

ART HISTORY

English-language articles

Poseidon from Cape Artemision. The geometry of a Greek Masterwork
1980-2002

Geometry in Art. John the Baptist
1974 -2006

Piero della Francesca. Convenerunt in unum.
Supporting David King's interpretation.
(see the article „A Leap of Faith“ in „Nature“ 29 March 2007)
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Villa Farnesina. In honor of Gertrud Batschelet.
1979-2002

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Poseidon from Cape Artemision

The Geometry of a Greek Masterwork

[Poseidon 1](#) / [poseidon5.GIF](#) / [poseidon6.GIF](#)

POSEIDON FROM CAPE ARTEMISION The Geometry of a Greek Masterwork

Poseidon, standing upright on his left foot, arms raised, balances his body weight with his right leg and sights over his left hand, aiming a (now missing) trident at a far away target we can only guess at. [Poseidon 1](#) The figure of this Greek god displays such composure, creates a wonderfully balanced effect, majestically at rest upon itself. How did the unknown master achieve this effect? First, he applied the famous contraposto: Poseidon extends his left arm and his right leg simultaneously, while bending his right arm and his left leg. Second, he used a principle I call self-reference: stretch out the left arm and you duplicate the line of the right upper arm; extend the right leg and you reach the left shoulder via the navel; prolong the left upper thigh and you reach the right shoulder via the navel again; extend the left lower thigh and you reach the left shoulder. Third, the figure is held together by a geometry which my drawings render visible: [Poseidon 2](#) / [Poseidon 3](#) / [Poseidon 4](#) A large circle around the navel and touching the tip of the middle finger of the left hand seizes the right hand and the heel of the right foot while resting on the ground. The height of the navel, and therefore the circle's radius, measure 18 large or 72 small units, and the circle's diameter measures 36 large or 144 small units. Draw an arc around the nadir of the circle. Its radius will measure 30 large or 120 small units. The arc will brush Poseidon's head and cross the circle in the point marked by the tip of the middle finger of the left hand (aiming finger tip). The height of this point is that of the horizontal arm line and measures 25 large or 100 small units. The height of the figure measures 30 large or 120 small units. The distance between the navel and the height of the arm line measures 7 large or 28 small units. The aiming fingertip marks the upper right-hand corner of a pair of right triangles that are correlated by the equation 30×30 minus 25×25 equals 18×18 minus 7×7 equals 275. The golden section of the circle's vertical diameter (144 small units) is marked by the figure's nipples (height 89 small units) and the glans (height 55 small units). How long was the former trident in Poseidon's right hand? Take a rod (or paper roll) and slide it through the opening of the hand. The rod (or paper roll) will show towards the aiming fingertip. Fix the rod (or paper roll) in such a position that the hand holds it roughly in the middle. If the rod (or paper roll) is 15 large units long, the distances from the fingertip to the fore and hind ends of the rod (or paper roll) will again be in the golden ratio: about 25 and 40 large units.

The wonderful bronze statue was found on the seabed by Cape Artemision at the northern end of the Ionic island of Euboea and is kept in the National Museum of Athens (no. 15161). The height of the figure measures 209 centimeters, corresponding to an Ionic orgyia (fathom) that measured 208.98 cm. 5 large units equal one Ionic pous (foot) measuring 34.83 cm. 30 small units equal one Ionic paechys (cubit) measuring 52.245 cm. 15 large or 60 small units equal two Ionic paechei. 30 large or 120 small units equal six podoi or four paechei or one orgyia.

Large drawings from 2005: [poseidon5.GIF](#) / [poseidon6.GIF](#)

Available on request: geometrical examinations of the Kouros from Tenea, of the Gettys Kouros and of the Kroisos from Anavyssos.

Geometry in Art; John the Baptist

Many reconstructions and interpretations (large files), Greek antiquity, Piero della Francesca, Andrea del Verrocchio, Leonardo da Vinci, Raphael, Giorgione

[gia01.JPG](#) [gia02.GIF](#) [gia03.GIF](#) // [kouros1a.JPG](#) [kouros1b.JPG](#) [kouros1c.JPG](#)
[kouros1d.JPG](#) [kouros2a.JPG](#) [kouros2b.JPG](#) [kouros2c.JPG](#) [kouros2d.JPG](#)
[kouros2e.JPG](#) [kouros3a.JPG](#) [kouros3b.JPG](#) [kouros3c.JPG](#) [kouros3d.JPG](#)
[kouros3e.JPG](#) [kouros3f.JPG](#)

[gia04.JPG](#) [gia05.GIF](#) [gia06.JPG](#) [gia07.JPG](#) [gia08.JPG](#) [gia09.JPG](#) [gia10.GIF](#)
[gia11.JPG](#) [gia12.JPG](#) [gia13.JPG](#) [gia13a.GIF](#) [gia14.GIF](#) [gia15.GIF](#) [gia16.JPG](#)
[gia17.JPG](#) [gia18.JPG](#) [gia19.JPG](#) [gia19a.JPG](#) [gia19b.JPG](#) [gia20.GIF](#) [gia21.JPG](#)
[gia22.JPG](#) [gia23.JPG](#) [gia24.GIF](#) [gia25.JPG](#) [gia26.JPG](#) [gia27.JPG](#) [gia28.JPG](#)
[gia29.JPG](#) [gia30.JPG](#) [gia31.JPG](#) [gia32.JPG](#) [gia33.JPG](#) [gia34.JPG](#) [gia35.JPG](#)
[gia36.JPG](#) [gia37.JPG](#) [gia37a.JPG](#) [gia38.JPG](#) [gia39.JPG](#) [gia40.GIF](#) [gia41.JPG](#)
[gia42.JPG](#) [gia43.GIF](#) [gia44.GIF](#) [gia45.GIF](#) [gia46.GIF](#) [gia47.JPG](#) [gia48.GIF](#)
[gia49.JPG](#) [gia50.GIF](#) [gia51.JPG](#) [gia52.GIF](#) [gia53.GIF](#) [gia54.JPG](#) [gia55.JPG](#)
[gia56.JPG](#) [gia57.JPG](#) [gia58.JPG](#) [gia59.JPG](#) [gia60.JPG](#) [gia61.JPG](#) [gia62.JPG](#)
[gia63.JPG](#) [gia64.JPG](#) [gia65.JPG](#) [gia66.JPG](#) [gia67.GIF](#) [gia68.GIF](#) [gia69.GIF](#)
[gia70.GIF](#) [gia71.JPG](#) [gia72.JPG](#) [gia73.JPG](#) [gia74.JPG](#) [gia75.JPG](#)

(By the end of 2005 the British company Fulcrum TV contacted me on behalf of a documentary on a London picture attributed to Leonardo da Vinci: *John the Baptist and Christ as Infants*, dubbed *The Lost Leonardo*. I answered their forty-four e-mails, patiently, at length, taking all my time, and compiled a CD for them. In January 2006 I got two *panettone* from Italy, then - nothing. Complete silence. Did a professor intervene? Here you are with the material of my CD for Fulcrum TV, improved and enlarged. But still in my own personal freestyle English, on which I hold a copyright, so please no one dare copy my mistakes ;-)

Geometry in Greek and Renaissance Art

Poseidon from Cape Artemision, Athens: [gia01.JPG](#) / Geometry: [gia02.GIF](#) [gia03.GIF](#) / Text: [poseidon.htm](#) // *Kouros from Tenea* [kouros1a.JPG](#) [kouros1b.JPG](#) [kouros1c.JPG](#) [kouros1d.JPG](#) // *Getty Kouros*, in my opinion the work of a young pupil of the master of the kouros from Tenea (photograph courtesy J. Paul Getty Museum) [kouros2a.JPG](#) [kouros2b.JPG](#) [kouros2c.JPG](#) [kouros2d.JPG](#) [kouros2e.JPG](#) // *Kroisos from Anavyssos*, in my opinion a work of the mature master of the Getty Kouros [kouros3a.JPG](#) [kouros3b.JPG](#) [kouros3c.JPG](#) [kouros3d.JPG](#) [kouros3e.JPG](#) [kouros3f.JPG](#)

Leonardo da Vinci, Neptune and Seahorses, Windsor: [gia04.JPG](#) / The geometry of this drawing is based on the golden section: [gia05.GIF](#) / The red circle holds a dramatic group: [gia06.JPG](#) /

Concentric circles reveal the dynamic of this composition: [gia07.JPG](#) / The drawing may have been a cartoon for a mural in the saloon of Agostino Chigi's villa in Rome: [gia08.JPG](#)

Raphael, Galatea, Rome: [gia09.JPG](#) / Geometry: [gia10.GIF](#) [gia11.JPG](#) [gia12.JPG](#) [gia13.JPG](#) [gia13a.GIF](#) / The fresco may originally have been planned as a mural for the saloon of the summer Villa of Agostino Chigi, called Farnesina: [gia14.GIF](#)

Leonardo da Vinci, Isabella d'Este, Paris / Leonardo, drawing of a woman's profile in a circle: [gia15.GIF](#) / Isabella d'Este, circle of the head, arc of the shoulders: [gia16.JPG](#) / Reconstructing the original format 4:3, grid 4 by 3 large or 8 by 6 small units. The diameters of the circles and of the arc measure 1, 2, 3 and 4 units: [gia17.JPG](#) [gia18.JPG](#)

Piero della Francesca, Baptism of Christ, London: [gia19.JPG](#) / Geometry, a square grid of 12 by 12 units, an upper circle, a lower circle, a pyramid ascending to the center of the upper circle: [gia20.GIF](#) / Geometry applied to the picture. The center of the upper circle, zenith of the lower circle, and top of the pyramid, is marked by the dove's beak: [gia21.JPG](#) [gia22.JPG](#) (An aside. Kenneth Clark, B.A.R. Carter and James Elkins tried in vain to find a geometry underlying Piero's painting, and so they concluded there is no surface geometry in Renaissance art, which, unfortunately, has become an almost insurmountable dogma of art history: [gia19a.JPG](#) [gia19b.JPG](#))

Andrea del Verrocchio and Leonardo da Vinci, Baptism of Christ, Florence, in the original format of a square: [gia23.JPG](#) / Geometry: [gia24.GIF](#)

Leonardo da Vinci, Burlington House Cartoon, London / Circle of arms: [gia25.JPG](#) / Reconstructing the original format: [gia26.JPG](#) [gia27.JPG](#)

Raphael, Madonna with Child, a drawing, and the painting in Zurich / Drawing, based on a lovely and simple geometry: [gia28.JPG](#) [gia29.JPG](#) [gia30.JPG](#) [gia31.JPG](#) / The painting in Zurich is based on a more elaborate and complex geometry; here just the painting: [gia32.JPG](#)

Leonardo, Madonna of the Rocks, first version, Paris: [gia33.JPG](#) / Thomas Brachert found that height and width of this charming painting by the young master Leonardo stay in the golden ratio. The top of the head of Mary, and the top of the head of the angel divide the height in the same ratio. Starting from this insight, I added a grid of the golden ratio: [gia34.JPG](#)

Raphael, La belle jardinière, Paris: [gia35.JPG](#) / Geometry, format 3:2, golden grid: [gia36.JPG](#)

Leonardo, Madonna of the Rocks, replica, London: [gia37.JPG](#) / The figures are closer together and slightly bigger than in the first version. They form a group that is held together by a circle. Its area halves the large square, whose upper side marks the height of the start of Mary's part: [gia38.JPG](#)

Leonardo, John the Baptist, Paris: [gia39.JPG](#) / Original format 4:3, grid 4 by 3 large units, or 8 by 6 small units. The axis of the eyes lies on the half-diagonal that joins the middle of the left margin with the upper right corner. The axis of the face lies on the diagonal that joins the bottom right corner with the upper left corner. The half-diagonal and the diagonal stand perpendicular to each other. Here just these two lines in the grid of 8 by 6 units: [gia40.GIF](#)

John the Baptist and Christ as Infants, London [gia41.JPG](#) / There are several versions of this motif by Leonardo. Only the one in London contains a geometry, which, moreover, is precisely observed. I examined the geometry of the picture in 1984, then again in December 2005, this time on the basis of a large digital photograph, which allows me to confirm the basic features of the geometry found in 1984. Some shapes fit even better, while some proportions from 1984 have to be modified. / Here you see the painting in the original format 6:5, a musical format: [gia42.JPG](#) / The grid of the painting measures 6 by 5 large units, or 12 by 10 small units: [gia43.GIF](#) [gia44.GIF](#) / Large central circle, diameter 5 large units, radius 5 small units, periphery marked by twelve points of the grid 12 by 10: [gia45.GIF](#) [gia46.GIF](#) / Here you see the circle applied to the picture. John places his right forefinger on the breast of Christ. The center of the circle, marked by a red dot, is just above the foremost joint of the right forefinger: [gia47.JPG](#) / Diagonals of the grid 12 by 10 explain the position of two feet: [gia48.GIF](#) / Diagonals applied to the painting: [gia49.JPG](#) / Large triangle of arcs, standing inside the large central circle. The lower corners are given by two points of the grid 12 by 10. The radii of the arcs measure 4 large or 8 small units each: [gia50.GIF](#) / Large central circle and triangle of arcs applied to the painting. The upper corner of the round triangle is marked by a small overhang of the rock: [gia51.JPG](#) / Small circle of the arms. Its radius measures 1 large unit. Its center divides the width of the original format into 2 plus 3 large units, and the height in a ratio that involves the golden number $g = 0.6180339\dots$. The ratio of the shorter to the longer part of the height equals $(2g + 1) / (2g + 2) = 0.690983\dots$: [gia52.GIF](#) [gia53.GIF](#) / Large central circle and small circle of the arms, applied to the painting. The center of the small circle is given by the lips of Christ: [gia54.JPG](#) / The golden section plays a crucial role in several above compositions. In the case of *Poseidon from Cape Artemision* the height of the figure and diameter of the circle measures 1 Ionic fathom, 36 large units or 144 small units. The nipples and glans divide the height of the figure in the golden section. Height of head 144, of the nipples 89, of the glans 55 small units. These numbers belong to a golden number sequence that is named for Leonardo Fibonacci but was already known in antiquity: 1 1 2 3 5 8 13 21 34 55 89 144 ... The grid of Leonardo's *Neptune with Four Seahorses* measures $G+2+G+G+2+G$ by $G+2+2+G$ units, the ratio of height to length equals $G + 2 / 2G + 2$ (yielding 0.690983...). The reins held by Poseidon and the bared teeth of the rearing horse divide height and length of the original format in the golden section. In the case of Raphael's *Galatea* the top of the woman's head divides the height of the format in the golden section. In the case of Leonardo's *Burlington House Cartoon* the right eye of John and the vertical line of his cheek divide height and width of the original format in the golden section. In the case of Raphael's study for a *Madonna* there is a hidden cross of four lines which divide width and height of the original format in the golden section. Leonardo's first version of the *Madonna of the Rocks* and Raphael's *Belle jardinière* are ruled by the golden ratio. And here, in the London picture of the two infants embracing, the eye of Christ divides the height of the original format in the golden ratio, while his member and the tip of his forefinger placed on John's throat divide the width of the original format in the golden ratio: [gia55.JPG](#) / The geometry of the painting goes along with its meaning, as you shall see in the next chapter. / Conclusion. The large digital photograph in the tiff format, here rendered in jpeg, allowed me to re-adjust the geometry I discovered in 1984. The longer I work on this photograph, the more I admire the lovely plants: ivy, bright anemones beneath Christ's feet, dark violets beneath John's feet, and further plants surrounding the boys. I see the master's hand in it all. However, the painting may be unfinished. When comparing it with the fist version of the *Madonna of the Rocks* one may

miss a final shading of the children. Another sign of the unfinished state may be the missing ivy strings. The ivy leaves hover like butterflies – and thus appear on the lovelier to me: [gia56.JPG](#)

Art, Man's Creation, and Nature, God's Creation

Andrea del Verrocchio and Leonardo, Baptism of Christ, Florence: [gia23.JPG](#) [gia23a.JPG](#) / In this painting by Andrea del Verrocchio, young Leonardo painted his first figure, the angel on the left side, and the waterfalls above him. Andrea was so amazed by the skills of his pupil that he allegedly never again carried out a painting, leaving that kind of work to his most talented pupil. / Strangely, the angel looks up to John, while he should look up to Christ in the center of the picture. How come? Have a closer look at the angel: [gia23a.JPG](#) He observes John quite critically. In a similar way Leonardo may have observed his teacher Andrea: critically, already feeling superior, and it seems that the kneeling angel is about to raise and stand up ...

May it be that Leonardo saw himself in the angel, and his teacher in John the Baptist? Yes, it may well have been so, not only on the psychological but also on the symbolical or philosophical level. John the Baptist announced the arrival of Christ: *He that cometh after me is mightier than I* (Gospel according to Matthew, Chapter 3, 11). Art is humankind's noblest creation, and the task of art, Leonardo believed, is to praise nature, God's creation. The painter who praises nature in his work conveys a similar message: *John the Baptist had been telling his followers that the one who comes after him is mightier than he, and in a similar way nature is mightier than my art --- more splendid and complete than any work by any human being can ever be ...*

Leonardo, Madonna of the Rocks, first version, Paris: [gia33.JPG](#) / The infant John has found the entrance into a cave, where, to his marvel, he finds Mary, an angel, and the infant Christ. Mary seizes little John, draws him near and presses him on his knees, while blessing her son, who, on his turn, is looking at John and blessing him by raising his hand. / Leonardo, meanwhile a master of the fine arts, having opened a workshop of his own, sees himself in young John. As a boy he had discovered the entrance to a cave, and now he shows himself via his alter ego John the Baptist entering a cave. He feels attracted by the beauty, fertility and secret of nature, symbolized by Mary, and by the very essence of nature, symbolized by Jesus. / Why does the angel point toward John? While Mary takes up little John into the sacred circle of the holy group, the angel looks at us and points toward John, symbol of young Leonardo the painter, who carries out his work with his hand: eye to eye, hand to hand ... While Mary symbolizes the beauty of nature, the angel symbolizes the beauty of art, and while Mary is taking up John into her sacred circle, the angel, silently smiling at us, invites us to join the very same circle that is still open to the foreground ...

John the Baptist and Christ as Infants, London: [gia41.JPG](#) [gia42.JPG](#) / Here you see little John on the left side, embraced and kissed by little Christ in the center. Leonardo, present in John, is feeling favored by nature represented by Jesus. However, there is a fine symbolism that places nature above art, Jesus above John. Christ appears in the middle, John on the side. You can see the member of little Christ, while the one of John is hidden, meaning that nature is fertile, while art is sterile – a painted anemone may be as pretty as can be, yet it is just painted, sterile, there will be no seeds that spread and grow new flowers. Have a closer look at the left hand of Christ: he places his forefinger on the throat of John, thus indicating that art can make nature speak. Which is the very task of art: in itself sterile, yet able to praise nature. While Christ places his forefinger on John's

throat, John places his forefinger on the breast of Christ, indicating nature's being, nature's heart. Nature is, while art praises nature using a visual language ... / *If you despise painting*, Leonardo wrote, *you despise a fine piece of philosophy that considers all qualities of nature*.

Leonardo, Burlington House Cartoon, London: [gia27.JPG](#) / In the *Burlington House Cartoon* John has grown, as Leonardo has advanced in his mastership. We see him being taught by little Jesus, hence by nature in the arms of Mary, symbol of beauty, fertility and the secret of nature.

Leonardo, Madonna of the Rocks, replica, London: [gia37.JPG](#) / When painting his replica of the *Madonna of the Rocks*, Leonardo, a mature master on the zenith of his career, could no longer render himself as a child, and so all that remains of the juvenile masterwork is the religious shell, which is why conventional nimbi appear in the picture. The figures are larger, they form a self-sufficient circle, we are no longer invited to join them, the angel does not longer look at us. He looks over to little John, critically, yet with a secret pleasure — much in the way Leonardo may have looked at himself when painting his replica and remembering the former days when he was a young master, and so this painting is not just a replica, it has become a new testimony of how Leonardo felt as a painter ... This angel is showing one of the prettiest faces Leonardo ever painted: [gia37a.JPG](#)

Leonardo, John the Baptist and Nymph, missing / Windsor: [gia59.JPG](#) / John the Baptist arrives at the bank of a river, with one hand he points over his left shoulder, with the other one down into the ground. This drawing was kept in Bergamo, but is missing since World War II: [gia57.JPG](#) / A nymph stands or rather hovers over a river bank, smiling at us in an ethereal, almost unearthly way, before a mysterious landscape with big flowers, and pointing to the right side: [gia58.JPG](#) / The two drawings may have been small cartoons for a pair of murals on the opposite walls of the former audience room in the Belvedere of the Vatican, where Leonardo lived when at Rome. The two murals on opposite walls could have represented John the Baptist, hence Leonardo as painter, nearing the end of his career, and having a glimpse at the beyond, the nymph standing on the other side of the river. When seen from the side, in passing the gangway, there is a remarkable optical illusion: John is now pointing across the room, and the nymph into the depth of her mysterious landscape: [gia59.JPG](#) / We know little of what Leonardo did when in Rome, just that he got a commission by the Pope, whereupon he, Leonardo, went to his laboratory and experimented with a new varnish. The Pope was upset by Leonardo's reaction and exclaimed: *This man will never finish anything, he starts with the end instead of the begin!* Leonardo should have drawn sketches, instead he experimented with a varnish, the last layer to be added to a finished painting. But it makes sense to experiment with a varnish if you wish to paint the *beyond* and hide it behind a secret mist achieved by means of a special varnish, and this would have been the last example of the famous *sfumato* invented by Leonardo ...

Leonardo, John the Baptist, Paris: [gia39.JPG](#) / In his last painting, Leonardo shows John the Baptist as a grown up man, before a dark background. He smiles at us, his eyes are overshadowed, yet his front is bright and clear. With his right hand he points toward the sky; with his left hand – consider that Leonardo was a left-hander – to his own breast. While the right arm is completely visible and the hand very bright, the left arm is only partly seen, and the hand in the shadow. John looks at us as if he wishes to tell us something, yet as a figure in a painting he can't really speak, so he speaks to us in the way Italians do, by means of his hands and gestures:

God created the world,
whereas I, Leonardo,
born into God's world,
now soon departing,
have seen his work.
Much of what I saw,
did I study, draw, describe,
and paint. Yet my work is
incomplete, and only a shadow
of nature, God's brilliant creation.
And if you lose a great artist in me,
don't be sad; just look at nature,
consider the work of the greatest
artist, the splendid creation by God.

As an apprentice, Leonardo painted the angel in Andrea del Verrocchio's *Baptism of Christ*. Now, at the end of his career, he paints John. Yet the scene of the last painting, announcing Christ, immediately precedes the one of the first painting, baptizing Christ. Thus, Leonardo closed the circle, and also, if you like, considered the possibility of a new one ...

Leonardo, Raphael and Giorgione

When Leonardo was painting his replica of the *Madonna of the Rocks* he might have been teaching Raphael and Giorgione, his informal pupils, telling them what he had in mind when he had been painting his first version of the *Madonna of the Rocks*. Both painters would then have honored their teacher: Raphael by painting his mural *School of Athens* in the Vatican, which made his fame in Rome, and Giorgione by painting his *3 Philosophers*.

Raphael, School of Athens, Rome: [gia72.JPG](#) [gia73.JPG](#) [gia74.JPG](#) [gia75.JPG](#) / The passageway in the center of the painted architecture has a similar form as the frame of the *Madonna of the Rocks*: a standing rectangle topped by an arch. The main figure, Plato, shows the features of Leonardo. Plato/Leonardo raises his right hand in a similar way *John the Baptist* does, and in his left hand he holds Plato's *Timaios*, the famous dialogue wherein the Greek philosopher explains, among other things, that all matter is composed of geometrical shapes that are ruled by numbers. Meanwhile Aristotle, by the side of Plato, is holding his right hand in the same way Mary is holding her left hand in both versions of the *Madonna of the Rocks*: [gia73.JPG](#) / In Leonardo's juvenile masterwork there is an angel at the right side, looking out of the picture, inviting us to join the holy group: [gia33.JPG](#) / At the right margin of the *School of Athens* Raphael painted himself: looking out toward us, inviting us to join the school of philosophers, poets, singers, painters, sculptors and architects ... He has an angelic face, and resembles the angel in Leonardo's painting, even more

Leonardo's study for that angel: [gia74.JPG](#) / Giorgione's enigmatic painting of the *3 Philosophers* may be a homage to the hypothetical lessons Leonardo gave him and Raphael at Florence, telling them what his first version of the *Madonna of the Rocks* really means, and about his discovery of a cave when a boy ... Now we see an entrance to a cave on the left side, and three philosophers on the other side, from left to right: *Giorgione*, sitting, looking toward the entrance of the cave; *Raphael*, standing, in the middle; *Leonardo*, standing, on the right side, looking and pointing toward the entrance of the cave, holding a pair of compasses and a sheet with geometrical / astronomical drawings: [gia75.JPG](#)

Similar geometries

The drawings of *John the Baptist* and the *Nymph* by Leonardo, and of a *Venus* by Raphael, may show the central figures of a planned mural each, and composition is based on a similar geometry containing a standing ellipse of the format 4:3 in the center. The upper focus of each ellipse is marked by an eye, while the height of the lower focus is marked by a foot: [gia57.JPG](#) [gia58.JPG](#) [gia59.JPG](#) [gia60.JPG](#) [gia61.JPG](#) [gia62.JPG](#) [gia63.JPG](#) [gia64.JPG](#) [gia67.GIF](#) [gia68.GIF](#) [gia69.GIF](#) [gia70.GIF](#) / *Raphael, study of figures in a standing ellipse*: [gia13a.GIF](#) / On the ceiling of the entrance hall of Agostino Chigi's Villa, the so-called Farnesina, are two frescoes painted by Raphael's school. In the center of the right painting you see a young man who strongly resembles *John the Baptist* in the above cartoon by Leonardo: [gia65.JPG](#) / In the center of the left fresco appears a woman who is pointing toward the right side. If you look at her from the right side, however, she is pointing across the table – the same optical illusion we encountered with Leonardo's *Nymph*: [gia66.JPG](#) [gia58.JPG](#) [gia59.JPG](#) / Raphael's *Venus* may have been the central piece of a cartoon for a fresco in the enlarged saloon of Agostino Chigi's villa (Farnesina), however, it was not to be. First, Raphael would have had to give up his plan of painting the Galatea in the saloon – out of whatever reason –, and so he painted a part of his composition in the (then open) garden loggia. Now he would have had to give up to paint his Venus fresco in the enlarged saloon – out of whatever reason –, and instead he painted his a charming Venus cycle in the entrance hall, under the long frescoes that show the pointing young man and woman in the respective center, presumably by a pupil after drawings by the master. Here one of the Venus panels by Raphael himself: [gia71.JPG](#)

Geometry in Renaissance paintings can be used for restoring original formats, attributing a composition to an artist, finding out an original composition among different versions of the same motif, and, in some cases, for interpreting a picture.

Piero della Francesca

Supporting David King

[gia19.JPG](#) / [gia20.GIF](#) / [gia21.JPG](#) / [gia22.JPG](#)

[conv01.JPG](#) / [conv02.GIF](#) / [conv03.GIF](#) / [conv04.GIF](#) / [conv05.GIF](#) / [conv06.GIF](#) / [conv07.GIF](#) / [conv08.GIF](#) / [conv09.GIF](#) / [conv10.GIF](#) / [conv11.GIF](#) / [conv12.GIF](#) / [conv13.GIF](#) / [conv14.GIF](#) / [conv01.JPG](#)

Piero della Francesca, *Baptism of Christ*, picture, geometry (square, grid 12 by 12, lower circle of Christ, pyramid of Christ, upper circle of Holy Spirit present in a dove), geometry applied to the picture: [gia19.JPG](#) / [gia20.GIF](#) / [gia21.JPG](#) / [gia22.JPG](#)

Piero della Francesca, *Convenerunt in unum* (Flagellation of Christ) [conv01.JPG](#)

Frame 24 by 18 units, format 3/4, grid 20 by 14 units [conv02.GIF](#) / [conv03.GIF](#)

Braccio Fiorentino 58.36 cm; proposed unit for Piero's painting 1/16 braccio or 3.6475 cm; frame 65.655 by 87.54 cm or 9/8 by 3/2 bracci Fiorentini.

The picture is slightly larger than the grid 14 by 20 – observe the thin strips under and above the grid: [conv04.GIF](#)

Grid applied to the picture, yellow dot: center of perspective, red dot: center of grid, blue dot: center of small picture within the picture: [conv05.GIF](#)

Small picture within the picture, 12 by 12 units, area 144 square units, one third of the area of the picture and frame together (18 x 24 = 432 square units): [conv06.GIF](#) / [conv07.GIF](#)

Diagonals of the square 12 by 12: [conv08.GIF](#)

Geometry applied to the picture: [conv09.GIF](#)

The vertical lines of Christ and cardinal Bessarion divide the length of the picture into 7 plus 6 plus 7 units, the length of the frame into 9 plus 6 plus 9 units or in the ratios 3/8 and 5/8 (approximating the golden section). The diagonal connecting the bottom right corner of the left field 14 by 7 with the top left corner of the right field 14 by 7 is hold by the Roman. Geometry applied to the picture: [conv10.GIF](#) / [conv11.GIF](#) / [conv12.GIF](#)

Left square 14 by 14 plus diagonals, right field 14 by 7 plus diagonals, applied to the picture: [conv13.GIF](#) / [conv14.GIF](#)

The geometrical examination of Piero's painting confirms David King's fine interpretation and suggests a modification as well: Piero came first, the inscription on the astrolabium for Cardinal Bessarion second. One may assume that Regiomontanus was a good friend and informal pupil of Piero della Francesca, well acquainted with the picture, whereupon he encoded not only the names but also some of the crucial numbers of the painting into the inscription on the astrolabium honoring Cardinal Bessarion:

length of grid 20 units — 20 letters in the first line
 height of frame 18 units — 18 letters in the second line
 from right side of frame to line of Christ,
 from left side of frame to line of Bessarion
 15 units each — 15 letters in the third line
 height of grid 14 units, big square 14 by 14 —
 14 signs in the last line (count as one sign)
 SUB DIVI BESSARIONIS DE — 20 letters
 CARDINE DICTI PRAEISEI — 18 letters
 DIO ROMAE SURGO IO — 15 letters
 ANNIS OPUS :- 1062 — 14 signs

For the interpretation of the couplet see David King. Here just one addendum. The lines of Christ and Bessarion divide the length of the picture into 7 plus 6 plus 7 units. Divide the first line accordingly and you get

SUBDIVI BESSAR IONISDE 7+6+7 letters

Sub divine Bessarionis ‘under the divine Bessarion’ becomes

SUBDIVI (...) DE

subdivide, a pun by the astronomer and mathematician Regiomontanus who transformed the painting by his presumed friend and informal teacher Piero della Francesca [conv01.JPG](#) into a dedication to Cardinal Bessarion, encoding both names and numbers of the painting.

Geometry in art, John the Baptist (reconstructions and interpretations) [gia.htm](#)

Broken Perspective

Leonardo da Vinci , *Last Supper*

BROKEN PERSPECTIVE - Leonardo da Vinci's Last Supper in the Former Refectory of the Monastery Santa Maria delle Grazie at Milan

[Last Supper 1](#) / [Last Supper 2](#) / [Last Supper 3](#) / [Last Supper 4](#) / [Last Supper 5](#) / [Last Supper 6](#) / [Last Supper 7](#) / [Last Supper 8](#) / [Last Supper 9](#)

A visitor standing in the former refectory of Santa Maria delle Grazie will see the large figures of Christ and his twelve disciples painted high up on a wall, set in a virtual prolongation of the room itself and seated in a row behind a long table positioned horizontally to the space. Jesus is in the center, six and six disciples by his sides. From left to right: Bartholomew, Jacob, Andrew, Judas, Peter, John, Christ, Thomas, Jacob the Elder, Philip, Matthew, Simon, and Thaddeus. Jesus has just announced that one of those present will betray him. The men have sprung up, bent forward and leaned backwards, turned towards and away from each other, in this way forming four distinct groups of three men each. Who would betray the Lord? Although the name of the traitor has not been uttered aloud, the disciples look and point toward Judas - as if revealing him in a subconscious manner. Matthew, Thaddeus and Simon are all indicating him directly. Philip has jumped up and points at his own breast, as if saying: Look at me, my sweet Lord, I could never betray you! - while gazing in Judas' direction. Thomas, too, is looking at Judas, while raising his right hand in a menacing manner. Jacob the Elder leans backward, opening his arms in disbelief and gazing at the bowl between Christ's right hand and Judas' left (it was by dipping his bread into this bowl that Judas would reveal himself as the traitor). Bartholomew, Jacob and Andrew have their eyes on the back of Judas' head. Andrew has his arms raised - as if to protect himself against him. John is leaning toward Peter with his eyes closed; if he opened them he would have to look directly into Judas' face. Jacob is reaching out for Peter's arm, and seems to be pointing at the back of Judas' head (an action evident only in the shortened projection of the virtual room onto the wall. A picture, however, lives from allusions). Peter turns towards John and asks him for the traitor's name; he even pokes the hilt of a knife at Judas' back, as if trying to push him out of the picture. Judas, alarmed by Jesus' words and menaced by Peter, is leaning backwards, away from Jesus, and bending over the table, away from Peter - but he cannot fall out of the picture, for the table prevents him.

Judas is the one who will betray Jesus, and therefore the other disciples look at him, point in his direction, and menace him. On the other hand, Jesus will die for the sins of all men and not just because of Judas; God's plan requires the betrayal of Jesus, and therefore Judas belongs to the fated community of the Last Supper and for that reason is held firmly within the picture by the bar of the long table. Jesus, knowing who will betray him, does not seem angry with Judas; he simply looks away, sadly lowering his head and eyes.

In my opinion, Leonardo's Last Supper raises a philosophical question: Do we have, or do we not have, free will? Did Judas act according to his own will? or was he just fulfilling a part of God's plan? Do we have free will? or is our will determined by the many laws of biology, psychology,

economy, and so on? Only God knows the answer. We humans will always find arguments for one point of view and for its opposite. All we can do is to consider both of them, in spite of their inevitable contradictions.

Now let me demonstrate to you how Leonardo discussed this philosophical problem not only in the drama of his wall-painting, but also on the levels of geometry, architecture, and possibly - and surprisingly - even on that of music.

E se tu dicessi la musica essere composta di proporzione, o io con questa medesima seguita la pittura Leonardo

Thomas Brachert, formerly at the SIK (Schweizerisches Institut für Kunstwissenschaft) examined the geometry of Leonardo's Last Supper. He found that it contained an ideal grid of 6 by 12 units and had musical proportions in the wall-hangings. Breadths of wall-hangings (underlined> and visible parts of the wall (very narrow ones ignored), 17 parts equal 1 unit:

2 (?) 24 8 12 5 8 3 6 () (68) () 6 3 8 5 12 8 24 2 (?)

In these numbers are seen the octaves 24:12:6:3, the tierce 12:8, and the fourth 8:6. The radius of the arc above Christ's head measures 1 unit.

Relying on Brachert's work, I discovered an ideal geometry embracing the virtual and actual room (see my drawings). Here I consider only the ideal geometry. (Large scale realizations of a geometrical model interfere with the idiosyncrasies of visual perception and require minor modifications, which are neglected here; I speak always and only of the ideal scheme).

Jesus holds the top of a large pyramid (base 12 units, height 6 units). A pair of large arcs (radii 4 units) remain on the floor while touching the walls and the small painted arc above Christ. Smaller circles (radii 4 units) rolling on the frame seize and move the disciples and explain their arrangement into four groups.

Complete the arc above Christ, making it into a circle. Its center lies on Christ's forehead. Its radius measures 1 unit. Now consider the square defined by the vertical line of the arc, by the rear line of the table, by Peter's finger, and by the left line of the window frame between the left and the central opening. One corner of the square lies in the palm of Christ. Compare the circle and the square: they have the same area. Leonardo tried in vain to square the area of the circle. In this famous wall-painting he assigns a solution to Christ, as if saying that only He can comprehend what we humans fail to understand.

The virtual room of the painting prolongs the actual room (the former refectory). Brachert's grid 6 x 12 appears again in the coffer-work ceiling of the virtual room: 6 x 6 panels are visible, 6 x 6 further panels are concealed; together we obtain a grid of 6 by 12 squares.

Now please have a look at the lines of the perspective: ideally, all the long lines would meet in the center of the picture, yet seen from every accessible point of view only some lines continue, while the others bend. If we could rise to a height of some 450 cm above the floor and take a position opposite Christ - being his equal, so to speak - the long lines of the actual room and those of the virtual would align perfectly; but as long as we remain on the ground only some lines arrange themselves well, while others bend. There is always a break between the two perspectives.

We stay on the floor and look up to a table standing high above our heads - and yet we see down onto the table. Here we again have two perspectives: one from above, and one from below. We understand each, but we cannot really connect them.

Now let me return to the musical proportions of the painting. The dark areas and bright openings of the rear wall provide the following numbers (29 parts equal 2 units, numbers of dark areas underlined): 9 6 8 12 8 6 9 These numbers comprise the octave 12:6, the tierces 12:8 and 9:6, and the fourths 12:9 and 8:6. The rectangle of the rear wall above the bright openings measures ideally 1.4 by 4 units. Multiplying the numbers by a factor of 5, we obtain the rectangle 7 by 20. This rectangle has a very special property. Consider the long side 20 to be a string that, if plucked, would vibrate in the note f. Now consider the diagonal 21.189620... (square root of 20x20 plus 7x7) as a string of equal tension: if plucked it would vibrate in e, according, however, to the tempered scale (equal steps from one to the next half-note). Divide the square root of 449 by 20 and you will obtain 1.0594810... which is very close to the twelfth root of 2 = 1.0594630... the minute mistake would be undetectable by the human ear. Leonardo was famous for inventing and playing several instruments; may it be that he also conceived of a tempered scale?

Let us again consider Brachert's numbers for the side walls and combine them with the notes of the small octave, ascending from c and descending from c':

6	3	8	5	12	8	24	(2)
c/c'	c/c'	g/f	dis/a	c/c'	g/f	c/c'	(f/g)

If the outer lines of the outer wall-hangings are wavy, the breadth of these wall-hangings would change depending on the height, and so might represent both Brachert's number 24 and a larger number between 25 and 26 (a difference of some 21 to 43 millimeters). Calling this larger number c we obtain the following notes of a tempered scale:

6	3	8	5	12	8	25-26	(25.427)
cis/h	cis/h	gis/e	e/gis	cis/h	gis/e	c/c'	

By combining these impure notes with the pure ones generated by Brachert's number 24 we obtain the following sequence:

c cis () dis e f () g gis a () h c'

Using these notes I tried to compose a musical "Passion" on a piano. Here my sequence of chords (please strike both the c and the c' in the opening chord and in seven following ones):

c-e-g-c' opening chord
c-f-gis-c' mirror chord, serious, grave
cis-e-gis a dissonance: betrayal
e-gis-h mirror chord, anticipating redeem
c-g-c'
c-f-c'

c-e-g-c' back to the first chord

c-dis-g-c' reaching the darkest hour, Christ's Passion

c-f-gis-c'

c-f-a-c'

c-e-g-c' these three chords solve the previous tension,
back to the first, now radiant chord: Easter

Again:

c-e-g-c' c-f-gis-c' cis-e-gis e-gis-h c-g-c' c-f-c'

c-e-g-c' c-dis-g-c' c-f-gis-c' c-f-a-c' c-e-g-c'

These chords are to be played on a normal piano. The chords of the tempered scale are impure, but they allow us to change from one key to another - to explore the musical universe, so to speak - whereas pure chords allow us to combine only a few keys. Many have tried to combine the advantages of pure chords with a tempered scale, but no one has really succeeded. Many have tried to square the circle (some are still trying), but no one has ever succeeded. Many have tried to solve the philosophical problem of free or unfree will; no one has really succeeded. The human mind will never comprehend the world as one, and we cannot avoid broken perspectives. (One may also consider the two contradicting perspectives in the landscape of the Mona Lisa.)

[Last Supper 1](#) / [Last Supper 2](#) / [Last Supper 3](#) / [Last Supper 4](#) / [Last Supper 5](#) / [Last Supper 6](#) / [Last Supper 7](#) / [Last Supper 8](#) / [Last Supper 9](#)

For comparison:

Piero della Francesca, The Baptism of Christ, geometry based on the grid 12 x 12, on two circles, and on a pyramid: [Piero 1](#) / [Piero 2](#) / [Piero 3](#) / [Piero 4](#)

Leonardo da Vinci, Burlington House Cartoon, main circle, original format 4:3 (grid 8x6, radius of the circle 1.6, coordinates of its center 2.2/5.6, frame 10x8): [Burlington 1](#) / [Burlington 2](#)

Raphael, study for a Madonna; underlying format 6:5 [Raphael 1](#) / [Raphael 2](#) / [Raphael 3](#) / [Raphael 4](#) / [Raphael 5](#) / [Raphael 6](#) / [Raphael 7](#) / painting based on a modified and more complex geometry; more information and original format on request [Raphael 8](#)

Allegory of Seeing

Leonardo da Vinci, *Mona Lisa*

MONA LISA, an Allegory of Seeing

[Mona Lisa 1](#) / [Mona Lisa 2](#)

Noi conosciamo chiaramente chella vista e delle veloci operationi chessia, ed in un punto vede infinite forme: niente di meno non comprende se non una cosa per volta. Poniamo chaso che tu lettore guarderai questa carta scritta, e subito giudicherai questa esser piena di uarie lettere, ma non conoscerai in questo tempo che lettere sono, ne che volino dire, onde ti bisogna fare apparola apparola verso per verso a voler notizia d'esse lettere. (Leonardo da Vinci, B.N. 2038. 28a) Dicho chellochio portando consecho infinite linie le quali sono appichate overo unite con la sopravvenienti chessi partano dalle chose vedute, e sola la linia di mezo d'essa sensuale e quella che cognosce e giudicha i chorpe colori, tutte l'altre sono false e bugiarde (W 19148b) L'occhio a una sola linia centrale, e tutte le chose che vengono all'ochio per essa liniasono bene vedute. Dintorno a essa linia sono infinite altre linie aderenti a essa centrale, le quale son di tanto minore valitudine quanto esse son di magore remotinone dalla centrale (W 19010b) L'occhio a in se una sola linia posta in mezo a infinite altre linie aderenti a quella la quale e detta centrale e tutto le spetie delli obietti che venghono all'occhio per essa linia sono perfectamente vedute sella troppa lungha disstantia non le impedisce. Dintorno a essa linia ne sono infiniti aderenti a quella le quali son di tanta magore o minor valitudine quanto sono vicine o remote a tal centrale (D 10b) La linia media / centrale / maestra / principale / maestra delle altre linie / abbraccia con vera cognitione le chose grandi da lontano come le pichole da presso / si dirizza sempre a tutti quelli obietti di che sa avere certa e vera notizia / L'occhio fa una linia maestra / capace di comprendere i termini / L'ochio manda moltitudine di linie che circondano questa principale di meza / linie di debole comprensione, meno potente die conoscere il vero / onde le chose, delle quali i termini sono giudicati di esse linie, son confuse (B.N. 2058. 23b, D 8b) // Muovesi lamato per per la cosamata come il senso per il sensibile e consecho s'uniscie effassi una cosa medesima. // l'anima, figliola della natura // essai chelluomo emodello dello mondo // La natura e piena d'infinite ragione che furono mai in esperienza // Le spetie del nostro emisperio enitrino epasino con tutti li corpi cielesti per il punto naturale nel quale s'infondano e vniscano nella penetratione e interseghatione luna dell'altra come l'altra delluna ... la spetie della luna alloriente elle spetie del sole allocidente in tal punto naturale sono unite ... chi crederebbe chesi brevissimo spatio fussi capace delle spetie di tutto luniverso o magna actione qualle ingiegnio potra penetrare tale natura qual lingua fia quella chesplicare possa tal meraviglia cierto nessuna // Inefetto l'omo non si uaria dalli animali senon nell'accidentale chol quale si dimostra essere cosa diuina perche doue la natura finisce il produrre le sue spetie, lomo quivi comincia colle cose naturali affare collaiutorio dessa natura infinite spetie le quali nonessendo necessarie achiben si correggie come fan li animali none dispositio cercarne (Windsor 19030 verso) // Qui Adam, Eva di là – Oh human misery; of how many things you make yourself the slave for money // Se tu sprezzarai la pittura, la quale è sola imitatrice di tutte l'opere evidenti di natura, per certo tu sprezzarai una sottile invention, la quale con filosofica e sottile speculatione considera tutte le qualità delle forme: mare, siti, piante, animali, herbe, fiori, le quali

sono cinte d'ombra e lume. E veramente questa è scintilla e legittima figlia di natura // Non mi legga chi non è mathematico // e se tu dicessi la musica essere composta di proporzion, o io con questa medesima seguito la pittura

'Seeing' may appear to be the simplest of acts: we merely open our eyes and perceive the world around us. However, it is actually a wonderfully complex physiological and psychological process. Let me explain.

1) We see what we look at, and we see what we know

When we open our eyes we see a multitude of varied and shifting colors. Using our minds we turn them into objects: one of the reds I see becomes my pullover, another my blanket, and yet another a ring binder. I can only see the spines of the books on my shelf, but – as I know my books well - I have a visual image of their respective covers. You may see only your sleeping wife's cheek and her hair on the pillow, and yet you see the whole person so familiar to you. If a tourist asks me the way to the Chagall windows in the Zurich Fraumünster, I virtually see the alleys and streets threading between the mass of houses; the church I know from all sides and at every hour of the day; the small chapel; its tall windows; and the colors in Chagall's beautifully stained glass. Even if a house is hidden behind foliage, with only a few stones and bricks visible, we nevertheless perceive a hole structure and not a ruin. .When I turn my head I see a moving kaleidoscope of colors, and yet all the objects in my room, the walls included, stay firm, for I know that they remain still while I move my eyes. I see only one side of the objects in front of me, and yet I see whole objects, for I know them from all sides. What I see and what I know and what I believe come together in my visual perception.

Ask someone to draw a can, and he will most probably render the lid as a kind of circle rather than an ellipse, for he knows intellectually that the round piece of sheet metal is formed in a circle. Beginners in artistic drawing have to forget much of what they know in favor of what they actually see. They learn to see anew: they discover the wonderful, stimulating garden of opposing and blending colors, lights and shadows which are the common objects of our daily life as they appear to our eyes. Once I read about a blind man who underwent a successful operation on his eyes. Afterwards, could he see immediately? No: the man was lost in a sea of colors, lights and shadows, and it took months for him to move securely in this disturbing world. As children we learn how to see, how to use our senses, bodies and limbs; we experience our surroundings and gradually acquire a reliable knowledge of the world. It is this knowledge, combined with an inborn, which allows us to perceive the world 'simply' by opening our eyes.

2a) We dispose of a 'drop' of concentrated and moveable attention in a wide field of stationary attention; 2b) We perceive the thing to which we apply our moveable attention, while everything else remains in a more subconscious background; 2c) the more moveable attention an object attracts, the larger this object appears, and when two objects of different sizes attract an equal amount of the moveable attention, they seem to have the same size

Look at the moon rising above the horizon: its beautiful, round, orange form attracts all of our moveable attention and thus appears much larger than in a photograph. However, when the moon is seen high on the sky we have to raise our heads to see it, and are no longer secured by the firm objects along the horizon. We see a small disk of light swimming in an ocean of dark air, we may

feel slightly dizzy, and are therefore no longer able to concentrate wholly on the moon – this, in my opinion, is why we now perceive its size as a camera might. Or you may observe a herd of grazing cows. Now and then a cow jumps, and then something peculiar happens: that cow appears to be much nearer than her companions, if only for a fraction of a second. The jumping animal attracts all of our moveable attention at once, and therefore appears much larger than the other cows, yet as we know that they are more or less the same size, our minds turn large into near. Imagine a row of people sitting at a table. Those nearby should appear large, those farther away small. Yet we perceive all human faces to be about the same size, for each face attracts roughly the same amount of moveable attention. Only a face very close up appears very large (for example when kissing), and only people very far away appear truly small (or tiny when seen from a tower, or wandering along a hill). Thus the drawings of children and so-called naïve artists often demonstrate a peculiar perspective that may be called a perspective of attention.

The moveable drop of high attention may focus on a visual contrast, a sound, a touch, or another stimulus provided by one of our senses (there is no outer-sensual perception, but we may have more senses than we know). It may move from one contrast to another; it may zoom in on a tiny spot of the highest concentration; it may expand to a larger field of weaker attention. It may even be absorbed by the field of stationary attention – and immediately spring to life again, for example if, while reading or daydreaming, we suddenly hear a door slam.

3a) We see sharply by focusing our eyes on a given object; 3b) we see clearly by looking straight at a given object

Many years ago I made a series of drawings by means of an unusual procedure. I fixed my eyes on a delicate but strong, small but clear point of contrast in my visual field and tried to depict the surrounding objects as unclearly as my eyes rendered them. What happened? As long as my moveable attention was busy exploring the point of contrast everything was fine. But after the spot had received lengthy and careful examination, my moveable attention, restless, fanned out in all directions and tried to tug my focus towards another promising point near the first. I refused to give in, and kept my look steadily on the same tiny spot. My moveable attention made another urgent plea to move on, which I ignored – so it freed itself from my focus and explored my visual field on its own! At this juncture something odd began to happen. The objects around me began to lose their shapes; a dark portion of one object joined the dark portion of another; shapes began joining and melting; and instead of the common objects I perceived a peculiar world of shadows and lights that had a strange life of their own. But when I could retain my focus no longer and finally released it, it joined my moveable attention, and all the objects were restored at once to their proper states and looked firm and steady as never before! Thus: as long as we move our eyes we revive and update our transient knowledge of the many casual details of our respective surroundings; yet if we fix on a single point in the visual field over a long period this transient knowledge fades away and we begin to see what we see with our eyes alone, without the help of our minds.

4) Thanks to the wonderfully complex organization of our visual system we see a complete and ever-renewed picture of the world we live in: an image we construct from a few impressions and which we influence by our feelings, needs and desires

When we are in love, the world seems bright and shining; fresh, as if wet; or in warm, soft pastel shades. But when we suffer through love the same world may appear gray and closed. We notice

what corresponds to our being and mood, and as we fabricate our image of the world from a few impressions we color it according to our needs, wishes and feelings.

With great difficulty I managed to keep my focus on a single point of contrast for up to twenty minutes. It was hard work! You will realize this if you try it for yourself. It was even harder to draw the unclarity that I perceived peripherally, for my hand, incorporating subconscious knowledge, freely produced all kinds of forms and shapes. One afternoon a model was invited to our drawing class. She stood naked in front of us, and I carried out one of my experiments: I looked straight into her eyes and drew her body as unclearly as it appeared to me. She noticed my strange behavior and smiled charmingly. It was my best drawing ever (unfortunately, someone else 'stole' it from me). In those weeks I had a casual look at a reproduction of the Mona Lisa – and was immediately fascinated by her smile: I looked into her eyes, steadily and firmly as I had during my experiments, and there was a real smile! Then I looked at her lips, and the smile disappeared. I looked into her eyes again, more systematically. When I looked into her left (the eye in the center of her head), the smile returned: a kind smile, a loving smile, full of warmth and understanding. I repeated my experiments over several weeks, and I saw many other smiles, which seemed to depend upon my own: sometimes critical, at times closing and withdrawing; at others kind and embracing [Mona Lisa 1](#) / [Mona Lisa 2](#)

When I looked into her eye, the shadows of the lips and those of her rounded cheeks blended until I could no longer really discern the corners of her mouth; yet as I knew that the corners were there I placed them somewhere in the field of blending shadows, and as these places lie to the sides of the actual corners of her mouth and slightly above them, her lips seemed to extend toward the sides, while the 'stroke' of her mouth turned into a bow, and so she seemed to smile. Yet when I looked at her lips in order to catch her smile it was gone. For I could see her lips clearly again and discern the corners of her mouth from the shadows on her cheeks. A surprisingly moveable smile, capable not only of moving its appearance but also of altering its expression! The smile appeared especially beautiful when I smiled myself. Try this: look slightly from below at a reproduction of the Mona Lisa's face in its original size, relax your lips, keeping them free of any emotion, and then draw in the corners of your mouth. As easily as you are smiling now, the shadows on the woman's face will blend, and your smile will reinforce hers to bring forth her most beautiful and loving.

When I was carrying out these experiments I had the impression that the Mona Lisa's changing smile was kind of an answer to me, her viewer. Why? As we don't really see her lips we project our feelings onto those vague shadows. My happy surprise evoked a loving, understanding smile. Other feelings evoked different expressions that in some way reflected my state of mind.

I read what several authors had written on the Mona Lisa's smile, and developed the impression that a description of the smile could be a description of its author. Leonardo had, after all, said that a picture must be like a mirror. His painting of the Mona Lisa was an accurate portrait of a Florentine beauty, and is, moreover, a mental mirror of the viewer's nature and feelings.

When we gaze into a normal looking glass we see our own faces; yet when we look into the very special 'mirror' offered to us by a great artist – such as the Mona Lisa by Leonardo da Vinci – we see our feelings appear on the face of a stranger, such that we do not recognize them as our own; rather, we have the impression that she can read our minds and souls, and that she, in order to understand us better, adopts our feelings for a while and radiates them in her smile. We are

surprised, feel recognized, and in reaction to this new feeling her smile once again changes, into the smile of someone we believe able to read our very souls.

I was convinced that Leonardo da Vinci had carried out similar experiments to my own, and was of course pleased to find evidence of it. Over the years I have found seven passages in his surviving written works that mention rays of vision and say that only the central rays are strong and true, while those surrounding weak (*debole*) and deceitful (*bugiarde*). Studying the Mona Lisa painting, I could see how the soft shadows of the cheeks lead our focus and moveable attention to the left eye, and how the shadow of that eye leads them right inside it, a clear and delicate point of contrast pleasing to our moveable attention. And why does the Mona Lisa have no eyebrows? This may have been the current fashion, but it may also have been one that pleased Leonardo, as lack of eyebrows lays more emphasis on the eyes. Leonardo made very sure, in all ways, that we would look into the eyes of the Mona Lisa, and doing so be rewarded by a loving smile.

[Mona Lisa 1](#) / [Mona Lisa 2](#)

When the eye of a woman is given so much importance, it must have special significance. What if the Mona Lisa is not only a lively and accurate portrait of a Florentine beauty, but also an allegorical embodiment of seeing? This woman is looking at us, and we are looking at her. She is looking and being looked at, thus seeing both in the active and passive form. We see with our eyes, and for this we need light. Her eyes occupy the center of the upper part of the painting, while the brightest part of the painting area, namely the shine on her breast, lies just above the very center of the painting. The dark green-brown hem of her garment may be seen as the horizon, while the bright shining spot may represent the rising sun, and the lines of the veil thrown over her left shoulder would symbolize the trajectories of the sun traveling over the sky. We see the Mona Lisa sitting in a dark room, close to the bright opening of a small balcony. If the lateral columns were still there, we would have the strong impression that it were a window. We stay inside the dark chamber, looking out: the chamber may well symbolize the chamber of the eye. If so, the opening of the balcony would represent kind of a pupil (square instead of round). The windows are to the house what the eyes are to the body. Inside the virtual eye, the Mona Lisa would occupy the so-called natural point hailed by Leonardo: namely that wonderful interface of the eye where all rays of light received from seen objects meet and join at one single point. The woman is turning towards us from the picture plane. Her legs are parallel to the balcony, but the upper part of her body is rotating in our direction, her face first: but her eyes have already reached us, and gaze straight out of the picture at the viewer, joining the plane of vision with the direction of view. Her upper part body forms a kind of circle, and her head forms a second, smaller one around her left eye in the center of the upper part of the painting.

To the left and right of the woman mountains, lakes and river valleys can be seen. They form an almost prehistoric landscape which, in its dreamlike breadth, may symbolize nature itself. It has well been noted that in the painting we are looking down upon the left lake, but are on the same level as the right one. You will recall the two perspectives that we found in the Last Supper. Here we have another pair of perspectives, and they communicate to us the same thing: that we can never really understand the world and life by looking at it from just one point of view. Leonardo himself concurred with the antique understanding of the living being as a tiny cosmos. The Mona Lisa, by representing the natural point in the eye, may refer to the ancient belief of microcosm within

macrocosm (this belief may appear strange belief, but the modern theory of fractal geometry teaches us that the same forms may appear on the highest and deepest level of structures). In the picture we have nature; a living being; and ‘artificial’ objects: a veil, a dress, a stool, a balcony, a house, roads, a bridge. The woman is depicted in obvious balance with the nature surrounding her, while the artificial objects occupy a modest place and accompany and suit her; they also form a kind of artificial pupil (window) in an artificial body (house). All of this may be a symbol of art as the harmony of the artificial world with life and nature. And yet the house lifts the Mona Lisa high above nature: it hovers above the landscape in the background, much as would a balloon. This may symbolize that our artificial trappings lift us higher than the lives and necessities of common animals. In a mysterious and frequently mistranslated passage, Leonardo wrote that humans are distinguished from the animals by our use of tools. In one of his drawings he depicted objects falling to Earth. Above he wrote: *Adam here, Eve there*; and below: *Oh human misery; of how many things you make yourself the slave for money*. In other passages of his writings he praised the human eye. It would not be too difficult to find a quote for every element of my above interpretation.

May I also mention that Leonardo’s writings are full of geometrical sketches? He considered his art to be a science, and said that no science can do without mathematics. Furthermore he praised proportions, and compared his way of putting together a picture with that of composing a piece of music: *e se ti dicessi la musica essere composta di proporzione, o io con questa medesima seguito la pittura* – and if you say that music consists of proportions, I as a painter also use that means (namely proportions).

Take me, thus, take a look at the underlying geometry of the Mona Lisa painting. If the columns on the sides of the balcony were still there, the inside format would be 4:3, a much-used proportion during the Italian Renaissance. The unit is given by the breadth of the woman’s head on the height of the small fold in her hair veil (nearly on the level of her eyes). Move one unit to the left and one to the right of her head and you obtain the original width, while the height measures 4 units. The left line of the balcony sill divides the height 4 units in the ratio 2:3 (or into 1.6 and 2.4 units). Draw two arcs of the radius 4 units around the lower corners of the inside format. Now draw a circle, whose radius should measure 1,5 units, around the center of the inside format. It will seize the edge of Mona Lisa’s hair. Draw another pair of arcs with a radius 4 units around the upper corners of the inside format. The four arcs will touch the circle in four points: the very points where the two diagonals of the inside format 4:3 cross the circle. These four points are very important in the geometry of this composition. Their horizontal distances measure 1.8 units, their vertical distances 2.4 units, and their oblique distances 3 units. Now imagine circles around all four points. Their radii shall measure 0.1 / 0.2 / 0.3 / 0.4 / 0.5 / 0.6 / 0.7 / 0.8 / 0.9 / 1 / 1.1 / 1.2 / 1.3 / 1.4 / 1.5 / 1.6 / 1.7 / 1.8 / 1.9 / 2 / 2.1 / 2.2 / 2.3 / 2.4 ... units. Apply the circles as very fine and precise grooves on a transparency and place this over a reproduction. If seen from below and from the sides the circles joining into S-lines. Two vertical lines follow the cheeks of the woman, cross on her breast and follow the upper arms, while a horizontal S-line explains the shifting of the landscape. It is all as if the figure of the woman were created by the circles; as if Leonardo, who had carefully studied all motions of the water, had anticipated the wave-nature of light and matter! Moreover, four circles meet at the point where the parting in her hair begins: a very close double point on the height 3.5 units (half a unit below the upper edge of the inside format). The left radii measure 0.8 and 2.8 units, the right ones 1.1 and 2.9 units, while the horizontal distance of the two very close points

measures 1.8 minus the square root of 0.55 minus the square root of 1.12 = 0.00007962... units. The numbers are based on the equations $55 = 8 \times 8 - 3 \times 3 = 28 \times 28 - 27 \times 27$ and $112 = 11 \times 11 - 3 \times 3 = 29 \times 29 - 27 \times 27$. The very small distance marked by the double point may, once again, symbolize the two mental perspectives of our human life: coming very close but never really meeting.

May I plead for the reconstruction of the original inside format 4:3? One might simply add a pair of narrow panels and color them according to the sky, the columns and the balcony. A new frame should have a strength of one unit and measure 6 by 5 units (inside measurements 4 by 3 units). Paintings by Leonardo, Raphael and others gain much when displayed in their original formats. Leonardo's Last Supper is a ruin of a painting, in that it has lost much of its original color. However, its composition has survived undamaged and still has a strong effect on its viewers.

[Mona Lisa 1](#) / [Mona Lisa 2](#)

Geometry: *Non mi legga chi non è matematico / e se tu dicessi la musica essere composta di proporzione, o io con questa medesima seguito la pittura*

[Mona Lisa 3](#) / [Mona Lisa 4](#) / [Mona Lisa 5](#) / [Mona Lisa 6](#) / [Mona Lisa 7](#) / [Mona Lisa 8a](#) / [Mona Lisa 8b](#) / [Mona Lisa 8c](#) / [Mona Lisa 8d](#) / [Mona Lisa 8e](#) / [Mona Lisa 8f](#) //

For comparison: Isabella d' Este, reconstruction of the original format 4:3 (grid 8x6 small units); radius of the circle of the head 1 small unit, radius of the circle of the upper part of the body 2 small units, radius of the central circle around the first circles 3 small units, radius of the arc of the hair around the left upper corner of the original format 4 small units [Isabella d' Este 1](#) / [Isabella d' Este 2](#) / [Isabella d' Este 3](#) // [Villa Farnesina](#)

PS. The explanation for the smile of the Mona Lisa has been found by Marcel Duchamp (some 100 years ago), by me (1974), by Dr. Margaret Livingstone, Harvard neurologist (2001); and presumably by several others at various times. In an old movie the Toulouse-Lautrec character declares that the charm of the Mona Lisa's smile lies in her eyes ... Those interested in Marcel Duchamp might have a look at his *L.H.O.O.Q.*: the very fine endings of the moustache curl precisely towards the Mona Lisa's pupils. Pronounce the ominous letters L.H.O.O.Q in English and you hear the word *look*. Pronounce them in French and you hear the well-known iconoclasm *elle a chaud au cul*. Read the letters in a spirited manner, namely by adding *aire* (air), and you get *elle a chaud oculaire*. In the elaborate artistic language of Marcel Duchamp, air symbolizes the mind or spirit (*ruach* in Hebrew, *pneuma* in Greek, *spiritus* in Latin) while warmth means life in the sense of vivacity. Taken together we can read the five letters as follows: Mona Lisa appears perfectly alive when you look into her eye ... The wit of Marcel Duchamp's famous joke is that while seemingly making fun of the Mona Lisa he was actually proposing the first real interpretation of Leonardo's masterwork! You may also consider the enigmatic title of Marcel Duchamp's Grand Glass:

LA MARIEE MISE A NU PAR SES CELIBATAIRES, MEME, MARCEL DUCHAMP

MON A LIS A VUE PAR SES SPECTATEURS, M' AIME, MARCEL DUCHAMP

'Mona Lisa, looked at by so many people, loves me, smile at me, Marcel Duchamp ...'

Readers of German may refer to my online-essay [DIE SYMBOLSPRACHEN VON MARCEL DUCHAMP UND PABLO PICASSO](#)

Bibliography: I published my interpretation of the Mona Lisa in various photocopied papers and books from 1974 on, for example: *Mona Lisa ein Gleichnis des Sehens*, Zürich, 1989 (copies are kept in several Swiss libraries); *Amphitrite und Poseidon im Salon der Villa Farnesina, oder "Alles ist gleich, alles ungleich"* Zürich, 1974 - ?? (this project for an electronic book, some 400 pages, also contains a brief interpretation of the Mona Lisa, and won me a prize by the university of Zurich, *dies academicus* 1994); *Geometrische Bildanlagen in der Griechischen Antike, im Mittelalter und in der italienischen Renaissance*, 1979-2001 (again with a brief interpretation of the Mona Lisa and a reconstruction of the painting's original size)

Creator Mundi

Let there be light ...

Many old master paintings are lost, but luckily some of them survive in copies by pupils, and then it can happen that an alleged copy, carefully restored and freed from overpaintings, turns out to be the original. This miracle happened with a Leonardo copy ascribed to Giovanni Beltraffio. Dianne Dwyer Modestini restored it, removed the old overpainting, and recognized a masterpiece from Leonardo's hand, well preserved in several parts, less well in others.

The panel shows God in the appearance of Christ, looking at us frontally, surrounded by blackness, eyes veiled, forehead shining, his beautiful mouth giving the impression as if he had just spoken, holding a crystal ball in his left hand (on the right side), raising his right hand (on the left side), and pointing with his shining middle finger to the base of his parting (Scheitelansatz).

Most experts follow Modestini while some deplore the "dull composition." It is much improved when you add the missing parts of the panel on the sides and below. The radius of the orb measures 1 unit, the diameter 2 units. Add one unit on the right side of the orb, and 5 units on the left side; 1 unit below the orb and 7 units above. Thus you obtain the original format 10 by 8 units, or 5:4. Now Leonardo's "diuine proporzione" unfold, play their visual music, and serve the meaning of the picture [creator.jpg](#)

The center of a painting is important in Leonardo. Here the center of the original format is the throat (Halsgrübchen) indicating the Word by which God created the world according to the gospel of John 1:1

In the beginning was the Word, and the Word was with God, and the Word was God.

Genesis 1:3

And God said, Let there be light: and there was light.

We see light on his forehead, chest, raised hand, and a first weak gleam in the transparent world sphere, making the holding palm, shining through, appear as the Earth with a range of hills or mountains, the dark blue cloth as night sky, and a brighter fold as Milky Way [creator2.jpg](#) Two lines from a Dylan song

Once I had mountains in the palm of my hand

And rivers that ran through ev'ry day

We see the transition from darkness to light in the contrast of the dark cloth and bright chest, while the seam mirrors the original format by the numbers: its height measures 4 units (very slightly more in order to counterbalance the optical effect that makes an arc appear slightly flatter than it is), height of throat (Halsgrübchen) in the center 5 units, height of head above the seam 5 units, height of figure $4 + 5 = 9$ units, half the sum of original width and height. We perceive these relations at once, like a harmonious chord rich in overtones [creator.jpg](#)

Lines and diagonals of the grid 10 x 8 explain several features of the composition, especially the fingers of the raised hand, but while the base of the parting (Scheitelansatz) is well defined in several Leonardo paintings, here it can't be fixed (at least not rationally), and this, I believe, holds meaning. We admire and study the world, feel the presence of a divine hand in the marvels of nature, but we can't really explore God's mind.

(Comparisons. The Mona Lisa painting is an allegory of seeing. The lateral pillars, which flanked the window of the balcony, symbol of the eye lens – the room a symbol of the eye chamber – were trimmed from the panel. The original format was 4:3. In the center of the original rectangle appears the bright reflex on the woman's bosom – like a sun above the dark green-brown 'horizon' of the seam. Also the original format of John the Baptist, last painting by Leonardo, would have been 4:3, only that the panel was deliberately made smaller. John, alter ego of the painter, soon to be swallowed by the dark shadow in the background, announces a greater one than himself, God, whose Creation surpasses every human work in completeness and brilliance. Compare the hands, and consider that Leonardo was a left-hander.)

La Bella Principessa

[bella1.JPG](#) [bella2.JPG](#)

The profile of a beautiful princess [bella1.JPG](#) on vellum on an oak panel measures about 10 by 13.5 inches and contains a precise and meaningful geometry we can ascribe to Leonardo da Vinci. The head of the young woman is framed by a circle (invisible, of course) around the ear (opening of the ear). Add one radius on the left side, on top and on the right side of the circle, and three radii below the circle and you obtain the original format 5:4 [bella2.JPG](#) (You may add half a radius for the frame on each side, outer format 6:5 inner format 5:4.) Proportional divisions of the sides yield important diagonals. Divide the top line in the proportion 1+3 and the bottom line in the proportion 6+5. The straight line between them connects meaningful places of the profile of the young woman: her ‚Scheitelansatz‘ (beginning of the parting of her hair above the forehead) and corner of her eye and throat and line of neck – in Leonardo symbols of thinking and seeing and talking respectively.

Another geometry is found in the profile of Isabella d’Este on the carton in the Louvre, starting again with a circle framing the head, radius 1, as on a small scetch by Leonardo, while the circle of the body has radius 2, a larger circle holds the two circles, the big middle circle of radius 3, yielding the original format 8:6 or 4:3, confirmed by the hair that follows an arc of radius 4 around the left upper corner [este1.JPG](#) [este2.GIF](#) [este3.JPG](#) [este1.JPG](#)

Ginevra de Benci looks out of her picture, her head fitting closely into a circle around the pupil of her left eye. Add one radius on the left side, on top and on the right side of the circle, and three radii below the circle and you obtain the original format 6:4 or 3:2 that goes along with the painted decoration on the back of the panel.

Ginevra de Benci, La Bella Principessa and Isabella d’Este are stations on the way to the Mona Lisa, allegory of seeing (original format 4:3 or 8:6 or 40:30, with a way more complex geometry, and a multiple meaning, painted philosophy).

Here again the princess in her wider space [bella2.JPG](#) The young woman looks out of a window on the left side, listening to someone talk, considering what she hears, ready to turn around and answer, perhaps making a decision? Her finely modulated face appears lively.

If you are interested in a detailed expertise you may contact me via e-mail.

Getty

A letter of inquiry (April 11, 2003)

Poseidon from Cape Artemision, geometrical analysis from 1980, prepared for the Internet in 2005: [gia01.JPG](#) [gia02.GIF](#) [gia03.GIF](#) [poseidon.htm](#)

Kouros from Tenea, Getty Kouros, Kroisos from Anavyssos, geometrical drawings from 1992, prepared for the Internet in 2006: [kouros1a.JPG](#) [kouros1b.JPG](#) [kouros1c.JPG](#) [kouros1d.JPG](#) [kouros2a.JPG](#) [kouros2b.JPG](#) [kouros2c.JPG](#) [kouros2d.JPG](#) [kouros2e.JPG](#) [kouros3a.JPG](#) [kouros3b.JPG](#) [kouros3c.JPG](#) [kouros3d.JPG](#) [kouros3e.JPG](#) [kouros3f.JPG](#)

Mona Lisa, an Allegory of Seeing (interpretation from 1974/75, geometrical reconstruction from 1979) [seeing.htm](#)

Leonardo da Vinci, The Last Supper (interpretation and geometrical analysis from 1979) [ls.htm](#)

Villa Farnesina, in honor of Gertrud Batschelet [farnes.htm](#)

Geometry in Art, John the Baptist, geometrical analyses from 1980-1995, prepared for the Internet between 2003 and 2006: [gia.htm](#)

Zurich, April 11, 2003

Dear Mrs. Colkin,

thank you very much for your letter from April 3. Unfortunately you have been unable to play my compact disk, and so you ask me to submit a letter of inquiry. I checked the returned CD on my HP Omnibook XE-3 and had no problem opening the file "homepage" using Explorer 6. Did you try opening the CD using another program than Microsoft's Internet Explorer 5 or 6? Anyway, let me outline my letter of inquiry, and firstly excuse myself for my poor English. I hope the lack of style will be outweighed by what I have to say.

Taking the long way

Out of financial reasons I had to give up my studies at the university of Zurich. Since then I work outside of academe, almost 29 years by now, with all the difficulties and all the freedom of my position, which allows me to investigate new alleys of research. In that I am a follower of Richard Feynman's, the eminent American physicist, and, in my opinion, a worthwhile theorist of the sciences as well, who wrote that it ain't no use if thousand scientists are trying to tackle the same problem using the very same set of scientific tools; at least someone should try the other way round, using different methods. My scientific work began with an exhibition of Cy Twombly at Berne in Switzerland, back in 1974. The catalogue mentioned Leonardo da Vinci's drawings of water, and so I lent a Leonardo monograph from my library. I remember well spending half an hour looking at John the Baptist without understanding anything at all. Half a year later, absolving an art school, I began carrying out visual experiments, in the course of which I discovered the same effect Margaret Livingstone, neurologist of Harvard, has rediscovered and published recently: a certain flicker of

the lips of the Mona Lisa when one moves ones look over her face. Look on her lips, and she is hardly smiling. Look into her eyes (into her left eye in the center of the circle of her head) and you can't see her lips clearly anymore, the corners of her mouth and shadows of her cheeks are joining, we can't really see the corners of her mouth any longer, but we sure know they are there, and so we project them somewhere into the shadowy region where they can be expected, however, misguided by clever Leonardo, who said that only the central rays of vision are true and strong, all others weak and deceptive (*debole e bugiarde*) we place the corners of her mouth a little beside the actual corners and above them, what results in a smile, and if we are surprised by her smile and smile in return, she will unfold her true and loving smile ... My discovery led me to a complete interpretation of the Mona Lisa as an Allegory of Seeing, and the Mona Lisa made me understand John the Baptist: this one must be Leonardo's alter ego as a painter, symbolizing his career from a pupil of Andrea del Verrocchio (left angel in this ones and Leonardo's Baptism of Christ) via his initiation as a master of the fine arts (young John entering the grotto of the Madonna of the Rocks) and his remembering of the early days (replica of the Madonna of the Rocks, where Leonardo is present in the way the angel is looking over to young John/Leonardo) to his final work, namely John the Baptist, where Leonardo is speaking in the Italian manner, using his hands: "God created the world [raised arm, brilliant right hand]; I, Leonardo, once born in his world, have seen it. Much of what I have seen [eyes] and studied [front of the head] found its way into my work [left hand]. However, my work is incomplete and only a weak reflex of the beauty of Nature, God's work. - My dear pupils, friends and followers, I will soon leave you. The black shadows behind me are already enveloping my half naked body. What are the dark veils hiding? You may see or merely guess a hint of a bush and eventually some hills or mountains, but as soon as this happens the space is closing in and you are again confronted with the black wall no one can see through. I am already half taken by the darkness, and sooner or later I shall be gone. But don't be sad, and if you loose a great artist, study the work of a far greater one - study Nature, God's work that surpasses all human works.

My interpretations of the Mona Lisa as an Allegory of Seeing and of the Baptist series as an illustration of Leonardo's career stem from 1974. In the same year my then professor of art history invited me to explain to him my views of Leonardo's Baptist pictures. Which I gladly did, however, my professor warned me to project my own limitations onto a painting. The Swiss Tagesanzeiger-Magazin told me in around 1984 that my work is very interesting, however, according to the opinion of the entire redaction, everything had already been said and told about the Mona Lisa. My work was not welcome. So I worked on in private, on my own. I found that I was not the first one to interpret the Mona Lisa. Long before me Marcel Duchamp must have come to the same conclusion: his seemingly iconoclastic L.H.O.O.Q actually is the first true interpretation of the Mona Lisa: pronounce the letters in English and you obtain LOOK. The very fine ends of her moustache are pointing precisely to the pupils of her eyes, and if you are patiently looking into her eyes (into her left eye) you see her loving smile appear. Pronounce the same letters in French, however in a spirited way, namely by adding "aire" (air, an age old symbol of mind and spirit, cf. Hebrew *ru-ach*, Greek *pneuma*, Latin *spiritus*), you obtain something like "elle a chaud oculaire". Now please understand that in Duchamp's elaborate symbolic language "warm" means lively, and so you will get about this message: Mona Lisa appears lively regarding her eyes - look into her eyes and you see her come to life ... 1979 followed my interpretation of Leonardo's Last Supper, which, in my opinion, ponders the question whether we humans have a free will or not. Leonardo's answer: we

humans can't really understand the world as a whole from one single perspective; only God can see the world as one, we humans have to deal with broken perspectives, we have and will always have to consider different and plain contradictory aspects (cf. the double perspective in the background of the Mona Lisa). Since 1979 I examine surface geometry in selected works of art, for example in Leonardo's and Raphael's paintings and preparatory drawings. Not all the painters made use of surface geometry, far from that, but some very good ones did, and I found that surface geometry almost always goes along with the meaning of a picture. Consider again the case of the Mona Lisa. The original format was 4x3 units, one unit given by the vertical measurement of the head on the level of the eyes, more precisely on the height of the small bending of the veil. Add one unit to the left and one to the right of the hair, and you obtain the original width of the painting, while the left line of the balustrade marks the 2/3 height (1.6 plus 2.4 units). Now draw the large middle circle (radius 1.5 units); it will seize the bow of the hair of the Mona Lisa. Then draw arcs of the radii 4 units around the corners of the original format 4:3. The arcs will touch the circle in the same points wherein the long diagonals (5 units) cross the circle. The arcs around the lower corners touch the woman's head. Now draw circles around the four points, wherein the large circle, the diagonals and the arcs meet and cross, and let the radii measure 0.1, 0.2, 0.3, 0.4 ... units or 1, 2, 3, 4 ... small units. The resulting waves explain both the figure of the woman and the shifting of the landscape. As if Leonardo anticipated the physical double nature of matter and wave ... Moreover, four circles meet in a mathematically very close double point on a height of 35 small units (half a unit below the frame), and this close double point is marked by a special iconographic point, namely by the begin of the parting of the woman's hair, hence a point on the front of her head, symbol for the mind, relating seeing (activity of the eyes) with reasoning (activity of the mind).

Meanwhile I examined the geometry of more than 200 (two hundred) paintings, drawings, statues and buildings, what allows me to answer several important questions: is a given work an original, perhaps painted over by a less gifted artist and thus long overseen? begun by the master but finished by a pupil? a copy? a free one or a true one? even a copy of a copy? perhaps a true copy of a true copy? has the canvas been cut? and if so, what was the original format? and what may the composition mean?

For example I can show that the Getty Kouros is a) an original, and b) related both with the Kouros from Tenea (kept at Munich) and the Kroisos from Anavyssos (National Museum Athens.) I even dare say that we may speak of Master A and B: Master A was the creator of the Kouros from Tenea and the teacher of Master B, who created the Getty Kouros as a juvenile masterwork, with an almost lyrical quality to the lines, and the Kroisos from Anavyssos on the summit of his career, making use of a fully developed and proudly unfolded geometry. The school of Master A and Master B may also have produced the unknown master of the wonderful Poseidon from Cape Artemision. In this bronze statue I found another geometry worth of the Greek mind, displaying the artistic principles of measure and rhythm (articulating a composition), of symmetry and a-symmetry (holding a composition together and bringing it to life), and self-reference (the equivalent to *autopoiesis* in biology). Furthermore, and most rewarding in my opinion, are geometrical reconstructions, for example the ones of the formerly shorter saloon of the Villa Farnesina at Rome and its picture program. One of my results: Leonardo's famous drawing of Neptune and his four sea-horses was originally planned as a wall-painting for the saloon of Agostino Chigi's villa, and so was Raphael's Galatea (the original format of which having been a square). Another reconstruction

regards a pair of hypothetical Leonardo wall-paintings in the Belvedere of the Vatican (former audience room, today's parrot chamber in the Museum): John the Baptist on one bank of the River Lete, and the Nymph on the opposite bank. If you pass the hypothetical wall-paintings from the side (following the gangway) you will observe another amazing optical illusion: John, pointing beyond his shoulder, is now pointing toward the side of the Nymph, while she, pointing toward the right in her picture plane, is now seemingly pointing into the depth of her mysterious landscape ... Did Leonardo dare give us a glimpse into the beyond? and if so, could he have painted Elysium or paradise in bright daylight? No, certainly not. He would have rendered that landscape no one ever saw in a hazy manner, veiled by layers of deep air, so that one will more guess than actually see (have a look at Leonardo's Nymph drawing at Windsor: you have to guess about the landscape, more than you can really see). How could Leonardo possibly have obtained such an effect? By covering his hypothetical and probably never carried out Nymph painting with a special varnish. What we know for sure is that he got a commission from the Pope, but instead of drawing and painting he began experimenting with all kinds of varnishes, whereupon the Pope exclaimed in despair: This man will never complete anything, because he begins with the end.

In short

Having worked in vain but very productively for 10'000 days or nearly 29 years now, having published brief summaries of a part of my related work in the Art History section of my web site www.seshat.ch (work in progress, with 529 illustrations, designed for Explorer 5 and 6): Poseidon from Cape Artemision, the geometry of a Greek masterwork / Broken Perspective, Leonardo da Vinci's Last Supper / Mona Lisa, an Allegory of Seeing / Villa Farnesina, in honor of Gertrud Batschelet / John the Baptist, German summary / Die Symbolsprachen von Marcel Duchamp und Pablo Picasso, and having much more to publish that would be lost otherwise, I ask the Getty Center for a contribution to my work, knowing well that I will hardly match any given grant program, but kindly asking you to consider that progress in the sciences can never really be anticipated and regulated; one has always to be prepared for the unexpected and cope with new insights, which, after all, are the aim of scientific endeavors. Living modestly, needing hardly any money for myself I can do a lot with a small sum. As a first reward for an eventual contribution you will obtain a ring binder with drawings of mine, ready for 3-dimensional CAD reconstructions, and copies of all my further works, both as Bitmap graphics and word documents on CD, and if you wish as laser prints on paper. All new texts in English, corrected by Katherine (daughter to an American physicist). If someone at the Getty Center should be working on similar topics, he or she may always get my advice online via [fgn\(a\)bluemail.ch](mailto:fgn(a)bluemail.ch).

Sincerely yours, Franz Gnaedinger, Zurich, Switzerland

Kouros from Tenea [kouros1a.JPG](#) [kouros1b.JPG](#) [kouros1c.JPG](#) [kouros1d.JPG](#) // Getty Kouros, in my opinion the work of a young pupil of the master of the kouros from Tenea (photograph courtesy J. Paul Getty Museum) [kouros2a.JPG](#) [kouros2b.JPG](#) [kouros2c.JPG](#) [kouros2d.JPG](#) [kouros2e.JPG](#) // Kroisos from Anavyssos, in my opinion a work of the mature master of the Getty Kouros [kouros3a.JPG](#) [kouros3b.JPG](#) [kouros3c.JPG](#) [kouros3d.JPG](#) [kouros3e.JPG](#) [kouros3f.JPG](#)

Villa Farnesina

Leonardo da Vinci, *Neptune with Four Sea-Horses / ed alcune teste di dei marini bellissime* (in honor of Gertrud Batschelet) / *Ordine Italiana* (combined measures of Florence and Rome, Renaissance and Antiquity)

In honor of Gertrud Batschelet, who discovered the painting Amphitrite and Poseidon (an exciting story that will be told in a later version of this chapter)

[Farnesina 9](#) / [Farnesina 10](#)

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Leonardo da Vinci, Neptune with Four Sea-Horses

Leonardo da Vinci, Neptune with Four Sea-Horses, Windsor, reconstruction of the original format. A small cartoon for a wall-painting in Agostino Chigi's Villa? Frame 576 by 754 small units, painting 398 by 576 small units. Grid $89+89+110+110+89+89 = 576$ by $89+89+110+89+89+110+89+89 = 754$ small units. 396 small units equal 1 canna Romana. 144 small units = 81 cm. 576 small units = 324 cm. Painting 223.875 by 324 cm. Frame 324 by 424.125 cm. Scale of the Windsor drawing exactly 1:8 [Neptune 1](#) / [Neptune 2](#) / [Neptune 3](#) / [Neptune 4](#) / [Neptune 5](#) / [Neptune 6](#) / [Neptune 7](#)

For comparison: [Anghiari 1](#) (Rubens, Vienna) / [Anghiari 2](#) / [Anghiari 3](#) / [Anghiari 4](#) / [Anghiari 5](#) / [Anghiari 6](#) / [Anghiari 7](#) field of force (ellipses and hyperbolae)

[Neptune 3](#) / [horse](#) / [Leda 1](#) / [Leda 2](#) / [Leda 3](#) / [Leda 4](#)

ed alcune teste di dei marini bellissime

Amphitrite and Poseidon: [A&P 1a](#) (yellow version) / [A&P 1b](#) (yellow version, large) / [A&P 1c](#) (sepia) / [A&P 1d](#) (blueversion, small) / [A&P 1e](#) (blue version, negative, reveals the plastical quality of the composition) / [A&P 1f](#) (black and white, small).

A few words on the Amphitrite and Poseidon painting: oil on a fine hand-woven canvas, about 105 by 150 cm, doubled, large areas including the angels and further small figures and the complete sky have been removed and painted anew in the 19th century. Painting purchased by Gertrud Batschelet in 1968 (?) at Roma Corwin's, Wiltshire Boulevard., Los Angeles. In my opinion, it might well be the true copy (carried out by the some 14 years old Noël-Nicolas Coypel?) of a now lost true copy (a drawing by Rubens?) of a lost small cartoon for another wall-painting in Agostino Chigi's villa.

Amphitrite and Poseidon as a virtual wall-painting in the formerly shorter salon of Agostino Chigi's villa. Painting 283.5 by 405 cm (14 by 20 units), ideal frame 324 by 445.5 cm (16 by 22 units). Frame standing on the floor. Height of the vertical axis at the eye level of a standing man (8 units or 162 cm) [A&P 2](#) / [A&P 3](#)

Deriving the ideal plans of the villa from a cube. 11 units equal 1 canna Romana or about 223 cm. 44 units equal 4 canne Romane or about 891 cm [A&P 4](#) / [A&P 5](#) / [A&P 6](#) / [A&P 7](#) / [A&P 8](#) / [A&P 9](#) / [A&P 10](#)

Geometry of the composition: grid 14x20, axes, rhomb, a small standing ellipse for the couple Amphitrite and Poseidon, a large lying ellipse for all the figures, a large lying oval, a large lying rhomb, circles and squares. The axes of the small standing ellipse measure 8 by 6 units; its focuses are marked by the pupil of the left eye and by the hollow of the left knee of Amphitrite. The axes of the large lying ellipse measure 14 by 20 small units; its focuses are marked by the left eye of the standing man and by the left eye of the boy riding on the white horse [A&P 11](#) / [A&P 12](#) / [A&P 13](#)

How the measurements of the virtual wall-painting fit in the ideal salon [A&P 14](#) / [A&P 15](#) / [A&P 16](#)

Comparisons [A&P 17](#) Agostino Chigi's medal (recto), Amphitrite, Giorgione's Tempest, Michelangelo's Delphian Sibyl, Francesco Albani's Galatea, Rembrandt's Bathseba (Louvre) / [A&P 18](#) drawing of an angel by Leonardo (Venice, Academy, n 259 v), right angel from A&P, couple of hovering angels from Francesco Albani's painting of Adonis and the Sleeping Venus (from the cycle of the Four Elements, Louvre) / [A&P 18a](#) Comparing the faces of Amphitrite and Giorgione's Tempesta woman / [A&P 19](#) Amphitrite, Michelangelo's Delphian Sibyl / [A&P 20](#) Master of the Dice, Venus riding on Dolphins, a dove whispering into her ear / [A&P 21](#) and [A&P 22](#) A&P, Nicolas Poussin's first sketch for his Amphitrite painting (Stockholm) / [A&P 23](#) Nicolas Poussin, Neptun and Amphitrite (Philadelphia) / [A&P 24](#) woodcut after Nicolas Poussin's painting) / [A&P 24a](#) Noel-Nicolas Coypel, Abduction of Europe / [A&P 25](#) Tazza Farnese; cameo showing Poseidon, Amphitrite and swimming boys (both acquired by Adrea del Verrocchio for the Medicis)

Alles ist gleich, alles ungleich ... (all is equal, all unequal)

Alles, was uns daher als Zierde ansprechen soll, muss gegliedert sein, und zwar im höheren Sinne, dass es aus Teilen bestehe, die sich wechselseitig aufeinander beziehen. Hiezu wird erfordert, dass es eine Mitte habe, ein Oben und Unten, ein Hüben und Drüben, woraus zuerst Symmetrie entsteht, welche, wenn sie dem Verstande völlig fasslich bleibt, die Zierde auf der geringsten Stufe genannt werden kann. Je mannigfaltiger dann aber die Glieder werden, und je mehr jene anfängliche Symmetrie, verflochten, versteckt, in Gegensätzen abgewechselt, als ein offenes Geheimnis vor unsern Augen steht, desto angenehmer wird die Zierde sein, und ganz vollkommen, wenn wir an jene ersten Grundlagen dabei nicht mehr denken, sondern als von einem Willkürlichen und Zufälligen überrascht werden.

Frank Miller

Ordine Italiana (combined measures of Florence and Rome, Renaissance and Antiquity)

Braccio Fiorentino		58.36 cm
golden minor		22.2915...cm
palmo Romano	22.234 or 22.319 or 22.34 cm	
canna Romana	222.34 or 223.19 or 223.4 cm	
partica decempida	280 e = 297.105... cm	(Imperium Romanum)
canna Romana	210 e = 222.829... cm	(Renaissance, Rome)
passus	140 e = 148.527... cm	(Imperium Romanum)
gradus	70 e = 74.276... cm	(Imperium Romanum)
braccio Fiorentino	55 e = 58.36 cm	(Renaissance, Florence)
cubitum	42 e = 44.565... cm	(Imperium Romanum)
palmipes	35 e = 37.138 cm	(Imperium Romanum)
pes	28 e = 29.710... cm	(Imperium Romanum)
palma	7 e = 7.427... cm	(Imperium Romanum)
digitus	7/4 e = 1.856... cm	(Imperium Romanum)
	1 e = 1.061... cm	(Imperium Romanum)
unit a	210/11 e = 20.257... cm	(Villa Farnesina)

Width of the former and now extant salon of the Villa Farnesina 3 particae decempidae = 4 canne Romane or about 891 cm, ideal measurement 891.316 cm.

(Cf. *Hermos Hermaes homoios homaereo Homaeros / Sinn und Aufgabe der Geisteswissenschaften / Anmerkungen zum System Polias von Gerhard Goebel (Hypnerotomachia Poliphili) / Leon Battista Albertis Pläne für Rom*)

Raphael, Galatea and Venus

Raphael, Galatea, planned as a fresco for the salon of the Villa Farnesina? Original format 1:1, grid 8 by 8 palmipedes, standing ellipse 8 by 6 palmipedes, golden section of the height marked by the woman's head. Fresco 1 by 1 partica decempida = 297 by 297 cm, frame 16 by 16 a = 324 by 324 cm. Vertical axis marked by the sea level (on the eye level of a standing visitor, 8 a = 162 cm above the floor) [Galatea 1](#) / [Galatea 2](#) / [Galatea 3](#) / [Galatea 4](#) / [Galatea 5](#) / [Galatea 6](#) / [Galatea 7](#) / [Galatea 8](#) / [Galatea 9](#) / [Galatea 10](#) / [Galatea 11](#) / [Galatea 12](#) / [Galatea 13](#) / [Galatea 14](#)

Raphael, Venus and Cupido, central part of a small cartoon for a fresco on the opposite wall?
Format 5:7, grid 10 by 14 palmipedes, lying ellipse 10 by 14 palmipedes, standing ellipse in the center 8 by 6 palmipedes, upper focus marked by Venus' left eye, lower focus marked by a toe; golden section of the length marked by Venus' left hip and upper thigh [Venus 1](#) / [Venus 2](#) / [Venus 3](#)