

1 Activities 2

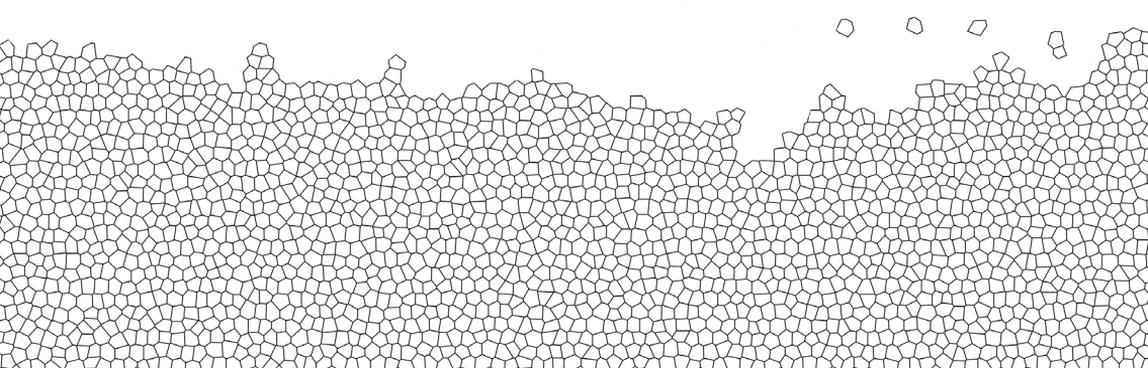
Martmatics

A presentation by Fernando Corbalán

MATHELAB



laboral
Centro de Arte y Creación Industrial



1. In Search for Beauty:

The Common Territory of Art and Mathematics



Do you think that there is any relationship between art and any part of mathematics that you know?

Write a small paragraph about it.

3. The Golden Ratio



Check that your Identity Card (ID) is also a Golden Rectangle. Measure it carefully and obtain its dimensions, divide the longest side between the shortest and you will get approximately ϕ .

Take the measures of some rectangles you frequently find (DIN A4 paper, membership cards, bus tickets, notepads, books, calendars, bills...) and check if any are Golden Rectangles.

4. Where to find the Golden Ratio



A Fibonacci sequence is a set of numbers where each number is the sum of the two preceding:

1, 1, 2, 3, 5, 8, 13, 21...

The ratios between each number and the preceding one, like $8/5$, $13/8$, $21/13$, etc., are a good approximation to ϕ . The approximation gets better and better the farther we go along in the sequence. In the preceding poster you have found approximate values of ϕ . Do the quotients of the Fibonacci sequence get closer and closer to these values?

5. The idealized human figure... according to its height



Comment on the proportions you see in the ideal man of Leonardo da Vinci. Then take your measures. Are they similar to yours? In which ones does ϕ appear?

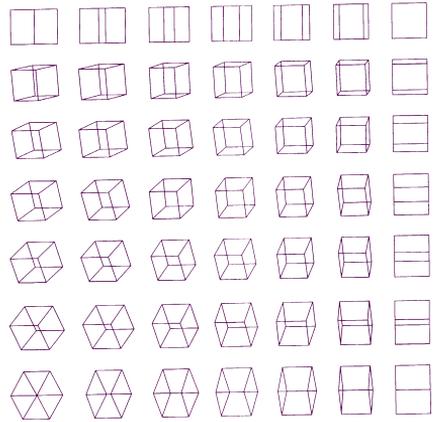
6. Perspective (1 & 2)



On the right you can see multiple perspectives of a cube. Where do we have to stand in order to see them like this?



In what way does the cube have to rotate as you follow the rows and columns on the right of the pictures?



10. The path towards abstraction (1 & 2)



Visit a local museum or you can either look through a book on the history of painting or visit a virtual museum on the Internet, and then find the viewpoint in paintings dating from the 18th and 19th century.



Try to find the different viewpoints used in Picasso's *Las Meninas*, either in the one on this poster or in others you find in books or on the Internet.

12. Impossible objects



Describe the reasons why the objects on this poster appear ambiguous, paradoxical or impossible.

15. Decoration and symmetry



Find geometric figures and symmetries in: sewer lids, embroidery, domestic furniture, textile design, urban furniture, and other objects of everyday use.



Some sewer lids in London

18. Optical illusions



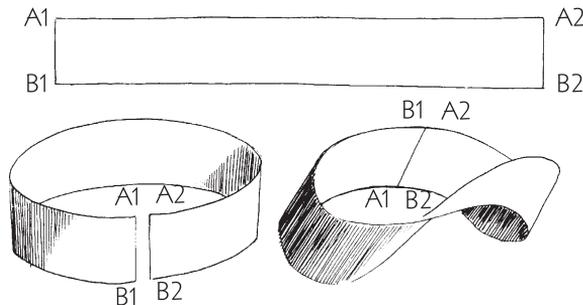
Measure the lengths of the objects in each optical "illusion" carefully with the aid of a ruler and check if they actually are the same size and check if the lines are parallel.

19. Sculpture (1 & 2)



Construct a Möbius band and check that you can go from one point to any other without going over the boundary: It is a one-sided surface!

How to construct a Möbius strip



Look for geometric sculptures in your area. Try to make a sketch of each one that captures its geometric features.

21. Architecture



Build a tetrahedron and a cube, using equal sticks (12 for the cube, 6 for the tetrahedron) and a non-rigid joining material (for example, small pieces of elastic bands). Put them on a flat surface. Which is more stable? Do you think that this has anything to do with what happens with planar polygons?

23. Gaudí (1)

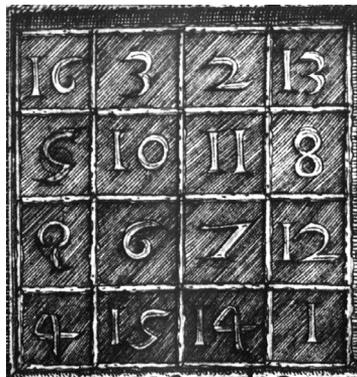


Find ruled surfaces in constructions or sculptures in your town, or in books on art and architecture.

25. Mathematics as an artistic object



In the engraving by Dürer you can see the following magic square: The sum of all numbers along each horizontal, vertical or diagonal line is always the same "magic" number. Which one is it for this magic square? Construct a 3x3 magic square using the numbers from 1 to 9. Solve the most difficult puzzle, creating a 5x5 magic square with the numbers from 1 to 25.



1. In Search for Beauty:

The Common Territory of Art and Mathematics



Do you know any mathematicians or artists' quotations that link the two areas?

2. Elementary Shapes



Find more information about the authors and pictorial movements represented here.

Find other examples of paintings composed basically of elementary figures.

3. The Golden Ratio



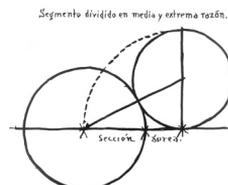
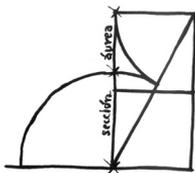
Find the reason for the fact that in a golden rectangle, the line through AB passes through C.

Try to find a more exact value for ϕ by using equations. Take a rectangle of side lengths 1 and ϕ , adopting the rule that it must be golden and then solve the equation.

4. Where to find the Golden Ratio



Below you see two geometric ways of constructing the golden ratio, both from the painter Torres-García. Do you really obtain line segments whose length ratio is ϕ ?



5. The idealized human figure... according to its height



Take the measures of some friends and classmates and obtain the mean. Are the means now closer to the "ideal man"?

Make a *Modulor* based on your height. Are the desks, chairs or windows you use at a good height for you?

7. Perspective (2 & 3)



Go to a local museum or consult books on art and try to determine the vanishing points in some paintings that you find interesting.



In order to check if a perspective on floor tiles is correct, we can verify if the diagonals of all squares meet in a single point, sometimes called a "distant point". Verify this in *The Annunciation* by Carlo Crivelli (1486). Can you find the vanishing point?



9. Anamorphosis



Many graphics editing programmes, such as, Photoshop, Paint Shop Pro or Gimp, have a distortion filter ("polar coordinates"). Use it and generate your own anamorphosis for cylindrical mirrors.

11. The path towards abstraction (2)



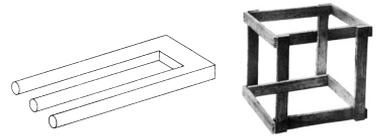
Starting from a rectangular-based painting by Mondrian, try to draw a building that represents it.

Find paintings by other cubist artists and analyze the process of describing reality used there.

12. Impossible objects



Try to plan how you would take a "photograph" of an impossible object like the ones shown here?



18. Optical illusions

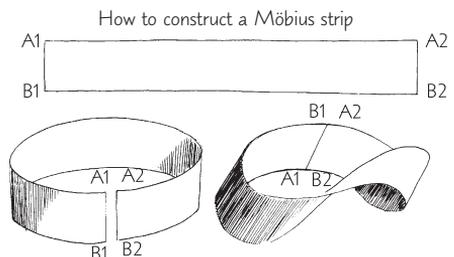


Find other optical illusions and try to find out how they work.

19. Sculpture (1)



Cut a Möbius band down the middle lengthwise, but before doing it think about what you will get! Then check your result. You can repeat the process: first, think about what will happen, then do it and finally, check your result.



20. Sculpture (2)



Take advantage of your visits to museums with sculptures of great artists (Chillida, Sempere, Oteiza...) and study their geometry. You can also consult books on this topic.

23. Gaudí (1 y 2)



Find interesting surfaces by visiting some of Gaudí's houses or also looking through books on art and architecture.



You can build a hyperboloid from a cylinder made from string or elastic bands by rotating top and bottom around their axes. Try it!



25. Mathematics as an artistic object



Let your imagination run wild: design artistic representations of mathematical concepts. You have a whole world to discover. It's all in your imagination!