

'Cursus in clausula', an Online Analysis Tool of Latin Prose

Linda Spinazzè
Dept. of Humanistic Studies
University of Udine
Via Petracco 8
Udine, Italy
linda.spinazze@gmail.com

ABSTRACT

The analysis of *cursus* in a Latin text could be a crucial aspect of textual criticism and it could be helpful in solving attribution problems or authorship questions. The perception of this 'suprasegmental' [1] stylistic element is quite challenging, especially in the case of prosodic *cursus* or *cursus mixtus*, as the ability to differentiate between short and long syllables is lost by contemporary reader likewise it is still sort of mystery the way reading in ancient time took place, where the reading aloud was the main and more common manner to read. In order to study this rhetorical device it is necessary firstly to distinguish the ending sentences in a metrical and/or accentual classification and then to apply quantitative methods (internal/external comparison). A rigorous system for evaluating the definable cadences in the closes of periods of a certain author is important in order to understand if this particular feature is a stylistic conscious choice of the writer. This paper provides an in-depth description of the online tool '*Cursus in Clausula*'. The instrument aims to help the Latinist both with the phase of collecting *clausolae* and with statistical analysis.

Categories and Subject Descriptors

D.2.4 [Software Engineering]: Software Design/Statistical Methods - Text Analysis/Stylometrics.

Keywords

Latin prose rhythm, Cursus, Quantitative textual data analysis, Tool online.

1. INTRODUCTION

Cursus in clausola is an online tool designed for the analysis of rhythm in Latin prose, thought as an instrument to scientist who perform quantitative studies of the *clausulae* applying statistical analysis for data interpretation.

Generally, every text – declaimed or simply read aloud – has a particular rhythm. However, during Classical Antiquity,

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specifically in Rhetoric the word "rhythm" (ῥυθμός for ancient Greek, *numerus* for Latin, then *cursus* or *appositio* for medieval authors) means a technique used to achieve certain some rhythmical cadences inside a text; the phenomenon is considered particularly important for sentence closings. In Latin language, from the classical era to the Middle Ages the doctrine of *numerus*, originally based on the quantity of syllables, has evolved, and during the late antiquity the accent as well as quantity became a determining factor in clausular patterns. In fact as the perception of short and long syllables distinction (linguistic factor) was getting weakening, the traditional quantitative closings coincided always more with accentual patterns. Thus, during the XI century the prose rhythm, having already become something different from *numerus*, was catalogued in a 'canon', called *cursus* and based solely on accent, before inside the papal chancellor's office, then among the schools of various *magistri* like for example Boncompagno da Signa.

2. FROM NUMERUS TO CURSUS

The perception of a stylistic ornament as the rhythm is particularly difficult especially if it is applied to a language that marks the quantity of syllables [2, 163-4]. Latin is known to have ten vowels, five short and five long ones, and that there are some rules to recognize the length of a syllable depending on the nature or the position but, as a matter of fact nobody could imagine how the words were articulated. The Di Capua studies, in the 30s ([3], [4]), and then later other scholars illustrated that during classical era the reading aloud (*clare legere*) was the habit in almost all situations. Even if the recent works on reading in the past demonstrate the fact that the ancients could read silently (*tacite legere*), Johnson [5] underlines that the reading in antiquity (its work is dedicated to the high Roman empire period) has to be seen as sociocultural system.¹ and for this reason any reader had certain essential «masteries of language and style: words, phrases, even rhythms» [5, 201]. Given that Latin prose was deeply influenced by rhetorical elements strictly dependent on oral rendering, it is strongly recommended to consider the study of rhythm in textual analysis. Regarding the fact that nowadays for the ear it is impossible discern immediately and appreciate this stylistic feature, it is essential to focus on outlines of rhythmic cadence patterns. First of all it has to be understood what is considered a rhythmical pattern in various contexts (prosodic or accentual).

¹ [5, 203]: «Reading, by this analysis, is deeply embedded within the community itself».

2.1 Classic Latin: the metrical *clausulae*

Clausula is the definition given by Roman rhetoricians at the rhythmical closing of a sentence: for the doctrine of the *bonus orator* the *clausulae* have to respect some quantitative patterns of long and short syllables and varying levels of pauses. Among the Ancient Latin writers, the stylistic ornament of ‘*clausulae numerosae*’ was generally explained and discussed by more authors: Ciceron, Quintilian, Gellius, Martianus Capella;² nevertheless it is difficult to mark out a doctrine of *numerus* as the theorists themselves do not always use the favoured and defended *clausulae*.³ Thanks to specific studies about Ciceron’s rhythm it is widely known that he used a very large and adaptable system of rhythm whereas many later writers isolated only some forms as typifying Ciceronian style. Among these Ciceronian patterns stand out these four cadences:

- Cretic-spondee (cretic-trochee): +++ +* (esse credebant);
- Dcretic: ++ +-* (esse credemini);
- Paeon-trochee: +---+* (esse videatur);
- Trochee-cretic: +-+ -* (esse debuit).

Here for scanning the metrical endings, the conventional signs are used, employed in the web-resource as well: the symbol + denotes a syllable with long quantity, instead the sign - stands for a short syllable; the asterisk indicates an *indifferens* syllable (the final syllable can be always considered an *anceps*). Thanks to modern studies on the prose rhythm in classical Latin, today one could observe that different authors in various genres prefer using some patterns very far from the Ciceronian suggestions [8]. Thus, there is neither cohesive and coherent picture of theory about prose rhythm, nor the practice of ‘*structurae numerosae*’ strictly regulated and applied. As Quintilian wrote in IX liber of *Institutiones*:

Ratio vero pedum in oratione est multo quam in versu difficilior [IX, 4, 60].⁴

2.2 The canon of Middle Age: *cursus*

In term of definition, for the Ancient authors the word *cursus* meant the flow of speech (see *supra* Quintilian), but for the modern scholars the principal meaning of the term is the one acquired in the Middle Ages when *cursus* became a synonym for *appositio*. The *magister* Boncompagno da Signa wrote in his *Boncompagnus* (1.1.11):

*Appositio que dicitur esse artificiosa dictionum structura, ideo a quibusdam cursus vocatur [...]*⁵

So *cursus* means the purely accentual rhythm consisted of a specified number of unaccented syllables between two word

accents and after the last accent. Four patterns standard constitute the medieval canon of prose rhythm:

- *cursus planus* has two unaccented syllables between the two accents and one after the final accent: ex. *mèntis ostèndat, còrde curràmus* (xooxo or p 3p);
- *cursus tardus* is almost equal to *planus* but it presents two syllables after the last accent: ex. *moderatiòne dispònere* (xooxoo or p 4pp) or *ecclesiè ràpuit* (pp 3pp);
- *cursus velox* is found as four unaccented syllables between the two accents and one after the final accent: ex. *reverèntia collocàbit* (xooooxo or pp 4p) or *sui benignitàte* (xooooxo or p 5p);
- *cursus trispondaicus* is comprised of three unaccented syllables between two stresses and one after the last accent: ex. *immèritus ascèndi* (xoooxo or pp 3p).

Among the conventional methods of noting the *cursus* it is used both a “graphical way” that uses the symbols x (=accented) and o (=unaccented) for indicate every single syllable, either the “Janson system” of notation that explains the pattern of *cursus* based on typologies of words, using p (=paroxytone), pp (=proparoxytone) [9, 13 ss.]. Since XII century, this canon is especially used by *dictatores*, the medieval rhetoricians who worked as chancellor – like, for example, Alberto di Morra (1100-1187) then pope Gregory VII – or the professor of Rhetoric, like Boncompagno da Signa (1165-1240). For the epistolary genre the employing of *cursus* was the rule: Dante Alighieri, for instance, widely used the canonical *clausulae* in his *Epistolae*. And in general the stylistic rhythmic ornament was widely diffused and variously engaged.

2.3 Period of transition: *cursus mixtus*

Writing with stylistic care of the *numerus* was typical of high polished prose; in the mid-third through early fourth centuries the authors began to employ a rhythmical style «that strived for a coincidence between Cicero’s preferred metrical patterns and the stress patterns of the words conveying the meters» [8, 8]. This agreement of metrical and accentual rhythm as the principle rhythmic ornament modality is defined *cursus mixtus* by the modern scholars [10], [11], [8]. An example of *cursus mixtus* is the cretic-spondee: *apòstolo dicunt* (+-+|-), that is also a cadence of *cursus planus* (pp 2p xooxo). Probably the weakening (or progressive loss) of perception of syllables length among the Latin speakers together with the practice learned in rhetorical training were responsible for the success of these metrical and at the same time accentual *clausulae*.⁶ For the Latin authors of the late and early medieval literature, an in-depth analysis of the *clausulae* as quantitative and accentual patterns could offer a strong point in the debate over the continuity or discontinuity (for linguistic and literary settings) between late antiquity and the Middle Ages.

² Even if it is dated, the more complete collection of authors’ citation about the *clausulae* is [6]; see also the works by Oberhelman [e.g. 8].

³ [2, 157]: «It is however important to realize that by no means all the *clausulae* found in Cicero’s serious writings can be called canonical.»; [7, 105 ss.]; [8, 267]: «ancient theory contradicted itself from author to author, from period to period, from language to language.».

⁴ «On the other hand the management of feet is far more difficult in prose than in verse» trans. H.E. Butler, 1920.

⁵ «The *appositio* is said to be the harmonic setting of words, sometimes it is also called *cursus* [...]».

⁶ [9, 35]; [11, 7]: «Provincial teachers must have encountered frequent frustration in attempting to educate their student, who were much more sensitive to stress patterns, in the nuances of clausular meters...Rhetorical teachers must have realized that Ciceronian metrical patterns could be better comprehended and used if word-accented were made to coincide as consistently as possible with the ictus».

2.4 Neolatin: numerus or cursus?

The Italian humanists rejected the practice of medieval *cursus*⁷ and wanted to apply the metrical *clausulae* that they read in rhetorical treatises of Cicero (*Orator* rediscovered in 1421) and Quintilian (complete text of *Institutiones* with IX book found out in 1416). But natural linguistic sensitivity for prosodic rhythm was definitely lost; nevertheless some neo-Latin authors attempted to imitate the ancient clausular rhythms employing in their own prose some of the quantitative rhythms taken from the theories of Cicero or Quintilian. At the end, also for the humanists it was almost impossible to deeply appreciate the prose rhythm, but they aspired to recreate the artistic high Latin prose in all aspects:⁸ it is actually difficult to say which rhythm the humanists had the tendency to use. In fact, at the moment the studies of rhythm in neo-Latin literature ([12], [14], [7], [15], [16]) aren't very widespread, but they could be very helpful in better understanding of humanists method and *modus operandi*.

3. METHODOLOGIES FOR ANALYSING AND EVALUATING THE PROSE RHYTHM

The analysis of the cadences in the closes of periods in a Latin text could be highly important for textual criticism in order to resolve authorship attribution problems, chronological issues etc. Since the Meyer works written at the end of 19th century, it was clear that a 'suprasegmental' [1] stylistic element as prose rhythm had to be described, studied and compared using charts and calculuses.⁹ Thus for correct and efficient usage of the stylistic ornament evidence it is necessary to choose between some rigorous systems for evaluating the phenomenon. In fact there are several modern statistical methods that they can reveal firstly whether a writer favors or dislikes certain rhythmical patterns.¹⁰ Here, only the methods taken into account in the on-line tool *Cursus in clausula* will be summarized.

3.1 Accentual Patterns Internal Comparison: Janson's Method

The system explained by Tore Janson and applied to the study of medieval *cursus* in 1975 is called «internal comparison» [9]. The principle assumption is that any type of clausula has to be considered as random and not chosen by the author.¹¹ This method is founded on the definition of "accentual *clausula*" as a simple pattern of two components that represent the last two words of a clause. For the evaluating of canonic medieval *cursus* it is relevant to know the position of stress on the penultimate and

the accent position with length in syllables of the ultimate word. Considering the Latin accentual laws, the options on the position of the accent are quite restricted: the stress falls on the penultimate syllable (paroxytone word, marked as *p*) or antepenultimate one (proparoxytone word, *pp*); a third possibility is that the word could be monosyllable.¹²

3.1.1 System of notation

The conventional style of notation adopted by Janson [9] for identifying cursus patterns is quite simple and widely used. For the penultimate word it is sufficient to notate the typology of stressed word with a *p* for a paroxytone-stressed word, *pp* for a proparoxytone-stressed one and *l* in case of a monosyllable; for the ultimate element of the clause it is necessary to write the figure for the number of syllables followed by *p* or *pp* to determine the accent. Thus *p 3p* stands for a *cursus planus* (as *corde curramus*, or *mentis ostendat*) where the first word stressed on penultimate syllable is represented by *p* and the second paroxytone-stressed word containing three syllable is denoted by *3p*. Thus, in order to study the *cursus* in a text, it is crucial that every sentence closing should be converted in this type of pattern: thanks to this abstraction it will be possible create a chart with observed frequencies of a certain variety of *cursus* and carry on statistical analysis.

3.1.2 The method of internal comparison

As Oberhelman noted the nature of Latin language is paroxytone ([2, 153], [21, 85-86], [22, 138]), thus the laws of the accentuation are founded on the quantity of the penultimate syllable. The frequency of finding a paroxytone word as a first component of a sentence closing is higher than the occurrence of proparoxytone. Another main statement underlined by Tore Janson is that there isn't such a thing as a «neutral» distribution of cadences with which we could compare supposedly rhythmical authors and directly register their preferences» [9, 18]. For this reason, Janson thought of the internal comparison, applying elementary law of probability to the two elements of accentual pattern and then the Chi Squared test as test of goodness of fit.

3.1.2.1 Computing/statistical procedure.

After counting the observed occurrences (**o**) of each element (**I**= first element, for example *p* or *pp*; **II**= second element, that could be *4p*, or *3pp* etc.), it has been computed the probability for the two components of the *clausulae* (e.g. *pp 4p*) to occur together, applying the formula in order to obtain the expected frequency (**e**) is:

$$e = o(\mathbf{I}) * o(\mathbf{II}) / \text{total of } clausulae$$

This virtual value, **e**, suggests the theoretical frequency asserted by the null hypothesis, in our case if the writer doesn't care about the rhythm.¹³ The further step to evaluating which rhythmical

⁷ Coluccio Salutati (1331-1406) still was compelled to use medieval *cursus* in his official letters, even if his aesthetic sense made him avoid it: see [12, 125-26], [13, 221].

⁸ With regard to the excess of imitation, Erasmus of Rotterdam underlined in his *Dialogus Ciceronianus* (1528) some pointless imitations of ancient style by his peers; *Opera Omnia* 1971, p. 609, ll. 30-33.

⁹ For an exhaustive definition of "suprasegmental" features see [17, 1 ss.].

¹⁰ Among the most interesting and widespread methods are the ones studied by [18] on metrical endings, by [19] on *cursus mixtus*, and by [20] on medieval *cursus*.

¹¹ [9, 12-13]: «[...] we need a method by which it is possible to compare the actually observed frequency of any cadence with the frequency to be expected if the author is indifferent to the use of that cadence.»

¹² The monosyllables, especially in the clausula, entail certain problems as they are usually unstressed and it is necessary to decide whether to consider them stressed, enclitic or proclitic (*consillabatio*); see [12, 27].

¹³ [23, 397]: «the expected frequency of a clausula means how many times the clausula is ever likely to occur in the text under consideration, owing to the general nature of the language and/or to the author's taste for vocabulary and style but without any specific attempt on his part to employ the clausula itself.»

patterns are intentionally placed by writer is computing the Chi Squared value:

$$\chi^2 = (o-e)^2/e$$

Then this value has to be compared in a table of distribution of Chi Squared that collects the critical values for Chi Squared precalculated for the degrees of freedom¹⁴ and level of probability. If our outcome is equal or, even better, is higher than the value that corresponding to 5% (0.005) there is a high probability that certain patterns are nonrandom linguistic choices.

3.1.2.2 Limitations and the “neighbor effect”

It is important to remember that this statistical test is suitable only for large samples (the total amount of observed occurrences should be greater than one hundred) and it presents some limits of application:

- It should be applied to absolute values: never to relative values (for example percentages) and not to dimensions/sizes.
- The results of test imply a lack of precision when the values are too low for theoretical frequency: numbers lower than 5 have to be avoided.
- All errors in computing the degrees of freedom can distort the results.

Last but not least, during the evaluation of test’s results it is important not to forget that the “neighbour effect” could distort some particular outcomes [9, 27-28].

3.2 Quantitative Patterns Internal comparison: Orlandi’s method

Giovanni Orlandi [23] adopted the same *modus operandi* to find out if the tendency of metrical *clausolae* is random or not.¹⁵ A recent study in 2012 [24] compared the older and more complex method developed by Hans Aili with the one settled by Orlandi; the comparison demonstrates complementary advantages of both methods, the Orlandi method in particular better ensures the comparability between metrical and accentual endings. Orlandi system attributes a decisive importance to the word-break or *caesura*, in fact every *clausula* has to be split into its two words-components (the monosyllable has to be considered as proclitic or enclitic particles), «classifying the types of the first according to the quantity of the syllables from the stressed one downwards, and the types of the second in its entirety» [23, 401].

3.2.1 The system of notation

The system of notation used by Orlandi and his followers is canonical one: the symbol $\bar{\quad}$ stands for long syllables and \sim stands for short ones. However in translating the system in an on-line tool for automatic scansion of quantities, we have assumed a different convention (equally intuitive but easier for automatic treatment): the sign + symbolizes the long syllable, the symbol – the short, lastly the star, *, denotes the *indifferens* or not known

quantity of a syllable. So, the more common typologies of *clausolae* will appear as we have seen in §2.1.

4. THE TOOL *CURSUS IN CLAUSULA*: DESCRIPTION

Cursus In Clausula (henceforth called *CiC*), started in 2013 as part of the *Traditio Patrum FIRB project* and it is still under development. The main aim of *CiC* is creating a web-based tool for the automatic analysis of Latin *clausolae*, either quantitative or accentual. Conforming to the project’s specifications, the navigation and the usability of the device have to be considered as a priority, given that the targeted audience for this web tool is the large community of specialists of Latin Literature (from classical to Renaissance) without technical advanced skills. After the challenging design of the user application interface, the crucial point of the entire development is the program for the identification and the scanning of the *clausolae*, written in PHP. The main object in the data structure is the dynamic lemmatized vocabulary of Latin developed by Luigi Tassarolo.

4.1 Vocabulary with quantity of word forms

The database of Latin vocabulary provides a skillful organization of the word roots, theme vowels and case endings connected with about 52,000 lemmas (extracted by a digitalized version of *Oxford Latin Dictionary* revised by Lewis and Short¹⁶). Thanks to this database combined with fit PHP scripts, the program can recognise more than 600,000 word forms, which is almost all the possible forms of nouns, adjectives, verbs and pronouns used in classical Latin. For every word form the software retrieves all different possibilities of metrical scansion. For example, the word “FINIS” could be scanned like the genitive case of the noun *fīnīs*(+), or as *fīnīs*(++), that is the indicative form of verb of IV conjugation *finio*; in another example - the double scanning of form “INDICAT”, that could be both the indicative form of the verb *indīco* of I conjugation – that is *indīcāt*(++-) – either the subjunctive form of the verb of III conjugation *indīco*, namely *indīcāt*(+--). The program also embraces a different syllabic division up of the the semivowel U/V: e.g. “VOLVERIT” stands for *volvērīt*(+--, trisyllable) or *vōlūērīt*(----, quadrisyllable). Medieval graphical variants (for example, for the recognition of diphthongs it is necessary to write “-AE”, the graphical variants “-E” isn’t recognized) and the disparate forms of proper nouns (like in Jerusalem: Hierusalem, Hierosolyma, Ierusalem, Ierosolyma...) remain the main problems for a full coverage of lexicon.

4.2 Analyzing Program

The program for scanning the *clausulae* is designed to examine the *clausolae* of entire text and then to obtain immediately the statistical charts of internal metrical and accentual endings comparison. The full stops, question and exclamation marks are recognized by program as hard break; backwards from them the software considers at least six syllable (and maximum of 8) in order to isolated the *clausular* endings. After listing *clausulae* the program looks for the word form in the vocabulary database for scanning endings metrically and then thanks to Latin accentual

¹⁴ The value of degrees of freedom strictly depends on the number of pairs involved; in our cases, where the expected values are collected in only one column, it is necessary to consider the total of records – 1.

¹⁵ [23, 401]: «...suggesting a way of analyse the frequency of quantitative *clausulae* which is a straightforward application of Janson’s method to this field».

¹⁶ *A Latin Dictionary*, Founded on Andrews’ edition of Freund’s Latin dictionary revised, enlarged, and in great part rewritten by Charlton T. Lewis, Ph.D. and Charles Short, LL.D. Oxford, Clarendon Press, 1879; the digitalized XML version is allowed by *Perseus Project*.

laws they are also converted in the rhythmical pattern (with Janson annotation and graphical way). Once all *clausulae* have been translated in their fitting metrical and accentual patterns, the program calculates, depending on typology, the observed and expected frequencies, the percentages, the Chi Squared organizing all new data in various tables, one on prosody, another on cursus with Janson pattern, the last one on *cursus* with “graphical way”. This operating software part of project is written in PHP; both the database devoted to vocabulary either the one dedicated to the analysis of text use the MySQL. The entire project, the database, programming item and user-interface are developed using the ZEND framework.

4.3 The site: users’ side

The home page of the site *CiC* website, with a short presentation, is accessible at: <http://www.cursusinclausula.eu>. In order to initialize a personal/private space inside the DB of tool, the *CiC* user has to log in. Then the researcher can test the basic functionality of scanning single ending expressions visiting the page “singulariter” where it is possible to type in one or more words for obtaining an immediately outcome with accentual and metrical patterns (Figure 1). As may be seen from the example, the software recognizes double variants, but it harvests the first results to construct metrical patterns. In order to change the outcome so that it matches the semantic meaning, the user can compel the choice of software with a simple mark-up annotation next to the engaged word. In the case of example it could resolve annotating both *finis*, as *finis*(==+--) either ‘*indicat*’, as *indicat*(==+--): as may be seen in Figure 2, not only the metrical pattern is changed, but also the accentual schema.

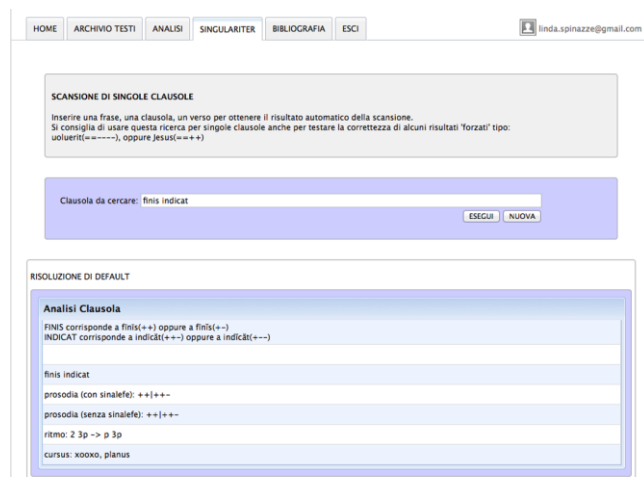


Figure 1. Searching *clausulae*. Page “singulariter”.

Getting acquainted with the *modus operandi* of scanning software, the user could proceed with the main use of the tool and upload a Latin text (not formatted and possibly coding in UTF-8) inside the “archivio testi” page. At the end of uploading the instant output looks like a report with a list of all words in *clausulae* that the program wasn’t able to detect or found with more than one option. The user can check and directly mark up every word that he/she considers important for a reliable result of the further statistical calculations. At this stage the user could also modify the punctuation in order to delete (e.g. a *clausula* that correspond to a biblical quotation) or add *clausulae* (e.g. putting full-stops in place of commas).

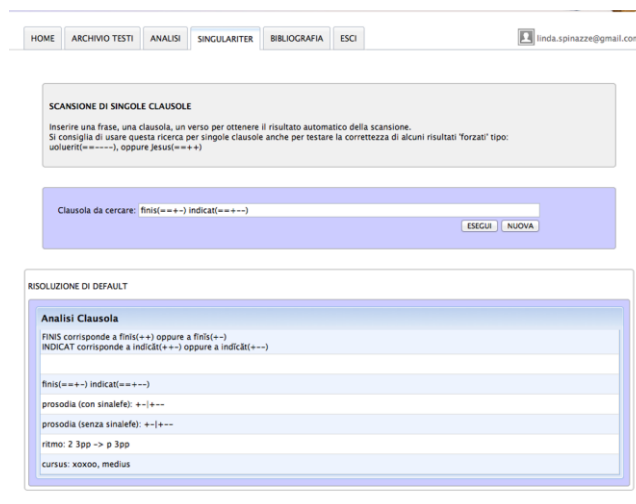


Figure 2. Changing of metrical pattern and accentual schema.

Inside the “analisi” page, the user can select from his/her archived texts the item that he/she wants to analyze, then clicking on the “analizza” label it will possible:

1. to access a general grid that shows all the *clausulae*, clicking on “clausole” button;
2. to consult three different typologies of statistical charts clicking on “analisi statistiche” button.

As can be seen in Figure 3, for every rhythmical (or metrical) pattern it is possible to check the effective endings. All the grids can be ordered according the column criterion (for example the general grid presents by default the endings in order of appearance, but it is possible to sort them according rhythmical or accentual patterns); it is also possible to save a PDF copy of every grid created by tool.

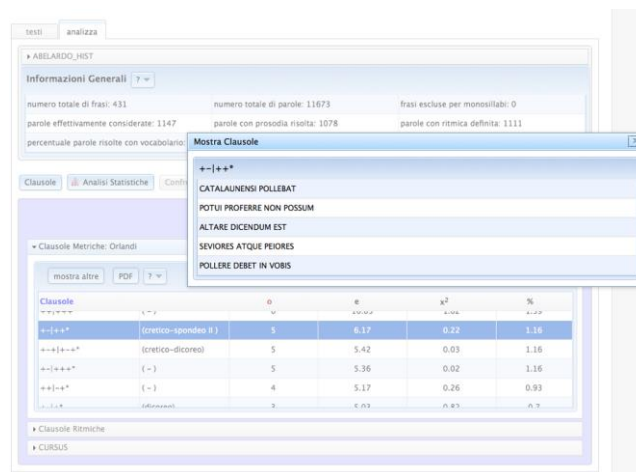


Figure 3. Showing *clausulae*. Endings of patterns.

5. CONCLUSIONS

The web-based tool for analyzing Latin prose, *CiC* is still a work in progress, and this article offers a quick overview of the main objective and principle features already fully developed and put in action. The future desirable elements aim at improvement of report, the refinement of certain options for the patterns creation (according to a different treatment to monosyllable, the case of synalepha etc.) and enlarging the number of opportunities for

comparison between texts or corpora of texts. Obviously an English translation of the site is in the planning stages, too.

Being an ongoing project in a huge research agenda, the CiC is already a part of the network dedicated to Latin, especially with *Pede Certo. Digital Latin Metre* (<http://www.pedecerto.eu/>).

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