

THE GEOMETRY OF ROMAN LETTERING

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Is there any justification for applying measurement to visual proportion? If so, when and in what way should it be applied? Not very long has this subject been controversial. In all advanced civilizations artists and other craftsmen seem to have felt little hesitation about using all the faculties of their minds – perception, intuition, thinking, calculation – wherever they served the purpose. Rudolph Arnheim: From 'A Review of Proportion'.

This article gives me the opportunity to extend some research into a possible proportioning system for classical Roman capitals, dating from the end of the first century to the beginning of the second century AD. The original impetus for this research was provided by a weekend course on Sacred Geometry with the geometer and architect Keith Critchlow in the early 1990s. On returning from the course I was naturally keen to find out more about the subject and if possible find some application for it in my own field of lettering. I discovered I already had at home a copy of *The Elements of Dynamic Symmetry* by Jay Hambidge where a whole theory is clearly put forward for the use of a series of rectangles, with irrational numbers in their proportions. Hambidge maintains that these rectangles were known to the Egyptians and used extensively by the Greeks for the designing of buildings and artefacts.

It seemed a natural enough step to apply the rectangles described in Hambidge's book to Roman capitals and see if anything fruitful emerged. Here, I was very fortunate to have the line drawings by EM Catich published in a boxed set in 1961, made from rubbings by him of the inscription on Trajan's column in Rome of circa 112AD. This inscription is, of course, regarded by many as the high point of Roman inscripational art. I started, at first quite diffidently,

to analyse Catich's line drawings, not expecting anything of significance to emerge, but soon found to my surprise some interesting correspondences between the rectangles and the letters which encouraged me to carry on with these investigations.

One rectangle in particular seemed to occur again and again when finding key points on the letters – this rectangle is defined by Hambidge as the 'root five'. Hambidge describes the root five rectangle as 'the most distinctive shape we derive from the architecture of the plant and the human figure : a rectangle which has been given the name 'root five'. It is so-called because the relationship between the end and side is as one to the square root of five, 1:2.2360...'. Another interesting property of the root five rectangle is its close relationship with the rectangle known as the 'Golden Rectangle'. This is evolved out of the Golden Mean which is defined as the proportion that exists between two measurable quantities of any kind, when the ratio between the bigger and the smaller is equal to the ratio between the sum of the two and the bigger one. Robert Lawlor in his book *Sacred Geometry* writes very eloquently of the Golden Mean: 'Johannes Kepler, formulator of the laws of planetary motion, is quoted as saying, "Geometry has two great treasures: one is the theorem of Pythagoras, the other the division of a line into mean and

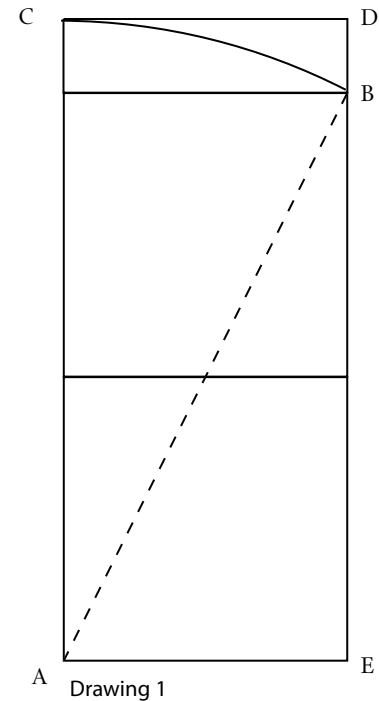
extreme ratios, that is ϕ , the Golden Mean. The first way may be compared to a measure of gold, the second to a precious jewel”.’

There are grand philosophical, natural and aesthetic considerations which have surrounded this proportion ever since humanity first began to reflect upon the geometric forms of its world. The proportion’s presence can be found in the sacred art of Egypt, India, China, Islam and other traditional civilizations. It dominates Greek art and architecture; it persists concealed in the monuments of the Gothic Middle Ages and re-emerges openly to be celebrated in the Renaissance. Although it pervades many aspects of nature from which the artists drew their inspiration, it would be wrong to say that one can uncover the Golden Mean throughout all of Nature, but it can be said that wherever there is an intensification of function or a particular beauty and harmony of form, there the Golden Mean will be found. It is a reminder of the relatedness of the created world to the perfection of its source and of its potential future evolution.

The chance to enlarge on this research came when I managed to obtain rubbings from the Italian calligrapher Mauro Zennaro and from Liz Farquharson of another fine Roman inscription – *The Memorial to the Children of the Freedman Sextus Pompeius* – which is on the Appian Way in Rome and is dated the 1st or 2nd century AD. Although the memorial has been pieced together from a series of fragments sufficient remains to form a good impression of the complete inscription. In common with the Trajan inscription it too has examples of nearly all of the letters of the Latin alphabet. Before making comparisons between

the two inscriptions it will be necessary to consider more closely the root five and Golden Rectangles.

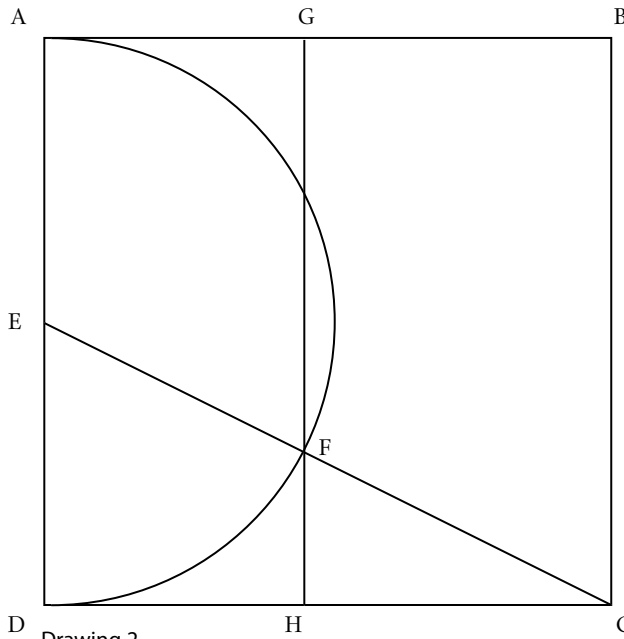
ROOT FIVE RECTANGLE



BASIC GEOMETRY

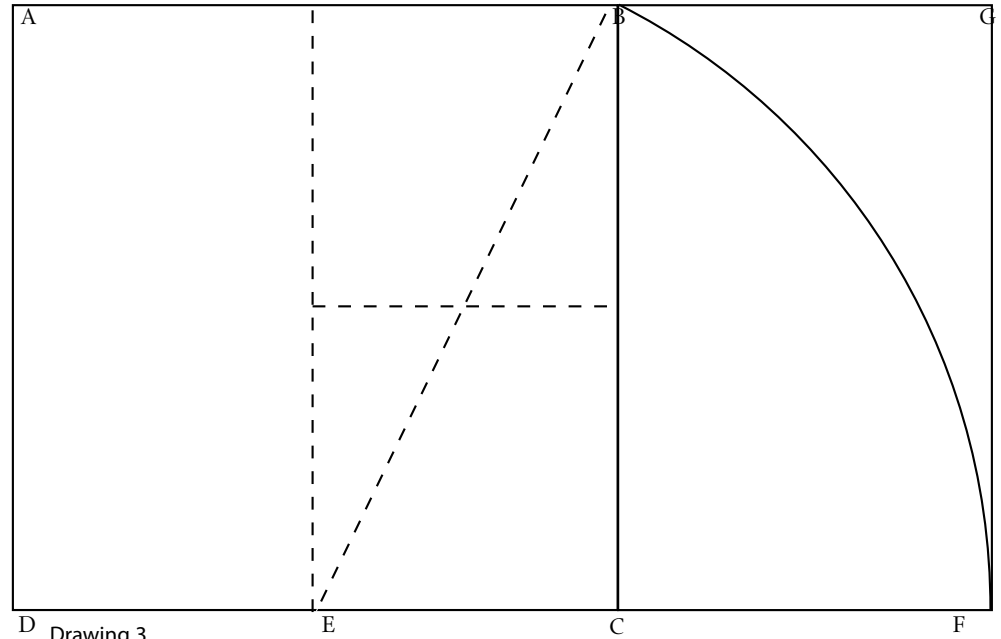
Drawing 1 shows how a root five rectangle is generated out of the double square or root four rectangle. The diagonal AB (dotted line) equals the square root of five. With compass point on A (radius AB) we can arc across to meet the extended side of the rectangle at C. The resulting rectangle CDEA is a root five rectangle.

ROOT FIVE IN SQUARE



Drawing 2

GOLDEN RECTANGLE



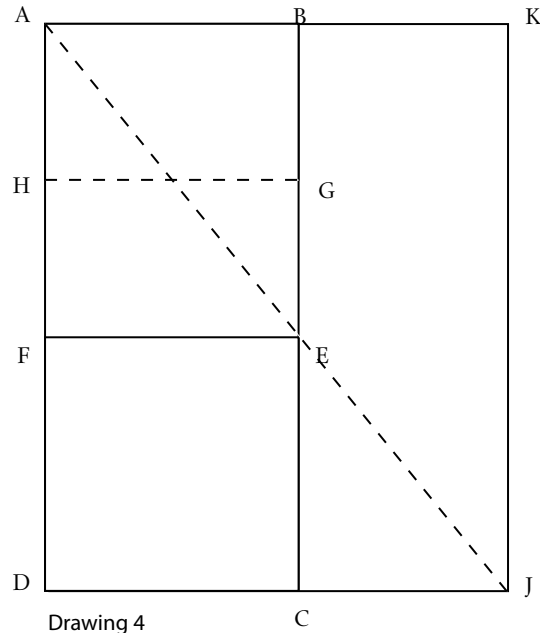
Drawing 3

Drawing 2 shows how a root five rectangle can be constructed inside a square. ABCD is a square. E is the mid-point on the side AD. With compass point on E (radius EA) a semicircle can be drawn on side AD. A diagonal line is drawn from E to C intersecting the semicircle at F. GH is drawn through point F parallel to AD. The resulting rectangle AGHD is a root five rectangle. It can be readily appreciated that, if the side of the square is equal in meas-

urement to the letter height, a root five rectangle may quickly be constructed at any given height.

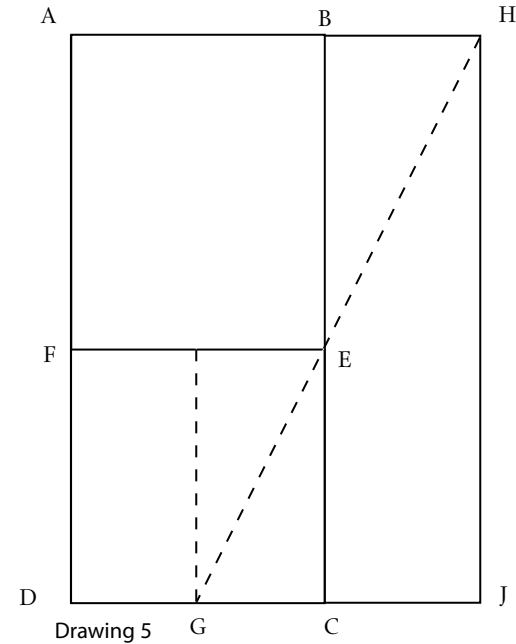
Drawing 3 shows how a Golden Rectangle can be constructed. ABCD is a square. finding the mid-point of DC at E draw in a diagonal from E to B. Using EB as a radius describe an arc down to cut the extended base line at F. The rectangle AGFD is a Golden Rectangle.

TWO GOLDEN RECTANGLES



In drawing 4 ABCD is a root five rectangle. If a square FECD is placed inside one end of a root five rectangle (in this instance at the base) the remaining area above it, ABEF is composed of two Golden Rectangles on top of each other HGEF and ABGH. A rectangle the same proportion as ABEF can be created by extending the diagonal AE to meet the extended base line at J. The rectangles ABEF and AKJD are therefore similar.

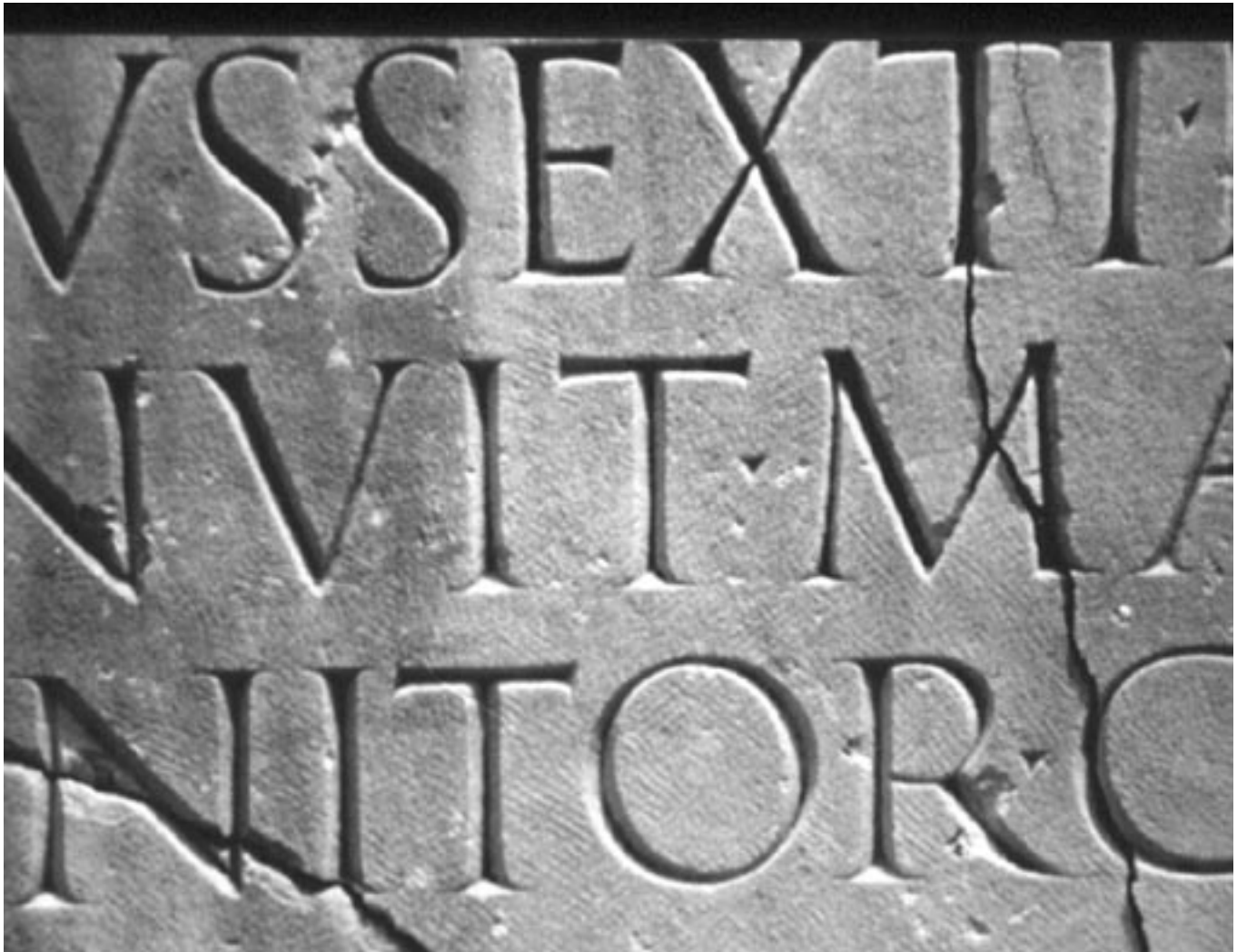
'THREE-QUARTER WIDTH' RECTANGLE



Drawing 5 shows another rectangle which can be constructed quite readily out of a root five rectangle – useful for proportioning such letters as the rather narrow 'H' form in the Appian Way inscription. ABCD is a root five rectangle with a square in the base FECD. Finding the midpoint between D and C at G a line is drawn from G through point E to meet the extended top line at H. By drawing a line parallel to BC from H to the extended base line at J the required rectangle is formed, AHJD.



22. *The Memorial to the Children of the Freedman Sextus Pompeius* – on the Appian Way in Rome and dated the 1st or 2nd century ad.



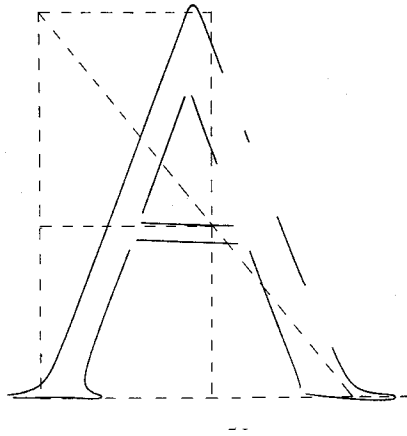
23. Detail from the Appian Way inscription



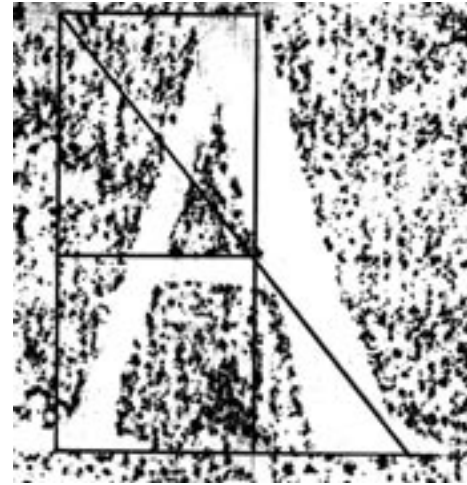
24. The inscription at the base of Trajan's column in Rome dated c112 ad

COMPARISON OF LETTER PROPORTIONS OF TRAJAN AND 'APPIAN WAY' INSCRIPTIONS

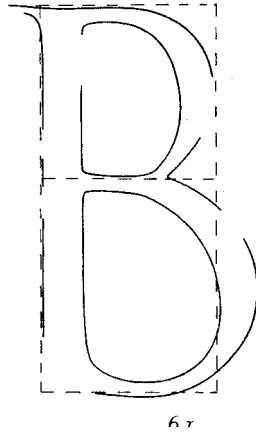
On the following pages the drawn letter on the left is from the Trajan inscription whilst the rubbing on the right is from 'The Memorial to the Children of the Freedman Sextus Pompeius' on the Appian Way in Rome

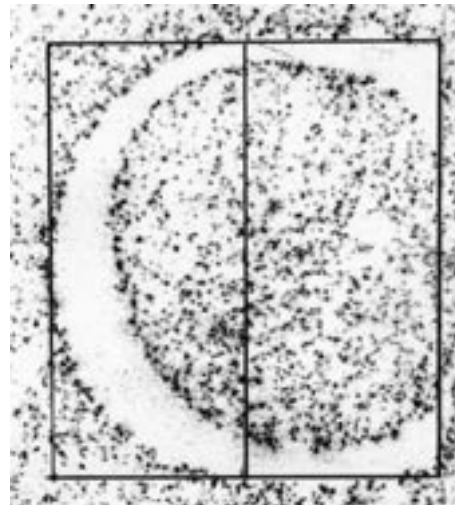
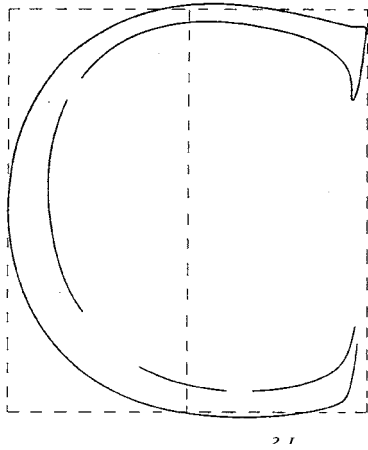


'A' is based on the double Golden Rectangle, as shown in drawing 4.

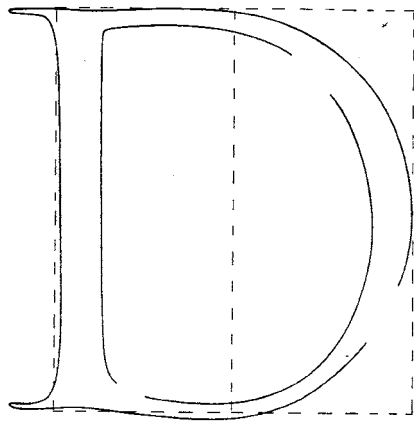


The Trajan 'B' is based on a root five rectangle whereas the Appian 'B' is a slightly wider form based on a half square.





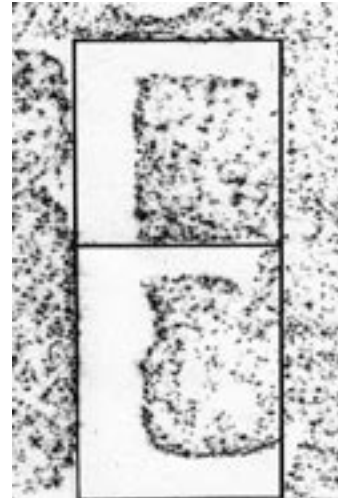
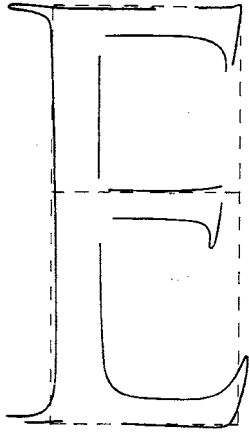
'C' is based on a double root five rectangle.



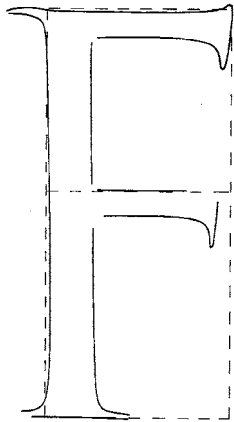
'D' is based on a double root five rectangle.

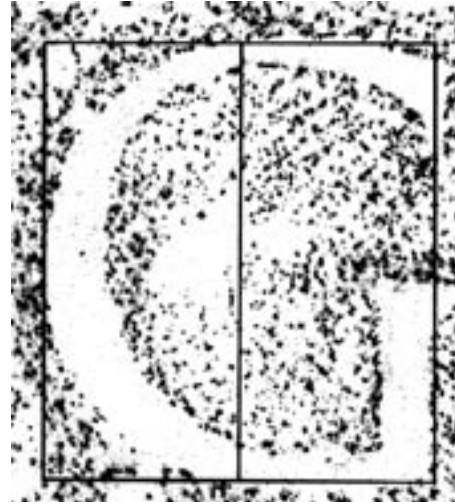
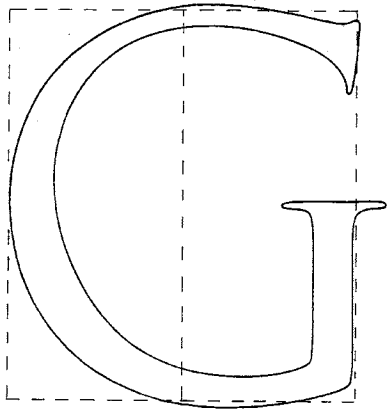
FONT

*'E' is based on a root
five rectangle*

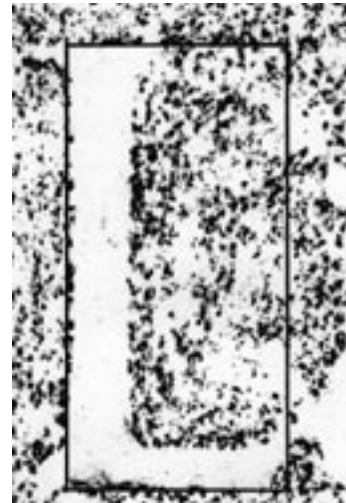
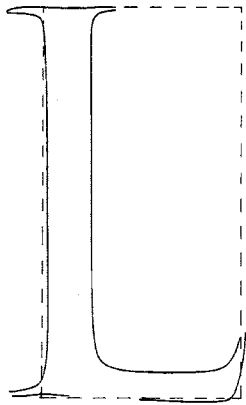


*'F' is based on a root
five rectangle.*





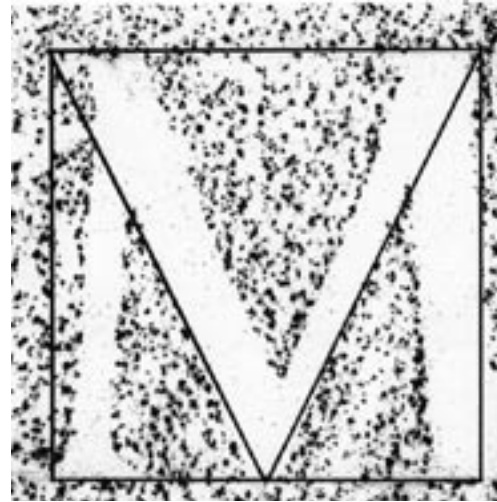
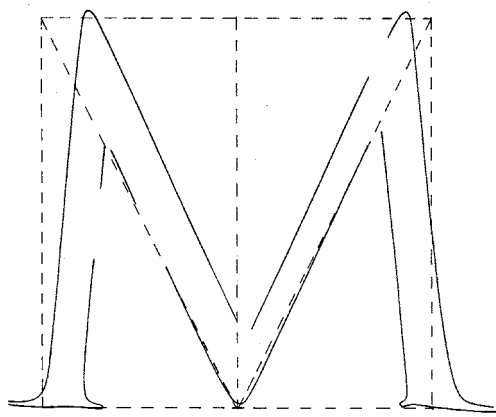
*'G' is based on a double
root five rectangle.*



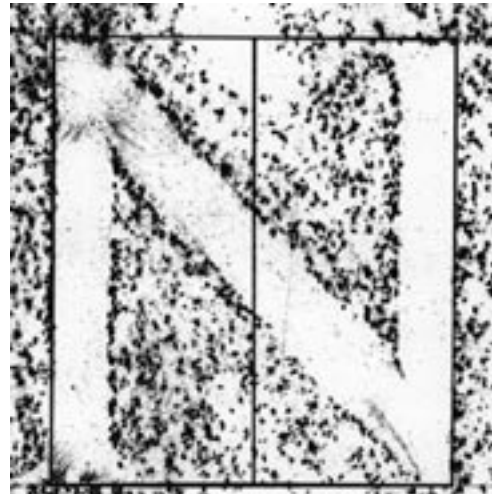
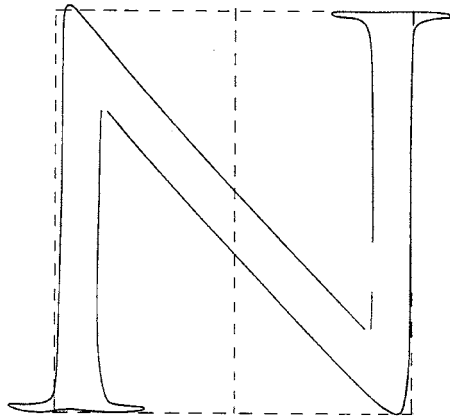
'L' is based on a half square

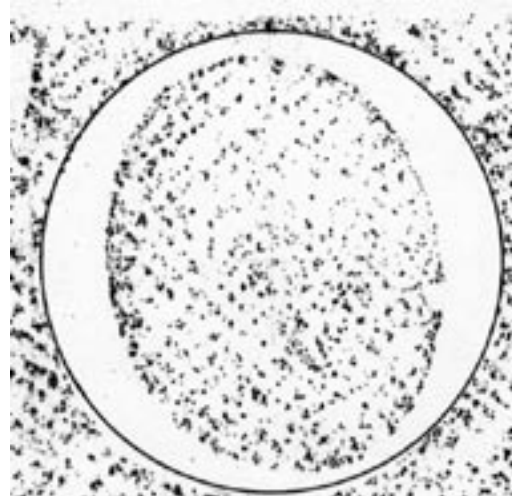
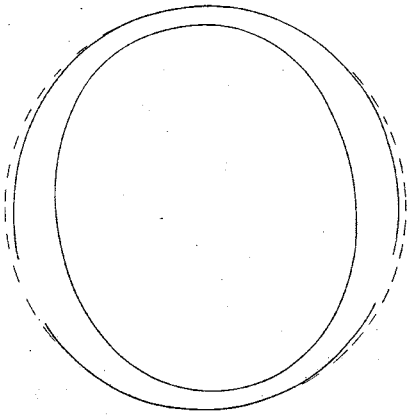
FONT

'M' is based on a square and the diagonals are contained within a half square.

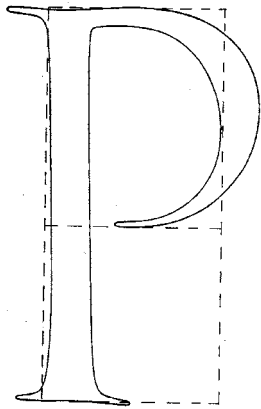


'N' is based on a double root five rectangle.



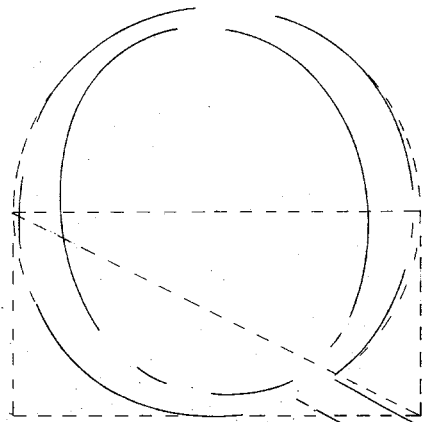


'O' is essentially circular, though one can see the Trajan form is very slightly compressed.

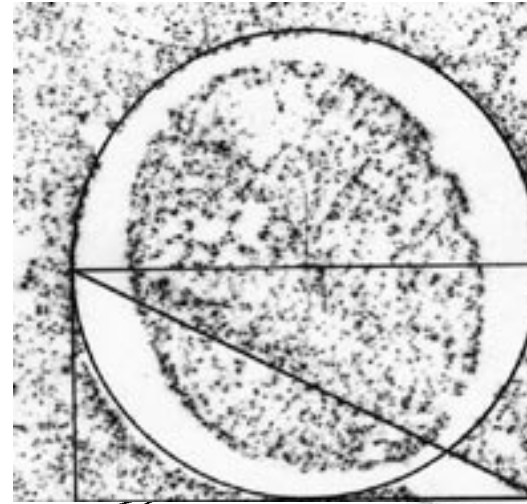


'P' is based on a root five rectangle with a square in its base.

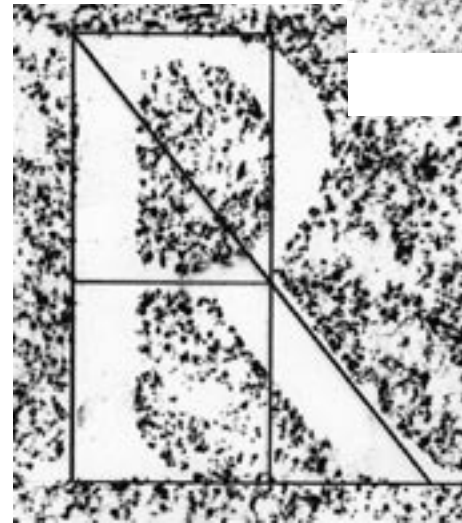
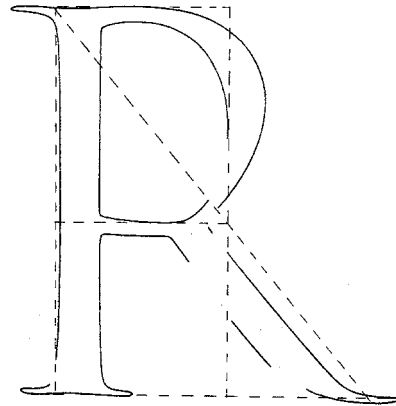
'Q' is essentially circular, though one can see the Trajan form is very slightly compressed. The position of the tail seems to be governed by the diagonal in the half square as shown.

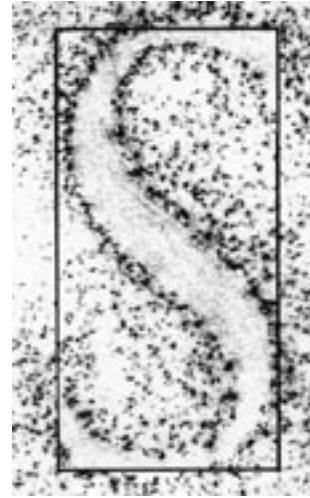
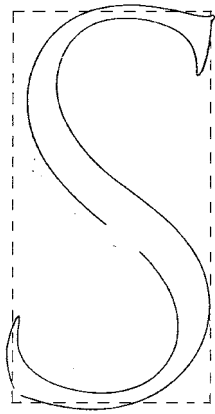


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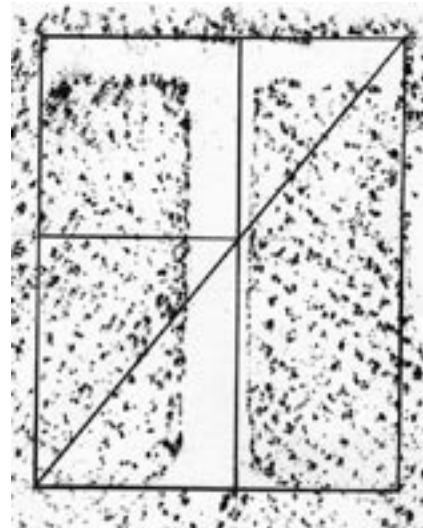
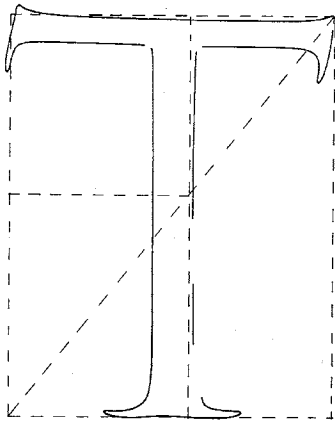


'R' is based on the double Golden Rectangle, as shown in drawing 4. The diagonal in this rectangle gives a very good indicator for the tail.





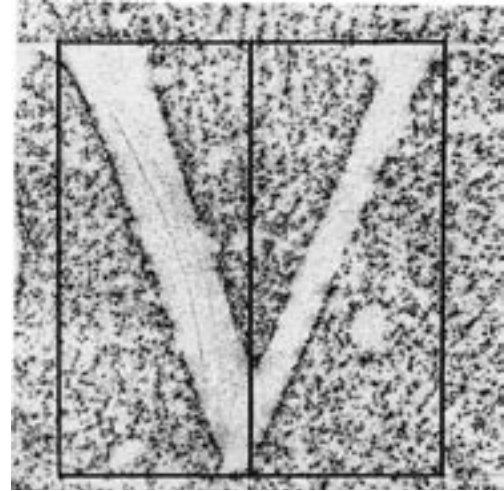
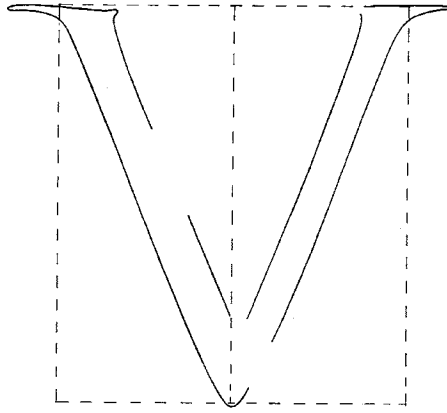
'S' is based on a half square.



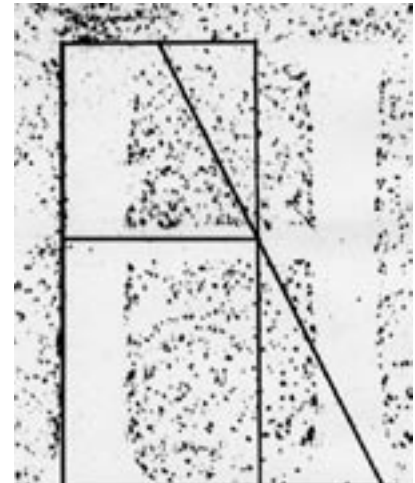
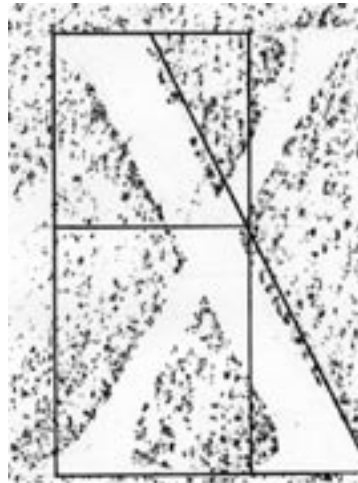
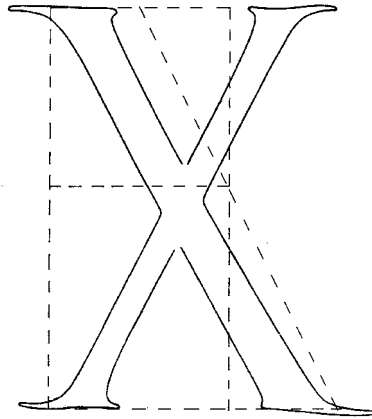
'T' is based on the double Golden Rectangle, as shown in drawing 4.

FONT

'V' is based on a double root five rectangle.



'X' and 'H' are based on the 'three quarter' width rectangle, as shown in drawing 5. There is no 'H' in the Trajan inscription.



CONCLUSION

The structural basis for Roman letters, as can be seen, is essentially an underlying geometry or grid which, with a little practice, will quite readily give accurately proportioned letters. A system such as this could have been used in the early stages of setting out an inscription prior to the brushing of the letters on to the stone. It is quite different from Renaissance theories of constructed classical letters where the rulers and compasses are allowed to dictate every detail of the finished form leading to over-elaborate schemes far removed from any practical application. In carefully planned inscriptions, such as the Trajan and Appian Way, some preliminary marking out of letters must have taken place before brushing the letters on – much in the same way that signwriters mark out their letters in chalk to ensure a good fit before painting. It is at these early stages of planning an inscription that some method for proportioning the letters would have been most useful. Not all of the letters in either of the two inscriptions examined will be found to conform as well to the proportional scheme as the letters illustrated here. If the letters were freely and rapidly brushed onto the stone, (see *The Origin of the Serif* by EM Catich for more information about brush made Roman letters), one would expect slight divergences from any preparatory marking out, however detailed that setting out may have been. Here also the words of Rudolph Arnheim, from his essay *A Review of Proportion*, are very much to the point. The rational model, then, is related to its referent in the way any law is related to the things in which it is active. Just as the norm of the oak leaf is not perfectly realized in any one specimen so no rule of proportion can

be expected to appear perfectly in anything. This makes the task of finding such a rule harder rather than easier, for instead of being satisfied when a model roughly applies, we must find out, through judicious examination of many specimens towards which principle the species converges. The paintings of the masters have been interpreted with many and often contradictory schemata. This does not mean that there is no law but that to find it takes more than mechanical measuring and fitting, it requires the scientific methods that permit distinction between the essential and accidental.

My main aim has been briefly to outline a method by which the letters of the finest era of Roman letter carving can be accurately proportioned and reconstructed. Classical Roman letters are the foundation of all letterforms used in the Western world and as such are an important part of the letterer's or the calligrapher's training. Any insight we can gain into their form or structure is therefore of great value in understanding the origins of our present alphabet. In the ancient world art had fixed ends and ascertained means of operation making it difficult to believe that such inscriptions could have been the product of craftsmen working in a purely intuitive manner. On the contrary such sophisticated artefacts must have been the products of minds well versed in the methods and procedures of their craft. The methods and procedures of stone masonry and carving are permeated through and through with an intimate knowledge of geometry.