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Quantity or Stress? Sequential Analysis of Latin Prosody*

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ABSTRACT

Degrees of linear orderedness of Latin hexameter samples, coded respectively as sequences of long vs. short and stressed vs. unstressed syllables, were compared using the ARIMA method. Formal stochastic process models describing the sequential (metrical and/or rhythmical) text structure were identified and subsequently interpreted in linguistic terms. The average percentage of the original variance explained by the models turned out to be much higher for the stress series than for the series based on quantity coding. Contrary to received opinion, the underlying basis of Latin rhythm was not quantity but dynamic stress placed on the strong parts of consecutive metrical feet.

INTRODUCTION

An overview of a number of encyclopaedias and academic textbooks in linguistics indicates that the most frequently quoted example of a language with quantity-based prosody is Latin.[1] This kind of prosody is commonly contrasted with the tonality systems found in Asian languages as well as with dynamic expiratory stress, typical of most of the Indo-European languages. The function of quantity in Latin becomes prominent especially in those texts that comply with specifically Latin norms of versification. Acquaintance with Latin versification allows us to represent a text (now inescapably written) as a sequence of metrical feet composed of long and short syllables.

Clear as the picture seems to be, it remains slightly ambiguous. First, one cannot help asking why the vast majority of the Indo-European languages (especially the Romance languages derived from Latin) exhibit stress in the

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[1]Cf. D. Crystal's remark in *The Cambridge Encyclopedia of Language*: 'By contrast, the length of a syllable (whether long or short) was a crucial feature of rhythm in Latin' (Crystal, 1997, p. 171).

absence of quantity.[2] Second, it is also difficult to accept the hypothesis that the prominent role played by stress in Vulgar Latin resulted exclusively from foreign influences or language degeneration, and had no foundation in some intrinsic features of Classical Latin. Third, it is noteworthy that for many centuries, in speech as well as writing, Latin was the supranational lingua franca of the cultural elite, functioning in peculiar symbiosis with the ethnic languages of modern Europe, which did not have quantity-based prosody. From a historical perspective, it is important to remember that during the first two centuries of the Christian era some provincial authors already failed to use quantity correctly and systematically, and from the third century on, quantity ceased completely to be perceived by Latin writers. Instead, dynamic stress became the only dominant factor in Latin pronunciation (Myśliwiec 1959, p. 141). Although more than a dozen of the subsequent centuries continued to witness a substantial number of poems being composed in accordance with the principles of ancient meter theory (many of which could be seen as genuinely excellent pieces), quantity as the basis of classical versification was at worst foreign to most Europeans who spoke Virgil's language, and at best unnatural and artificially acquired through conscious learning. Students of the phonetic development of preclassical Latin have noted that vowels in certain positions did not undergo any modification, which can be taken to indicate that they were dynamically stressed. As J. Safarewicz argues,

> Ten znany nam akcent łaciński uwzględniał, jak widać, dwa czynniki: miejsce w wyrazie (padał na sylabę przedostatnią albo trzecią od końca) i iloczas sylab (bo wybór sylaby drugiej czy trzeciej od końca zależał od iloczasu sylaby przedostatniej)'. (Safarewicz 1988, p. 521).[3]

The fact that classical Latin did not depend on word stress but only on the length of syllables is usually explained as a consequence of Latin's return at some stage to tonality (*ibid.*). Our practical reason for undertaking research on this topic is that meter is essentially a sequential phenomenon. As any metrical

[2]The opposition of long vs. short sounds is found in some of the Indo-European languages, where it can even be phonological. Still, the universality of dynamic stress in modern languages as well as its heavy functional load relegate quantity to a secondary status, at least within the Indo-European language family.

[3] The Latin stress as we know it was based on two factors: a syllable's position within a word (stress was placed either on the penultimate or propenultimate syllable) and syllable quantity (because the choice of the syllable to be stressed depended on the quantity of the penultimate syllable)' (transl. A.P. & M.E.).

text is neatly segmented into discrete units, such as syllables or feet, meter lends itself easily to quantitative analysis. At the same time, one must not forget that coding ancient prosody provides us merely with a feasible reconstruction, leaving room for inevitable uncertainty in the interpretation of results obtained in the process.

PROSODY AND METER IN LATIN: PREVIOUS RESEARCH

Quantity-based prosody along with all varieties of meter made their way into Latin directly from Greek poetry. Before 240 BCE, the date held to have marked the beginning of Roman literature, numerous written texts had probably been composed that followed the native Italic meter called Saturnian verse (*versus Saturnius*). Scholars disagree about the nature of the indigenous Italic verse: some believe that it was accentuation-based, while others see quantity as the key factor (Leo, 1905). After 240 BCE poetry became dominated exclusively by quantity-based versification. It consisted in a fixed sequential arrangement of long and short syllables, which made up metrical feet. Foot boundaries did not necessarily coincide with word boundaries or boundaries of rhythmical groups, and the discrepancy between the two orders has often been emphasized.[4]

Some types of verse (Aeolic metres, *versus Asclepiadeus minor*, *metrum Hipponecteum* and others) display a fixed number of syllables per line. Other varieties, such as iambic trimeter or dactylic hexameter, allow some flexibility in foot substitution provided that the overall duration of the foot remains unchanged. A dactyl (– U U) may be replaced by a spondee (– –), an iamb (U –) may be substituted for with a tribrach (U U U), etc. In hexameter as analyzed below the classical sequence of six dactyls (the length of a verse's last syllable being in free variation):

sive vetebat, an hoc inhonest(um) et inutile factu (Hor. *Serm.* I 4,124)
– U U |– U U |– U U |– U U |– U U |– U

It may even be replaced, if infrequently, by a series of six spondees:

olli respondit rex Albani Longani (Enn. *Ann.* 169)
– – | – – | – – | – – | – – | – –.

[4]In meters based on long feet the caesura (*caesura*, τομή) constitutes an intonational pause in the middle of a foot.

On the whole, there are 32 possible realizations of a hexametric line, for instance

turba sonans praedam pedibus circumvolat uncis (Verg. *Aen.* III 233)
– ∪ ∪ | – – | – ∪ ∪ | – – | – ∪ ∪ | – – .

A separate problem to be discussed is dynamic stress. Most scholars agree that verse rhythm cannot be exhaustively described in terms of a single parameter, such as the opposition of long and short syllables, for example.[5] It was the ancient analysts of meter who first provided a rationale for such a judgement by distinguishing two elements within a foot: a strong part (ϑέσις) and a weak part (ἄρσις). The terms were originally used with reference to dancing movements. *Thesis* meant a dancer's putting his foot down to the ground (the stronger part), whereas *arsis* designated his lifting it up (the weaker part).[6] What exactly the ancient evidence reveals about dynamic stress and how it should be interpreted, however, is now the subject of considerable controversy. On the one hand, some scholars contend it is incorrect to equate the strong part of a foot with dynamic stress. They have two basic reasons for dismissing the hypothesis. First, quantity-based Indic poetry did not have dynamic accent, only word-stress, and Greek hexameter, which served as a model for its Latin counterpart, was itself an adaptation of a foreign pattern, possibly one of Indic origin (Nagy 1974). Second, musical rhythm may be produced with instruments lacking the capacity for dynamic stress, such as the organs. In order to explain the nature of ancient poetic rhythm, proponents of the view just summarized give up the binary opposition of long versus short syllables, postulating instead several possible values of the syllable length parameter, e.g., six (Postal 1968) or seven (West 1970).

Proponents of the dynamic stress hypothesis, on the other hand, introduce the notion of *ictus*, or *metrical stress*, which they claim is different from word stress and falls invariably on the strong part of a foot (*arsis*). To support the idea of ictus, the scholars offer a number of arguments: (i) If it were not for ictus, an extended metrical series composed only of short or long syllables, e.g. spondeic hexameter – – | – – | – – | – – | – – | – –, would be entirely non-rhythmical as opposed to the same series with metrical stress: –́ – | –́ – | –́ – | –́ – | –́ – | –́ –. (ii) Some resolutions and contractions of particular feet would be distinguishable from each other only in terms of the placement of ictus; otherwise an anapest (∪ ∪ –́) resolved into a dactyl (– ∪́ ∪) would be the same as a dactyl proper (–́ ∪ ∪). (iii) In Homer's poetry, lengthening occurs much more often in the *arsis* than it does in the *thesis*, which is indirect evidence for the historical reality of ictus. (iv) It is difficult to imagine an ictus-free song of the kind that was traditionally bound up with dancing.

[5]'Without the moulding power of rhythmic movement a purely quantitative rhythm cannot be sustained in language' (Hendrickson, 1899, p. 209).

[6]The Roman theoreticians reversed the meanings of these terms, so that now *arsis* refers to the strong part of a metrical foot, and *thesis* to the weak.

It has to be emphasized, however, that metrical accent does not correspond with paroxytonic or proparoxytonic word stress (tonal or dynamic). The difference between the two types of accentuation is purposefully highlighted in several meters. For example, hexameter tends to keep metrical accent and word stress separate in the initial section of the verse (roughly up to the major caesura), while in the final part both kinds of stress usually coincide.

absentes pro se ‖ memori rogat ore salutent (Ov. *Met.* VI 508)[7]

Although neither ancient theoreticians nor later scholars provide overwhelmingly unambiguous evidence for ictus, proponents of metrical stress have persuasively argued to show that there really was such a thing. Their line of reasoning gets additional strength from the fact that all versification forms in European languages, including vulgar Latin, operate on some kind of dynamic stress.

HYPOTHESIS

Based on the arguments given above, we assumed that, in classical Latin, text rhythm could be determined by both quantity and metrical stress (identical with ictus). Subsequently, we wanted to find out what the relationship was between these two kinds of linear arrangement. Given the universality and cultural versatility of quantity-based versification as well as the predominant scholarly opinion on the subject, one would expect sequences of syllables coded for vowel length to show a high degree of orderedness (especially in artistic texts from the classical period). On the other hand, the evidence cited above would suggest that accentuation contributed rather significantly to text rhythm. Arguing from these premises, the most plausible hypothesis we can

[7]Bold print indicates metrical stress (*ictus*); underscore indicates word stress.

advance is that both sequential orders, founded on syllable length and stress, respectively, play a part in determining text rhythm, the role of quantity being more prominent.

CORPUS AND QUANTIFICATION PROCEDURES

To verify the advanced hypothesis, we coded several samples of Latin hexameter by different authors (Horace—20, Ovid—10, Virgil—20).[8] The average sample length was 150 syllables. Our choice of textual material is justified by the contents of the hypothesis to be tested. In spite of its limitations, hexameter leaves the writer some space for variation in shaping the rhythmical structure of verse. Consequently, the rhythmical structure of hexameter is neither fully predictable (as opposed to syllabic verse with a fixed distribution of stresses), nor completely devoid of any formal determinants of rhythm (as opposed to ordinary prose).

The purpose of quantifying the samples was to produce two corresponding sequences for each: a quantity-based sequence and a stress-based sequence. Using a numeral scale of the ordinal kind, we assigned value 1 to marked syllables (i.e., long or stressed, respectively) and value 0 to unmarked syllables (i.e., short or unstressed, respectively). Previous research has shown binary coding of this sort to be very effective in the sequential analysis of prosodic and metrical phenomena in Hebrew (Azar & Kedem, 1979) and English (Bratley & Ross, 1981). Sequential analyses of Polish (Pawłowski 1997, 1999) and Russian samples (Pawłowski 2000), based in like manner on the binary coding of stress, have proved very felicitous as well.

The method of quantification is exemplified by the treatment of the following distich (Verg. *Aen.* III 236–237):

haud secus ac iussi faciunt tectosque per herbam
disponunt ensis et scuta latentia condunt.

which can be represented as a sequence of metrical feet:[9]

d s d s d c
s s s d d s

[8]A detailed list of the texts under analysis is included in the appendix. It was not within the scope of our study to examine the samples for possible differences depending on authorship or interconnections between particular texts.
[9]Notations: d – dactyl, s – spondee, c – catalectic dactyl.

or long and short syllables:

– ∪ ∪ – – – ∪ ∪ – – – ∪ ∪ – ∪
– – – – – – – ∪ ∪ – ∪ ∪ – –

or else stressed and unstressed syllables:

/ ∪ ∪ / – / ∪ ∪ / – / ∪ ∪ / ∪
/ – / – / – / ∪ ∪ / ∪ ∪ / –

RESEARCH METHOD

Given two samples {ABABABABAB...} and {BAAABAABBB...}, where A and B represent any relevant linguistic units, it would seem that in both samples elements A and B have the same positional parameters (e.g., frequency) and statistical distribution. From the linguistic point of view, however, both 'messages' are unquestionably different. A reliable description which takes into account, as a relevant feature, the order of units is feasible only with the help of sequential characteristics, such as the autocorrelation function (ACF), frequency spectrum, model of the underlying stochastic process, matrix of transition or conditional entropy. It should be stressed here that quantitative methods of sequential data analysis, both numerical (ARIMA) and probabilistic (Markovian and information theory models) allow us to describe any series of units, irrespective of their linguistic nature and/or method of coding (numeric or symbolic).

In the present study, discrete time-series, generated from Latin texts and representing sequences of long vs. short and accentuated vs. non-accentuated syllables, are treated by means of the ARIMA method in the time domain.[10] The choice of the ARIMA method was determined by its efficiency in the analysis of discrete linguistic longitudinal data, as well as its efficiency in other branches of the human sciences.[11] It produced very good results in the

[10]The ARIMA method was described in detail in our earlier studies (Pawłowski, 1998) and will not be the subject of exposition here. The original source on the ARIMA method is Box and Jenkins's work (1976). For linguistic applications handbooks are recommended (Glass et al., 1975; Montgomery & Johnson, 1976, 188–240; McCleary & Hay, 1980; Nurius, 1983; Whiteley, 1980; Courtrot & Droesbeke, 1984, p. 67–76; Gottman, 1981; Stier, 1989).
[11]'ARIMA modelling is perhaps the most commonly encountered and widely used of several stochastic process models adapted for use with time-series data.' (Nurius, 1983, p. 222).

analysis of text rhythm, providing evidence of consistent differences in this respect among the so-called *functional styles* of Polish (Pawłowski 1997, 1999), verse types (*ibid.*), and accentual systems (Pawłowski 2000).[12] A practical advantage of ARIMA modelling is that it requires relatively short samples of textual data. The treatment yields simple autoregressive AR(p) or moving-average MA(q) models (where p is the order of the AR process and q is the order of the MA process). The goodness of fit is measured by the percentage of variance in the series under scrutiny explained by the model (V_e). The more deterministic a given series (thus rhythmical and predictable), the greater the percentage of the original variance explained by the model.[13] Empirical evidence (*ibid.*) has proved that V_e is a good descriptive measure of the 'level of orderedness' in a text. For this reason, the models obtained for parallel stress- and quantity-based series are compared with regard to this criterion.

CASE STUDY

The subject of close sequential analysis in our study is an excerpt chosen at random from *The Aeneid* (Verg. *Aen.* III 229–238). In the initial stage of the procedure, which was subsequently applied to the whole corpus, the sample was segmented into metrical feet, each syllable (or vowel) being assigned length and/or stress values according to the principles already outlined.

Rurs(um) in secessu longo sub rupe cavata,
–́ – | –́ – | –́ || – | –́ – | –́ ∪ ∪ | –́ –
arboribus clausi circ(um) atqu(e) horrentibus umbris,
–́ ∪ ∪ | –́ – | –́ || – | –́ – | –́ ∪ ∪ | –́ –
instruimus mensas arisque reponimus ignem:
–́ ∪ ∪ | –́ – | –́ || – | –́ ∪ ∪ | –́ ∪ ∪ | –́ ∪
rurs(um) ex diverso caeli caecisque latebris
–́ – | –́ – | –́ || – | –́ – | –́ ∪ ∪ –́ –
turba sonans praedam pedibus circumvolat uncis,
–́ ∪ ∪ | –́ – | –́ || ∪ ∪ | –́ – | –́ ∪ ∪ | –́ –
polluit ore dapes. Sociis tunc, arma capessant,
–́ ∪ ∪ | –́ ∪ ∪ | –́ || ∪ ∪ | –́ – | –́ ∪ ∪ | –́ –

[12]The distinction is between languages with fixed stress and those with free accentuation.
[13]Cf. Pawłowski, 1998, p. 47.

edic(o), et dira bellum cum gente gerendum.
–́ – | –́ – | –́ || – | –́ – | –́ ∪ ∪ | –́ ∪
haud secus ac iussi faciunt tectosque per harbam
–́ ∪ ∪ | –́ – | –́ || ∪ ∪ | –́ – | –́ ∪ ∪ | –́ ∪
disponunt ensis et scuta latentia condunt.
–́ – | –́ – | –́ || – | –́ ∪ ∪ | –́ ∪ ∪ | –́ –
erg(o) ubi delapsae sonitum per curva dedere
–́ ∪ ∪ | –́ – | –́ || ∪ ∪ | –́ – | –́ ∪ ∪ | –́ ∪

Translated into quantity and stress values, the sequence has the following form:

The two binary time-series thus obtained were further analysed using the ARIMA method. Figures 1 and 3 show the respective functions of ACF and partial autocorrelation (PACF) for the quantity series, while Figures 2 and 4 present the same functions for the series based on stress coding.

Contrary to expectation, ACF and PACF for the two series suggest that it is the stress sequence, not the quantity one, that generates the most conspicuous rhythmical effect. In the stress sequence, the ACF value for lag 1 is very high: $r_1 = -0.71$ (statistically significant are the values outside the interval $\{-0.084;0.084\}$). The subsequent values of r_i have the form of a dying-out sinusoid. In the quantity sequence, the height of the bars looks more random. Although some of the ACF and PACF values for this series are statistically significant (for lags 1, 2, and 5), they are still much lower than the autocorrelations obtained for the stress series. In addition, no clear pattern of regularity seems to emerge from the data on Figure 3.

Table 1.

Quantity	Metrical stress
1111111110011	1010101010010
10011111110011	10010101010010
100111110010010	100101010010010
1111111110011	1010101010010
100111001110011	100101001010010
1001001001110011	1001001001010010
1111111110010	1010101010010
100111001110010	100101001010010
11111110010011	10101010010010
100111001110010	100101001010010

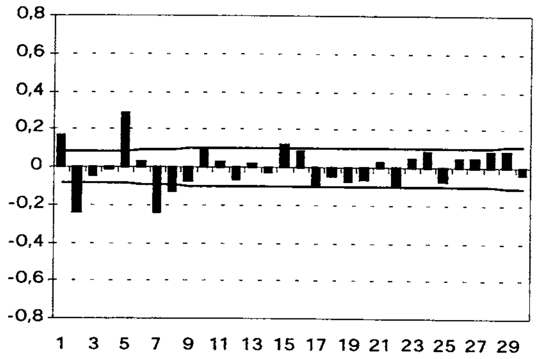

Fig. 1. ACF for the quantity series.

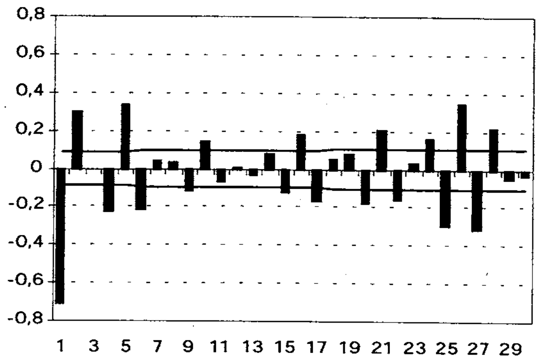

Fig. 2. ACF for the stress series.

The selection of an estimated model is influenced by the functions of ordinary partial autocorrelation. If we assume that the process is going to be of the simple type (AR or MA), not of the mixed kind (ARMA or SARMA), we can use the chart in Table 2 (Gottman 1984, p. 142).

It goes without saying that only seldom do real-life processes fully correspond to the idealized schema, the researcher often having to make intuitive decisions which are at least partly arbitrary. In this particular case, we decided to accept AR(5) or MA(2) as the most probable models for the

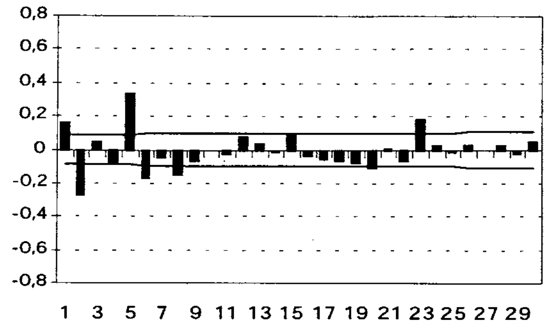

Fig. 3. PACF for the quantity series.

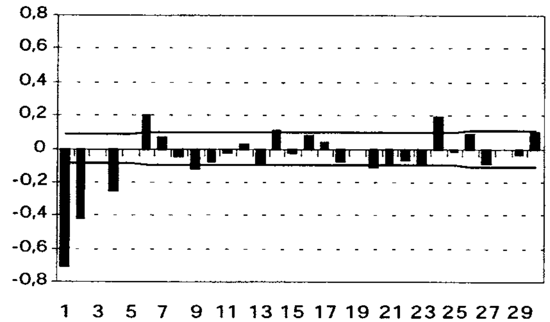

Fig. 4. PACF for the stress series.

Table 2.

	ACF	PACF
AR(p)	Dies out	Stops at lag p
MA(q)	Stops at lag p	Dies out

quantity sequence, and AR(2) or AR(4) for the stress sequence. As we have already claimed, the criterion of fit is the percentage of the original variance explained by the model (V_e). Table 3 contains percentage statistics on the extent to which the models adopted in our study match the data.

Table 3.

Quantity		Metrical stress	
AR(5)	MA(2)	AR(2)	AR(4)
19%	15%	58%	61%

The results for V_e corroborate our earlier conjectures. Although the quantity series does contain a deterministic component, it is only responsible for less than 20% of the total variance exhibited by the time series under analysis. Consequently, the quantity sequence is hardly predictable. A markedly different result is obtained when we analyse the stress sequence, whereby the adopted stochastic process models account for as much as 60% of series variance. It follows from this observation that, statistically considered, the stress sequence is more rhythmical and more predictable than the quantity sequence. Besides the percentage of the variance explained, model selection is also influenced by considerations of simplicity, or the number of parameters involved in the analysis. In general, a simpler model will usually be thought more parsimonious than a more complicated one and therefore superior to it. Guided by the principle of simplicity, we accepted as optimal the following models: MA(2) for the quantity sequence, and AR(2) for the stress sequence. The moving-average model for the quantity sequence could be defined as in formula (1):

$$x_t = e_t + 0{,}344e_{t-1} - 0{,}367e_{t-2} \quad (1)$$

where x_t—series value at moment or position t; e_t—value of normally distributed noise N(0,1) at moment or position t; while the autoregression model for the stress sequence could be represented as in formula (2):

$$x_t = -x_{t-1} + 0{,}416x_{t-2} + e_t \quad (2)$$

where x_t—series value at moment or position t; e_t—value of normally distributed noise N(0,1) at moment or position t.

It is noteworthy how profoundly different the two stochastic models are from each other despite their being estimated for essentially the same stretch of text. This remarkable difference provides us with further evidence for the claim that quantity- and stress-based rhythmical patterns are in fact unrelated.

The crucial, and arguably most difficult, task in the quantitative analysis of textual data is to convincingly interpret mathematical models in linguistic

terms. The linguistic counterpart of parameter x_{t-1} is of course the syllable feature (0—short or unstressed, 1—long or stressed). The coefficients in the two models (1 and 2) indicate the degree of correlation between the feature of a given element and the features of the preceding elements in the series. Autocorrelation values can be interpreted in like manner. If the coefficient of x_{t-1} approaches -1, for example, the correlation is saliently negative, suggesting that in most cases a stressed syllable will tend to 'force' an unstressed one as the immediately succeeding element in the series, and vice versa. This can be seen in the stress-based model (see equation 2). The seemingly strange ACF for the quantity series (Figure 1), and the salient bar for lag 5 ($r_5 = 0.288$) in particular, indicate a noticeable positive correlation between syllable features at t and $t-5$ in the linear order of text. Taking a closer look at the quantity series will enable us to see multiple-syllable sequences of long syllables divided by two- or one-syllable sequences of short syllables.

If we restrict our analysis to test the hypothesis as outlined above, however, an equally meticulous analysis of the particular samples will turn out to be unnecessary as a means of arriving at generalizations. In that case, we will need a more comprehensive parameter to capture the phenomenon of text rhythm. As stated above, the percentage of the original variance explained by the model (V_e) meets this condition for possible criteria. The parameter in question shows the degree of sequential orderedness characteristic of a given time-series under analysis, and in linguistic terms it constitutes a comprehensive measure of text rhythm.[14] The value of V_e can be computed for any series, which clearly means that it is not dependent on the kind of textual input fed into the algorithm. A practical gain from using this method is that it enables the researcher to compare literally any two samples, irrespective of their language, style (verse or prose) or length. It was precisely the use of V_e that made it possible for us to falsify our initial hypothesis.

SUMMARY RESULTS

In analysing the samples, we found it rather difficult to identify a single distinctively recurring pattern of autocorrelation. For this reason, it seemed rational to us to compute the average ACF values for lags 1–5 for all the samples under analysis. Although no exactly determined confidence intervals

[14]On no account should 'the degree of orderedness' be automatically interpreted in aesthetic or axiological terms. In the present context 'orderedness' is merely a typological category.

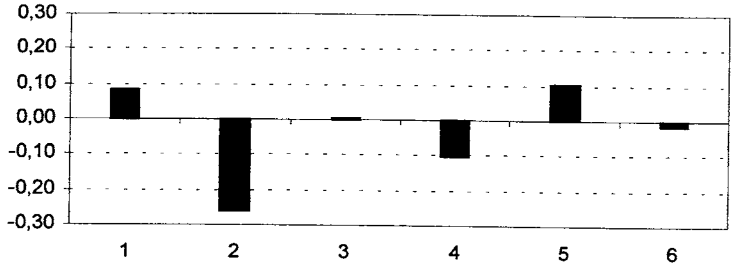

Fig. 5. Average ACF for the quantity sequence.

emerge from the computation, one can note that only r_2 is statistically significant, while the other values either verge on non-significance (lags 1, 4, 5) or simply equals zero (lags 3 and 6). This implies a relatively minor degree of linear arrangement of long and short syllables in classical hexameter. An analogous autocorrelation graph for the stress series proved unnecessary. The model presented in the previous chapter, indicating a strong negative correlation for consecutive syllables, recurred with remarkable regularity in all the samples.

A more accurate verification of the hypothesis that hexametric rhythm is generated by both quantity and stress, however, was made possible by comparing the average values of the comprehensive parameter V_e for each sequence (as stated above, V_e constituted a numerical measure of a text's sequential orderedness). The results we obtained have failed to corroborate the initial hypothesis, which predicted that the respective degrees of rhythmical order generated by the quantity and stress sequences should be rather high and mutually comparable. The value of V_e averaged 15% for quantity sequences, and 61% for sequences based on dynamic stress. Contrary to widespread opinion, it is not the length of syllables but the regularity of stress in consecutive metrical feet that produces the rhythmical fabric of hexameter. In more general terms, it may be claimed that, recited with metrical stress, Latin texts will tend to sound more rhythmical than is the case when only quantity or both quantity and metrical stress play a role in oral performance.

DISCUSSION

It has been shown that, in the case of Latin hexameter, quantity didn't directly underlie text rhythm because, as for the linear arrangement of text, long and

short syllables correlated too poorly within the sequence. If we still wanted to defend quantity's decisive contribution to text rhythm, it could only be by dispensing with our original definition of rhythm altogether. The fact that our finding stands in certain contradiction to a time-honoured theory calls for serious reflection and careful interpretation. The phrase 'certain contradiction' is not a mere euphemism here. It is surely undeniable that classical Latin versification was based on the principle of quantity, the phenomenon of metrical stress being recognised as a factor in its own right. But on the other hand, the glaring disproportion between the V_e values for quantity and stress is a hard, empirical fact and, as such, cannot be simply ignored.

Our conjecture is that, in the case of classical Latin, quantity was a superstructural form, a cultural addition, as it were, that no doubt organised Latin versification and was related to the musical context of performance, peculiar to certain texts.[15] However, the sequential structure based on quantity apparently failed to overlap with the natural rhythmical patterns that facilitate the generation, understanding, and memorisation of texts under any communicational circumstances.[16] Such rhythmical patterns, described by means of formal models, have been shown to function effectively in the prosody of modern languages (cf. Dreher et al., 1969; Pawłowski, 1997, 1999, 2000), and much evidence supports the claim that they may well be a universal property of natural language. Disruptive as our conclusion seems to previous accounts of the subject, it presents Latin intractably as no exception to this general rule.

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[15]In the course of reciting a text, the performer would signal the strong part of a metrical foot (*thesis* or *arsis*) by pounding his foot against the ground or producing extra sounds with a musical instrument.

[16]Rhythm is one of the mechanisms often used in mnemonic techniques.

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APPENDIX

Hor. *Serm.* I 3, 66–75; I 4, 115–124; I 9, 63–72; I 10, 41–50; II 3, 176–185; II 4, 4–13; II 5, 28–37; II 7, 108–117; II 8, 71–80; Hor. *Epist.* I 1, 53–62; I 7, 1–10; I 11, 19–28; I 13, 10–19; I 16, 24–33; I 20, 4–13; II 1, 199–208; Hor. *Ars* 60–69; 147–156; 220–229; 351–360; Verg. *Aen.* I 419–428; III 229–238; IV 634–643; V 72–81; VI 585–594; VII 770–779; IX 88–97; X 668–677; XI 764–773; XII 233–242; Verg. *Georg.* I 84–93; I 328–337; II 184–193; III 16–25; III 414–423; IV 206–215; Verg. *Ecl.* I 59–68; IV 11–20; VII 57–66; IX 32–41; Ov. *Met.* I 454–463; II 52–61; III 583–592; IV 742–751; V 228–237; VI 503–512; VII 147–156; VIII 713–722; IX 370–379; X 702–711.