Rhythm and stress intervals in Greek and Russian

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Abstract
This paper presents the results of a pilot study of stress interval durations in Greek and Russian. Native speakers of each language were recorded producing utterances in which the number of syllables between stressed syllables varied. The results showed a noticeable tendency towards isochrony in Greek but not in Russian, according to which there is an inverse relation between the number of syllables and syllabic durations in produced utterances. Second, lexical stress has a lengthening effect in Greek but hardly in Russian, while focus has no effect in either language.

Key words: rhythm, focus, stress group, isochrony, duration, Greek, Russian

Introduction
The term "stress group" is used in descriptions of the temporal properties of a language and is defined as a speech unit consisting of a stressed syllable and any unstressed syllables that may follow up to, but not including, the next stressed syllable (Pike 1946, Abercrombie 1967, Grønnum 1998). Languages are classified as either stress-timed in which stress groups and thus stress intervals tend to be isochronous such as English and Russian, or as syllable-timed in which syllables recur at regular intervals, such as French and Spanish. Absolute isochrony has not been reported for any language and the main question is about relative isochrony, which may vary between different languages with different prosodic structures.

Despite the stressed-timed and syllable-timed taxonomy of languages, acoustic evidence is basically ambiguous, leading some phoneticians to consider isochrony as a perceptual rather than a production related phenomenon (e.g. Lehiste 1977, Dauer 1983). This pilot experiment examined syllable and stress-group durations, as a function of different focus conditions in Greek and Russian.

Experimental methodology
The speech material consists of four test sentences with a varying number of syllables per stress group for each test sentence, i.e. 1 to 4, produced twice by two Athenian and two Saint Petersburg female speakers, in their twenties, with focus in different places and at normal tempo (Table 1.). The speech material was directly recorded into a computer disc and measurements were carried out with the Praat software package.

Table 1. Test sentence syllabic sequences with different stress intervals in Greek and Russian (broad phonetic transcription and free translation).

Greek	Russian
i me.la.'ni 'ma.lo.ne ti 'ma.na mu	ma.'ri 'my.la u.nix ix.man.da.'ri.ny
Melany was scolding my mother.	Mary was washing at theirs their mandarins.
i me.'li.na 'ma.lo.ne ti 'ma.na mu	ma.'ri.na 'my.la u.nix ix.ma.'li.nu
Melina was scolding my mother.	Marina was washing at theirs their raspberries.
i me.'li.na mu 'ma.lo.ne ti 'ma.na	ma.'ri.na lo.'ma.la u.nix ma.'li.nu
Melina was scolding mother.	Marina has broken at theirs raspberries.
i me.'li.na mu ma.'lo.ni ti 'ma.na	ma.'ri.na na.lo.'ma.la ix.ma.'li.nu
Melina is scolding mother.	Marina has broken their raspberries.

Results

Figure 1 shows the durations of stressed and unstressed syllables in Greek and Russian. The difference between stressed and unstressed syllable durations was significant for Greek ($t(115)=5.758$, $p<.01$) but not so for Russian ($t(118)=1.474$, $p>.05$). It should be noted (cf. the transcribed Russian sentences above) that the unstressed syllables used in Russian were more complex than the ones used for Greek. Even so, their durations do not exceed those of the stressed syllables.

Figure 2 shows the average durations of syllables as a function of number of syllables in the stress group in Greek and Russian. The differences in average syllable durations between stress groups were highly significant in Greek ($F(3,113)=7.157$, $p<.01$) but not so for Russian ($F(3,116)=1.830$, $p>.05$).

Figure 3 shows the durations of stress groups as a function of the number of syllables in Greek and Russian. Stress group durations increase as syllables are added to the group and this effect is significant for both languages. Analysis of variance showed a significant effect of number of syllables ($F(3,87)=452$, $p<.01$) and a significant effect of language ($F(1,87)=44$, $p<.01$). Stress groups were longer in Russian than in Greek. There was no interaction between number of syllables and language.

Figure 4 shows average syllable durations as function of focus in Greek and Russian. Syllables were longer in Russian than in Greek ($F(1,231)=38$, $p<.01$) but focus did not affect their durations ($F(2,2310+.139$, $p>.05$) and there was no interaction with language.

Figure 5 shows stress group durations as a function of focus for both languages. There were no significant effects or interactions.

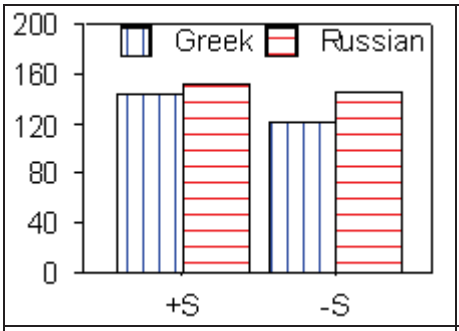

Figure 1. Average syllable durations as a function of stress (+stress/–stress) in Greek and Russian.

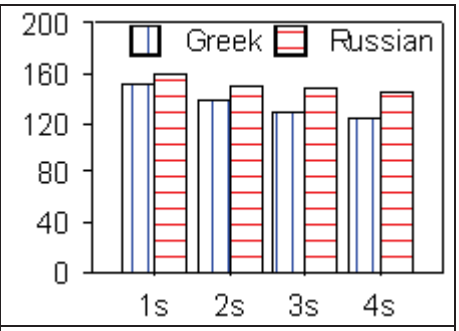

Figure 2. Average syllable durations as a function of syllables per stress group in Greek and Russian.

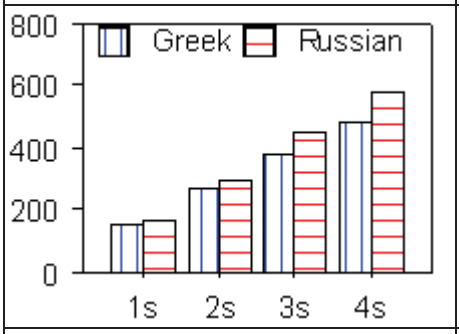

Figure 3. Average stress group durations as a function of syllables per stress group in Greek and Russian.

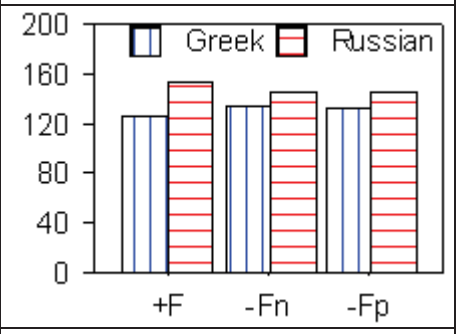

Figure 4. Average syllable durations as a function of focus (+focus/-focus neutral/–focus post position) in Greek and Russian.

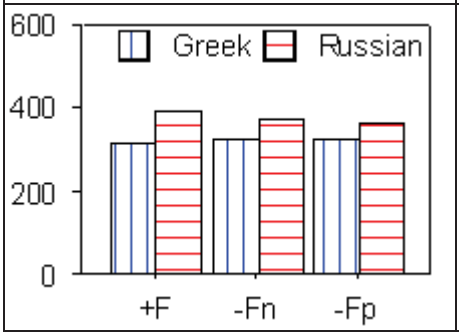

Figure 5. Average stress group durations as a function of focus (+focus/–focus neutral/–focus post position) in Greek and Russian.

Discussion and Conclusions

A main finding of the present investigation is that the different focus conditions did not significantly affect the average durations of syllables and stress groups. This finding agrees with earlier research which found no significant durational effects of focus on either segments or syllables (e.g. Botinis 1989, Fourakis et al. 1999, Botinis et al. 2002). Russian seems to behave like Greek in this respect, according to the present results, which should however be further corroborated before conclusions are drawn.

Russian has been traditionally classified as a "stress-timed" language whereas Greek is reported as an "unclassified" language (see e.g. Dauer 1983). However, Greek and Russian do have similar rhythmic structures (see especially Fig.3), at least with reference to stress intervals presented in this paper, which is in accordance with Dauer's conclusions that there is no clear-cut distinction between stress-timed and syllable-timed languages as most analysed languages show some degree towards isochrony. Still, both Greek and Russian show minimal isochrony for any of these languages to be taxonomised as a stress-timed language.

References

Abercrombie, D. 1967. Elements of general phonetics. Edinburgh: Edinburgh University Press.

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

Botinis, A., Bannert, R., Fourakis, M. and Pagoni-Tetlow, S 2002. Crosslinguistic segmental durations and prosodic typology. Proceedings of Speech Prosody 2002, 183-186. Aix-en-Provence, France.

Dauer, R. Stress-timing and syllable-timing reanalyzed. Journal of Phonetics 11, 51-62.

Fourakis, M., Botinis, A. and Katsaiti, M. 1999. Acoustic characteristics of Greek vowels. Phonetica 56, 28-43.

Grønnum (Thorsen), N. Intonation in Danish. In Hirst, D. and Di Cristo, A. (eds.), Intonation Systems, 131-151. Cambridge: Cambridge University Press.

Lehiste, I. 1977. Isochrony reconsidered. Journal of Phonetics 5, 253-263.

Pike, K.L. 1946. The intonation of American English. Ann Arbor: University of Michigan Press.