Prosody and temporal productions in Greek

Antonis Botinis¹, Athina Kontostavlaki¹, Evgenia Magoula², Olga Nikolaenkova³, Charalambos Themistocleous⁴

¹Lab of Phonetics & Computational Linguistics, University of Athens, Greece

²Department of Primary Education, University of Athens, Greece

³Department of General Linguistics, Saint Petersburg State University, Russia

⁴Department of Swedish, University of Gothenburg, Sweden

<https://doi.org/10.36505/ExLing-2018/09/0005/000338>

Abstract

In this study, we have investigated the temporal patterns of syllable onsets, nuclei, and codas in Greek. The main findings showed significant effects of stress and focus on syllable constituents, which suggest complex effects of lexical and sentence prosody on intrasyllabic constituents. Nevertheless, there was no significant effect of syllable constituents and focus on the overall syllable duration despite the fact that consonants at coda position differed in their intrinsic duration. This finding suggests that the syllable exercises control over the duration of intersyllable constituents.

Key words: syllable structure, onset, nucleus, coda, focus, stress, Greek

Introduction

Syllable duration depends on a variety of factors such as its internal structure and position, whether it is stressed or focused (Botinis 1989) and whether it carries edge-tones (Themistocleous 2014); Therefore, the duration of segments that make up the syllable is conditioned by its structure and role as a prosodic constituent. This is also evidenced by controlled experiments and studies on free speech (e.g., Greenberg, Carvey, Hitchcock, Chang, 2003). In this study, we look at the temporal patterns of syllable onsets, nuclei, and codas in Greek, in order to uncover prosodic effects on segmental durations.

Experimental methodology

Four male and five female Athenian speakers produced a set of twelve test words (Table 1) in the carrier phrase ['eɣe ____ θeti'ka] (he was saying ____ positively) either in a fairly neutral way or in focus (see Botinis 1989 relevant discussion). We conducted two regression analyses: in the first, the response variable was the duration of syllable constituents and in the second, the response variable was the total syllable duration. The syllable constituent (onset, nucleus, and coda C_m, C_n, C_η), stress (stressed vs. unstressed), focus (information focus vs. neutral), and their interactions were the predictors in both tests. Statistics were conducted in R (R Core Team, 2016).

Table 1. Test words with antepenultimate and penultimate lexical stress.

Antepenultimate stress	Penultimate stress	Gloss
[ˈsin̩.fonos], singular	[sin̩.ˈfonus], plural	Concession
[ˈsin̩.vulos], singular	[sin̩.ˈvulus], plural	Advisor
[ˈsin.θetos], singular	[sin.ˈθetus], plural	Complex
[ˈsin.ðezmos], singular	[sin.ˈðezmus], plural	Link
[ˈsin̩.xronos], singular	[sin̩.ˈxronus], plural	Synchronic
[ˈsin̩.ɣrapsɛ], past	[sin̩.ˈɣrapsi], future	wrote/will write

Results

The results are presented in Figures 1-2 and Tables 2-3. Lexical stress and sentence focus have a lengthening effect on overall syllable duration: unstressed non-focused syllables are 126 ms, stressed and unfocused syllables are 160 ms and stressed and focused syllables are 163 ms. Also, there are statistically significant effects of stress and focus on duration. Stress has significant effects on syllable nuclei and coda that differ from the intercept (i.e., syllable onsets) in their durations. Also, codas and nuclei differ from onsets and there are significant interactions of foci and stresses on nuclei and codas.

Figure 1. Onset, nucleus and coda syllable constituents as a function of lexical stress and sentence focus.

Figure 2 Total syllable duration in ms. for syllables ending with /ŋ, n, ɲ/.

Table 2. Linear regression model for syllable constituent, stress, and focus on duration. The model had a residual standard error: 16.51 on 2277 degrees of freedom; multiple R-squared: 0.5996; Adjusted R-squared: 0.59; $F(11) = 310$, $df=2277$, $p < 0.001$.

(Intercept)	108.995	1.153	94.53	0.001
Nucleus	-29.576	1.631	-18.13	0.001
Coda	-36.79	1.631	-22.56	0.001
Unstressed	-5.637	1.696	-3.32	0.001
FocusN	-7.589	1.627	-4.66	0.001
Nucleus:Unstressed	-26.004	2.399	-10.83	0.001
Coda:Unstressed	-1.488	2.399	-0.62	0.535
Nucleus:FocusN	11.015	2.3	4.78	0.001
Coda:FocusN	7.95	2.3	3.45	0.001
Unstressed:FocusN	3.923	2.398	1.63	0.102
Nucleus:Unstressed:FocusN	-9.259	3.392	-2.73	0.006
Coda:Unstressed:FocusN	-6.008	3.392	-1.77	0.076

Nevertheless, a linear regression model with total duration as the dependent variable shows no significant effects of focus and syllable constituent. We observe that stress and syllable constituent (as it is evident by the significant effect of the coda consonant [n] over the intercept) affect syllable duration ($p < .05$) significantly.

Table 3. Linear regression model for syllable constituent, stress, and focus on total syllable duration. The model had a residual standard error: 14.61 on 751 degrees of freedom; multiple R-squared: 0.1813, Adjusted R-squared: 0.17; $F(11)=15.12$, $df=751$, $p < 0.001$.

(Intercept)	77.25	1.92	40.27	0.001
Cn	11.47	2.71	4.23	0.001
Unstressed	5.59	2.69	2.08	0.05

Discussion

The syllable is one of the fundamental units of speech production across different dimensions including representation, processing and implementation. In this study, we have provided acoustic evidence from Greek syllables that realize the first morpheme of multimorphemic words. The results show that onsets are clearly longer than nuclei and codas. One of the main reasons for that is that the intrinsic duration of sibilant consonants in Greek is long (Themistocleous 2017), which to a certain degree explains this effect. Overall, the syllables do not significantly differ in their total duration despite the fact that their coda consonants differ in their intrinsic duration. One account for this phenomenon is that syllables ‘regulate’ the duration of their constituents so that there is a tendency to lengthen or shorten their segments to accommodate for their intrinsic duration (about the role of syllables vs. segments, see Hickott 2014). So, this study provides evidence that favors a predominance of syllable over subsyllabic constituents and explains why despite different consonantal realizations of syllables retain their overall duration.

References

Botinis, A. 1989. Stress and prosodic structure in Greek. Lund University Press.

Greenberg, S., Carvey, H., Hitchcock, L., Chang, S. 2003. Temporal properties of spontaneous speech—a syllable-centric perspective. *Journal of Phonetics* 31(3-4), 465-485.

Gregory, H. 2014. The architecture of speech production and the role of the phoneme in speech processing. *Language, Cognition and Neuroscience* 29:1, 2-20.

Hickok, G. 2014. The architecture of speech production and the role of the phoneme in speech processing. *Language, Cognition and Neuroscience*, 29(1), 2-20.

Themistocleous, Ch. 2014. Edge-tone effects and prosodic domain effects on final lengthening. *Linguistic Variation* 14(1), 129-160.

Themistocleous, Ch. 2017. Effects of Two Linguistically Proximal Varieties on the Spectral and Coarticulatory Properties of Fricatives: Evidence from Athenian Greek and Cypriot Greek. *Frontiers in Psychology* 8, 1945.