Denis Muzerelle

The Scribe's Gesture and its 'Shadow'

An Essay on the 'Modular Ratio' of Scripts

Since it was first introduced by Léon Gilissen in his classic work *L'expertise des écritures médiévales*,[1] the notion of a 'modular ratio' in scripts will have become familiar to most palaeographers—or at least, it should have done. The modular ratio is, as we know, the proportion that characterises an individual letter in a given script, or more broadly speaking, the entire set of characters composing that script: it is the relationship between the width and height of letters, or vice versa. To the Belgian scholar's way of thinking, this parameter ought to represent a 'distinguishing feature' which makes it possible to identify a particular hand among a group composed of several others executing scripts of the same type—in the present case, the various scribes involved in transcribing a lectionary at Lobbes in the 11th century, a task which involved the contributions of no fewer than nineteen individuals. Gilissen's calculation was carried out in a simple enough way: in order to immediately ascertain the average width of the letters forming a given alphabet, he proposed to divide the width of the line by the number of characters written on it.

From the moment of its publication, Gilissen's approach has been the subject of fierce criticism on the part of Ezio Ornato.[2] In essence, Ornato's objections can be condensed into two main points:

– On the one hand, the way of calculating the average width of the characters generates a certain amount of 'noise', owing to the presence of spaces on the lines, punctuation marks, and/or abbreviations to be kept count of in a more or less meticulous way. This 'noise' would be regarded as a negligible epiphenomenon if it did not result in divesting the differences—which are always quite small—of statistical significance.
– On the other hand, it appears that the modular ratio is to a great extent conditioned by the module itself (i.e. the average 'eye' height of the letters), since small scripts tend to be consistently wider than large ones. Ezio Ornato observed a ratio

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1 Gilissen 1973.

2 Ornato 1975 [1997].

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> of 0.727 between these two variables, which suggests a very clear correlation. Now, in order to be able to consider a parameter (whatever it may be) as being specific to a particular writer, it should not depend on any other circumstantial factor, and this in fact is not the case.

One must, however, be careful to avoid throwing out the baby with the bathwater, as it were. All things considered, the arguments we have just set out only call into question the rather clumsy application of a concept which is otherwise valid, and whose relevance becomes apparent as soon as one sets about the task of analysing the complex set of problems that has to be confronted when managing the space on a page. The modular ratio has therefore continued to be observed in different contexts by means of the application of a variety of procedures, all within the general framework of research which, in the wake of Ezio Ornato, has been dedicated to addressing these issues for the last twenty years or so.[3] On the whole, based on the accumulated observations, it would appear that the correlation identified in the case of the *Lobbes Lectionary* is not entirely unique to this context.

We can begin to get an idea of this by studying Graph 1, which shows the distribution of 712 manuscripts described in the French *Catalogue des manuscrits datés* covering the period that stretches from the beginning of the 11th century to the middle of the 13th, with respect to the module and the modular ratio of the script. The graph represents 'raw' data which has not undergone any selection process, and which encompass a very diverse range of book types and writing styles jumbled up in such a way so as to render them indistinguishable from one another (which accounts for the somewhat amorphous appearance of the points cloud). This, however, only lends more weight to the trend which is plain to see: the cloud is far from assuming the globular form that would be generated by pure chance or by factors independent from those which were taken into account. Indeed, it clearly assumes a stretched-out form marked by a gentle and consistent 'dipping' trend. It is therefore incontrovertible that, tendentially, the smaller scripts are, the higher their modular ratio is—in other words, the greater their increase in width.

In addition, it can be stated that this is a phenomenon that affects the writing itself, and not merely the result of various dimensional constraints which exert an effect within the confines of the page. For example, one observes that no correlation of this kind exists between the ruling unit and the modular ratio—even if there is a clear and statistically observable link between the line spacing value and the height of the writing that occupies it (that relationship being, all things considered, relatively complex and still rather under-investigated).

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3 In large part the results of this research can be found collected in [Ornato et al.] 1997.

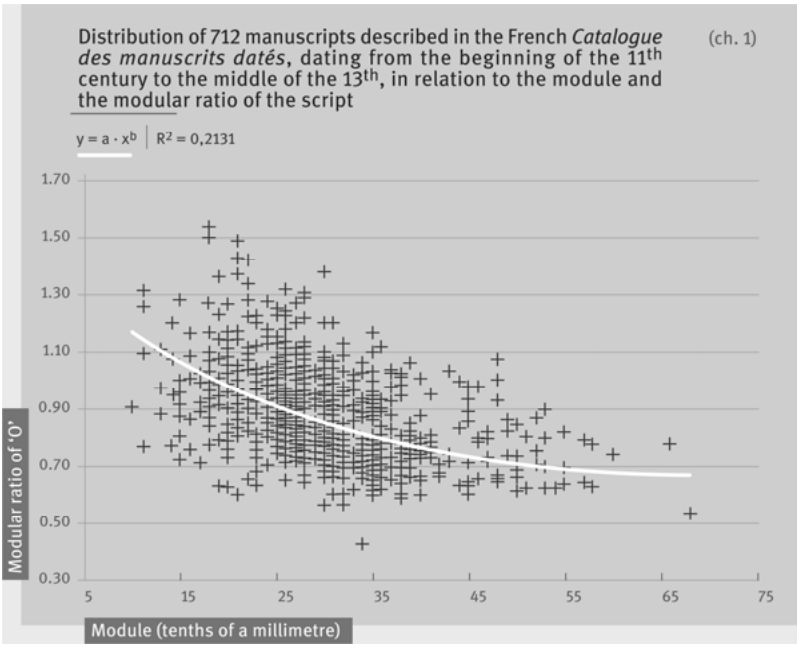

Chart 1: Distribution of 712 manuscripts described in the French *Catalogue des manuscrits datés*, dating from the beginning of the 11th century to the middle of the 13th, in relation to the module and the modular ratio of the script

Up till now, we have had to content ourselves with merely registering this trend, without being able to demonstrate its mechanism. To account for it, we have resorted to rather vague notions, such as a preoccupation with preserving legibility by means of a hypothetical horizontal 'compensation effect' produced by the reduction in script height. These notions should probably not be cast aside, but in any event they would certainly require close analysis.

More recently, the 'Lobbes Syndrome' has taken on particular significance, on the heels of some observations made by Antonella Tomiello during a research project dedicated to juridical manuscripts bearing glosses that frame the main text.[4] Our colleague undertook a comparative study of the palaeographic characteristics of a text (in large script) and its glosses (in small script) written by one and the same hand. With respect to the topic that concerns us here, the results of Tomiello's detailed analysis can be broadly summarised in the following way: the scripts employed for the main text and for the glosses are morphologically identical; they differ in only two ways, namely the frequency with which abbreviations are employed (considerably more often in the glosses), and the proportions of the characters, which are systematically wider in the smaller script.

Therefore, the phenomenon does not simply correspond to a generalised trend: it manifests itself at the level of each individual writer, irrespective of his writing style or personality. All this appears to happen as if the reduction in the height of letters automatically leads to their increased width … and vice versa. In order to simplify our exposition, we have only considered the facts with respect to the former direction. But whether there be reduction or growth, the comparison of the smaller with the larger leads to the same conclusion, regardless of the direction in which the scale is changed. The inversion is therefore immediate.

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Let us now examine a rather simple case—indeed, a grossly simplified one, it could even be said. The case is that of a circle resembling, more or less, the letter **o**, and our aim is to see what happens when one reduces the height of a character (Fig. 1–2, 1).

4 Tomiello 2000.

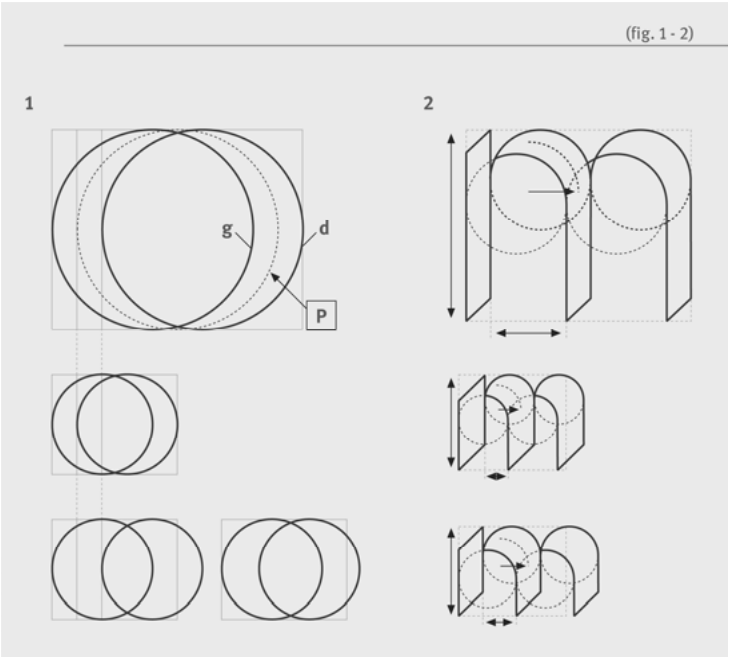

Fig. 1–2: Tracing of letters 'o' and 'm'

Right from the outset, we must make an important observation—it may seem like a trivial one, but its consequences will soon become apparent to us. To simulate our **o**, we must draw two circles (Fig. 1a; g, d), each of which coincides with the path traced by the two extremities of the edge of the pen's nib. Each of the two extremities perfectly reproduces the circular gesture made by the scribe's hand. Strictly speaking, if we wanted to illustrate this, we would have to draw a third circle of equal size positioned precisely midway between the first two circles and corresponding to the axis of the pen's pathway (P). However, we can simplify the representation if we consider that one of the two circles corresponds to the gesture described by the scribe's pen, and the other to the 'shadow' cast by the pen's nib, with a displacement that depends on its breadth. (The displacement depends equally upon the angle formed between the pen and the vertical, but for the sake of clarity we shall ignore for now the impact of this parameter by hypothesising a zero angle.)

The scribe has thereby formed a character of 1:1 proportion; but when the palaeographer (or codicologist) measures the inscribed form, he/she is in fact measuring the sum of the gesture and its 'shadow', and will therefore note a

distinctly wider proportion. Hence it follows that one should think in terms of a 'gestural ratio', as distinct from a 'modular ratio'.

Now that these introductory remarks have been made, we can embark on our investigation by reducing the **o** by half in a way which is very familiar to us: we are all accustomed to using mechanical, optical and electronic means to carry out such reductions (Fig. 1b). In geometric terms, this represents a perfect homothety, which is to say all the dimensions of the original figure have been reduced by half in the resulting figure (given that our rate of reduction in this case is two). The width of the pen's nib—which can be determined by measuring the 'track' it produces—clearly contributes to these dimensions. In other words, to obtain the same result using a real pen, it would be necessary for the width of the pen's nib also to be reduced by half. If the scribe continues to use the same pen and reduces the size of his script by half, he will produce a 'track' whose proportions are noticeably wider than those of the original figure (Fig. 1c).

Naturally, the scribes were not so stupid as to have failed to notice, or at least to have felt the effects of this phenomenon; indeed, it is well known that the smaller writings were generally achieved using more fine-nibbed pens. But the scribe could not be expected to adjust the size of his pen with each change of script size, and even less to carefully adjust each new script's proportions accordingly. It can also be supposed that in order to maintain a certain degree of writing comfort, there was a tendency for the scribe to keep the size of his pen as close as possible to that which best 'fit his hand'. Generally speaking, then, this very imperfect adjustment only partially compensated for the phenomenon, without entirely curbing it. Fig. 1d shows the same **o** reduced by half; it was made using a pen whose breadth was only reduced to three quarters the size of that used to draw the original figure.

The phenomenon we have examined above in the 'simplest case' is purely geometric and does not involve any intervention by an actual implementer. Things change when instead of a figure drawn using a single gesture, one is dealing with a letter formed from multiple elements joined together. There is no better example than the letter **m** (Fig. 1–2, 2), composed of three downstrokes which 'lean' on each other successively, one after the other.

Fig. 2b illustrates what happens when one simply reduces the character's size by half while still using the same sized pen. The modular ratio is affected in the same proportion as before, but the 'track' produced is hardly satisfactory. In fact, if one simply reduces the size of one's pen strokes by half throughout the drawing of the character, a far greater reduction in the gap that separates two successive downstrokes results; and despite the fact that, overall, the letter may have increased in width, it looks as though it has contracted. Clearly, this gap plays a

key role in the reader's perception of the letter and contributes to its 'identity'. The scribe would have had a natural inclination to react against this distortion, so he would have widened the movement of his pen in such as way so as to mitigate the reduction of the space between the legs of the **m** (its 'crotch', so to speak), thereby making it proportionate with the letter's height (Fig. 2c). Ultimately, the increase in the modular ratio that we observed in the case of a simple form (**o**) is seen here multiplied (roughly speaking) by the number of downstrokes.

In order to proceed with our analysis, we must now consider the effect of the 'pen's angle', which up until now we have chosen to ignore. First of all, we should clarify its definition: it is the angle formed between the edge of the pen's nib and the horizontal—or the angle formed between the barrel of the pen and the vertical, if one supposes the pen's nib is cut square. (Most of the time this is probably not the case; however, it is palaeographically and geometrically impossible to determine whether the pen is slanted towards the left or towards the right, and to what extent. One can only work with an 'apparent angle', as if the pen were cut at 90°, without knowing the 'real' angle; but this makes no difference to our demonstration.)

Now let us observe its effect (Fig. 3). In order that the nib of the pen should exert an effect on the horizontal dimension alone (as was the case in the previous examples), it is necessary and sufficient for the edge of the nib to coincide with the horizontal—in other words, that the pen's angle be zero. As soon as the pen shifts from that position to form an angle with the vertical, which we shall call **ζ**, the effect of the pen's width will be divided between the two dimensions, according to a trigonometric function of that angle: the vertical 'gain' is proportional to SIN **ζ**; the horizontal 'gain' to COS **ζ**. As long as **ζ** remains lower than a certain critical value (Fig. 3a), the proportional increase in the width remains higher than the proportional increase in height. Taking into account these factors, we remain in the province of the phenomenon that we have just studied. On the other hand, beyond this limit the height proportionally increases more than the width (Fig. 3c), causing the opposite effect, so the modular ratio decreases in comparison the gestural ratio. When a balance is achieved between these two tendencies (Fig. 3b), the modular ratio remains precisely the same as the gestural ratio, regardless of the width of the pen's nib: this is what we call the 'homothetic angle' of the track (i.e. the mark left by the nib of the pen).

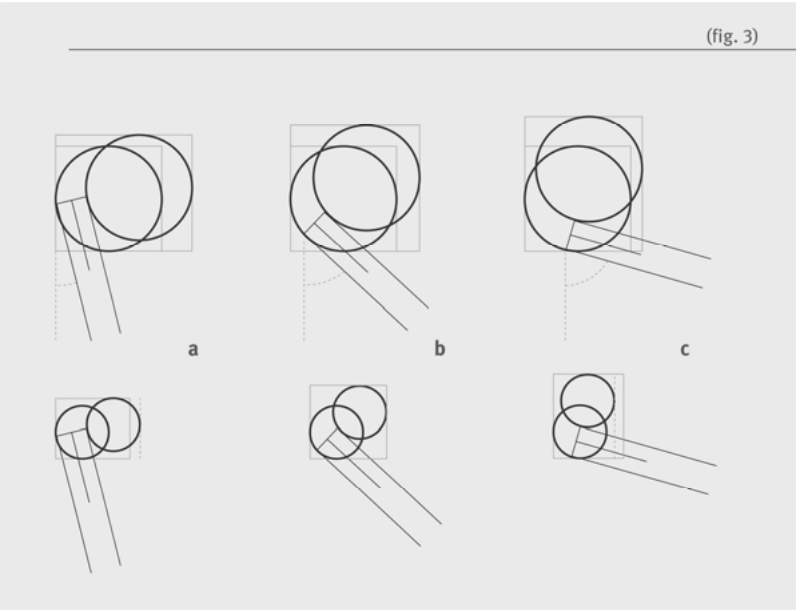

Fig. 3: Effect of the pen's angle on the tracing of letter 'o'

To confirm the hypothesis according to which the increase in the modular ratio is induced by the horizontal impact of the nib's width, we must determine the aforementioned critical value and verify that it is normally the first case which applies, rather than the second. Now, the said value is not fixed; indeed, it depends on the letter concerned—the gesture or actual written letter, since both are of the same proportions—and corresponds to the position in which the edge of the pen is orientated with the diagonal of the rectangle where the letter is inscribed. If one names the height of this rectangle **h** (hauteur), and its width **l** (largeur), the homothetic angle can be calculated through $\boldsymbol{\zeta} = \mathrm{tg}^{-1}(\mathbf{h}/\mathbf{l})$. Tab. 1 and Fig. 4 present some values of $\boldsymbol{\zeta}$ (purely as examples).

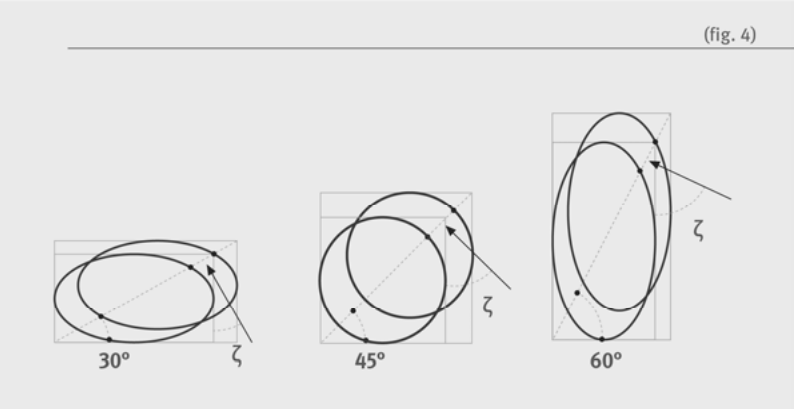

Fig. 4: Values of ζ according to different modular ratios for letter 'o'

Values of ζ according to different modular ratios for letter 'o' tab. 1

Modular ratio	Zeta (ζ)
0.75	53.130°
1.0	45.000°
1.25	38,660°
1.50	33.690°
1,75	29.745°
2.0	26.565°

Tab. 1: Values of ζ according to different modular ratios for letter 'o'

The values calculated for **ζ** appear to be much higher compared with those seen in practice. The angles measured in the *Lobbes Lectionary* fall between 12° and 30° (with one exception, which we shall return to in due course), the average being 21°. Various surveys carried out here and there (which I do not purport to have any statistical value) allow us to suggest that, by and large, the pen angle adopted by scribes did not exceed about thirty degrees. There is one famous exception, namely the Roman majuscule—still called 'rustic capital'—which, as we know, was written with an almost 'reversed' pen angle in comparison to later practices, with the edge of the nib tending towards a vertical orientation. Seen from another perspective, the width of certain cursive scripts of the Late Middle Ages grew to

such an extent—equivalent to a very high modular ratio—that the homothetic angle can easily be ascertained.

Keeping in mind the above caveats, one can conclude by stating that in the vast majority of cases we find ourselves within the zone where the pen's angle exerts a *positive* effect on the modular ratio.

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Up to this point, we have focused on strictly theoretical issues and geometrical demonstrations of the relevant phenomena. We have done this out of necessity, rather than on a mere whim. The phenomena that we have examined are not of the kind that immediately strike one's eye; indeed, they manifest themselves on a very small scale, and one should also bear in mind the fact that they can be further 'blurred' by the contribution of other factors. We can therefore only hope to observe them 'in the wild', so to speak, if they have been predicted beforehand by the theory.

To measure the effects *in rebus*, we shall now return to the *Lobbes Lectionary* and examine three aspects of the writing: the gestural ratio, the pen's angle, and the modular ratio.

Fig. 5 illustrates the characteristics of the hands of five scribes chosen for their 'exemplary' behaviour (it should be noted that the five artisans are anonymous, with the exception of Goderan; the rest are identified by means of the name of the saint whose biography they wrote). This is an experimental approach: the geometrical figures shown do not represent specimens of the letter **o** of the kind that the scribes would have written; rather, they are ellipses or circles drawn (to scale) in accordance with the dimensional characteristics associated with each of the scribes' writing styles.

The handwriting styles encountered in *Alexis* and *Cyril* straight away present some interesting characteristics. The writer of the first appears to calculate his gesture so that the resulting script is of rigorously square proportions; the writer of the second seems adamantly to adopt square proportions for his writing gesture, leaving the other two parameters to operate freely. The remarkably 'geometric' character of these two styles points towards two different models. However, the actual distribution observed makes it impossible to justify such a conclusion, since the writing of other scribes is distributed in a fairly uniform way, without any tendency to cluster around potential 'poles of attraction'.

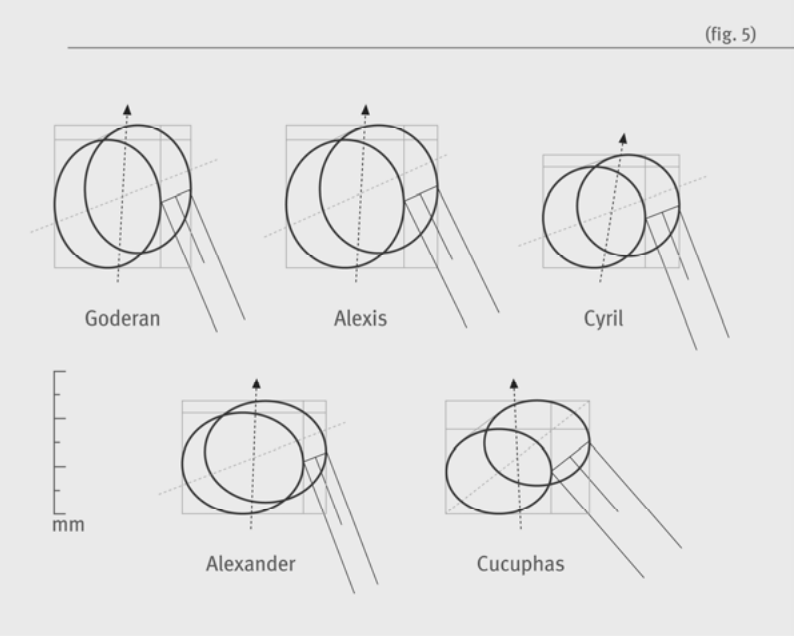

Fig. 5: Letter 'o' as written by five 'exemplary' scribes of the Lobbes Lectionary

The behaviour personified here by *Alexander's* script is the same as that of the aforementioned scribes and of many of his colleagues, all of whose writings exhibit various signs of amateurishness (*George, Martial, Thierry III*): the gesture is already distinctly wider than the 1:1 proportion and gives rise to an even wider pen stroke. Upon closer inspection, one can see that the gestural ratio adopted by the scribes corresponds (roughly) to the modular ratio that would have resulted from a gesture with a ratio of 1:1. It is tempting to view this as fresh evidence of their inexperience—not having mastered the necessary deftness of hand and the angle at which to hold the pen, the scribes naively worked hard to reproduce what they saw, without making the all-important adjustment to the width of the pen's nib.

Goderan's method is quite the opposite: it is, on the contrary, the trace delineated by the writing that has the proportions best suited to the movement of the scribe's hand to produce a ratio of 1:1. We can suppose that this represents a sort of 'hypercorrection'—in fact, all the evidence would point to Goderan being the most experimental scribe. According to Gilissen's analysis, he appears to be the 'master of the atelier', whose writing serves as a benchmark and a model for his collaborators to follow. In this respect, then, it has to be said that Goderan's

example is not very well followed by his team, because his writing performance is completely different from that of the others.

Only the peculiar case of *Cucuphas* remains, whose writing stands radically apart from that of the other scribes. Executed with an exceedingly broad-nibbed pen held at a very 'open' angle, it has an unsettling appearance; indeed, one must agree with Gilissen, who considered it rather inelegant and coarse. And it is not altogether surprising to find that the angle of *Cucuphas*' pen corresponds exactly to that of the 'homothetic angle', which seems almost impossible to imagine meeting with in reality. The combination of such an unusual writing angle, a non-standard pen size and a gestural ratio that compensates for the disadvantages of the first two handicaps can hardly be considered a coincidence. Is it the width of the pen that *Cucuphas* favours which forces him to adopt such an angle? Or is it the angle of the pen which is natural to him that allows him to take advantage of the wider nib? This question is a bit like asking: which came first, the chicken or the egg? At all events, his example seems to confirm that the finer points in the relationship between the three parameters were picked up on and mastered by the scribes—among the most skilled of them, at any rate.

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On the basis of the above, it emerges that the modular ratio—the simple outcome of a combination of factors—is not very significant from a palaeographic perspective. Even so, an examination of the correlation that links it to the module gives rise to some interesting observations.

In order to get a sense of the historical environment, we shall now transport ourselves to the other end of the Middle Ages—to the scriptorium at Cesena which, from 1450 to 1465 (or thereabouts), worked to create a library for Malatesta Novello, the local feudal lord. The fruit of this labour (roughly one hundred and twenty-five volumes) constitutes one of the most homogenous collections of books ever produced in the humanistic arena. Conserved *in situ* in its original context, it has been the subject of numerous studies, the most recent of which can be found gathered together in an important collection published some time ago.[5]

The most strictly palaeographical aspects—particularly the identification of scribes—have been studied more than once, most recently by Emanuele

5 *Libraria domini* 1995.

Casamassima and Cristina Guasti,[6] and by Albinia De la Mare.[7] Broadly speaking, the conclusions reached by these experts coincide; however, as an added precaution, the rare cases where their opinions differ have been excluded from this point forward.

The analysis is based on data gathered in the early 1980s, along with numerous other codicological parameters, during a systematic book restoration campaign. For reasons specific to this enquiry, the average dimensions of the letter **m** served as a control.

A quick glance at the images gathered in Chart 2 will suffice to show what one can expect from this kind of study. The graphs created for the groups of different writing hands (Charts 2a and 2b) present a totally anarchic scenario, whereas those which relate to one and the same scribe reveal a very close correlation (Charts 2c and 2e, and in the circumstances that we shall presently see, 2f). One can therefore take it for granted that the absence or presence of such a correlation constitutes a homogeneity criterion.

Chart 2d appears to contradict this law: it relates to manuscripts attributed to Johannes von Mainz (Iohannes Moguntinus). The term 'attributed' has to be emphasised here: in actual fact, these are volumes which lack scribal signatures. Casamassima and Guasti, after much deliberation, finally decided to see in them the work of the same hand (which remains anonymous, but for practical reasons was nicknamed 'l'Amico', 'the friend'), albeit with some serious reservations. Albinia de la Mare has the distinction of having identified this scribe with Johannes von Mainz, of whom, besides, we possess some signed specimens, although she, too, emphasises the great uncertainty that surrounds his signature. The correlation analysis neither corroborates nor disproves this identification, but it clearly illustrates the lack of homogeneity in the group in question and fully justifies the bepuzzlement of palaeographers.

Without doubt, though, it is Jean d'Épinal (Iohannes Antonii de Spinalo) who provides us with the most interesting case. We can consider this figure as the 'pivot' of the scriptorium at Cesena, where he exercised his skills from its inception (*c.*1450) and probably up until his death (in 1467). To him we owe about forty volumes of which three quarters bear his signature; unfortunately, only four of them bear dates.

6 Casamassima / Guasti 1992.

7 De la Mare 1995.

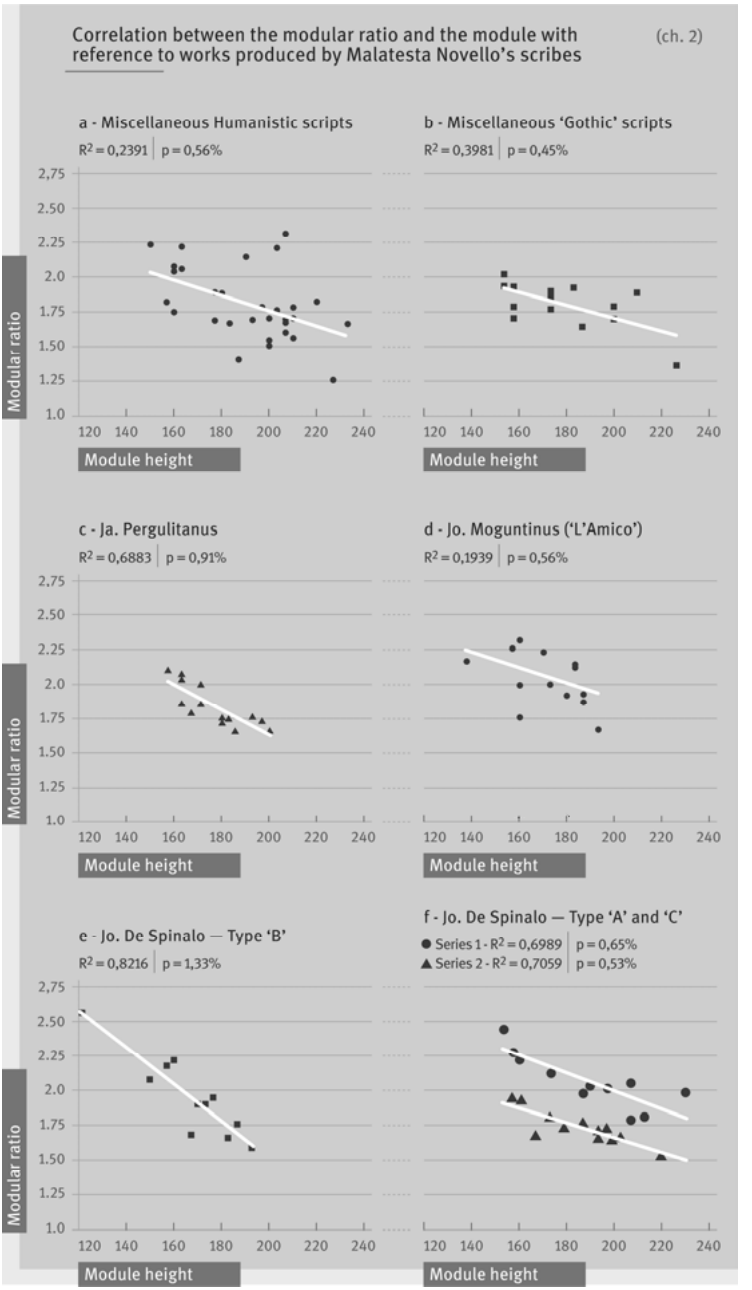

Chart 2: Correlation between the modular ratio and the module with reference to works produced by Malatesta Novello's scribes

The 'rough' graph that can be drawn to represent this group is totally chaotic (hence it would serve no useful purpose to present it here). However, the heterogeneous nature of the scribes' output does not represent a revelation. Already in 1959, in the monograph dedicated to him, Antonio Domeniconi[8] identified three different aspects of his writing. The first ('type A'), which seemed to Domeniconi to have been the most natural, is the humanistic semi-cursive, agile and rapidly written, which is employed in more than two cases out of three. The second ('type B') is a much more 'classical' antiqua, which is somewhat rigid and formal in appearance. In addition, Domeniconi identified a 'type C', represented by just one witness. This third type is positioned more or less midway between the first two types. However, this distinction seems superfluous to Albinia de la Mare, who sees it as merely a variant of the first type. Shortly, we shall see that our analysis is in sympathy with her point of view.

If we resume the analysis whilst taking this distinction into account, things immediately fall back 'into order' with respect to 'type B' (Chart 2e). The result is scarcely different from that which one obtains for Jacopo della Pergola (Chart 2c), who employed a very similar hand.

'Type A', on the other hand, continues to demonstrate its heterogeneity by consistently generating a rather diffuse cloud. However, this nebulousness is only superficial: a closer examination makes it possible to ascertain that the cloud is in fact composed of two series of aligned points scattered along the two parallel axes, with only one or two objects 'floating' in the intermediate space.

To the naked eye, and even under a magnifying glass, one cannot identify in the writings of one or the other series any fundamental difference which can justify this dichotomy. We must therefore discard the hypothesis of the existence of a 'type C', which we have merged with 'type A', having assessed it as being incompatible with former ('type B')—the volumes in that class can be placed in the two series, with no particular preference. The hypothesis that there is a possible chronological effect must also be rejected, since the four dated witnesses are distributed equally on both sides.

It is therefore in the codicological realm that the cause resides. In this context, a piece of evidence catches one's eye: almost all the volumes written in a full-page layout (with the exception of one, which is to say six out of seven) aggregate in the first series. The explanation for this is immediately at hand: Jean d'Épinal cramps his writing when he feels hemmed in by the line; conversely, he loosens it up when his pen can range over a long stretch before coming up against the righthand justification. But the origin of the phenomenon is certainly far more

8 Domeniconi 1959.

psychological than palaeographical or codicological—in fact, it only manifests itself in the context of his spontaneous writings, and no duality of this kind appears when the same scribe employs formal antiqua (in five cases on long lines, and in another six in two-column layouts).

The instances of five manuscripts with two-column layouts in which Jean d'Épinal employs his expansive writing (Biblioteca Malatestiana D.III.4, D.VII.3, D.IX.2 et 3, et D.XXI.6) still have to be explained. From a statistical standpoint, these have no parameters that differ from those of the other volumes with two-column layouts.

The interest of this analysis extends beyond that which it provides for a study of a particular scribe's 'graphological' behaviour. In the first place, this is because—methodologically speaking—it reveals a duality which is almost impossible to bring out by other means. The separate study of the writing's size and its proportions does not suffice: one can see that the spattering of points that compose the data cloud are in fact mixed up, just as much on the vertical axis as on the horizontal. The same is true with respect to the palaeographical level in its connection with codicology. The studies carried out over the last decades on the management of space within the confines of a page have led us to suspect that there should exist, between the size of the page and that of the writing, an interaction which is subtler than the mere adaptation of the module to the ruled unit. However, for the reasons mentioned above, this subtle interaction has previously been rather difficult to expose, but we can see it quite clearly now.

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