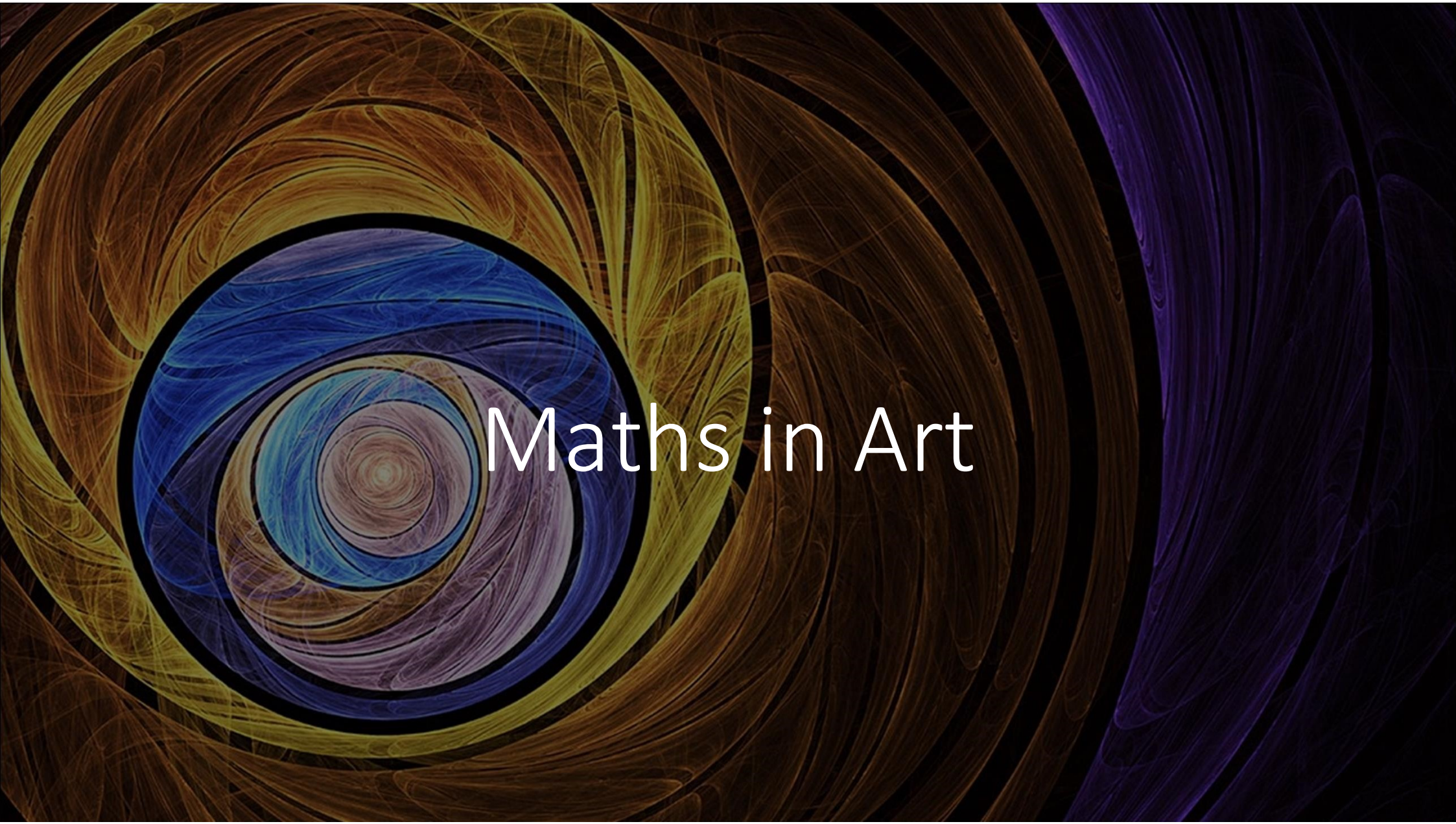
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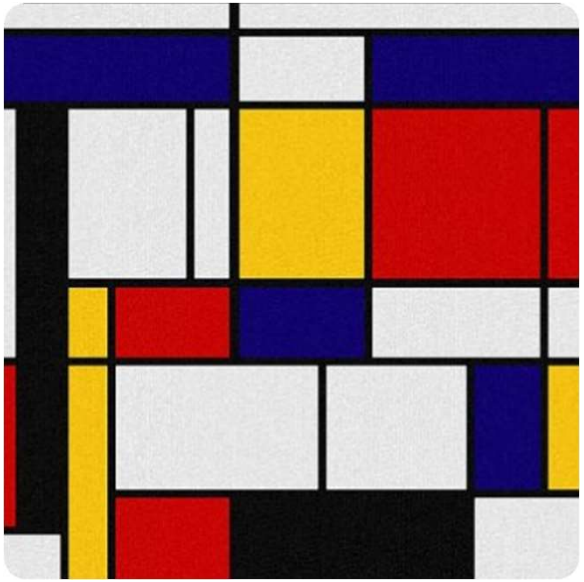
ERASMUS K2 « PASSPORT TO THE FUTURE »

PALAZZOLO ACREIDE 21-26 MARCH 2022

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Maths in Art





Mathematics and art can be considered an indissoluble couple. There are numerous interconnections, facets, convergences and divergences that show this link.

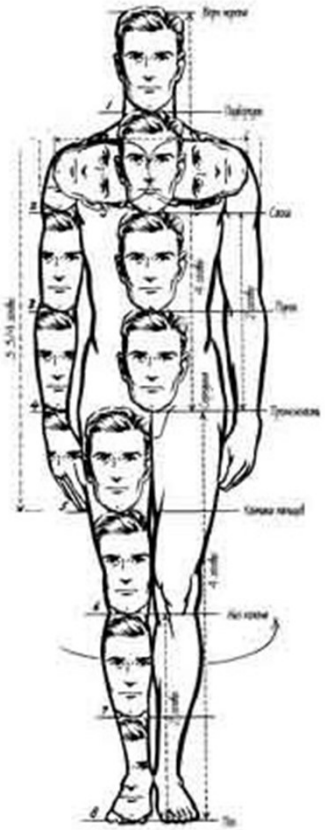
There is also a strong relationship between the world of figurative art and the world of mathematics. They both are based on fantasy and a rigorous language.

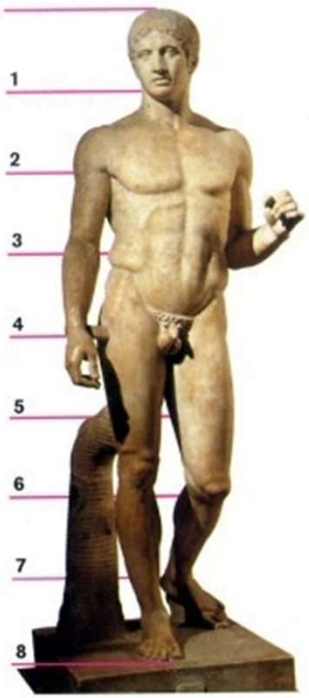
In the figurative arts, in fact, the correct proportions of the human body are studied as it is considered the symbol of perfection.

Renaissance artists must have had considerable technical skills and notions of disciplines **such as mathematics, geometry and optics which are strictly** related to art. In fact mechanical arts were elected to the dignity of liberal arts.

The ideal standard of beauty is defined as a harmonious and proportionate agreement of shapes with clear geometric and mathematical relationships

Proportions





The artists of the Renaissance followed the principles of the Greeks, and in particular they preferred a Greek artist: Lysippus. In his art the module is the height of the head and the rules are as follows:

The height of the face is divided into three equal parts: the first between the chin and the base of the nose; the second between the base and the root of the nose; and the third between the root of the nose and the hair implant.

The height of the face, from the base of the chin to the hair implantation line, is equal to the tenth part of the body height.

The total height of the head is equal to one eighth part of the height of the body.

The combined height of the head and neck corresponds to the length of the foot, and one sixth of the height of the body.

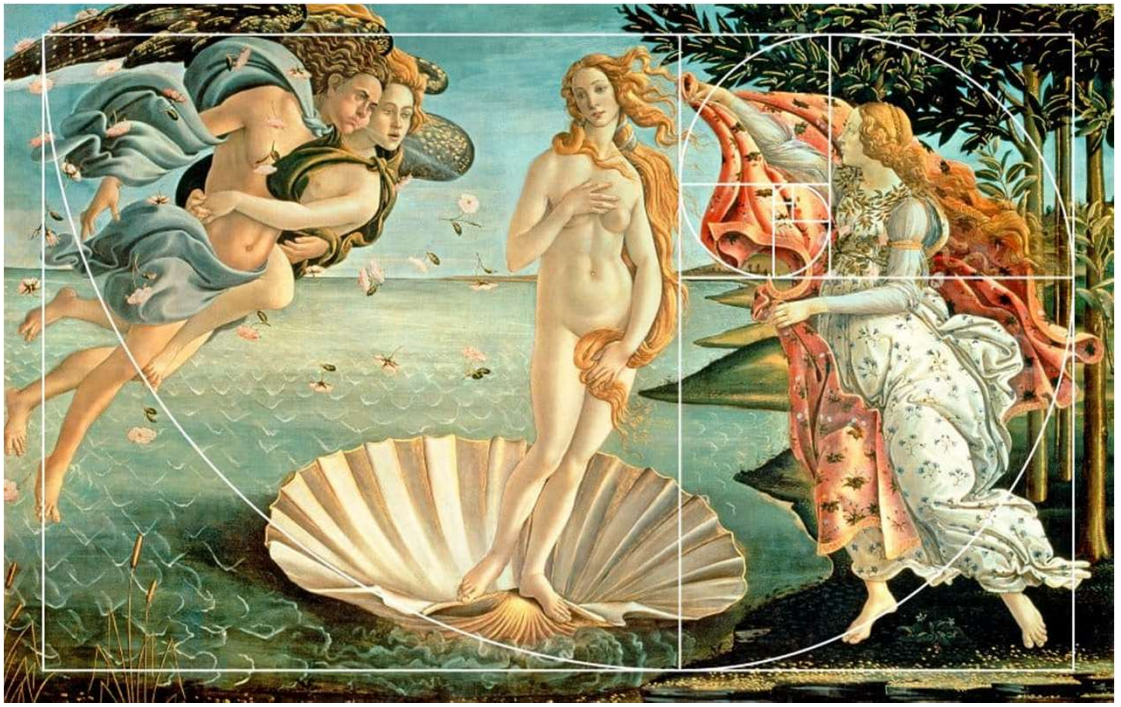
The navel is located in the center of the body.

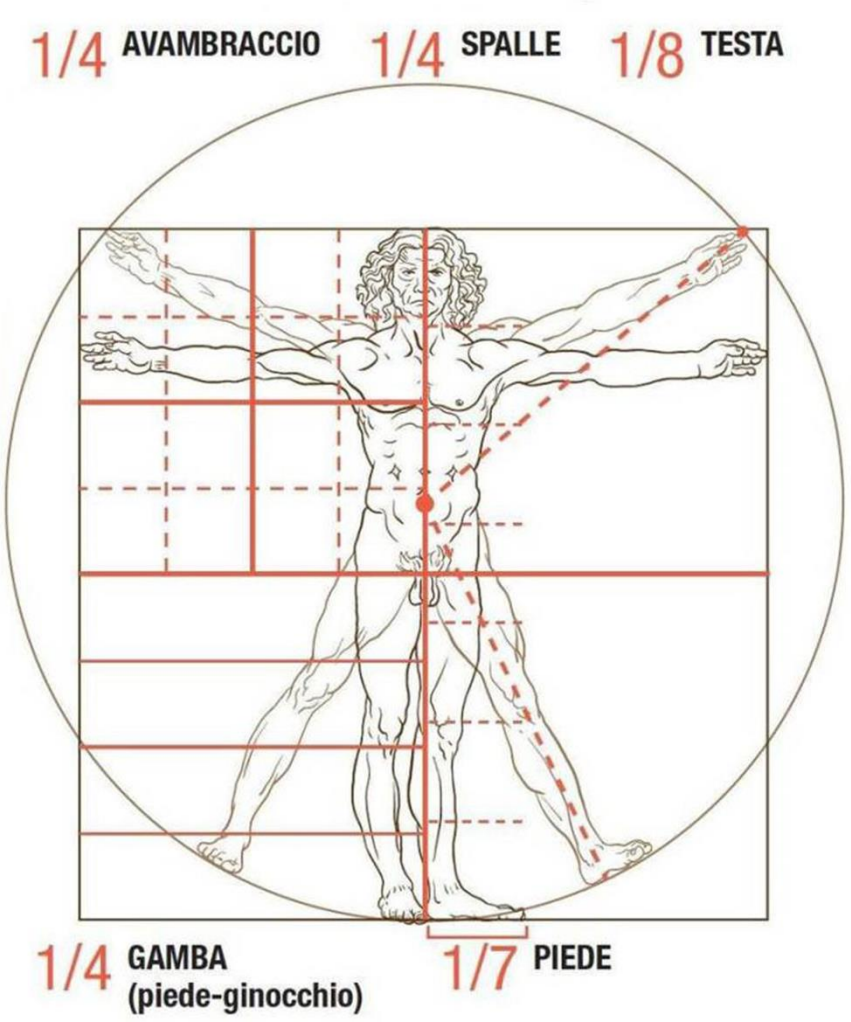
The height of the body is equal to the size of the open arms in the cross.

Leonardo da Vinci followed Lysippus' rule according to which the height of the head is equal to one eighth of the total height of the body.

The Golden Ratio

The golden proportion, also called the divine proportion or golden number, is a ratio between two unequal dimensions. This ratio corresponds to a non-integer number which is equal to 1.618 We find this divine proportion in nature, in the evolution of the sea waves, in shells, in some vegetables such as the "Roman cabbages" which have geometric elements repeated called "fractals". Since ancient times, this relationship indicates the continuous disposition to perfection. For this reason, lots of painters, sculptors, architects, designers have tried to respect this divine proportion so that their works convey a sense of harmony and beauty. The golden proportion, which is also called the golden ratio, was discovered by the Pythagoreans and defined by Euclid. For many years it has been the subject of studies and reflections, even symbolic, so much so that it has been defined as "divine proportion".





Leonardo da Vinci

Leonardo drew the Vitruvian man inspired by the text by the Latin writer Marco Vitruvius Pollio who had studied the actual proportions within the human body many years earlier (between 80 BC and 15 BC). This text struck him so much that he decided to create a drawing following step by step all the suggestions that the Latin writer and architect had discovered. Leonardo used pencil and ink and drew him on a 34x24cm sheet. This very precious drawing is kept in the Accademia in Venice and is one of the most precious works in the world.

If you want to involve children in the discovery of the Vitruvian man, you can adopt different projects. To make him understand the importance of this design, you can take 1-euro coins and show him that Leonardo's drawing is depicted in the Italian ones and then invite them to draw a drawing.

A nice game, on the other hand, is to demonstrate, with a meter, that even children respect the proportions of the famous drawing according to which the height of the person is equal to the distance, with open arms, between the middle finger of both hands. You can place a square-shaped card on the ground, have the children lie down and take measurements. You can use a measuring tape or different colored ribbons for the two measurements to compare together.

Maths in The Greek Theatre

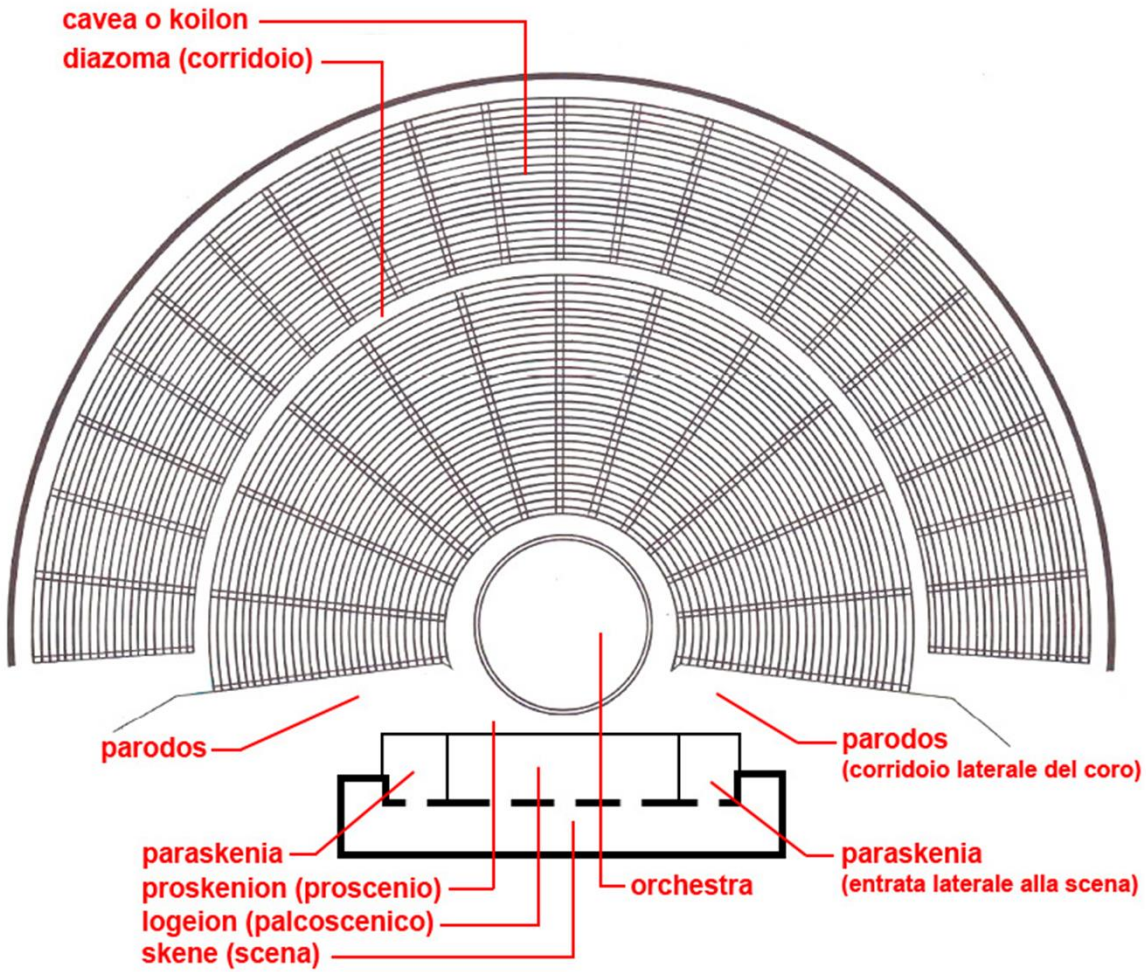


- Maths again is on the basis of the construction of the Greek theatres
- The secret of the acoustics of these theaters can be traced back to the particular semicircle shape that prevents the dispersion of sounds. They also took into account the reflection of sound waves related to the materials and their angle. The stage wall and the
- platform in front of the stage strengthened the acoustic intensity with the result that the voices were perfectly audible to more than 60 meters away.
- Some earthen amphorae had the function of sounding boxes to amplify the voice of the actors.

The Greek Theatre

The round and central space is called the orchestra and is placed right in front of the stage. The choir performed in the orchestra, the choristers sang and danced. The scene represented the backdrop, was often raised and allowed the actors to quickly change and re-enter. The actors performed on the proscenium: the space between the orchestr and the stage.

The public sat in the auditorium made up of many steps. The most important spectators could take advantage of more comfortable seats in the front rows. In the auditorium about thirteen thousand spectators could be accommodated and often under the steps.





The Greek Theatre of Palazzolo Acreide

The Greek theatre is certainly the most astonishing monument in ancient Akrai. From there there is a spectacular view is on the exceptional natural landscape of the Hyblaean spurs and, on the horizon, on Etna

It was brought to light by Gabriele Iudica in the successful excavation campaign s of 1824. It seems to have been built at the time of the monarch Gerone II in the second century. B.C

The theater is not dug into the rock, like the one in Syracusa, but it is set on a natural slope suitably prepared with dry stones on which the blocks of the steps rest and overlap. These, according to the canons of classical antiquity, face north.

The “koilon” (cavea) is made up of nine wedges, of different sizes, separated by eight ladders. Iudica rebuilt twelve rows of seats. The lateral wedges are supported by walls.

Each step is normally 27 cm high and 74 cm wide, of which 34 cm for the seat and 40 cm for the platform. The orchestra, the space in which the choir moved during the theatrical performances, is semi-circular in shape.

The small size of the theater, the asymmetrical steps, the compression of the scene, can only be explained by the fact that the theater complex was probably built in a central urban area, already delimited by the "agora", the decumanus , from the monumental gateway to the quarries.

The theatre, in the Roman-Imperial age, underwent some changes.

In the Byzantine era due to a serious decline of the town, a building for the processing of wheat was set up on the area of part of the scene. The discovery of large millstones and the presence of a large quantity of silos testify this transformation.

Perspective

Perspective is a set of geometric-mathematical projections and procedures that make it possible to construct the image of a figure on a plane.

The methods and techniques of representing the depth have been different in historical periods.

In order to represent the depth the ancient Egyptians implemented a sort of division into planes

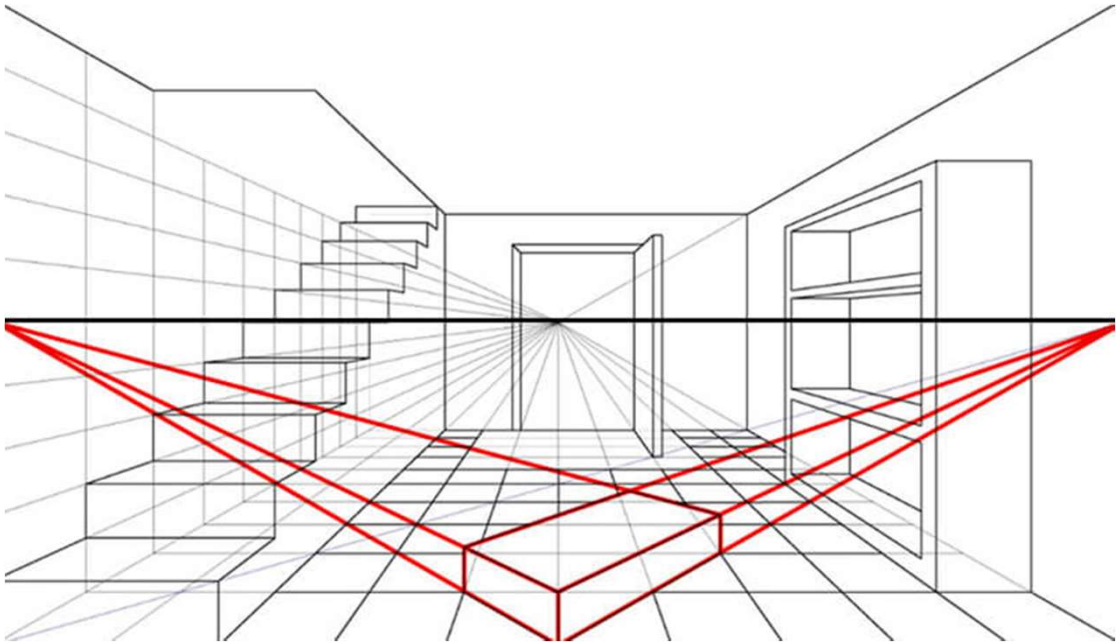
The Romans, on the other hand, simulated the three dimensions by inserting fake architectures in their frescoes and blurring the images of the background.

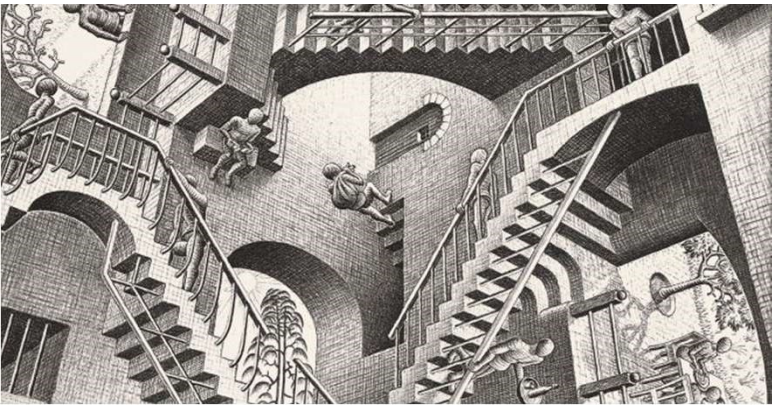
Giotto's fourteenth-century frescoes are the best examples of a good perspective

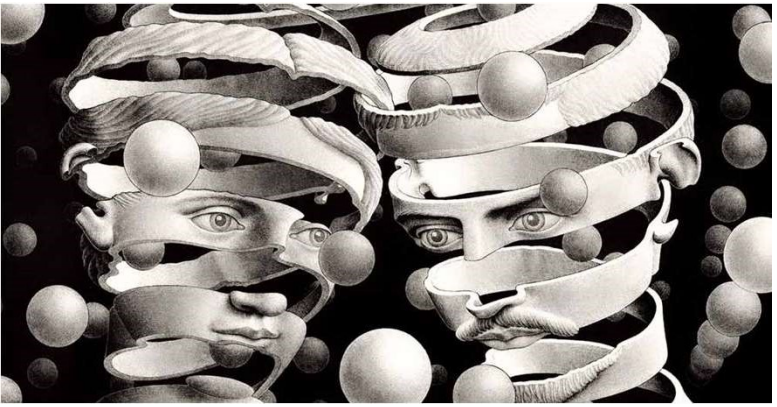
Filippo Brunelleschi was the first to theorize the rules to perform a painting in perspective.

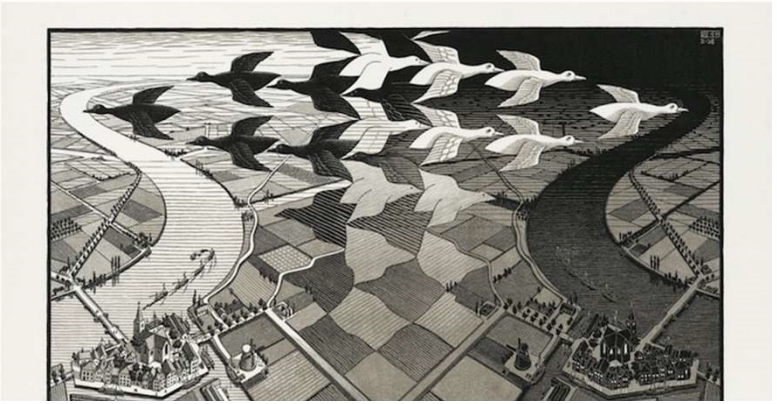
Linear perspective consists of three basic rules:

- At the observer's height there is a horizon line;
- On this line there is a vanishing point that indicates the observer's position with respect to the line;
- All lines that are parallel to each other in nature tend to converge at the vanishing point in vision.









Maurits Cornelis Escher

Another interesting example of the relationship between art and mathematics can be found in the works of Maurits Cornelis Escher, the great inventor of impossible objects and imaginary worlds ("Waterfall", "Ascending and Descending", to name two well-known drawings). He was influenced by the theories of the mathematician Poincaré and Penrose.

Combining fantasy and rigor, Escher becomes popular for the so-called "impossible structures", geometric paradoxes which, while never evading the laws of traditional perspective, trap the observer in a visual field of apparently unsolvable ambiguity.

In this inner world, free from the conceptual constraints imposed by the senses, Escher turned to what went beyond the appearance, looking for the para-doxa, the paradoxical, the one that goes beyond the sensory experience. In fact his works are representations in which the optical illusion plays a fundamental role.

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FOR YOUR ATTENTION

