

The Hidden Pavements of Michelangelo's Laurentian Library

Jay Kappraff

Does your hometown have any mathematical tourist attractions such as statues, plaques, graves, the café where the famous conjecture was made, the desk where the famous initials are scratched, birthplaces, houses, or memorials? Have you encountered a mathematical sight on your travels? If so, we invite you to submit to this column a picture, a description of its mathematical significance, and either a map or directions so that others may follow in your tracks.

Please send all submissions to
Mathematical Tourist Editor,
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Ever since publishing my book *Connections: the Geometric Bridge between Art and Science* [1], I have become used to playing the role of a "mathematical tourist." I am frequently contacted by researchers keen on discussing some discovery that they have made and seeking my advice as to the mathematical aspect of their work. Sometimes the work appears to shed new light on ancient or modern geometry; other times it seems to lead nowhere.

It is in this context that Ben Nicholson telephoned me three years ago. He had become privy to a set of facsimiles of fifteen $8'6'' \times 8'6''$ pavement designs—possibly created by Michelangelo—that lay hidden beneath the floorboards of the Laurentian Library in Florence [2,3]. He was trying to decipher their geometries in order to enable him and an artist, Blake Summers, to reconstruct them at full scale. This project definitely piqued my interest. One thing led to another, and I soon found myself a part of Nicholson's team of researchers devoted to the study of the pavements—

Blake Summers; Rolf Bagemihl, an archivist living in Florence; David Krell, a philosopher; Arielle Saiber, a graduate student at Yale specializing in Renaissance history; and Saori Hisano, a graduate student at Illinois Institute of Technology, the college where Nicholson teaches. From time to time we have also sought the help of other students of Nicholson's, Salvatore Camporeale, a Florentine theologian, and Ernest McClain, a musicologist.

I saw on my first visit to the studio of Blake Summers that he was recreating the pavement designs with the aid of a giant aluminum bar which served as a compass. Summers and Nicholson were using intuitive geometry very much in the spirit of Boethius, who translated the *Elements* of Euclid into a language understandable to the guilds of masons during Middle Ages. In the process of analyzing the pavements we feel that we have discovered a taxonomy of ancient geometry that commingles all of the geometric systems handed down from antiquity into an integrated whole. We have identi-



Figure 1. Entrance stairway at the Laurentian Library. (Figs. 1–7 are from *Firenze Biblioteca Medicea Laurenziana, salone de Michelangelo*. By permission of the Minister of Culture. Further reproductions are strictly forbidden.)

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fied six principal geometries upon which the pavements appear to be based: (1) the Vesica Pisces [1,2]; (2) the law of repetition of ratios popularized by the 20th-century designer Jay Hambridge under the name dynamic symmetry [4,5]; (3) the eight-pointed Brunes star discovered by Tons Brunes, the late Danish engineer [6,7,8]; (4) a set of constructions based on $\sqrt{2}$ and referred to by Brunes as the sacred cut [2,5,9]; (5) the ad-quadratum square-within-a square; and (6) the golden mean [1,5].

Let me summarize what I have learned about this remarkable set of designs and briefly describe the structure of two of them. The Laurentian Library, which was designed by Michelangelo, is situated on the second floor of the San Lorenzo church complex in the heart of Florence. Work on the library was begun in 1523 by Pope Clement VII, alias Giulio Medici, the nephew of Lorenzo di Medici, as a monument to his uncle; it was opened to the public 48 years later by his distant cousin, Grand Duke Cosimo I.

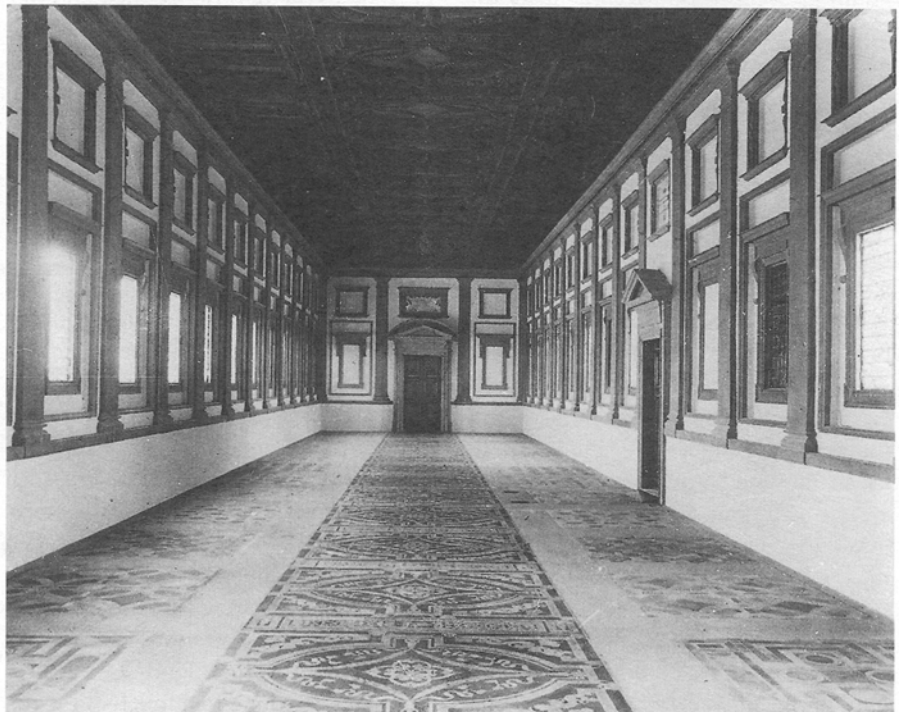
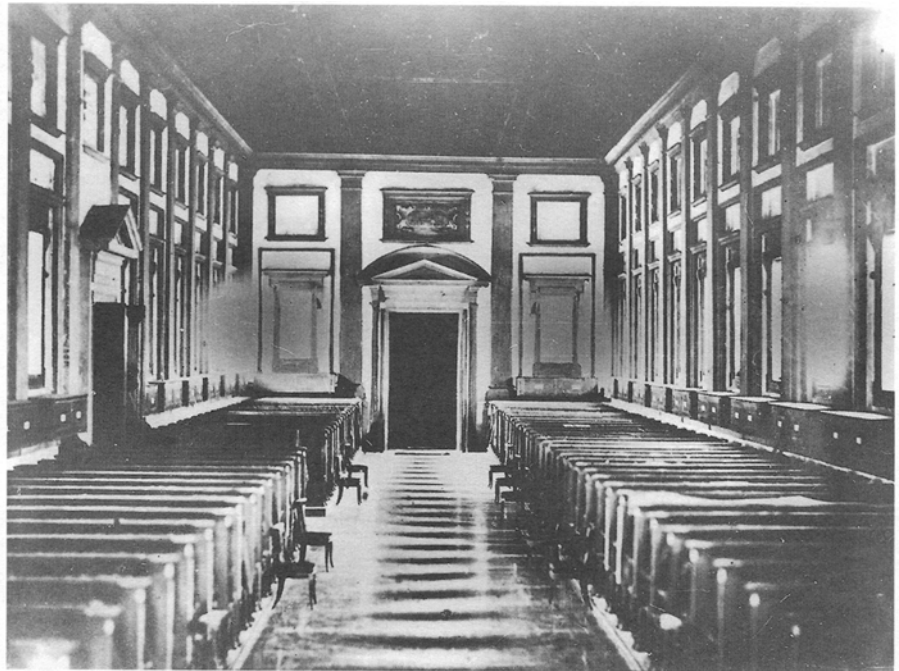
The Library was meant to be a home for the books from antiquity that survived to the Renaissance. The modest setting of the Library leaves one utterly unprepared for what one encounters upon entering. First one is confronted with a massive staircase (Fig. 1) calculated to provoke a numerological trance: There are two steps to get into the building, then series of 3 steps, 7 steps, and 5 steps, with 9 steps to the left and right. After mounting the staircase one enters the Reading Room (Fig. 2). Here the seeming regularity and normalcy hides a frenzy of paradox and ambiguity. Just look at the walls. There is no predominant structure. The wall consists of seven planes, completely disorienting the viewer.

In 1774 a portentous accident occurred in the Reading Room of the Laurentian Library. The shelf of desk 74, overladen with books, gave way and broke. In the course of its repair, workmen found a red and white terracotta pavement which had lain hidden for nearly 200 years beneath the floorboards. The librarian had trapdoors, still operable today, built into the floor, so future generations could view these un-

usual pavements. Further details of the history and significance of the pavements can be found in Nicholson's CD-ROM, *Thinking the Unthinkable House* [10].

Overall, the pavement consists of two side aisles and a figurative center aisle (Fig. 2). Desks situated on a raised wooden dais have been placed over the pavements. On the side of each desk are listed the books that were to be stored in it. Beneath the desks are a se-

ries of fifteen panels, of different designs, each about $8'6'' \times 8'6''$. The fifteen panels along one aisle mirror the ones on the other aisle, but differ in subtle ways. When juxtaposed, the 15 pairs of panels appear to tell a story about the essentials of geometry and number. In 1928 the pavements were photographed for the first time when the desks were removed temporarily whilst structural repairs were made to the subflooring (Fig. 3).



Figures 2 and 3. The Laurentian Library Reading Room—with and without desks.

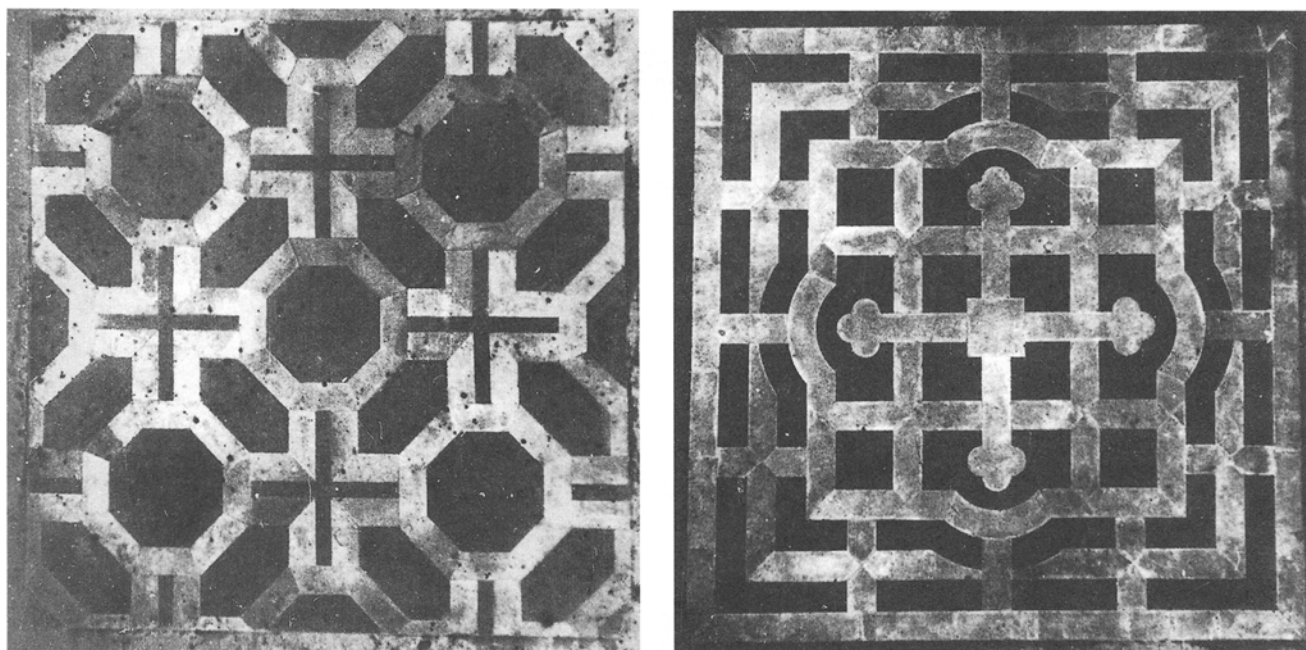


Figure 4. a) The Index Panel 1; and b) the Cross Panel 15. (Figs. 4-7 are details of the pavements.)

The spatial conundrums, paradoxes, and errancies of the building fabric reappear in the geometry of the pavements. We think that the apparent raggedness of the panels can be explicated as accurate and premeditated interpretation of antique geometry in terms of the philosophical concerns of the 1500s. Michelangelo was working with themes well understood at the time, a “secret art of geometry” which could be read in the pavement by the knowledgeable, but which is much more inscrutable today.

The books in the Library were organized with the sacred books to the East and the profane to the West, a throwback to the ancient “tree of knowledge”. On the East side, tucked behind the projecting entrance door, is a single desk whose books include the Koran, Kaballah, Machiavelli, and books of magic. These subjects escape the tidy categories used to order the Laurentian collection, and they were placed out of sight. The sequence hits its stride with 13 desks containing the works of Italian, Latin, and Greek poets, and continues on through books devoted to the quadrivium (music, astronomy, geometry, and arithmetic), leading to 27 desks loaded with Latin and Greek books of theology, ending with books devoted to the Pentateuch. On the West side of the Reading Room,

the books make a counterpart to those to the East and follow the epistemological form devised by Aristotle. Across from the poets are the texts related to the trivium (grammar, rhetoric, and oratory), then on to logic, medicine, history, ethics, and metaphysics. Aristotle's books were not bound in a single compendium as we might find them in a bookstore today, but were found in six different locations in the library, according to the part of his epistemology that they addressed. To traverse the length of the Reading Room could be thought of as a journey through the full extent of the world's wisdom and knowledge.

Monsignor Comporeale feels that movement from Panel 1 (see Fig. 4a) near the door to Panel 15 (see Fig. 4b) on the other side of the Room may have represented the Christian's journey from baptism to enlightenment. Panel 1 consists of octagons and crosses symbolic of baptism, while Panel 15, adjacent to the Pentateuch, also contains crosses and 10 concentric sets of squares surrounding a central square. That the Hebrew Pentateuch is placed here may be deliberate metaphor for the 10-ness that pervades it: the 10 Commandments, 10 generations to Abraham, and 10 more to the Flood. Also Ernest McClain has found that much of the numerology of the Hebrew *Bible* can be re-

lated to an ancient musical scale based on the first 10 numbers [11].

Let's analyze two of the pavements. Panel 14 is referred to by Nicholson as the *Timaeus* panel. It is composed of four diamonds set within circles that are cut with segments of circles, and the whole design is framed with a white border. In Fig. 5, this panel is shown juxtaposed with a reproduction by Fabbrini, from the circle of Michelangelo, of Michelangelo's system of proportions. Michelangelo felt that the system of proportions developed at the time by Dürer was inadequate to describe the supple human body, and that his own system better allowed for flexible joints within the body. You will notice that Michelangelo provides a scale on the right subdivided first into 2 parts, then 4 and 8 parts, with each unit further subdivided into 3 parts for a total of 24 equal parts. This is reminiscent of the lambda figure

		1	
	2		3
4		6	9
8	12	18	27

found in Plato's *Timaeus* and referred to there as the World Soul. This was one of the neo-Platonic ideas brought to the Renaissance by Ficino's academy. It forms the basis of the musical system studied by Pythagoras and writ-

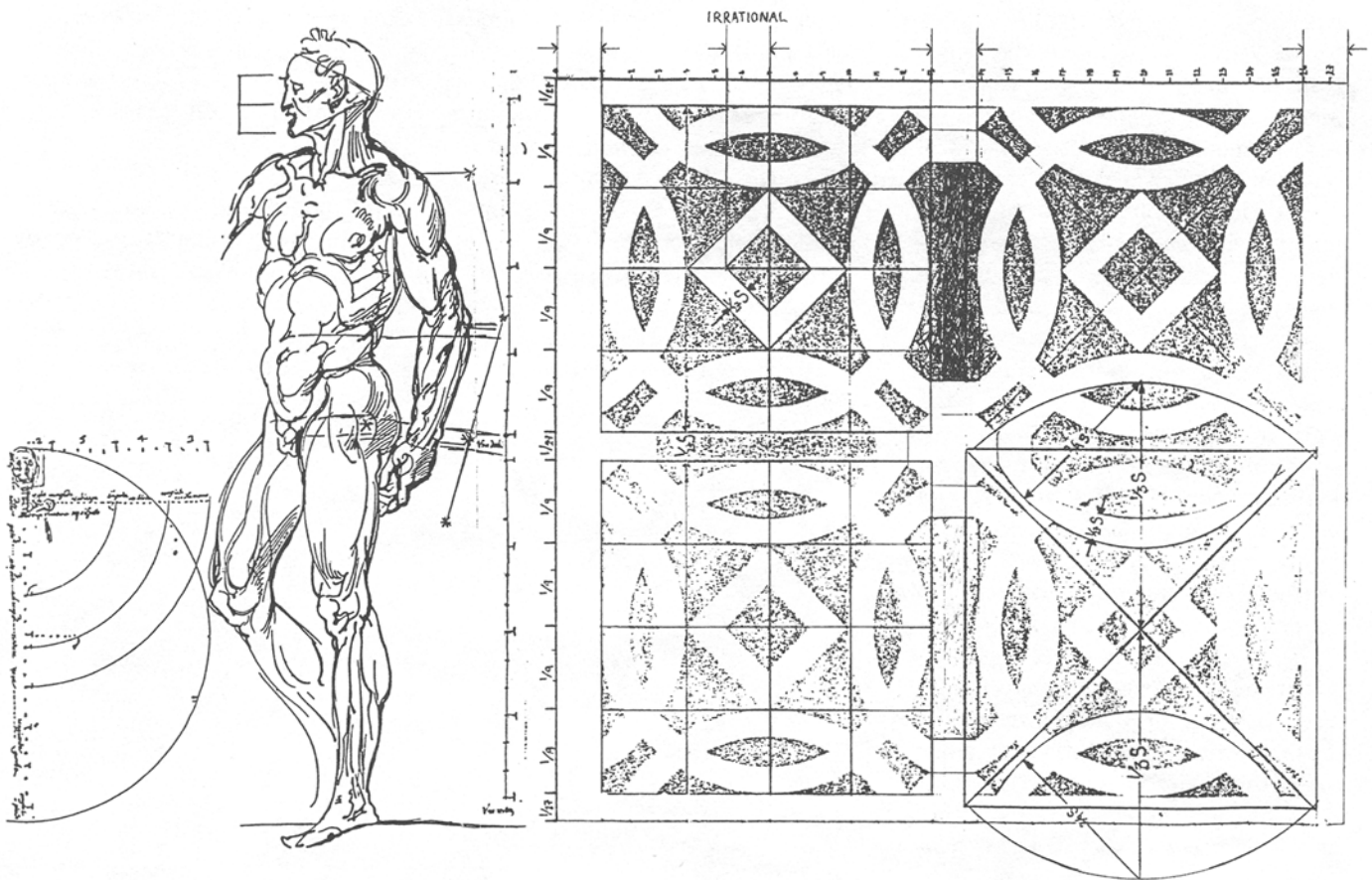


Figure 5. The geometric construction of the Timaeus Panel 14.

ten about by Nichomachus [12,13,14], and it was used by Alberti as the basis of his system of architectural proportions [5,9]. So we expect the number 27 in Michelangelo's system rather than 24. Sure enough, the head of the model projects higher, the foot projects beneath the floor plane, and an extra unit is intercalated at the hip. Now we have the 27 units of the World Soul.

The 27 units of Michelangelo's system of proportions can be found in Panel 14. The space from bottom to top

is subdivided into 27 equal parts. However, it is surely deliberate that the seemingly similar space from left to



Figure 6. The Medici Impresa.

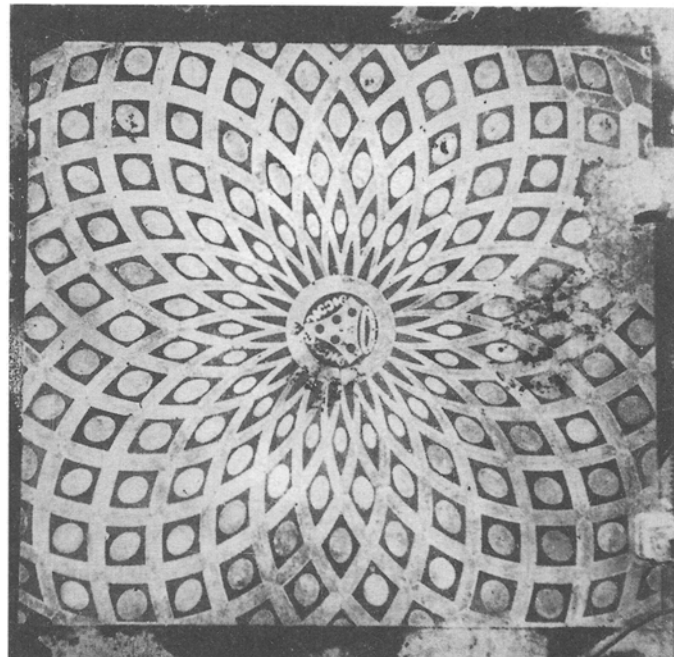


Figure 7. The Cosimo Panel 2.

right has an extra, incommensurate interval. The four circles of the figure echo the coat of arms of Cosimo di Medici, which is also emblazoned on the pavements of the central aisle (Fig. 6). Each of the 27 units is exactly 3 sol-dis in width resulting in an 81-square grid for the entire design. The panel across from this on the other side of the library appears to be based on an 80-square grid. Is it coincidental that the ratio 80:81, known in musical parlance as the syntonic comma, is exactly the ratio by which the tones of the ancient scale, attributed to the followers of Pythagoras based on the primes 2 and 3, differs from the Just scale, based on primes 2, 3, and 5? Such conundrums are found over and over in the structure of the pavements.

Panel 2, the Medici panel (Fig. 7), is a rosette form typical of many such antique rosette forms that appeared at the time in Florence. The pavement is a rectangle of dimension 12×13 . Nicholson feels that these numbers are significant as the number of months in the solar and lunar calendars. The small difference between a square and a rectangle is crucial to its construction.

1. In the first step in the construction, the rectangle is extended to a 13×13 square concentric with a 12×12 square, and the horizontal and vertical axes are placed in the squares. An equilateral triangle is drawn to a side of the 12×12 square. The distance from the center of the square to the vertex of the triangle is the radius of a standard circle of the construction called the pitch circle (Fig. 8a). Beginning where the pitch circle cuts the horizontal axis, six circles of radius equal to the pitch circle are drawn (Fig. 8b).
2. Next six additional circles are drawn beginning where the pitch circle cuts the vertical axis.
3. Twelve additional circles are drawn by repeating steps 2 and 3 for the pair of perpendicular diagonals of the squares resulting in a 24-rosette pattern (Fig. 8c).
4. Twenty-four additional circles are drawn half-way between the circles of the rosette. These will be widened into the white bands appearing in the

panel. For that step, the small difference between the diagonal of the 12×13 rectangle and the 13×13 square is exploited. Circles with this small difference as radii are drawn where the 24 circles intersect the pitch circle to yield 48 new points on the pitch circle (Fig. 8d).

5. Forty-eight additional circles with radius equal to the pitch circle are now drawn. These demarcate the white bands of the Medici panel (Fig. 8e).

6. In the final step eight varieties of ellipses are created to fill the diamond shapes. Nicholson's and Summer's reconstruction of panel 2 is shown in Fig. 9.

What appeared as a kind of errancy in the deviation of the rectangle from a square exploded into the entire design. Furthermore, in the steps leading to its creation, a series of 3, 6, 12, 24, 48, and 96 circles are created. This is the series that led to the Titius-Bode

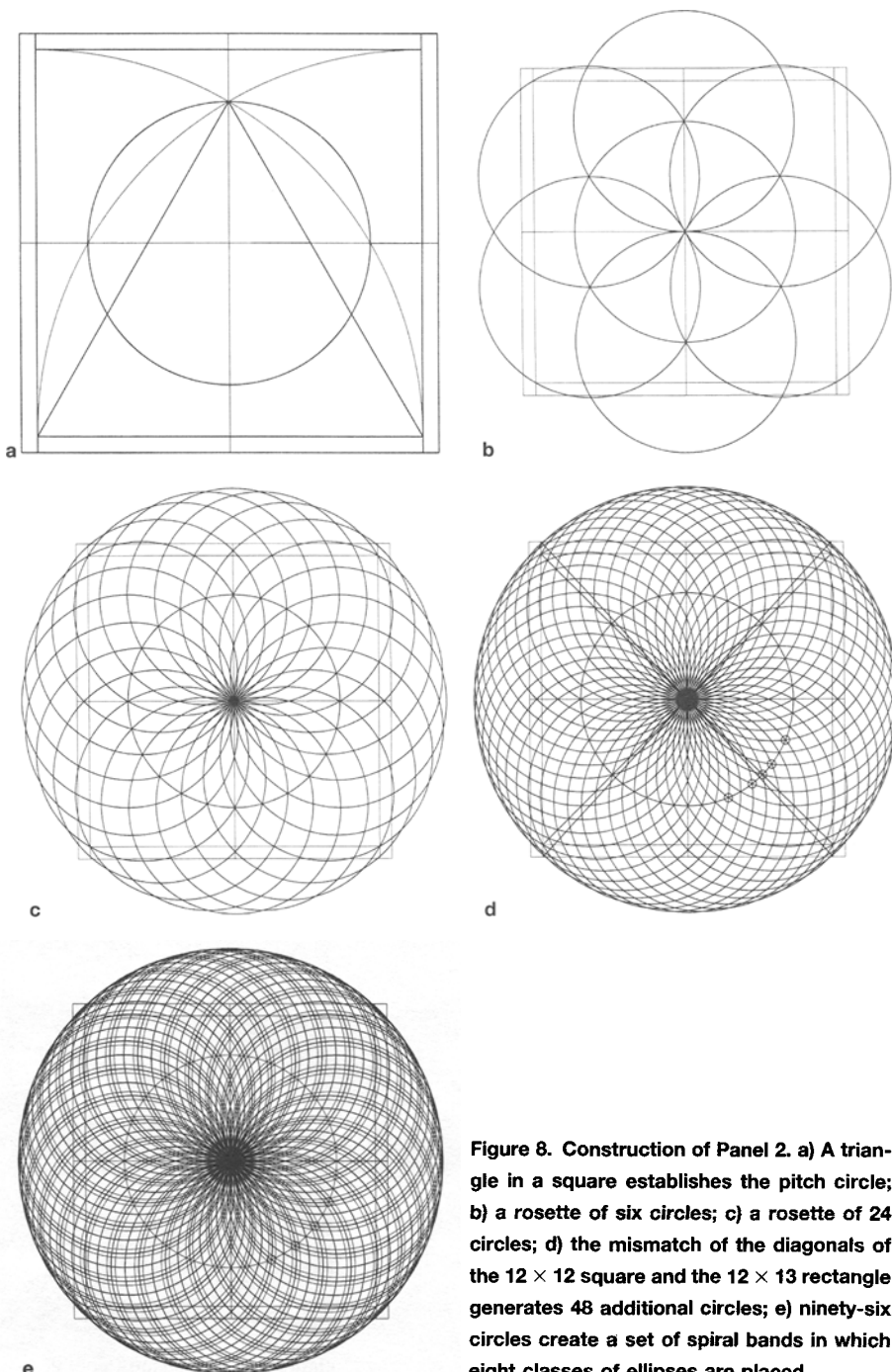


Figure 8. Construction of Panel 2. a) A triangle in a square establishes the pitch circle; b) a rosette of six circles; c) a rosette of 24 circles; d) the mismatch of the diagonals of the 12×12 square and the 12×13 rectangle generates 48 additional circles; e) ninety-six circles create a set of spiral bands in which eight classes of ellipses are placed.

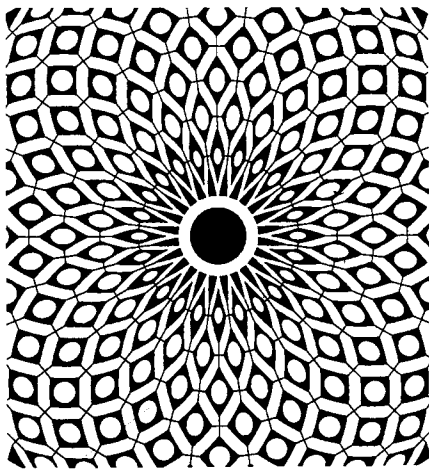


Figure 9. Nicholson's reconstruction of the Cosimo Panel.

law that predicted the positions of the planets up until Saturn. Again, is this coincidence or prescience? The pavement mirroring Panel 2 is placed in an 11×12 square perhaps symbolizing the 12 disciples and the 11 disciples once Judas was excluded.

The question begging to be asked is why 30 magnificent pavements would be constructed and then covered up. Perhaps some cryptic symbols were concealed within the pavements in the manner of Umberto Eco's *Name of the Rose* and then hidden to prevent their revelation. Nicholson has a more mundane hypothesis. When the library was conceived there were approximately 1000 books in existence. When it was completed, the Library contained over 3000. The Library had to be reconfigured to accommodate the new books. In the original plan for the Library, a triangular room was supposed to have been constructed to house the rarest of the books. However, this room was never built.

Unfortunately we do not know who created the pavements. The books listing the financial transactions in connection with them would most likely have listed the designer, but they have been lost. However, surely Michelangelo would at least have had a major say concerning such a crucial component of his library.

Acknowledgments

As you can see, this project has materialized for me into the ultimate of mathematical tours. I wish to acknowledge the fruitful collaboration that I have undertaken with my colleagues, Ben Nicholson and Saori Hisano, that has made this work a great pleasure.

REFERENCES

1. Kappraff, J. *Connections: The Geometric Bridge between Art and Science*. New York: McGraw-Hill Books. (1991).
2. Nicholson, B., Kappraff, J., and Hisano, S. "A Taxonomy of Ancient Geometry Based on the Hidden Pavements of Michelangelo's Laurentian Library." In *Art and Science: The Proceedings of the Second Conference on Art and Science* edited by J. Barrallo, San Sebastian, Spain: Univ. of the Basque Country Press (1998), and in *Bridges: Mathematical Connections in Art, Music and Science: Conference Proceedings* edited by R. Sarhangi, Arkansas City, KS: Gilliland Publ. (1998).
3. Nicholson, B., Kappraff, J., and Hisano, S. "The Hidden Pavements of the Laurentian Library." In *Nexus II: Architecture and Mathematics* edited by K. Williams. Fucechio, Italy: Edizioni dell'Erba (1998).
4. Hambridge, J. *The Elements of Dynamic Symmetry*. Originally published by Brentano's (1929) (rpt. By New York: Dover).
5. Edwards, E.B. *Pattern and Design with Dynamic Symmetry*. Originally published by Dynamarhythmic Design (1932) (rpt. New York: Dover).
6. Brunes, T. *The Secrets of Ancient Geometry and its Use*. Copenhagen: Rhodos (1967).
7. Kappraff, J. "A Secret of Ancient Geometry." In *Geometry at Work: A Collection of Papers in Applied Geometry* edited by K. Gorini. Math. Assoc. of Amer. Notes (In press).
8. Kappraff, J. *Mathematics Beyond Measure: A Guided Tour through Nature, Myth, and Number*. New York: Plenum Press (In press).
9. Kappraff, J. "Musical Proportions at the Basis of Systems of Architectural Proportion both Ancient and Modern." In *Nexus: Architecture and Mathematics* edited by K. Williams. Fucechio: Edizioni dell'Erba (1996).
10. Nicholson, B. "Architecture, Books + Geometry." In CD-Rom: *Thinking the Unthinkable House*. Renaissance Society at the University of Chicago (1997).
11. McClain, E. "The Star of David as Jewish Harmonical Metaphor." *International Journ. of Musicology*. Vol. 6, pp. 24-49. (1997).
12. McClain, E. Private communication.
13. McClain, E. *The Pythagorean Plato*. York Beach, ME: Nicolas-Hays (1978).
14. McClain, E. "Temple Tuning Systems." *International Journ. of Musicology*, 3 (1994).

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Revealing a Lost Body of Knowledge

In the summer of 1998, Ben Nicholson, Saori Hisano, and the author presented their research at two major conferences: The Second International Conference on Art and Mathematics directed by Vera Martha Winitzky de Spinadel and Maria Emiliana Uranga Otaegui in San Sebastian, Spain; and Nexus II directed by Kim Williams in Mantua, Italy. I then made a presentation at the Bridges Conference directed by Reza Sarhangi at Southwestern College in Winfield, Kansas. We also had a meeting in Florence with the Director and Chief Librarian of the Laurentian Library. As a result of this meeting, the Library agreed to sponsor an exhibition of the pavement research, which might prompt the community to think about exposing this lost body of knowledge to the open air.

More or Less Mathematics Wanted in Engineering?

Two images, one of the medieval cellarium at Fountains Abbey, England, and another of a tiled forecourt in Vernon, France, inspired two engineers to different conclusions. The first author considers that the importance of abstract mathematics is somewhat overrated, and he even makes an appeal to the scientific community to support his view. The second author calls for another kind of intervention: he asks for some mathematical assistance by proposing an unsolved problem to readers. Perhaps engineers and mathematicians will have reactions, outraged or otherwise, to contribute to The Intelligencer's letters.—D.H.

A. Less Mathematics and More Numeracy Wanted in Engineering

Edward Reed

To give academic respectability to a trivial piece of engineering research, it is standard practice to add some mathematics to make it appear more significant than it is. Mathematics is the silicon implants of academia. This is not to be confused with numeracy. Numeracy is highly relevant for engineers and unfortunately is often lacking (see Figure 1).

Most readers will have looked at the drawing, read the caption and answered the question before even reading the first paragraph. I understand this is a question in Trivial Pursuit, although I cannot confirm it. The answer universally accepted is the Great Wall of China. The real question is, is this true? I ask students, colleagues, and friends this question. Some look it up in books, like Hutchinson's *New Century Encyclopaedia* (Helicon Publishing Ltd., 1995), or the *Readers' Digest Book of Facts*. They choose between the supporters of the common positive answer, as proposed in the first reference, or the opponents, as in the latter. Few give a reasoned answer. What I am really after is some common sense, ap-

plied numeracy. We will return to this question later.

At school I liked and was good at mathematics. Once the prettiest girl in the class allowed me to kiss her in exchange for letting her copy my maths homework. That is the only time in my life, and I am a sexagenarian, that I've ever found a use for mathematics. More seriously, it has been my experience that very few engineers use mathematics in practice. They have of course to be numerate. The insistence on mathematics for all engineers has been a damaging deterrent to some highly capable, imaginative, and creative people. Engineering is after all about making things work. The empirical approach, trial and error, the ability to experiment quickly is of much more importance. Most problems cannot be solved by mathematics anyway, or they have to be reduced to too simple a model to be useful.

I expressed this view in a rather light-hearted manner in an article published internally within my university. To my surprise, many colleagues said that what I had said needed saying again and again. The professor of mathematics got the vapours, refused to speak to me, and shortly afterwards took early retirement. I also likened mathematics in engineering to the wowing of ladies: as there is supposed to be a lot of it about and since most men find little of it coming their way

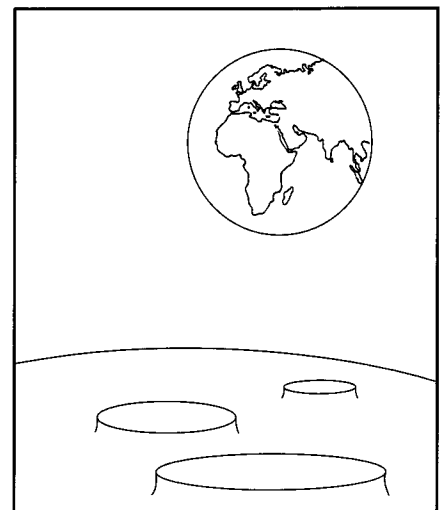


Figure 1. What is the only man-made object that can be seen on Earth from the Moon?

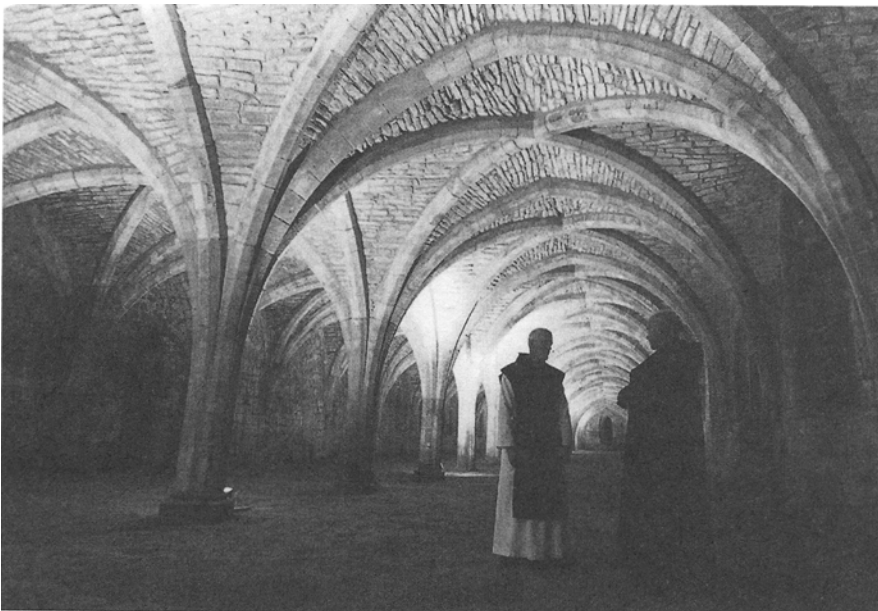


Figure 2. The medieval cellarium at Fountains Abbey, England (photograph reproduced by kind permission of *Yorkshire Post Newspapers*).

they believe somebody else must be doing awfully well.

After learning my views on mathematics, many of my critics tell me that they would not like to pass over a bridge that I had designed. Neither would I: My area is mechatronics. However, bridge-building will serve as an example. No bridge was ever built by mathematics. They are designed and built by teams of engineers requiring a vast range of skills; the more grandiose the bridge, the bigger the range of

skills. Bridges are built as something fit for the purpose at the most economical price, and they have been since time immemorial. The medieval builder had only wood and stone, but he could construct stone arches and knew that if a shape, known to us as a catenary, could be drawn so as to go through every stone, then his arch would stand up. The great medieval bridges and cathedrals of Europe were built without mathematicians, but the builders had to be imaginative, creative, skilled, and of

course numerate: they needed to calculate such matters as the number of eggs required for the mortar (see Figure 2). Back to the Great Wall problem. Here is one solution. Put your thumb in front of you and hold it up to the Moon. The Moon appears as a small disc about one-sixth the size of your thumbnail. By estimation it can be said that an object as far away and as big as the Moon—which is about 3000 km across—appears about 3 mm across to the eye. If we estimate that the wall is 5m across, we can calculate by proportion what thickness it would appear to somebody on the Moon. The answer is that it is much too small for even the most powerful of telescopes, let alone the naked eye. An often expressed view that the wall can be seen because it is over 2000 km long is patently daft. It is hoped that the wall example has demonstrated what is meant by numeracy.

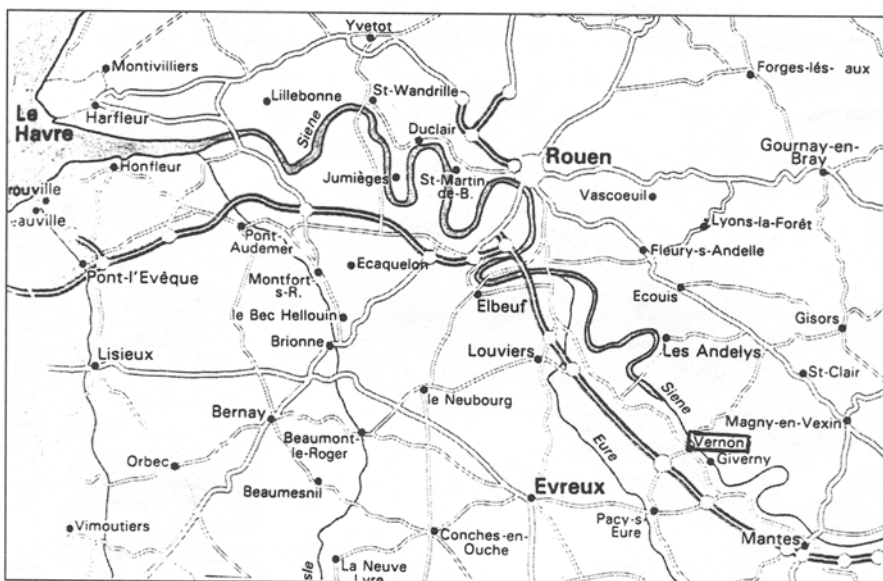


Figure 3. Map of France, locating Vernon.

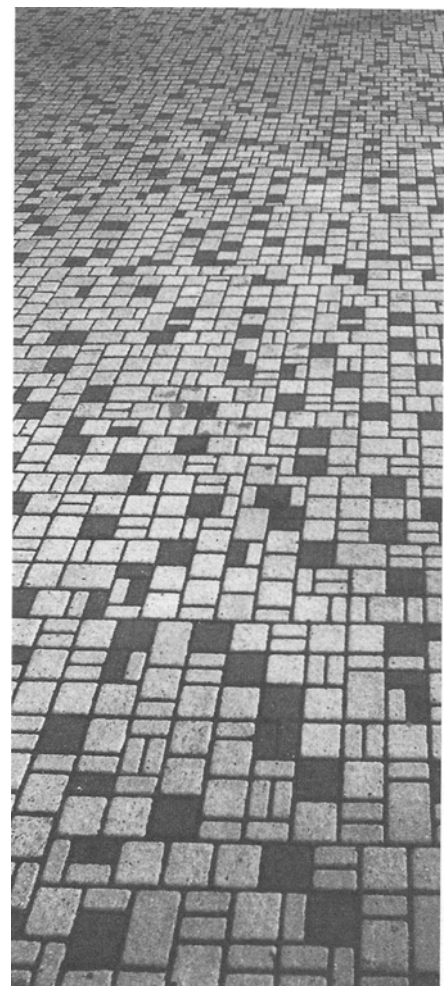


Figure 4. The tiled forecourt in Vernon—is there a pattern?

As a teacher of engineering, I have problems with students and their numerical skills even if their mathematics is good. I recently did an overseas exchange with another teacher, which involved us taking one another's classes. I found his students similarly poor at numerical work, so maybe this is a universal problem. Numeracy might be boring and mathematics exciting: I confess to having found this so at school. However it is numerical skills that are most lacking in engineering students. Perhaps mathematicians should address themselves to this problem.

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B. More Mathematics Required to Explain an Ingenious Tiling Pattern in Vernon, France

R.J. Holroyd

While on holiday in France I visited Vernon, a small town that stands on the Seine about midway between Paris and the sea. (See figure 3.) About a mile upstream is the small village of Giverny, with the house and gardens where Monet spent the last half of his life. While walking around the town, I came across a recently built arts centre (the Espace Culturel Philippe Auguste) with an intriguingly tiled forecourt. I was told that the workmen had a plan for laying the blocks, but no one could tell me how the plan was produced. The pattern, shown in figure 4, is made

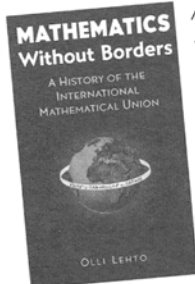
up of five different blocks: 3×2 , yellow; and 2×2 and 2×1 in both black and white, but their arrangement appears to be neither regular nor irregular. A mathematician suggested that the pattern might be an example of asymptotic periodicity and referred to me to some algebra textbooks, but so far as I could see these did not shed any light on the problem. Out of my depth about these mathematician's mathematics, apparently so different from the usual engineering computations, I would welcome any enlightenment about this fascinating pattern—or lack of pattern.

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