VCC, VVC, and VVCC. The third (overlong) quantity degree, in contrast, is a property of the foot rather than individual segments, where the distribution of lengthening depends on the phonemic length and quality of the segments in the stressed syllable (Lehiste 1997, Eek & Meister 2003).

Although acoustic aspects of the durational patterns of Estonian feet have been amply investigated (e.g. Lehiste 1997, Eek & Meister 2003; Lippus et al. 2013), little is understood about the articulatory mechanisms underlying the interplay between segment, syllable and foot (Türk, Lippus, Šimko 2017; Katsika et al. 2024).

This paper explores the kinematic relationship between the syllable and both lower (segmental) and higher (foot) level prosodic units in Estonian using Electromagnetic Articulography (EMA) – a point-tracking method for measuring the position of parts of the mouth during speech (see e.g. Rebernik et al. 2021). The aspects that are studied include the extent to which the phonemic length contrasts are reflected in differences in the kinematic profile (i.e., duration, displacement and velocity of constriction gestures) of the foot (i.e., across both its stressed and unstressed syllables), and how these differences are shared across different foot structures (i.e., disyllabic vs. trisyllabic). In addition, differences in the kinematic profile of syllables with primary vs. secondary stress are investigated.

Two-, three- and four-syllable test words with their first vowel varying in quantity (Q1, Q2, Q3) are considered, varying not just in terms of word length, but, consequently, in foot structure and stress distribution as well (see Table 1). The test words are elicited in frame sentences with balanced distribution of syllables and stresses. In the sentences, disyllabic and tetrasyllabic words begin with a two-syllable foot, which is followed by either the primary stress of the next word or by an unstressed syllable in disyllabic words and the secondary stress of the next foot in tetrasyllabic words. Trisyllabic words, on the other hand, are ambiguous as to whether they contain a disyllabic or a trisyllabic foot, but they unequivocally involve an unstressed third syllable. The EMA data are analyzed in terms of constriction gestures, identified semi-automatically on the basis of velocity criteria across the length of the test feet.

Table 1. Examples of test words used in the study.

	n syllables	word	transcription	glossing
Q1	2	<i>nabi</i>	'na.pi	catch.SG2.IMP
	3	<i>nabida</i>	'na.pi.ta	catch-INF
	4	<i>nabidagi</i>	'na.pi.,ta.ki	catch-INF-CLI
Q2	2	<i>daami</i>	'ta:mi	lady.SG.GEN
	3	<i>daamina</i>	'ta:mi.na	lady-SG.ESSIVE
	4	<i>daaminagi</i>	'ta:mi.,na.ki	lady-SG.ESSIVE-CLI
Q3	2	<i>daami</i>	'ta::mi	lady.SG.PART
	3	<i>daamide</i>	'ta::mi.te	lady-PL.GEN
	4	<i>daamidegi</i>	'ta::mi.,te.ki	lady-PL.GEN-CLI

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