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THE QUANTITATIVE STRUCTURE OF ESTONIAN SYLLABIC-ACCENTUAL TROCHAIC TETRAMETER

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Abstract. The paper contains the first attempt to analyze the quantitative structure of the Estonian literary syllabic-accentual verse; it has never been posed as an issue before. The analysis comprised 20 prominent authors and more than 9000 verse lines. In order to find out which regularities are specific to poetry in general or to a particular poet, these data were compared to that of pseudotrochees extracted from prose. The performed study showed that, first, quantity plays important role as well in syllabic-accentual verse, the indices of verse being considerably different from that of pseudoverse. Second, the tendencies in quantitative structure are in good correlation with that in accentual rhythm. Third, just like in the case of accentual rhythm, the quantitative rhythm allows the clear distinction between two groups of poets, whom we conditionally call Traditionalists and Modernists.

Keywords: Estonian verse, trochaic tetrameter, syllabic-accentual verse, Estonian quantity, statistical analysis

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1. Problem

In the syllabic-accentual verse, first, the number of syllables, and second, the placement of accent are relevant. Whether only the main stresses matter, as in Jaak Põldmäe's approach (1978) or different degrees of stress are to be distinguished (compare Lotman and Lotman 2007, 2011), is not significant in this case. On the other hand, in the syllabic-quantitative system, it is not the disposition of stresses, but the quantities that are relevant. These are, so-called, pure cases. But there are also verse forms, where the realization of a verse scheme is not assured by stress or quantity alone, but by the mutually complementary co-influence of both factors. If we regard these forms as quantitative, we have to admit that often in syllables, where the quantity prescribed by the scheme is missing, it is compensated with a stress, and if we regard these forms as accentual, we have to recognise that often a stress prescribed by the scheme is absent, but it is compensated with quantity.

Forms that can neither be called purely accentual nor purely quantitative will be called combined forms (M.-K. Lotman 2009:515–517).

We come across these combined forms in different verse traditions; they can be seen, for example, in ancient verse, but also in medieval Latin poetry (see, for example, Gasparov 1989:87–106). Even more complicated is the relationship between stress and quantity in the Hungarian iamb, which is usually treated as quantitative (Horvath 1969; Lotz 1972:102–105), but with the exception of the verse end, in all positions both stressed and unstressed, both heavy and light syllables can occur. Nevertheless, not everything is allowed in the Hungarian iamb: light unstressed syllables cannot be found in even positions, while in odd positions heavy syllables with strong stress are avoided (Kerek 1971:18–22, Gasparov and Lotman 1989:235–236). Thus, in the Hungarian iamb we are dealing with the negative compensatory principle: certain syllable types are prohibited in certain positions.

In this aspect, the meter of Fennic folk song is quite paradoxical: if we exclude the first syllable, in odd positions a light syllable with the main stress, in even positions a heavy syllable with the main stress is not admitted (the original form has been best preserved in Finnish *kalevalamitta*, but also in Estonian *regi*song, see Krohn 1926, compare the discussion in Põldmäe 1978:151–157). That is, we are dealing with the so-called anticompensatory principle: where the (main) stress is absent, it cannot be compensated with quantity, and vice versa.

In the Estonian literary verse the combined forms have not so far been described, although we can be certain that in secondary quantitative verse such forms are present (compare Põldmäe 1978:157 ff). Regardless, the relationship between stress and quantity in Estonian language and especially in Estonian poetry is an interesting question: they are closely connected to one another (for example, the third duration occurs mostly in syllables carrying the main stress; however, compare ch. 2). Yet, on the other hand, this connection is not absolute: these are the positions of main stresses where different durations have the clearest contrast.

The quantitative structure of the Estonian syllabic-accentual structure has not been made a matter of special study until now. Jaak Põldmäe confines his research to factors related to stress. Such an approach seems logical, almost the only possible way. If a verse is syllabic-accentual by definition, other factors are not related to the metrical nature of verse and should not be of interest at all. Nevertheless, from the aspect of the Estonian prosody, quantity is too important a feature to just be discarded from the study; while in syllabic-accentual verse it is not important from the aspect of meter, a priori, we cannot say the same about rhythm[1].

Verse speech is different from prose, among other things, for its tendency to make use of all elements of language prosody as much as possible and thus, the distribution of quantities poses two mutually connected problems.

First and foremost: does quantity perform a certain function in the syllabic accentual role, be it small or larger? If it is so, we have to study, whether in, for

[1] The main concepts, including the relationship between meter and rhythm are explained in Lotman, Lotman 2011:258–260.

example, syllabic-accentual trochaic tetrameter (T4), a quantitative pattern characteristic, first of all to verse is formed, not being automatically derived from meter or prosodic structure of language. We can answer this question, when we compare the distribution of quantities in different poetry texts with random tetratrochaic pseudolines selected from prose.

Second, if quantity becomes an aesthetically relevant factor in verse, we have reason to investigate whether there are divergences in different authors' practice and if there is potential for creating the typology. If typology based on quantity is possible, it would be interesting to compare how this typology is related to other ones, for example, whether it is connected with the lifetime and aesthetic orientation of a poet, just like according to our discovery it is characteristic of the stress rhythm.

2. Estonian quantity

There are two approaches to the Estonian quantity that are different in principle and are divided in turn into several not quite harmonious treatments. The first is offered by linguistics. It is an academic approach that is presented in many studies and although this matter is far from any consensus in essence, a silent agreement has evolved that it is the only possible approach. Yet on the other side there are poets and translators, who in their practical work are forced to deal with quantity as well, and they have developed different *ad hoc* systems, which often have not been explicitly formulated – varieties of systems can be distinguished by the analysis of their poetry works. In principle, there are three differences between, by convention, the linguistic and poetic approach.

First, a poet approaches the problem from the practical point of view (it could also be named synthetic): his/her aim is to accommodate the prosodic material to the chosen verse meter and thus he/she is interested in having as much quantitatively ambivalent syllables as possible, which would make it possible to use these in different positions of a line according to needs. Such syllables are called ancipitia[2].

Second, verse practicians are not interested in the question of how many degrees of quantity there 'actually' are in Estonian, their problem is how to divide all existing syllables into light, heavy or ancipitia.

Third, practicians cannot confine themselves only to syllables carrying the (main) stress, they have to define the quantity of all the syllables.[3]

Quantity is one of the most complicated problems in Estonian prosody. Many papers and books are devoted to it, but the issue seems to be far from being solved

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[2] For example, in Ain Kaalep, although he himself does not formulate it this way, most syllables of the second duration and monosyllabic words are ancipitia (in the case of monosyllables he follows Ervin Roos's principle of proportionality, Roos 1938).

[3] An interesting exception here is the classicist Ervin Roos (1938), who developed an analytical system for practical poetic creation; Roos's system was more influential for poets than linguists.

(see, for example, Hint 2001, and others). There is no consensus on the number of durations (some have offered four or more, but most of the discussions offer the gradation of three or four degrees, compare, for example, Turunen 1988:63, where short, halflong, long and overlong durations are distinguished) nor on which positions we can even talk about the contrast of quantity. It is neither possible nor necessary to dwell on the question of Estonian quantity in a paper dedicated to verse rhythm. At the same time, we cannot make use of any systems already developed, since differently from poets and earlier researchers of versification, we will not just study the syllables carrying the main stress. We will determine the duration of every syllable, while unlike poets and earlier researchers we will pursue the system of three durations.[4] We will only explain the principles that we followed in our analysis, and what is below will not pretend to be an original theory of quantity in any way, we have merely accommodated the most traditional system for the requirements of our analysis.[5]

Thus, while for linguists the problem of quantity is mostly confined to the syllable carrying the main stress, for poets and verse theorists it is important to determine the quantity of every syllable,[6] and often these determinations seem problematic from the viewpoint of phonetics. In the present study, we rely on the objective qualities of language prosody, not from artificial constructions.

Usually, there are no difficulties in determining the duration of syllables carrying the main stress. A certain exception here is constituted by words such as ‘päike’, ‘väike’, and so on, the first syllable of which can be determined both as of the second and of the third duration. In the present analysis, we have treated such syllables as of the third duration (there were less than two hundred occurrences of such cases in our material, i.e., at a statistically insignificant level, considering our total sample, which consists of ca 70 000 syllables).

It is more complicated to determine the quantity of the monosyllabic clitics. We will consider such syllables that do not contain long vowels or diphthongs or do not end with geminates or consonant clusters to be light; in any of these cases the syllables are potentially heavy. An otherwise light monosyllable can become

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[4] Nikolai Trubetzkoy’s attempt to reduce the Estonian quantity to two degrees of duration has been viewed as unsuccessful (as it is known, Trubetzkoy derived from Evgeny Polivanov’s description, according to which the Estonian prosodic system has four degrees of quantity, compare Trubetzkoy 2000:209–210, Polivanov 1928:197 ff). Jaak Põldmäe also reduces the number of durations to two, compare Põldmäe 1978:57: “…from now on, we will call the syllables of the first duration short, the rest of the syllables long.” As for the fourth and subsequent degrees, these are usually the further differentiation of the traditionally third duration, introduction of these would befog the verse profile.

[5] In more recent approaches to Estonian quantity we can clearly observe the tendency to prefer the system of three durations, compare the works by Karl Pajusalu and Pärtel Lippus, for example, Lippus 2011.

[6] Nevertheless, already Andrus Saareste determined the durations as well in non-initial syllables (Saareste 1952:22–25). Saareste’s system comprises “four more important durations” (22), and in addition to that, some intermediate degrees. Nevertheless, it is not suitable for rhythm analysis, since it has no clear rule set and is more of an illustrative nature.

heavy, if it acquires at least a secondary stress. For instance, 'ma', 'sa', 'ta', 'ka', 'ja', 'te', 'me', 'kel', 'sel' are generally of the first duration. Yet, if they are emphatic or form an independent phrase or even foot, they can be treated as syllables of the second duration. For example, in the verse *ka siis, kui süda lõhkeb sees* (Anna Haava, "Ma olen õppin'd" [I have studied]) the first syllable is of the first duration, while in the verse *kuulsin tema kandlehääli*, / *hakkasin ka mängima* (Ado Reinvald, *Isamaja* [Father's House]) 'ka' can be determined as a syllable of the second duration, and in the line by Ado Reinvald *Ja, lendavmadu, sulle ka* (*Baabiloni langemine* [The fall of Babylon]) the last word can be interpreted as of the third duration.[7] Words, containing a long vowel, diphthong or ending with the geminate or consonant cluster ('see', 'too', 'ei', 'neid', 'ning', 'et' and others) are of the second duration, but they can be treated as of the third duration when they are in emphatic position or form a separate phrase.

Important factors in determining the duration of non-initial syllables are the location of a syllable in a foot, the secondary accent and the internal structure of a syllable. Non-initial syllables that do not contain a diphthong or end with geminate or consonant cluster are of the first duration (long vowel occurs in original words only in positions of main stress). Otherwise we are dealing with syllables of the second duration, but only in position of (secondary) stress.

A separate problem is the question of non-initial syllables of the third duration. There are phonologists who do not admit their existence at all or treat these as anomalous. Nevertheless, it seems that it is an actual phenomenon. At any rate, duration can constitute significative pairs of contrast in non-initial syllables as well. Compare the contrasts in the following words: 'tegeliku' and 'tegelikku', 'igaveste' and 'igavesti', 'kodanike' and 'kodanikke'[8].

Let us bring two examples, both from Lydia Koidula's collection of poetry *Vainulilled* [Meadow Flowers] (1866):

* * *
* * * *
* * * * * * * *

Linnud laulvad, päike hiilgab –

* * *
* * * * * * *

kas k a seda tunnete ("Matuse kell" [Funeral bell]).

In the second line the word 'kas' is of the second duration, as well as 'ka', the emphasis of which is expressed with expanded spacing.

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[7] However, the shortened personal pronouns 'ma', 'sa', 'ta' and others can be only of the first duration (*ma olen siis nii õnnelik*) or, which is still debatable, of the second duration (*nii õnnelik siis olen ma* – Anna Haava); stronger emphasis requires full forms: 'mina', 'sina', 'temal'; compare also 'kel' and 'kellel', 'sel' and 'sellel' and others.

[8] See also Hint 1978:124.

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        *     *  *  *
*   *   *  *  *  *  *  *
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"Ema, kui ma suureks saanud,
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                    *
*           *  *  *
*   * * *   *  *  *
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armas ema, küll siis nääd (“Ukse kõrvas” [Near the door]).

In the first line, the duration of the second syllable in the word ‘suureks’ is problematic. Most quantitative poets and translators interpret such syllables as heavy. The exception here is Villem Ridala and his successors (most importantly, Ants Oras and August Annist), for whom the quantity of non-initial syllables is not of much significance at all.

Under no circumstances do the offered solutions pretend to be exclusive; most importantly for our analysis we fixed the firm principles and rules and followed these consistently. This will assure the uniformity, verifiability and comparability of the analysis and these factors are more important than the differences in treating one or another type of duration.

3. The summarized distribution of durations in the Estonian T4

The summarized distribution of durations in α-positions (i.e. in odd or 1st, 3rd, 5th and 7th position) in the Estonian trochaic tetrameter is presented in Table 1.

None of the durational indices show any clear prevalence here. In positions α_1 and α_3 the distribution of different durations is more or less even, while in positions α_2 and α_4 the decrease of the incidence of syllables of the second degree can be seen (i.e. a weak dissimilative rhythm has developed here).

In Table 2, the data of the summarized distribution of durations in β-positions (that is, in even or 2nd, 4th, 6th and 8th position) are shown.

As expected, the syllables of the first duration prevail here; a certain role is also played by the syllables of the second duration, while the syllables of the third

Table 1. T4: different durations in odd positions

	α_1	α_2	α_3	α_4	standard deviation
I duration	32.0	35.8	35.7	42.3	4.3
II duration	32.0	26.6	31.7	17.4	6.8
III duration	36.0	37.5	32.6	40.3	3.2

Table 2. T4: different durations in even positions

	β_1	β_2	β_3	β_4	standard deviation
I duration	86.1	84.4	92.3	95.1	5.1
II duration	13.4	14.6	7.4	4.6	4.8
III duration	0.5	1	0.3	0	0.4

duration are clearly avoided. At the same time, in the case of syllables of the third duration, especially marked are the positions β_3 and β_4, where the syllables of the second duration occur also considerably less often than in positions β_1 and β_2.

Even more telling is the distribution of durations in all positions (see Figure 1):

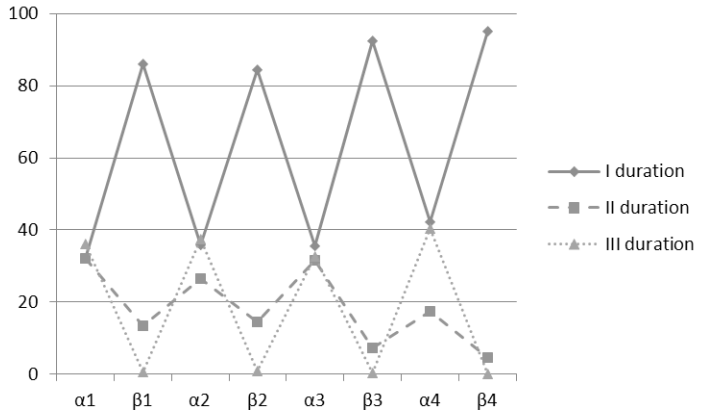

Figure 1. The distribution of different durations in Estonian T4.

The most distinctive contrast is between the distribution of syllables of the first and the third duration. The rate of syllables of the second duration, as a rule, conforms to the incidence of syllables of the third duration, which means that the primary opposition in verse is binary – heavy syllables are in contrast with the light ones and the opposition between the syllables of the second and the third duration is gradual: the contrast between the even and odd positions is not so clear in the profile of the syllables of the second duration. As for the occurrence of syllables of the first and the third duration, we can see here a mirror-like symmetry. With just one small exception, the indices of the third duration are lower than those of the first duration (only in the third position the index of the third duration slightly exceeds that of the third one).

Since in Estonian, quantity is closely connected with stress, it was expected that heavy syllables (the second and the third duration) are clearly preferred in odd positions, while light syllables are preferred in even positions. The question is whether the given regularity is an automatic consequence of the language rhythm or whether verse has certain special qualities. In order to find it out, we have to compare the statistical data of verse rhythm with that of the indices of quasiverses sampled from prose[9].

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[9] The methods of analysis of prose rhythm are described in Lotman, Lotman 2011:263; these were developed by mathematicians Andrey Kolmogorov and Alexandr Prokhorov (1985, but especially Prokhorov 1984:89–98), see also a presentation oriented on philologists in Krasnoperova 2004:73–75.

4. 'Random' T4

We analyzed three samples consisting of two hundred pseudoverses selected from the following texts: Eduard Vilde *Külmale maale* [To the Cold Land], Eduard Vilde *Prohvet Maltsvet* [Prophet Maltsvet] ja Friedebert Tuglase *Siil* [Hedgehog]. The corresponding data are presented on Figures 2–4.

On the whole, the distribution of durations in all three samples is similar both to summarized data and to one another, while small differences cannot be associated with the authorship: in some parameters one of Vilde's samples is closer to Tuglas than to the other Vilde's sample, for example, in Vilde's first sample is just like in Tuglas's case the syllables of the second duration occur in odd positions more frequently than that of the third syllable. In Vilde's other sample these indices are equal.

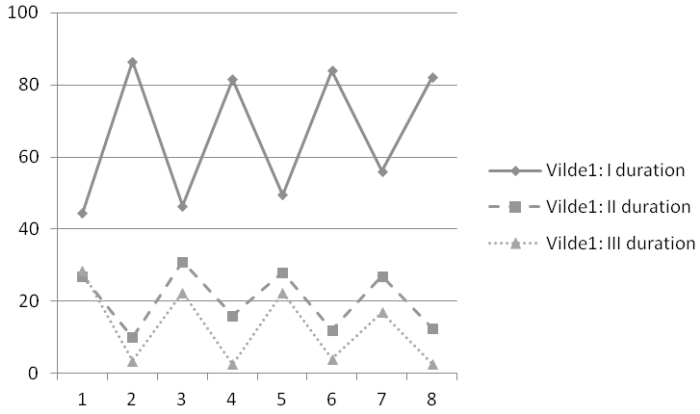

Figure 2. The distribution of durations: random T4 (Vilde 1).

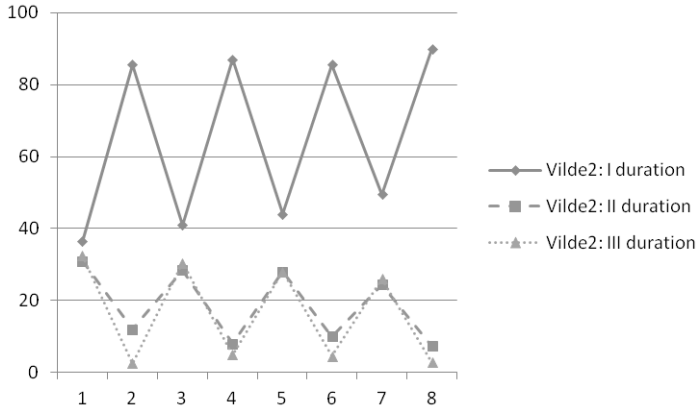

Figure 3. The distribution of durations: random T4 (Vilde 2).

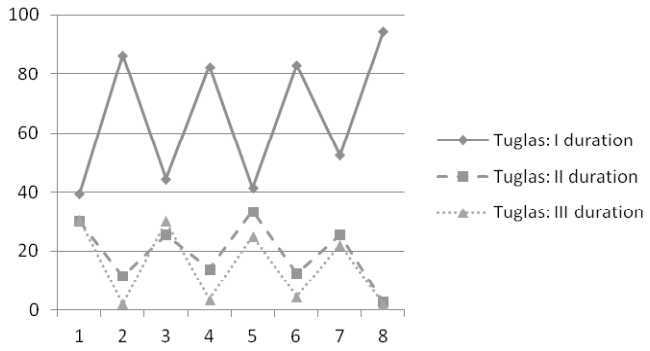

Figure 4. The distribution of durations: random T4 (Tuglas).

The summarized indices of random trochees are presented in Figure 5.

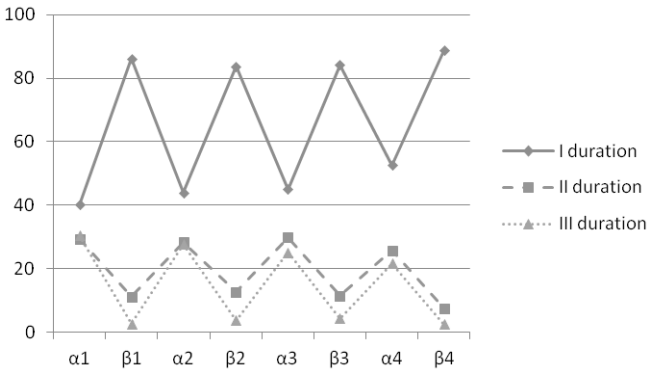

Figure 5. The distribution of durations: summarized data of random T4.

5. Durations in T4: verse and random pseudotrochees

When we compare the quantitative structure of random trochees with the summarized indices of real verse (Figure 1), the following important differences can be noticed. First, in verse the contrast of quantities is more distinctive: we can clearly see that the first duration is preferred in α-positions and mostly avoided in β-positions. In the case of the third duration this ratio is opposite and thus, the indices of the third duration form almost mirror symmetry with that of the first duration. As for the relationship between the second and the third duration, there is a clear pattern: the third duration is preferred in odd and avoided in even positions, while in the case of the second duration such preferences are far more amorphous. At the same time, what is characteristic of pseudoverses sampled from prose is that the incidence of heavy syllables in α-positions are not as prominent as they are

in verse and in most β-positions, the index of the second duration even somewhat exceeds that of the third duration.

What has been said, allows us to draw two conclusions: first, there is a clear tendency in Estonian syllabic-accentual trochee, according to which in even ('strong') positions heavy syllables are preferred, while in odd ('weak') positions the light ones. Second, syllables of the third duration are admitted only in odd positions and differently from prose, the contrast between heavy and light syllables reveals itself, first of all, in the distribution of syllables of the first and the third duration. Cf table 3, where the sum of the indices of α-positions is divided with the sum of the indices of the β-positions.

Table 3. The ratio of durations in odd and even positions

	Q1	Q2	Q3
T4 (verse)	0.41	2.7	81.3
'random' T4	0.59	2.4	7.1

While the indices of the first and the second duration are comparable in verse and prose, that of the third duration is higher by order of magnitude. Therefore, we can firmly claim that the preference of syllables of the third duration in verse is not a random variation.

6. Poets

Such is the overall picture. Let us compare it now with the data of different authors. In the first part of the study (Lotman and Lotman 2011) we found out that there are two rhythmical models, which are in good correlation with authors' chronological sequence and aesthetic orientation. Conditionally, we called the authors realizing the first model Traditionalists, and the representatives of the second model Modernists.

For the more detailed examination of the distribution of durations we chose three Traditionalists and three Modernists.[10] Friedrich Reinhold Kreutzwald, Lydia Koidula and Juhan Liiv, on the one hand, and Gustav Suits, Villem Ridala and Henrik Visnapuu on the other hand.

[10] The rhythmical data of the rest of the analyzed authors can be seen in Appendices.

6.1. Traditionalists

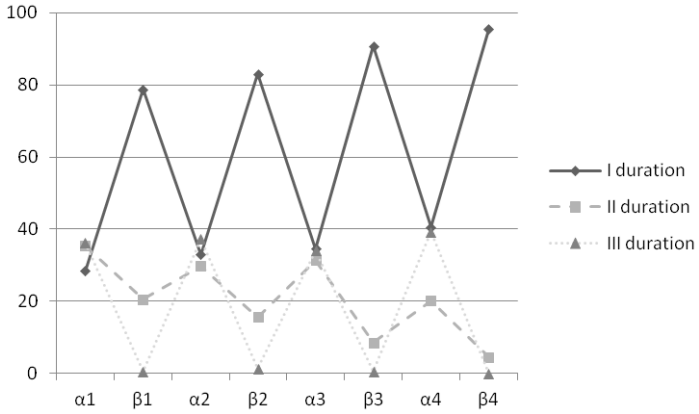

Figure 6. Kreutzwald's T4: the distribution of different durations.

As compared to the random trochee, the index of the first duration in Kreutzwald's T4 is lower in all the odd ('strong') positions, while the index of the third duration is higher. The second duration occurs also more frequently in all positions, except for the last. What is most important in Kreutzwald's T4, is also the general characteristic of the trochaic four-footed verse – here we can see the dissimilation of the indices of syllables of the second and the third duration between the even and odd positions: in even positions the second duration is preferred, in odd position the third. At the same time, in random trochees generally the second duration prevails: although the indices are almost equal in positions α_1 and α_2, in rest of the verse the second duration dominates (compare Figure 5).

Kreutzwald's data fit the general picture well. Only two things should be noted – first, the index of heavy syllables in Kreutzwald's verse is slightly higher than average (in Kreutzwald's T4 the incidence of heavy syllables is 39,4%, while the average index is 37,0%). Second, the index of the third duration exceeds that of the first not only in position α_2, but also in α_1.

Table 4. T4: durations in α-positions in Kreutzwald's T4 and random trochees

	α_1	α_2	α_3	α_4	standard deviation
Kreutzwald I	28.4	33	34.6	40.6	5.0
Kreutzwald II	35.4	29.8	31.4	20.2	6.4
Kreutzwald III	36.2	37.2	34	39.2	2.2
'Random' T4 I	40.2	44	45	52.7	5.2
'Random' T4 II	29.3	28.3	29.8	25.7	1.8
'Random' T4 III	30.5	27.7	25.2	21.7	3.7

As compared to the random trochee, the index of the first duration in Kreutzwald's verse is lower in all odd positions, while the index of the third duration is higher. The index of the second duration is also higher in every position, except for the last one.

Just like in the case of general data, we can clearly see here the dissimilative tendency and in comparison with the general picture, in Kreutzwald's verse it is even more distinctive. In even positions, Kreutzwald avoids syllables of the third duration, but the occurrence of these is still slightly higher there than the average, for example, in position β_2 their incidence is 1.6%.

Next, let us take a look at Lydia Koidula's indices of quantity. The general profile is rather similar to the distribution we saw in Kreutwald's T4, we will only add that in position β_1 the avoidance of syllables of the second and the third duration is more perspicuous in Koidula, while Kreutzwald tends to avoid these in position β_2.

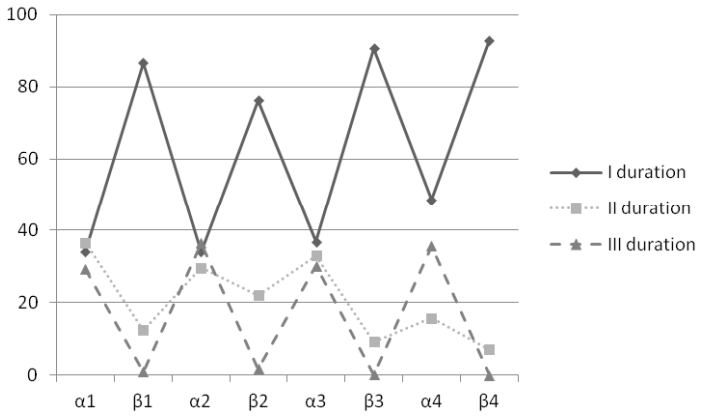

Figure 7. Koidula's T4: the distribution of different durations.

Table 5. Koidula's T4: durations in α-positions

	α_1	α_2	α_3	α_4	standard deviation
I duration	34.2	34	36.8	48.6	6.9
II duration	36.6	29.6	33	15.8	9.1
III duration	29.2	36.4	30.2	35.6	3.7

We can add here that the dissimilation between the second and the third duration is not so clear in Koidula's T4 as it is in Kreutzwald's: in positions α_1 and α_3 the index of the second duration is higher than that of the third, while differently from Kreutzwald's verse the index of the third duration is higher in position α_2. In positions α_1 and α_4, on the other hand, Koidula's indices are much closer to that of the random trochees.

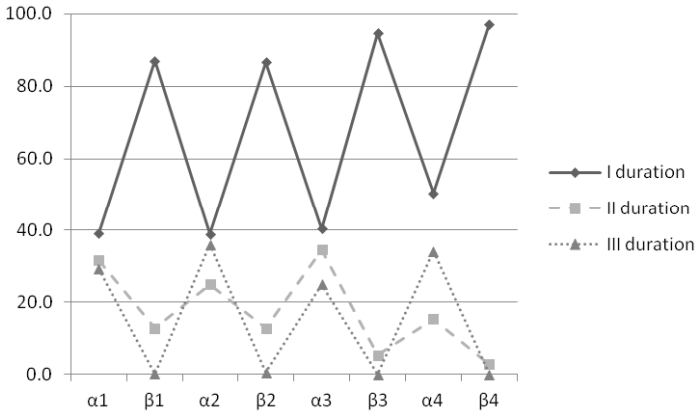

Figure 8. Juhan Liiv's T4: the distribution of different durations.

In Juhan Liiv's trochee the dissimilation between the second and the third duration is more complicated. In strong positions the prevalence of the second or the third duration is alternate: in positions α_1 and α_3 the second duration is more frequent, while in positions α_2 and α_4 the third prevails. Regarding the rest of the parameters, he is close to the Traditionalists studied above.

We should also note that in all the observed Traditionalists in the seventh position (α_4) light syllables occur more often than heavy ones.

Table 6. Juhan Liiv's T4: durations in *α*-positions

	α_1	α_2	α_3	α_4	standard deviation
I duration	39.2	39	40.4	50.4	5.5
II duration	31.6	25	34.6	15.4	8.5
III duration	29.2	36	25	34.2	5.0

6.2. Modernists

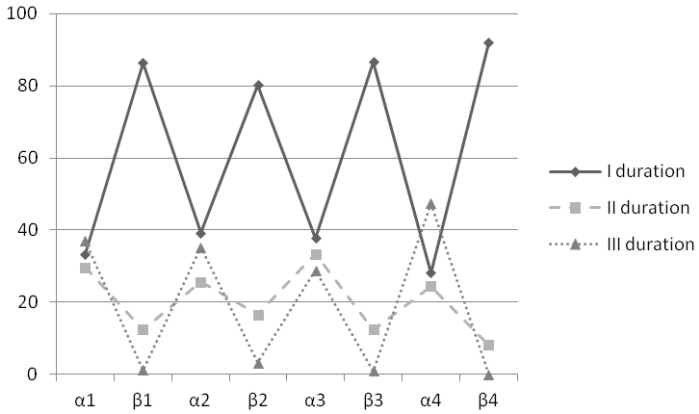

Figure 9. Suits's T4: the distribution of different durations.

We can see that in Suits's T4 the third duration occurs in position α_4 more frequently than the first duration, but as for the ratio of the second and the third duration, here only in position α_3 syllables of the third duration are slightly more preferred than that of the second syllable.

Table 7. Suits's T4: the distribution of duration in α-positions

	α_1	α_2	α_3	α_4	standard deviation
I duration	33.4	39.2	37.8	28.2	5.0
II duration	29.6	25.6	33.4	24.4	4.1
III duration	37	35.2	28.8	47.4	7.7

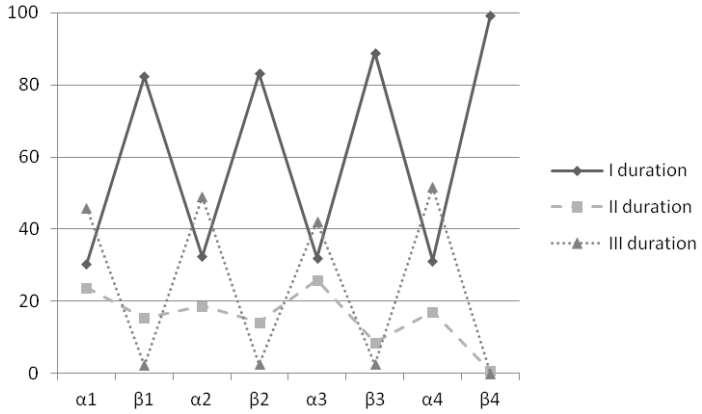

Figure 10. Ridala's T4: the distribution of different quantities.

In Ridala's verse, the third duration occurs in odd positions far more often than the second duration, while the dynamics of the second duration is the least defined. What is also typical to Ridala's verse is that in odd positions he prefers the third duration not only over the second, but also the first duration.

Table 8. Ridala's T4: durations in α-positions

	α_1	α_2	α_3	α_4	standard deviation
I duration	30.3	32.4	32.1	31.3	0.9
II duration	23.8	18.7	25.9	17.1	4.2
III duration	45.9	49	42	51.6	4.1

Visnapuu continues the same tendencies that we already noted in Ridala's case: he has higher incidence of the third duration in odd positions, as compared to the third and the second, but in position α_4 he has an unprecedentedly high index of the third duration and in position α_3 both syllables of the third and of the second duration occur more frequently than that of the first duration – this regularity is

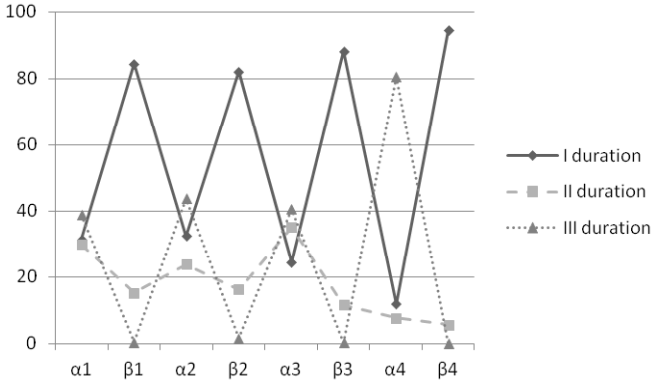

Figure 11. Visnapuu's T4: the distribution of different durations

unique in our material. Just like in Ridala's verse, in Visnapuu's T4 the dynamics of the second duration is the most amorphous. However, we would like to draw attention to its relatively high index in position α_3, resulting in two weight peaks in Visnapuu's verse: in position α_4, where it is nearly always on the account of the third duration and in position α_3, where the incidence of syllables of the second and the third duration is almost even.

Table 9. Visnapuu's T4: durations in *α*-positions.

	α_1	α_2	α_3	α_4	standard deviation
I duration	31.4	32.4	24.4	11.8	9.5
II duration	29.8	23.8	35	7.6	11.9
III duration	38.8	43.8	40.6	80.6	19.9

While in all Traditionalists α_4 is the lightest position, in all Modernists it is vice versa: the verse end is marked with the increase of weight.

7. Quantity and stress

The comparison of the distribution of durations and stresses can be quite revealing: while the placement of stressed (first of all, carrying the main stress) syllables into odd positions is intentional and follows from the rules of syllabic-accentual trochee, the quantitative structure of verse is either an automatic outcome of the qualities of language or is conditioned by some other factors. Let us first compare the relationship between main-stressed and heavy (i.e. summary of syllables of the second and the third duration) syllables in random trochees (Figure 12):

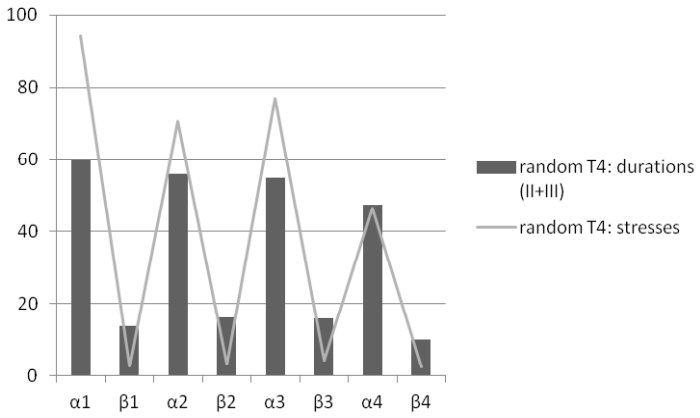

Figure 12. The relationship between the main stresses and summarized syllables of the second and the third duration in random trochees.

We can see that the accentual and quantitative structures are in strong correlation in trochaic fragments sampled from prose. However, the stress structure is considerably more distinct: in odd positions there are more stresses, in even positions less stresses than heavy syllables. Nevertheless, we would like to bring to attention two remarkable details: first, in random trochees the dissimilation of heavy syllables in odd positions can already be noticed, although it is not so clear as the dissimilation of stresses. And second, in the weakest strong position (α_4) the indices of stressed and heavy syllables coincide.

The general rhythmic characteristics of poetry are quite similar to that of prose. Although both in the case of stresses and durations we can see clearer differentiation of odd and even positions, each tendency observed in the case of random T4 apply here as well (Figure 13):

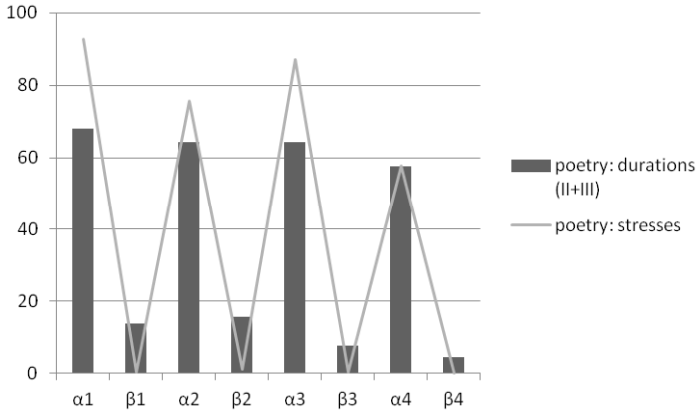

Figure 13. The relationship between the main stresses and summarized syllables of the second and the third duration in T4 sampled from poetry.

Yet when we leave aside the syllables of the second duration, the prosodic status of which is somewhat ambivalent, especially if they carry secondary stress, we can see that the distribution of the third duration in verse is from the standpoint of trochaic structure considerably more distinct than in random trochees sampled from prose (Figures 14 and 15).

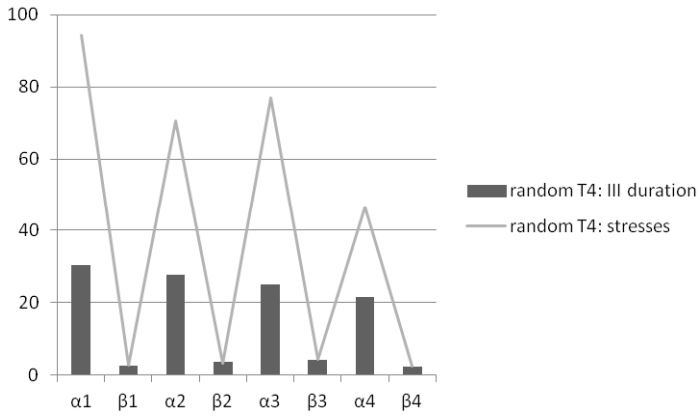

Figure 14. The relationship between the main stresses and the syllables of the third duration in random trochees.

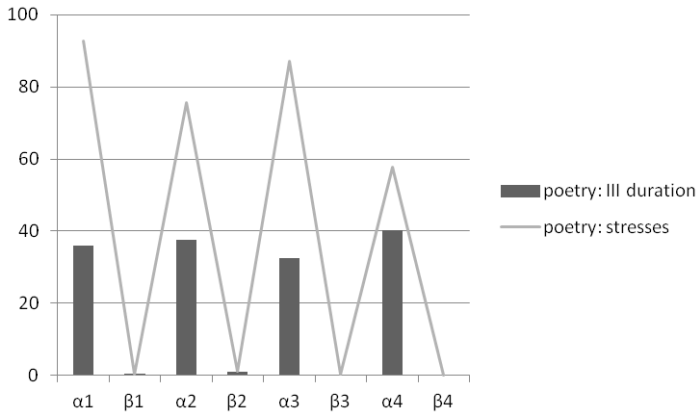

Figure 15. The relationship between the main stresses and the syllables of the third duration in T4 sampled from poetry.

Here we can see the particular quality of verse rhythm more clearly, and the peculiarity of position α_4 is especially worth noticing. In the distribution of summarized heavy syllables it is the weakest position both in verse and in random trochees, while in the distribution of syllables of the third duration this regularity

persists in verse. On the other hand it is the last α-position where syllables of the third duration are preferred.

Next we will study a few authors separately, comparing two Traditionalists (Kreutzwald and Koidula) and two Modernists (Ridala and Visnapuu).

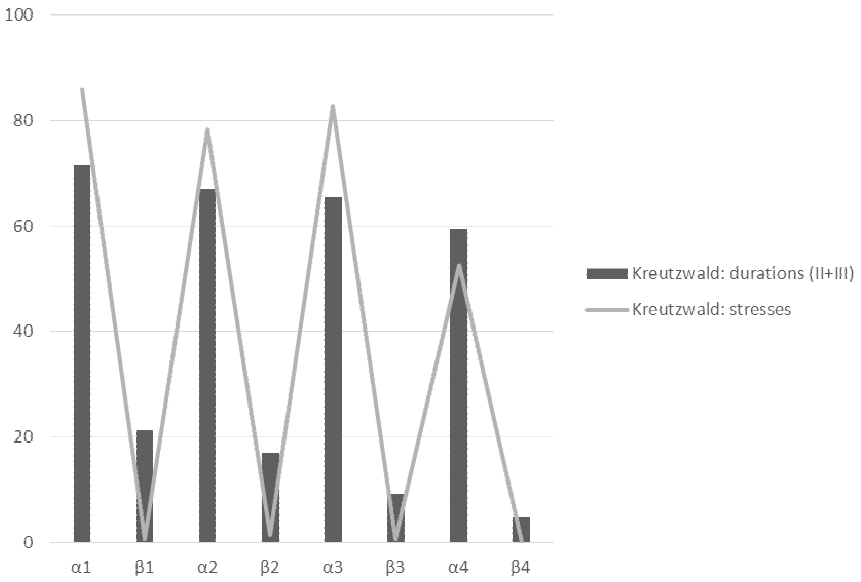

Figure 16. Kreutzwald's T4: the relationship between the main stresses and summarized syllables of the second and the third duration.

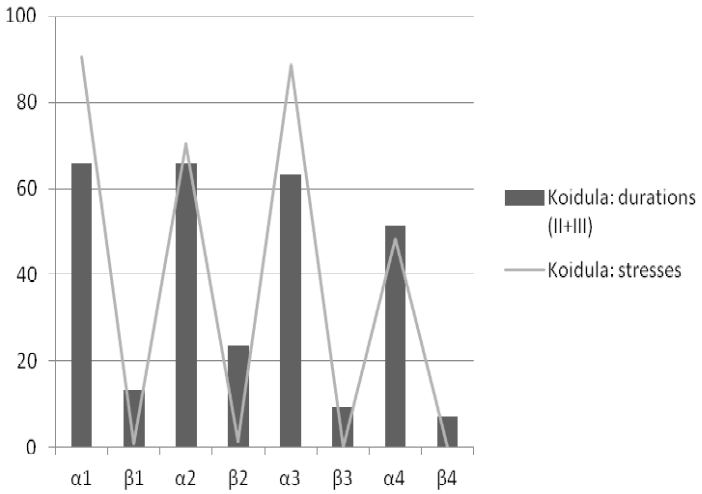

Figure 17. Koidula's T4: the relationship between the main stresses and summarized syllables of the second and the third duration.

The indices of the Traditionalists are rather similar to each other, let us just note in the case of Kreutzwald and Koidula that their verse has more heavy syllables in position α_4 than syllables carrying the main stress. The reason here is a high proportion of heavy clitics or heavy syllables carrying the secondary stress, first of all, in masculine clauses; compare, for instance, *et neid rõõmsad rõõmus-taks* (Kreutzwald, *Rõõmule* [To Joy]) or *suvetormi võimu all!* (Koidula, *Mets* [Forest]). Just like in random trochees and in the general distribution of indices of verse, α_4 is the weakest of α-positions in all Traditionalists, both in the aspect of stress and duration.

The corresponding data of Modernists are presented in Figures 18 and 19.

In comparison with the Traditionalists some important differences are revealed. Modernists perceive more sensitively the relationship between stress and quantity and therefore the incidence of heavy syllables is much higher in α-positions and the contrast between α- and β-positions is stronger. Here we should note the difference between Ridala and Visnapuu: while in Ridala's verse the percentage of heavy syllables in α-positions is persistently high (ca 70%), in Visnapuu's T4 it rises towards the end of the line and in position α_4 it reaches almost 90%.

The relationship between stress and quantity is revealed even more clearly, if we leave aside the syllables of the second duration, so that only indisputably stressed and indisputably heavy syllables are compared.

The relationship between the main stresses and the indices of the syllables of the second and third duration demonstrated that Traditionalists tend to follow the same tendencies, which can already be noted in random trochees, that is, which are

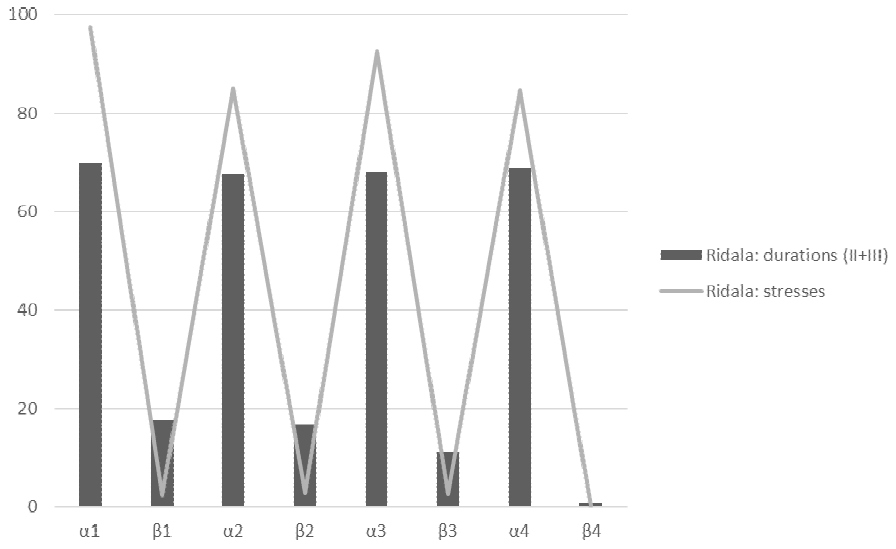

Figure 18. Ridala's T4: the relationship between the main stresses and summarized syllables of the second and the third duration.

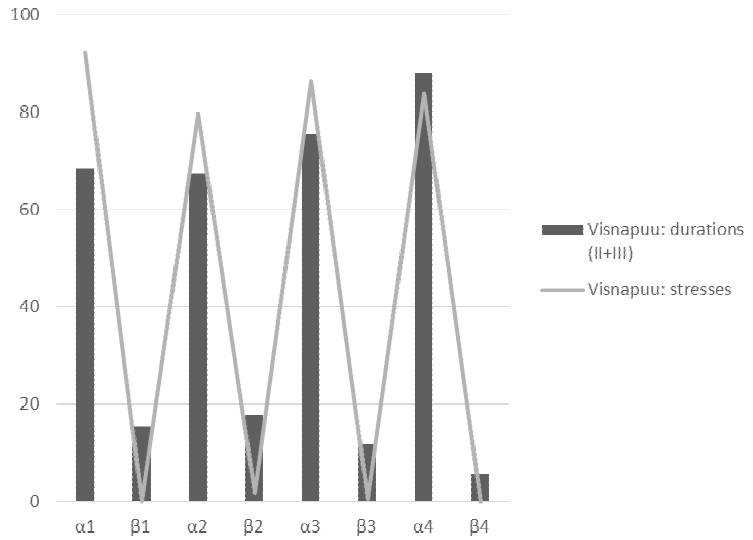

Figure 19. Visnapuu's T4: the relationship between main stresses and summarized syllables of the second and the third duration.

already existent in language, but are manifested in Traditionalist verse even more pronouncedly, while in Modernists' verse a different rhythmic impulse developed. The relationship between the main stresses and syllables of the third duration showed, on the other hand, that this impulse characteristic to Modernists is already latently present in random trochees. This means that natural language contains possibilities of various rhythmic impulses and Traditionalists and Modernists orient themselves upon different ones, so that hidden tendencies are revealed in a different way. The comparison of the data revealed in Figure 19 and Figure 23 shows that the high proportion of heavy syllables in position α_3 in Visnapuu's T4 occurs on account of elevated incidence of syllables of the second duration, while in position α_4 syllables of the third duration are predominant (cf also Table 9).

Another significant trend is the compensatory dissimilation of durations and stresses, which can be seen both in the even positions of Modernists' as well as some Traditionalists' (compare especially Koidula's or Juhan Liiv's, but others as well) verse. That is, in odd positions, where the incidence of the main stresses is lower, heavy syllables and especially syllables of the third duration occur more often (in position α_2 half and in position α_4 even three-fourths of the syllables carrying the main stress are of the third duration), while in positions α_1 and α_3, which in terms of stress are especially distinct, only one third of the main stresses occur on the syllables of the third duration. The elements of such compensation can already be noticed in random trochees, compare Figure 5.

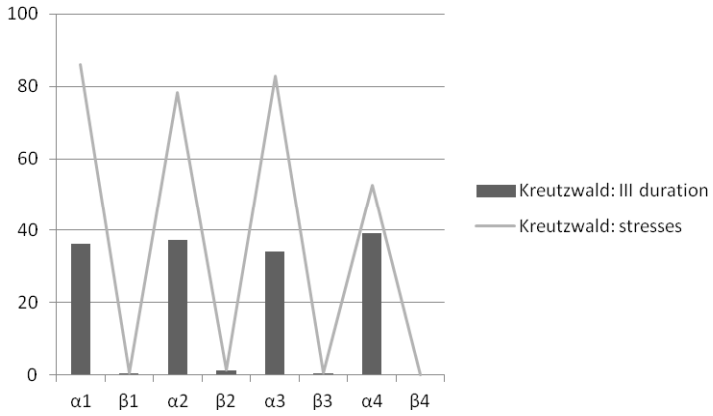

Figure 20. Kreutzwald's T4: the relationship between the main stresses and the syllables of the third duration

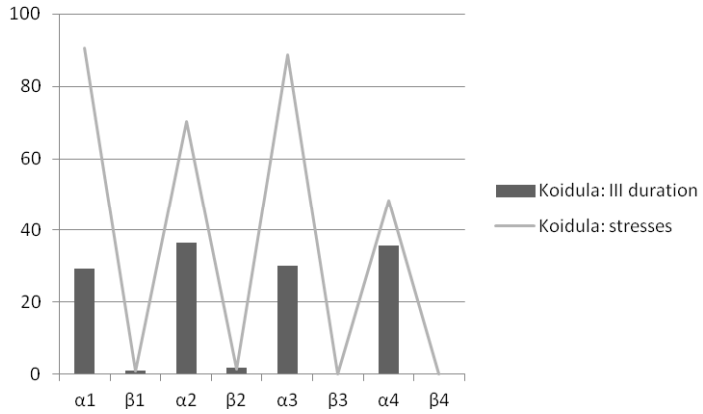

Figure 21. Koidula's T4: the relationship between the main stresses and the syllables of the third duration

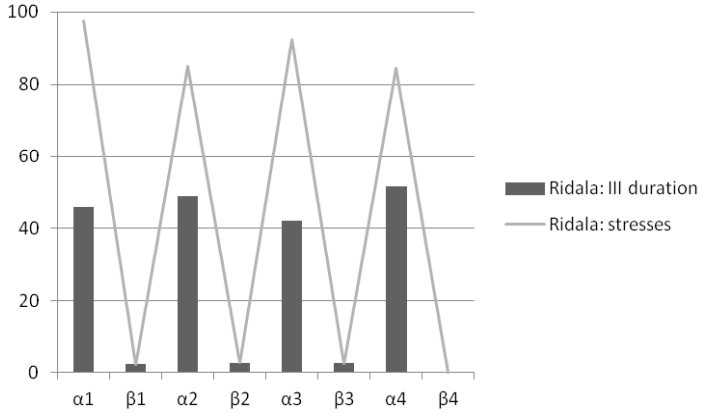

Figure 22. Ridala's T4: the relationship between the main stresses and the syllables of the third duration

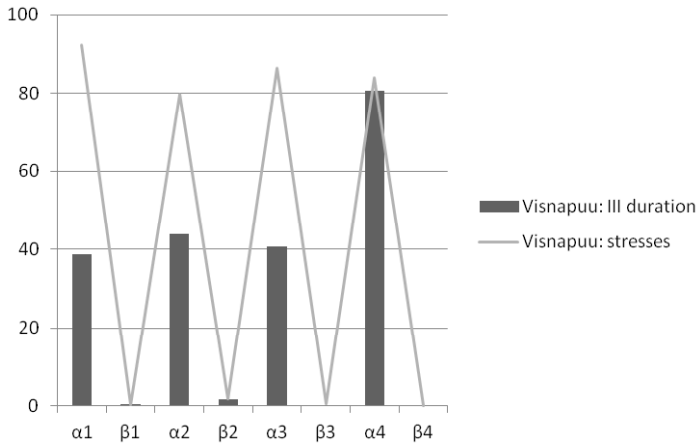

Figure 23. Visnapuu's T4: the relationship between the main stresses and the syllables of the third duration

8. Discussion and summary

The syllabic-accentual trochee was the main verse meter in the metrical repertoire of Estonian literary poetry in the 19th century and the beginning of the 20th century. We can even say that the canon of the Estonian syllabic-accentual verse established itself, first of all, around the trochaic tetrameter. Therefore, it was not too difficult to find 500 verses, which was the standard size of the sample, from most of the studied authors. The importance of the trochaic tetrameter started to diminish in the second and the third decade of the 20th century, making way for iambic verse meters, on the one hand, and for stress meters, on the other hand.

The predominant majority of previous statistical studies of versification have focused just on the occurrence of a single feature, for example, stress or quantity in one or another position. Thus, Jaak Põldmäe centred his attention, following from the traditions of Russian verse studies and Estonian linguistics, only on the main stresses. In the English tradition, which proceeds from Halle's and Keyser's generative metrics, the majority of attention is focused on syntagmatic or phrase accents (so-called *stress maxima*), although these descriptions are often not supported with statistical methods. It has been a constant call to fix stresses with different strengths, but such calls have not found many followers. For instance, Franz Saran (1907:55–62) describes nine degrees of stress in German verse, while Victor Žirmunskij (1968:13–15) confines himself to just three; Lev Ščerba (1912) distinguishes three degrees of stress in Russian verse, Vadim Baevski (1968) proceeds from Ščerba, but distinguishes as much as five. Yet such distinctions have not found wider recognition, since the subjective factor in them is far too big and there may also be some concomitant, implicit understandings, for example, that the second degree of stress is stronger than the first, or the stresses are too different to be comparable to one another. The corresponding description would

violate the established understanding of rhythmical forms, and consequently, as it was expressed by Põldmäe, these are not well suited for typological studies (Põldmäe 1971a:4, compare also Põldmäe and Remmel 1977:180–181 and Põldmäe 1971:236 ff): how is it possible to compare rhythmical modulations to one another if the only difference between them is the degree of stress in some position? In this sense, it is illustrative to compare the system developed by mathematicians Andrey Kolmogorov and Alexandr Prokhorov to transcribe Russian rhythm: a full and detailed transcription distinguishes between several types of stress and word boundary. They used it for the analysis of single poems, but when dealing with statistical data analysis, they used a simplified transcription instead, which is rather close to traditional studies (Kolmogorov and Prokhorov 1968).

For the present study a layered method was developed, which is based on the approach of metrical prosody (see, for example, Hogg and McCully 1991): we treat both accent and stress as gradual, while depending on the aim of description and its amount of detail it is possible to distinguish corresponding layers. For example, we could confine ourselves to the distribution of the main-stressed and heavy syllables, but at the same time we could extract the data of syllables carrying the phrase accents from that with main stresses and data of syllables of the third duration from the heavy syllables.

We compared the results obtained with the analysis of verse rhythmics – as it has become a tradition ever since Boris Tomashevski's and Andrey Kolmogorov's works – to the natural rhythm of language, which can be studied through random quasiverse fragments extracted from prose. This way it became possible to discern the peculiarity of verse on the background of the automatism of language. The practical results of the study demonstrate the efficiency of the offered methods of analysis.

In the first part of the study (Lotman and Lotman 2011) we discovered that there are two basic patterns of accentual rhythm in Estonian trochaic tetrameter and established the chronological-aesthetic framework of these models: Traditionalists and Modernists have different secondary rhythm in Estonian trochaic tetrameter. While in Traditionalists' verse the heaviest syllables culminate in the sixth position (α_3), in Modernists' poetry their culmination is in the eighth position (α_4). In Modernist verse an interesting phenomenon evolves: although the accentual constant is in the first position, the heaviest stresses occur most frequently in verse end. It appears that the strongest, that is, phrase stresses have a special role in establishing the secondary rhythm. Nevertheless, we warned that this outcome should be interpreted with a certain caution, since in determining phrase stresses, subjective factors may also have some significance. The analysis presented in the second part of the study shows that the distribution of durations is well supported with the conclusions made on the basis of the distribution of stresses, and the distinctness of the position α_4 in Modernists' verse is marked not only with the phrase stress, but also with heavy syllables, which are, first of all, of the third duration, and this could be regarded as a sufficiently objective feature.

The stress rhythm of the Estonian syllabic-accentual trochee is very stable, almost every strong position is marked with a prosodic signal, but even its quantitative structure is so clear that this alone (without any support by stresses) could be sufficient for realizing the meter. The comparison with random trochees reveals the selectivity of verse. Consequently, the so-called secondary rhythm, which in Mikhail Gasparov's terminology means not the rhythm of syllables, but that of feet, is formed and it is noteworthy that Traditionalists and Modernists have different secondary rhythm.

Acknowledgements

The present study is the sequence to the paper "Toward a statistical analysis of accentual rhythm (with reference to the Estonian trochaic tetrameter)" (Lotman, Lotman 2007, 2011); we will use all the concepts and terms of versification theory in the same meaning, therefore we will define only these concepts that were not applied in the previous publication. The authors are grateful to Ilse Lehiste and Tiit-Rein Viitsoo for the consultation; yet we take the full responsibility for all the possible mistakes and omissions. The writing of this paper was supported by ETF grants no 5243, 8341 and 9015).

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APPENDICES

1. Syllables of the first duration in T4 by position

Author	1	2	3	4	5	6	7	8
Kreutzwald	28.4	78.8	33.0	83.0	34.6	90.8	40.6	95.4
Kuhlbars	30.0	90.0	33.2	87.8	34.8	93.8	42.4	90.5
Veske	29.0	85.6	34.6	89.2	34.6	94.6	52.4	96.5
Koidula	34.2	86.6	34.0	76.2	36.8	90.6	48.6	92.9
Reinvald	27.8	88.8	35.6	88.6	38.8	96.0	43.6	95.9
Bergmann	33.4	90.4	31.2	86.4	38.8	98.0	55.8	97.4
Jakob Liiv	29.0	87.8	38.2	84.2	36.8	93.2	57.8	98.4
Tamm	26.0	84.8	31.8	80.8	27.6	93.6	45.0	100.0
Sööt	34.8	88.6	38.8	89.6	37.6	94.8	51.8	94.1
Juhan Liiv	39.2	87.0	39.0	86.6	40.4	94.6	50.4	97.2
Haava	32.3	84.6	37.2	83.6	34.6	93.2	43.2	96.8
Lõo	43.0	93.0	45.3	89.5	46.5	95.3	23.3	100.0
Enno	36.3	88.0	40.8	88.0	37.1	93.6	44.9	97.4
Proletaarlane	30.4	85.2	40.2	80.0	37.8	92.6	48.8	94.0
Under	33.8	81.0	38.2	82.6	39.6	86.8	33.0	94.9
Suits	33.4	86.4	39.2	80.2	37.8	86.6	28.2	91.9
Ridala	30.3	82.4	32.4	83.2	32.1	88.9	31.3	99.3
Visnapuu	31.4	84.4	32.4	82.2	24.4	88.2	11.8	94.4
Alle	36.8	88.6	33.4	87.4	36.2	89.6	30.6	92.8
Heiberg	29.0	88.0	42.0	85.0	40.0	97.0	59.0	93.7
Total	32.0	86.1	35.8	84.4	35.7	92.3	42.3	95.1
‘Random’ T4 (Vilde1)	44.5	86.5	46.5	81.5	49.5	84.0	56.0	82.1
‘Random’ T4 (Vilde2)	36.5	85.5	41.0	87.0	44.0	85.5	49.5	89.9
‘Random’ T4 (Tuglas)	39.5	86.5	44.5	82.5	41.5	83.0	52.5	94.4

2. Syllables of the second duration in T4 by position

Author	1	2	3	4	5	6	7	8
Kreutzwald	35.4	20.6	29.8	15.6	31.4	8.6	20.2	4.6
Kuhlbars	32.8	9.8	31.4	12.0	33.0	5.8	18.4	9.1
Veske	39.0	14.0	29.8	10.4	35.0	5.4	13.6	3.5
Koidula	36.6	12.4	29.6	22.0	33.0	9.2	15.8	7.1
Reinvald	33.1	11.2	23.7	11.4	27.5	4.0	21.2	4.1
Bergmann	34.2	9.2	24.6	13.4	31.2	2.0	18.0	2.6
Jakob Liiv	30.6	12.2	24.4	15.2	29.6	6.8	13.0	1.6
Tamm	35.2	15.2	27.4	19.0	35.4	6.4	7.2	0.0
Sööt	33.4	11.4	27.0	10.4	34.4	5.0	15.8	5.9
Juhan Liiv	31.6	12.8	25.0	12.8	34.6	5.4	15.4	2.8
Haava	31.0	15.0	28.2	15.6	34.0	6.2	23.6	3.2
Lõo	30.2	7.0	30.2	10.5	26.7	4.7	30.2	0.0
Enno	25.8	12.0	26.2	12.0	27.3	6.4	13.9	2.6
Proletaarlane	34.2	14.2	25.4	18.2	29.8	7.4	19.6	6.0
Under	29.0	18.6	24.8	15.8	26.4	13.2	20.2	5.1
Suits	29.6	12.4	25.6	16.6	33.4	12.4	24.4	8.1
Ridala	23.8	15.3	18.7	14.2	25.9	8.5	17.1	0.7
Visnapuu	29.8	15.2	23.8	16.2	35.0	11.6	7.6	5.6
Alle	26.2	11.0	31.8	12.2	30.4	9.6	25.0	7.2
Heiberg	35.0	12.0	25.0	13.0	30.0	3.0	18.0	6.3
Total	32.0	13.4	26.6	14.6	31.7	7.4	17.4	4.6
‘Random’ T4 (Vilde1)	27.0	10.0	31.0	16.0	28.0	12.0	27.0	12.5
‘Random’ T4 (Vilde2)	31.0	12.0	28.5	8.0	28.0	10.0	24.5	7.3
‘Random’ T4 (Tuglas)	30.0	11.5	25.5	14.0	33.5	12.5	25.5	2.8

3. Syllables of the third duration in T4 by position

Author	1	2	3	4	5	6	7	8
Kreutzwald	36.2	0.6	37.2	1.4	34.0	0.6	39.2	0.0
Kuhlbars	37.2	0.2	35.4	0.2	32.2	0.4	39.2	0.4
Veske	32.0	0.4	35.6	0.4	30.4	0.0	34.0	0.0
Koidula	29.2	1.0	36.4	1.8	30.2	0.2	35.6	0.0
Reinvald	39.2	0.0	40.7	0.0	33.7	0.0	35.2	0.0
Bergmann	32.4	0.4	44.2	0.2	30.0	0.0	26.2	0.0
Jakob Liiv	40.4	0.0	37.4	0.6	33.6	0.0	29.2	0.0
Tamm	38.8	0.0	40.8	0.2	37.0	0.0	47.8	0.0
Sööt	31.8	0.0	34.2	0.0	28.0	0.2	32.4	0.0
Juhan Liiv	29.2	0.2	36.0	0.6	25.0	0.0	34.2	0.0
Haava	36.6	0.4	34.6	0.8	31.4	0.6	33.2	0.0
Lõo	26.7	0.0	24.4	0.0	26.7	0.0	46.5	0.0
Enno	37.8	0.0	33.0	0.0	35.6	0.0	41.2	0.0
Proletaarlane	35.4	0.6	34.4	1.8	32.4	0.0	31.6	0.0
Under	37.2	0.4	37.0	1.6	34.0	0.0	46.8	0.0
Suits	37.0	1.2	35.2	3.2	28.8	1.0	47.4	0.0
Ridala	45.9	2.3	49.0	2.6	42.0	2.6	51.6	0.0
Visnapuu	38.8	0.4	43.8	1.6	40.6	0.2	80.6	0.0
Alle	37.0	0.4	34.8	0.4	33.4	0.8	44.4	0.0
Heiberg	36.0	0.0	33.0	2.0	30.0	0.0	23.0	0.0
Total	36.0	0.5	37.5	1.0	32.6	0.3	40.3	0.0
'Random' T4 (Vilde1)	28.5	3.5	22.5	2.5	22.5	4.0	17.0	2.7
'Random' T4 (Vilde2)	32.5	2.5	30.5	5.0	28.0	4.5	26.0	2.8
'Random' T4 (Tuglas)	30.5	2.0	30.0	3.5	25.0	4.5	22.0	1.9

4. Syllables of the second and the third duration in T4 by position

Author	1	2	3	4	5	6	7	8
Kreutzwald	71.6	21.2	67.0	17.0	65.4	9.2	59.4	4.6
Kuhlbars	70.0	10.0	66.8	12.2	65.2	6.2	57.6	9.5
Veske	71.0	14.4	65.4	10.8	65.4	5.4	47.6	3.5
Koidula	65.8	13.4	66.0	23.8	63.2	9.4	51.4	7.1
Reinvald	72.2	11.2	64.4	11.4	61.2	4.0	56.4	4.1
Bergmann	66.6	9.6	68.8	13.6	61.2	2.0	44.2	2.6
Jakob Liiv	71.0	12.2	61.8	15.8	63.2	6.8	42.2	1.6
Tamm	74.0	15.2	68.2	19.2	72.4	6.4	55.0	0.0
Sööt	65.2	11.4	61.2	10.4	62.4	5.2	48.2	5.9
Juhan Liiv	60.8	13.0	61.0	13.4	59.6	5.4	49.6	2.8
Haava	67.6	15.4	62.8	16.4	65.4	6.8	56.8	3.2
Lõo	57.0	7.0	54.7	10.5	53.5	4.7	76.7	0.0
Enno	63.7	12.0	59.2	12.0	62.9	6.4	55.1	2.6
Proletaarlane	69.6	14.8	59.8	20.0	62.2	7.4	51.2	6.0
Under	66.2	19.0	61.8	17.4	60.4	13.2	67.0	5.1
Suits	66.6	13.6	60.8	19.8	62.2	13.4	71.8	8.1
Ridala	69.7	17.6	67.6	16.8	67.9	11.1	68.7	0.7
Visnapuu	68.6	15.6	67.6	17.8	75.6	11.8	88.2	5.6
Alle	63.2	11.4	66.6	12.6	63.8	10.4	69.4	7.2
Heiberg	71.0	12.0	58.0	15.0	60.0	3.0	41.0	6.3
Total	68.0	13.9	64.2	15.6	64.3	7.7	57.7	4.6
‘Random’ T4 (Vilde1)	55.5	13.5	53.5	18.5	50.5	16	44	15.2
‘Random’ T4 (Vilde2)	63.5	14.5	59.0	13.0	56.0	14.5	50.5	10.1
‘Random’ T4 (Tuglas)	60.5	13.5	55.5	17.5	58.5	17	47.5	4.7