The birth of Venus

Florence – 1486

Sandro Botticelli
1445–1510

Analysis of Composition in Painting
Introduction to Comparative Geometry

Presentation
by Yvo Jacquier
Prague | December 2010
The birth of Venus
Venus anadyomène (Venus Rising From the Sea)

- Artist : Sandro Botticelli
- Technique : Tempera on canvas
- Actual size : 172.5 × 278.5 cm
- Date : 1486 (parfois 1485)
- Conservation : Offices gallery, Florence
- Model posthumous : Simonetta Vespucci
- Sponsor: Lorenzo di Pierfrancesco de Medicis

◊ Introduction

There are several approaches to this chef d'oeuvre of Botticelli. The most natural one needs only eyes : this is at first a painting, a picture. Curiously, this birth of Venus inspires so much dream that it makes us lose the touch with reality. This is one of the charms in painting. This ability to break from daily habits. From certain conventions too. However, we wish to understand this work. This is not a holiday photo, it tells a story, which might be complicated, certainly mysterious.

How to explain this work without breaking its mystery? How not to get lost in thought, forgetting the beauty of the painting, erasing its colors and lights? How to understand art? How to enjoy, to live with, in one's mind, and one's heart?

Maybe we could look at this work "differently", just a little bit. Perhaps we have to be confident in our eyes, by opening wide those eyes. That is how this research began, a few years ago. Without words, without instructions for use : only with eyes to say, as far as they were understanding.

These pages are a birthday gift to my daughter, Lou, who is eleven.
The great lesson of our eyes

From the first contact with the frame, all sights are for Venus. All is concerning Venus in this work. The Angels are looking at her, and a pretty Madam covers her with a majestic cape, worthy of a queen. She is beautiful, she is serene. It is at the center, standing on a shell in the form of a sofa.

Her pearly skin takes the light like a warm marble. And this light is in the top part of the painting. Below, the feet of the Beauty become darker. The sea is drowning in confusion with the sand. It is very difficult to put our eyes down, even in front of so much beauty. Anyway, the wind lifts our gaze, as it inflates the cloths and hair, as he sows the roses.

The landscape is bent, almost naive. His horizon is reluctant to stand up straight, and the waves sign with many V on the sea. We can not believe this background, we can at best contemplate it. The characters themselves are real: they could talk. Do they have the opportunity? Some seem busy, and Venus seems dreaming. Do we want to disturb the charm? Let's have a look again.

Venus holds the pose, and her wavy hair rise toward the woman who is close to put a cloak over his shoulders. Something suspends this gesture, not only painting, the art who stops the time... A true force maintains his arm, a powerful force like the wind when he gets angry. However, this pressure is quiet, serene and caring. What force can hold in that way all the elements of the scene?

The cape is too heavy to be the plaything of a gentle breeze. She wrinkles, and would begin to shake if it was in silk. On the contrary, the folds are deep and large: the garment is heavy enough to cause hollows at the places where it folds. Something overcomes our common sense, who must yet guide us to understand the scene. This softness and this strength should alert us, this fluidity of forms is not the effect of the wind. The unreality of the setting and many other details ... Venus sets foot on the brown part of the shell. This part should be "below". And under the foot of Venus, the color should be clear and pearly. The shells are not twisted like that!
And that's not all. Something else is wrong. We need a ruler to view. A vertical is highlighted by Venus: it passes straight on the top of her two thumbs. It is an invitation to watch from the painter. Venus is not standing in a normal way! Her feet are not under her weight. The center of gravity of a person is around the navel, and the vertical from this point is going outside. She would need a cane to stay that way....

Botticelli, the painter, could not be wrong. The quality of the characters demonstrates his talent as its accuracy. He knows what he does, he masters his picture. Proof: we don't immediately noticed the inconsistencies. The emerging impression from this scene is the one of great harmony, of a natural beauty. And all the inconsistencies would be free and without interest if they did not make sense to the understanding of the work. What interest indeed, in folding the shell? In drawing Venus in an unstable way? In adding weight to her cape? It would be so easy for Botticelli to put everything in order. His sense of beauty is strong enough, he doesn't need antics to seduce us. He could not abuse us, nor our eyes, as a game. He has better to do than to provoke. This work speaks of Beauty, not of questionable philosophy or technical challenge. These "performances" have nothing to do in a manifesto of Beauty, pure, straight and absolute.

We need geometry to show, as well as to understand. Venus is a mermaid, and she moves in his natural element, in the deep of the sea. If we think of it, we understand all, and there is no more inconsistency in the painting. Characters and clothes are floating with a great fluidity. The decor, including the shell, are distorted by the "aquarium effect" under the water. Moreover, the original title of the work is a valuable indication from its author: "Anadyomene Venus", which means Rising From the Sea...

Geometry is useful, even essential, to understand this painting. Botticelli would not get this balanced result without building his drawing with its particular tool.
Botticelli’s painting depicts characters from Greek mythology. Venus is the Latin name of Aphrodite, Goddess of Beauty. His father is Ouranos, God of Heaven. It is not very "fair" and he keeps his children in Tartarus, a place worse than hell! The mother, the Earth Goddess Gaia hides one of them, named Cronus. He cuts the sex of his father and ends his reign ... The seed of Ouranos then spreads into the ocean, and in contact with water, produces Aphrodite with foam. She is wind-driven Zephyr on a shell until the shores of Cythera and then Cyprus. Upon her arrival, three goddesses welcome Venus / Aphrodite, the three Hours (Horae), daughters of Zeus and Themis. They dress the Belle. The three Hours personify Discipline, Justice and Peace, but also the Spring, Summer and Winter. Zephyr is the son of Aeolus, god of the wind, and Eos, the Dawn. His partner is the nymph Chloris, honored as the Goddess of flowers by Romans under the name of Flora.

Two questions are pending:
- What is Mythology?
- Why does Botticelli take his characters in ancient Greece, rather than in his daily life, in his city of Florence?

What is Greek mythology?

The sum of stories that make up the great book of Greek Mythology builds on almost two millennia. This book begins 1550 years before Christ with the Mycenaean civilization, and continues to be written to the revival of Byzantium in 330 AD. At that time the Roman Emperor Constantine I proclaimed his city as the second capital of the Roman Empire. He founds the Byzantine Empire, which will last more than a thousand years. The era of Greece, finally conquered by Rome, is considered completed.

Before books, before history as we write it today, the men keep their memory in a different way than ours. They can not remember the events exactly as they are, for several reasons. The most important one is that only the winners are entitled to speak. Others become slaves or fugitives. Winners do not tell the whole truth about
the war that they have win, and losers can not afford to rectify anything. And it is more complicating with the time passing. The winners of yesterday are the losers today. Poets, philosophers and storytellers find a way to pass over this difficulty. They do not practice History: they invent stories. Thus are born the Epics of Homer (Iliad and Odyssey, with Ulysses and the Trojan War) and the poems of Hesiod, mainly Theogony. These stories come to us after all fascinated generations that preceded us. The first quality of these stories is in their seduction, passion of the storytellers, as well as the fascination of people who listen. The words are spread through orality and writing, drama and, later, film. The great strength of mythology is to accept all the forms of transmission between men.

Some think that the authors used religion above all, others on the opposite : the purpose of religion would be an excuse. The men of antiquity could not conceive of life without religion, even when they are interested in something else. They also like to dream and to share their dream. Their stories are a proof.

For all these reasons, we should not surprised to find several aspects of the same stories. They can be listened as family stories and warriors, you can also pick up their religious significance or their philosophical dimension, that the Greeks are promoting. Above all, one reading is different. It's called Symbolism. No doubt : one day in Greece, a son has cut the sex of his father before taking his throne. This story happened, and the names are forgotten. But the principle remains the same when a son is elected by the army as the new supreme head instead of his father. That's Symbolism : the passage of a concrete and particular thing to a general principle which is valid for a maximum of cases.

The mythological figures seem sufficient to the symbolic expression of the Greeks. They literally invented mathematics through Pythagoras and Euclid, but the paintings are not built on these mathematics completely. It would be difficult to succeed on the curved surface of pots, craters, dishes and fruit cups. Some monuments and some sculptures show proportions and harmonies : this path is at the origin the one of Egyptians, and others will find it back further, especially in Byzantium. This is where the Sacred Geometry will really assert itself.
Why does Botticelli choose Venus?

Botticelli is at first a painter of symbols. For that, he practices Sacred Geometry he receives from his masters, like Fra Filippo Lippi. He goes also to school, the Guild of St. Luke, and he exchanges with his colleagues Verrocchio and Leonardo da Vinci. Every one is very good in geometrical construction. These special Mathematics are a way of thinking typical to the Middle Ages, which expresses in this way its Symbolism. Behind the painting's rows are hidden geometric shapes, "magic", that can be translated into words by some "code numbers". Without these codes, the lines remain silent and without explanation. But with the grid, able to measure the work, we know immediately what we are talking about. For example, 3 is the value of Heaven, and 4 that of Earth. We'll come back ...

Painters of the Renaissance are doing a synthesis: two separate things at the outset are combining to produce a third. They apply their geometry with mythological subjects in which they appreciate beauty. Thus, they give new life to stories that were ignorant of geometry, and give a boost to Geometry through new subjects, which vary from those they use so far: mainly those of the Bible. It is often said that these new topics are "secular", opposite to "sacred." But it is unfair. First, the Greeks developed a real sense of the sacred. Then the subject is less important than how it is treated. Now what characterizes the work, the birth of Venus, in front of us, is its great sense of sacred. All the geometry is a proof of it.

Botticelli does not choose only Venus. He chooses the Golden Number to construct his frame. Venus will become the incarnation, the embodiment of this magic number. For the Ancients, Phi is the gift that God offers to Man for his own creations on Earth (preferably beautiful things). And always for the Ancients, Geometry is the pure language of God. Without the numbers, we can not understand anything, we can find only the infinite. In his great mercy, God allows us to speak about in a human language with the help of numbers, as the key of Geometry. The Science takes back this principle. It discovers laws, that involve numbers. Without these numbers, there is no science, no chance to understand the universe or the world in which we live. Kepler is the first to establish laws about the planets that revolve around the Sun. He studies the Sacred Geometry and Astrology, and Venus is its main source of inspiration! The Kepler's third law is modeled on Phi equation:

\[
\text{Phi} + 1 = \text{Phi}^2 \quad (= \text{Phi} \times \text{Phi})
\]
The first concern of Sacred Geometry is to be readable. To do this we need a grid. There is a grid in this Painting. To find it, look at its format: a Golden Rectangle. The long horizontal side is the multiple of the short one, vertical, by Phi. No one of the sides is measuring 1. They just have this proportion between them. We need to divide several times this large rectangle to find the 1.

The most unusual geometric property of golden ratio is explained here: when we remove a square with a golden rectangle, a small gold rectangle is remaining (equal to the greater divided by Phi). And you can repeat this process as much as you want ... Here, everything is multiplied by 2, for two reasons: the Sacred Triangle, which we discuss later, and the Greek Cross and we’ll describe now. Both are very important geometric figures. On the plate that we observe, the great side measures 2.\(\Phi^3\), the vertical side is 2.\(\Phi^2\), and we found inside a horizontal rectangle, which measures 2.\(\Phi\) wide by 2 high ...

The Greek Cross

A square contains a gold rectangle, vertically, which may stand in two ways: on the left and on the right. These two rectangles leave two traces, two vertical lines.

Then you can duplicate this figure, and rotate it 90 degrees, a quarter turn. Vertical lines become horizontal and form a cross.

Finally, we can add all the diagonals in this figure, up to complete it. This is the motive of the Greek Cross.
There are several Greek Crosses on the table. You can place the grid from the top right corner. A large horizontal line of the Greek Cross falls on a grid line. This is also the horizon of the painting, even if the sea rises... The other horizontal of the cross passes at the top of the shell...

The Sacred Triangle

It is the triangle 3_4_5.
Between segments 3 and 4, there is a right angle. Pythagore will build his theorem from this: $3^2 + 4^2 = 5^2$ (9 +16 = 25)
The hypotenuse is the size of the outer circle, which passes through the three points of the triangle.

The properties of this triangle are unexpected:
– The inscribed circle of the triangle, that touches the three sides, has a diameter 2.

Definition: a bisector cuts an angle into two equal angles.
In a triangle, the bisectors intersect at the center of the inscribed circle.
– The line bisecting the angle between the side 3 and 5, intersects the circle at the distance 2.Phi from the summit. Phi is in the triangle!
This 2.Phi is a reason of the appearance of 2 with measurements, in Venus frame.

The Sacred Triangle on the Painting

The Sacred Triangle finds its place on the grid as shown in this plate. The couple of Zephyr and Chloris is inside the medallion of the triangle, and the golden bisector, which holds the golden ratio, plunges up to the navel of Venus.
Another triangle, which circle is shown does the same symmetric thing, from the bottom.
The meaning of Numbers

Some History
Geometry would remain silent, like us, if there were no numbers to interpret. Their codes have taken millennia to develop. Their story begins in Egypt, long before the pyramids. At the same time, another civilization grows on the Atlantic coast. Megalithic Civilization, which raises huge stones to draw lines across a whole landscape. After the Egyptians and the Megalithic, the Greeks solve many questions that remain unanswered. They develop mathematics, especially they specify the numbers nature. Subsequently, the Byzantines use these skills coming from the Greeks, and they construct new geometrical figures in preparing their icons. The Geometry develops so much that the authorities of the Byzantine Empire, political and religious, see it as a threat to their power. Twice in the eighth and ninth centuries, they kill all the painters, their works are burned, and perhaps even their writings ... Since this tragedy, the Geometers of the Sacred hide their knowledge in their studio. They do not take the risk of passing their knowledge, in an other way than word of mouth, from master to disciple. Finally, with the modern era, the studios are gradually closing and this knowledge disappears from the mind of people, painters and amateurs ... Everything must therefore be replenished, but not from scratch, no, from the frame of the works. We must learn how to read the lines in the language of their design.

The nature of Numbers
The integers have not the same nature as the square roots. The Greeks have shown that these roots are irrational: no fraction of two integers is equal to $\sqrt{2}$, for example. The integers and square roots not necessarily express the same thing. The number 3, another example, is attached to Heaven by the Ancients, and this concept is easy for them, almost tangible. $\sqrt{3}$ is the root ($\sqrt{3} \times \sqrt{3} = 3$), and there is something else ... In Symbolic, root becomes synonymous with original, underlying cause, of "reason of why". In the case of Heaven, we know it exists, but we do not really know its origin. It is even a great mystery! In Symbolic $\sqrt{3}$ serves as a measure to this mystery. The size of the halo of Jesus Christ can make use of $\sqrt{3}$. It suits him very well. We can review the most usual numbers, used by the Sacred Geometry.
The main numbers
Let’s start with the 1 ... The Unit is the beginning of everything. Surprise: the ancients say that this dimension is that of Magic! Oh, not that we see in Harry Potter, not that one. For the sages of the Middle Ages, the Magic is to do something really amazing and not fake movies with special effects. For example, Leonardo da Vinci tries to create Superman, but the valet who serves as his cobaye brakes his ankle. No matter ! Vinci's dream will become aircraft. Vinci misses one thing for a successful project. The measurement of weight, of strengths, of strength of materials etc.. The Ancients say that the first step of Magic is in measurement. The Science was born much later, like to give them right : it spends its time measuring things...

The 2 is somewhat more difficult to define. It is the number of differentiation. We go from one, the Unit, to the two of the couple. The Ancients say 2 is the Number of Inspiration. It's too vague if you do not specify its source and nature. According to wisdom, the first step of Inspiration is the discernment. There is no inspiration without study, without attention to a subject. Inspiration begins with awareness. White and black, good and evil, before and after, up and down. When this is understood, we can mix our two cents to the conversation. On the opposite, talking before studying a subject means "to be misguided" or "to be not inspired at all"...

As we have seen, 3 is the Sky, or more exactly the Celestial. It refers to Heaven. The sky of the stars and of the angels. In Symbolic, they are the same for the eyes that rise towards him. The Celestial (3) differs from the Terrestrial (4, the one we see in looking down). And between Sky and Earth, there is not only a skyline, but also Love.

Love is the meeting of the Celestial and Terrestrial, the combination of 3 and 4, and it adopts the Number 6. The Sacred Triangle gives us the reason. Indeed, the meeting of 3 and 4 is shown in this triangle, with a right ange, and the surface of this triangle is 6 (half the rectangle of 3 on 4)...

5 is the size of the Hypotenuse of the triangle, the line that links the sides 3 and 4 of the Sacred Triangle. It is also the diameter of the circle that encloses the triangle. That is the figure of Man, the human world. The sages say that it is also the number of Dogma. What is a dogma? It is an idea which dreams of eternity. A sort of Act that is intended to be above all laws. Only men are capable of such challenges, and they often produce dogmas in God's name ..

Yvo Jacquier – The birth of Venus, Sandro Botticelli, 1486
God finds several places in these numbers ... He appears as a shadow behind multiple values. The 1 of the original Unity, the beginning of Magic. To the ancients, the first manifestation of God is that it allows us to measure things. Imagine that this would impossible, there would not be even have Internet...

√3 is among all values, the one which claims most from God. The mystery of the Trinity, the Triskel and many other figures such as the Vesica Piscis, are translated with its symbolic vocabulary. The Vesica Piscis is formed by two identical circles that put their center on the twin circle. If the radius of a circle is 1, the intersection measures √3...

√5 expresses the mystery of man. One of the most beautiful values of Sacred Geometry. This number falls within the definition of Phi, the Golden Ratio, equal to \((1 + \sqrt{5}) / 2\), close to 1, 618... The Golden Number is the key to all composition systems of in Sacred Geometry. The simple equation \(\Phi + 1 = \Phi^2\) enables all geometrical figures to combine. They end up at specific points and they unite their lines. Due to Phi, the geometric shapes stick together in a precise and accurate way. And instead of having a sum of figures like a pile of stone in front of the building, we are dealing with a system that builds a solid wall. Phi is a key component to the cement that holds the stones together.

**The translation from Numbers to Geometry**

It would not be fair to say that we translate the numbers by geometrical figures. Geometrical forms are according to specific numbers. By their measures, they fit together like a Lego set. The grid serves to measure and to place the figures: we have already seen, with the first Sacred Triangle of Venus. We will see that Botticelli do not let a single numeric value. The composition of his painting has many layers, and ultimately they are one system, a complete set. All figures cling to each other, as strongly as the stones of a wall. This structure, is incredibly consistent
We have seen the Greek Crosses, with their developments of Phi. Then a first Sacred Triangle, which points its golden bisector towards the navel of Venus. The Golden Ratio is quoted every time, because it allows to link the figures together. His "algebraic equation", ie the property of this number \((\Phi+1 = \Phi^2)\), is parallel to the first geometric property: if we remove a square from a golden rectangle, it remains a smaller golden rectangle.

The first property of the golden rectangle expresses the peculiarity of the Golden Ratio. But another figure uses the Golden Ratio to build itself: the Pentagram.

The Golden Ratio is so much at the base of the Pentagram, that it is difficult to compile a complete list. Here is the beginning:

- If \(a= 1\), then :
  - \(b = \Phi\)
  - \(c = \Phi^2\)
  - \(d = \Phi^3\)

Botticelli has explored all the possibilities of this figure. This is the main tool for constructing its frame. For starters, it flips the Pentagram. The large triangle highlighted in red is a Golden Triangle. Botticelli decides that it has exactly the same height as the great frame of Venus.

A pentagram has five golden triangles, as much as sides to draw a pentagon. The pentagram is the star, the Pentagon is the five-sided figure which encloses the pentagram.

The feet of Venus are out of the Triangle...
The magical coincidences in the figures

All the figures of the composition are welded together. If it was not the case, the leaves that connect to the same tree would be a pile of dead leaves, without interest. Here we see how the Greek Cross and Pentagram are clinging: the horizontal bar of the Pentagram takes a bar of the cross, in blue, and the intersection of the branches intersect at another bar of the cross (blue dots). The tip of the top is also on a vertical of the cross.

Le tip A of the composition

- Botticelli paints a first circle diameter $\Phi^2$
  
  Recall that $\Phi^2 = \Phi + 1 \approx 2,618$

- It stalls it on the lines 2 horizontal and 2 vertical grid (the origin $O$ is at the top right)

- It doubles the circle, diameter $\Phi^2$, and it shifts it to the left of $\Phi / 2$.

Through the magic of $\Phi$, the point of a Pentagram emerges here: it reaches the intersection of the circles at the top (point A), and passes through the center of the two circles. And that's not all ...

Remember the inverted pentagram of Venus, one with a golden triangle highlighted in red. In the circle that surrounds it, there is a pentagram in the place: its peak is the A that we just defined! And this Pentagram clings to the circles $\Phi^2$ in five point ...
The great Pentagram of Venus

It serves to Botticelli to guide his drawing. The portion from a geometric figure to the painting is not a simple filling, but a kind of dialogue between the lines of the painter and the mathematical lines. The feet of Venus and Horae, the face of Zephyr, are touching these lines, the Lady’s dress is as raised by the circle, and roses are like hanging to laundry son. The cape uses the Pentagram to design its limit and on the other side, the arm of Venus is using the symmetric part.

Golden Spiral

We saw the first Golden Triangle, and said there are five of it. Each produces a golden spiral. The most beautiful story of Venus:

1 – The curve has its origin in the sky, field of Uranus, father of Venus. Her hair is mixed with this origin, the bond that holds hair glues to the curve.

2 – Further, the Horae shows a shell in her hand: a Cyprée. This name recalls Venus: the poets use the derivative of Cyprus name, the place where she lands. Many sea shells refer to Venus. The man has the "revelation " of the spiral by watching these shells. Venus has chosen the symbol of the five-pointed star, for its Golden Principle, because the golden spiral is in the shell. The Horae takes up this Cyprée, that she claims as a diapason for the frame.

3 – The curve confuses its line with the cape, and then searches the armpit of Venus.

4 – A leafy branch hosts the line in its fall, and emphasizes the sense by three chevrons.

5 – The accuracy of the drawing never ceases to amaze when it glues to the dress of the Horae.

6 – The same for the shell, in contact with the wave, and its foam : this is the place where Venus was born.

7 – Before flying, the spiral finds Chloris, who runs on his way, with long strides. This spiral combines the notion of time and that of desire.
Diamond Venus is a mermaid

Sandro Botticelli is, along with Andrei Rublev and Albrecht Durer, one of three greatest masters of composition. And this picture is a real festival. All the values of Sacred Geometry are exposed and they create magic links. The 2 of Inspiration comes back all the time, and Phi too, the magic wand of numbers. The 4 is not yet fully emerged, although it is in the Triangle 3–4–5 ...

A new Greek cross appears, its height is 4. This number is related to terrestrial, the earth where human is landing (the earth even before the life). No wonder that the shell is fitting with this new motive, when this shell brings Venus up to the shore.

The golden rectangle also has a horizontal spiral, as the Golden Triangle has a one. And this new one will surprise us ...

Two spirals from the golden rectangle have rendezvous to form a heart on the painting.

On 4 of the Earth leads straight to 5:
This heart is inscribed in a circle of 5!
This is the great circle of the Sacred Triangle ...
Magic!
What to do with this circle of 5?
A Vesica Piscis.
Two circles of 5, separated by $5/2$ (radius of the circle).
The center of a one is on the circle of the other.
The new motive is linked to the others, as shown in this visual (red dots). It is a solid structure.

In this Vesica Piscis, Botticelli has placed two rectangles 3 on 4 (each has two Triangles 3–4–5). He inclines them in a truly special way: look at the left rectangle, blue. If we extend its right side, its reaches the angle at the top of the yellow rectangle.

**Table of 9**
All angles of the figure, the slope of the lines relative to the horizon, have a peculiarity: the sum of digits is equal to 9! But what does that mean?

\[ 9^\circ \times 2 \times 2 = 36^\circ = \text{Angle of the Pentagram} \]

This 9, found everywhere in the figure is the shadow of the Pentagram, the star with 5 branches. Botticelli chose this language to emphasize that Venus was human, or more exactly what she brings to Humankind: Beauty, as an absolute.

On this simplified image, the result becomes obvious: Venus is a mermaid, and we need Geometry to understand it.

It is the most beautiful secret of this painting.

Yvo Jacquier – *The birth of Venus, Sandro Botticelli, 1486*