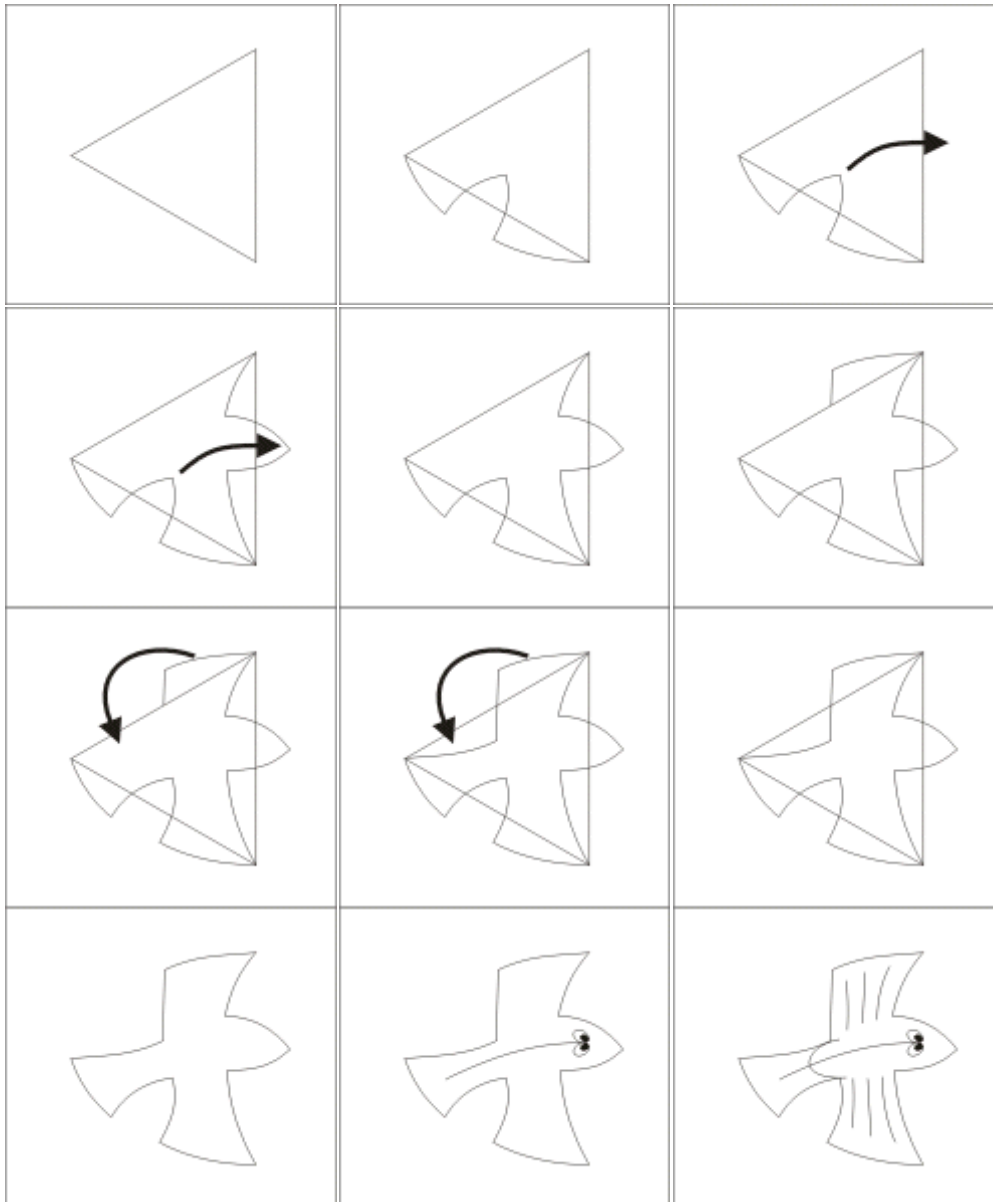
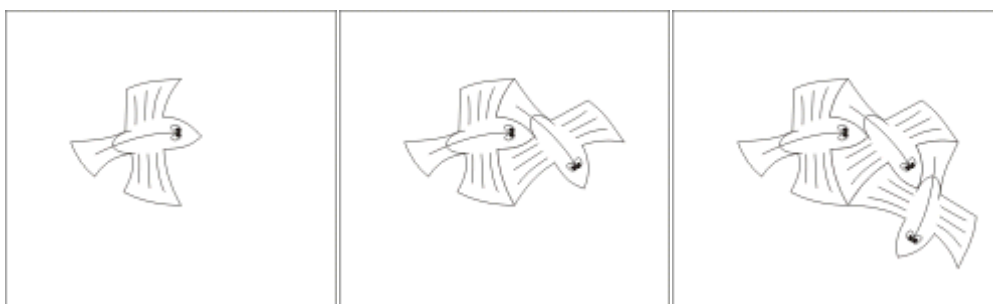


Rotação

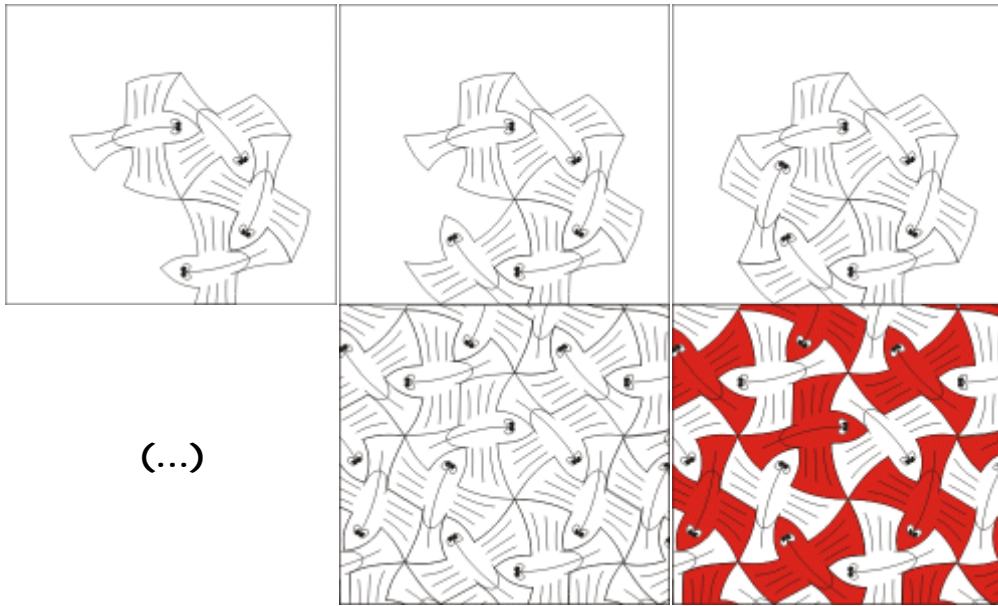
Construção da Região Fundamental



Pavimentação com Rotação

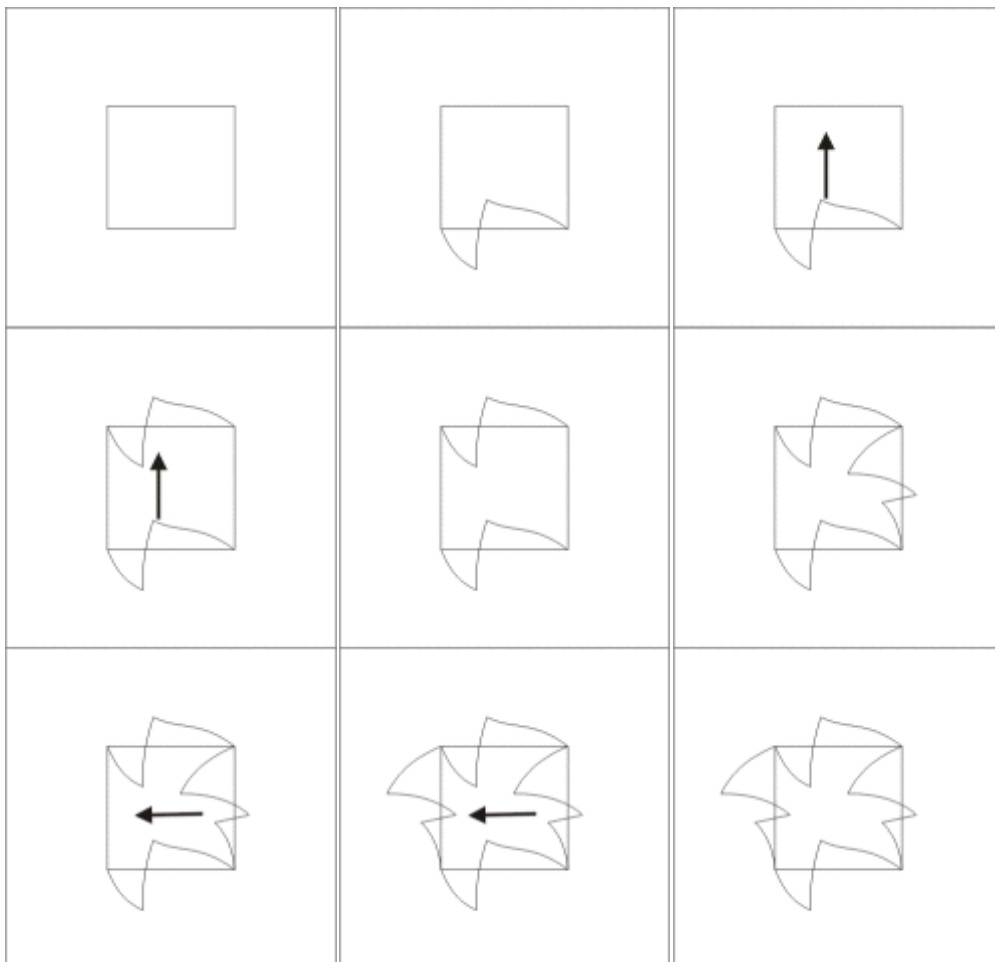


EJEMPLOS DE TESELACIONES DE ESCHER

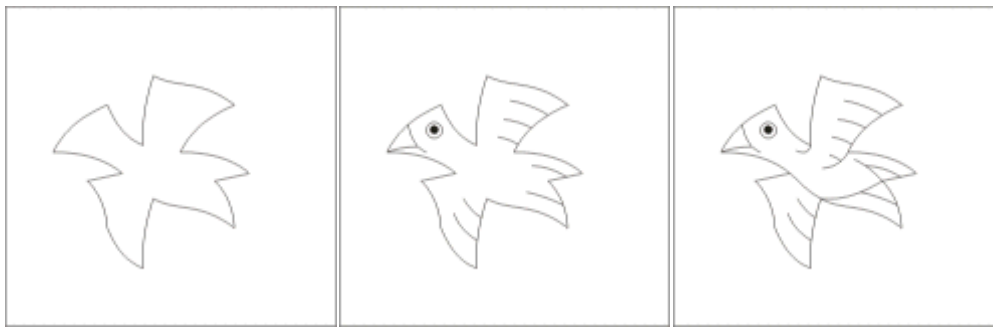


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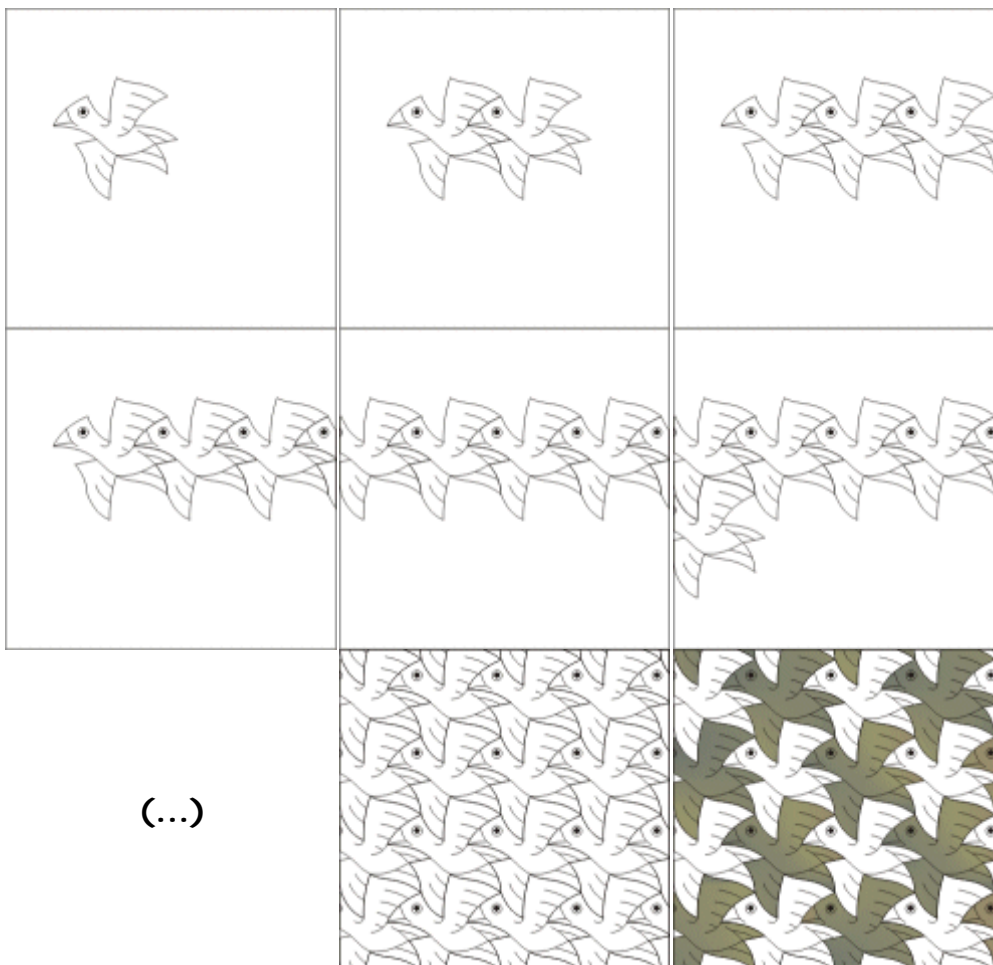
Construção da Região Fundamental



EJEMPLOS DE TESELACIONES DE ESCHER

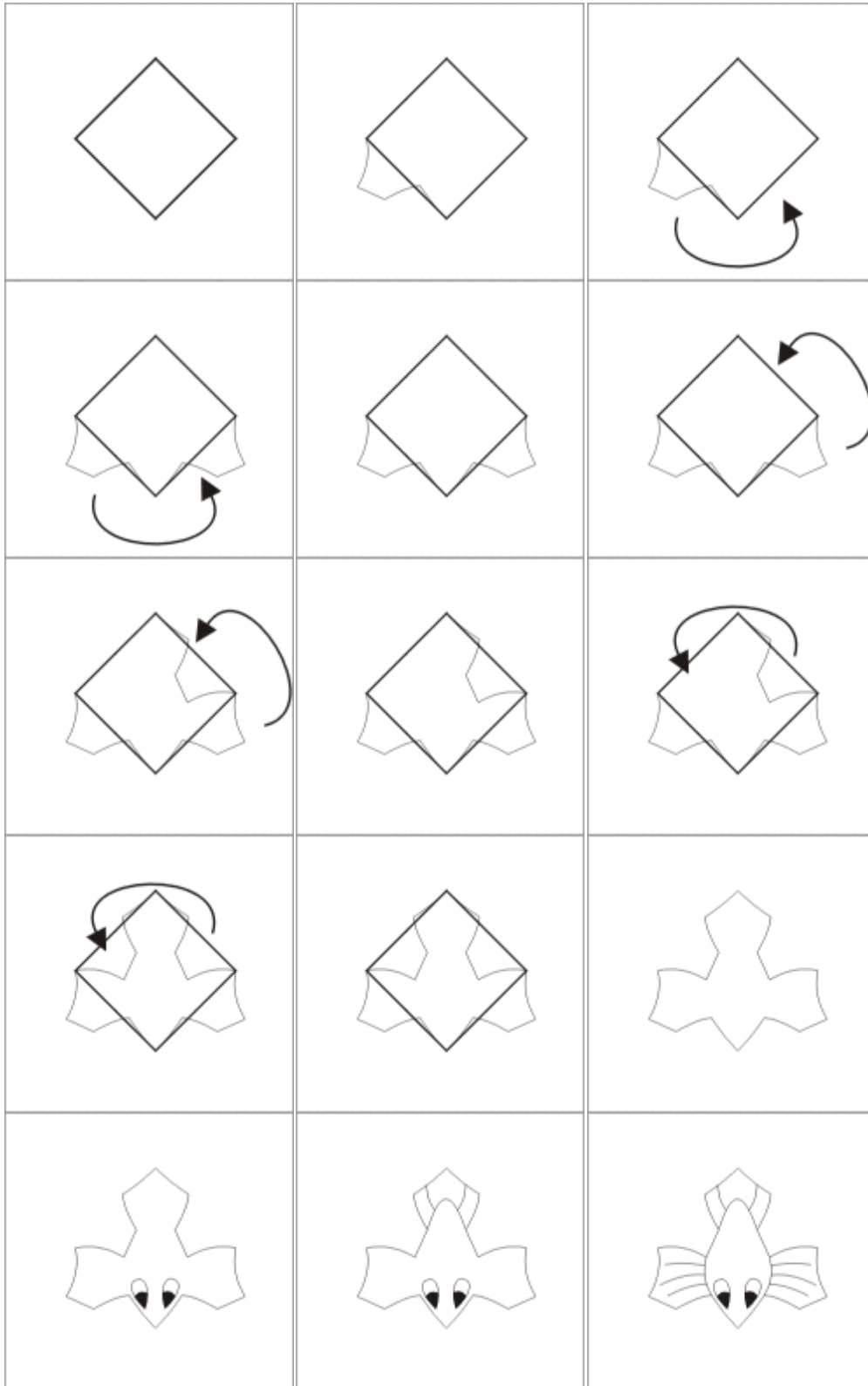


Pavimentação com Translação

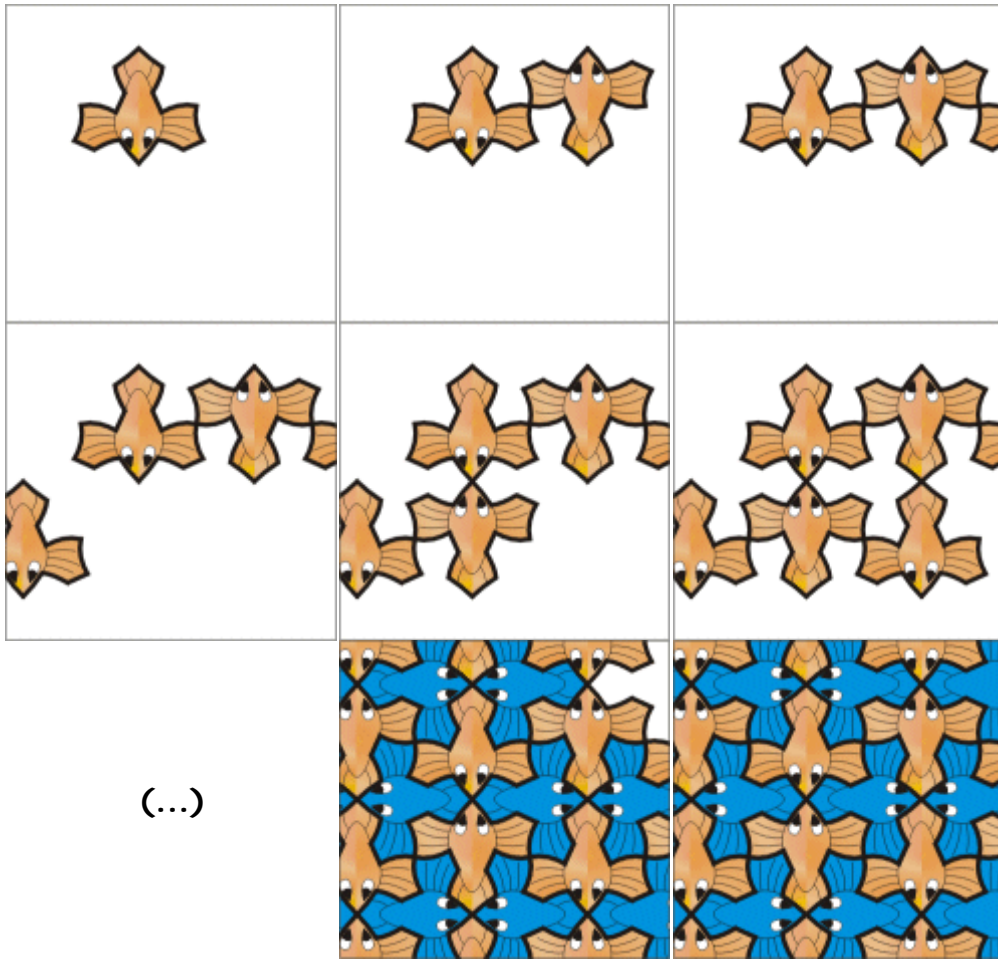


Simetria

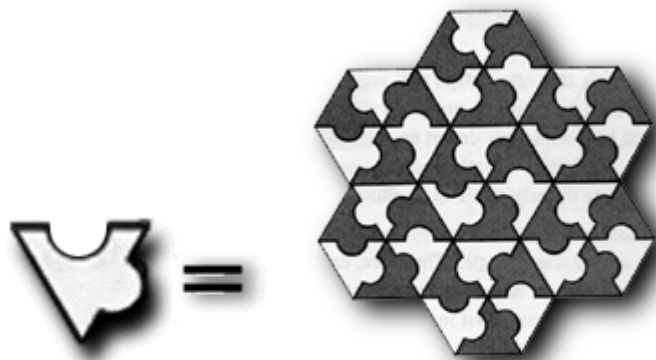
Construção da Região Fundamental



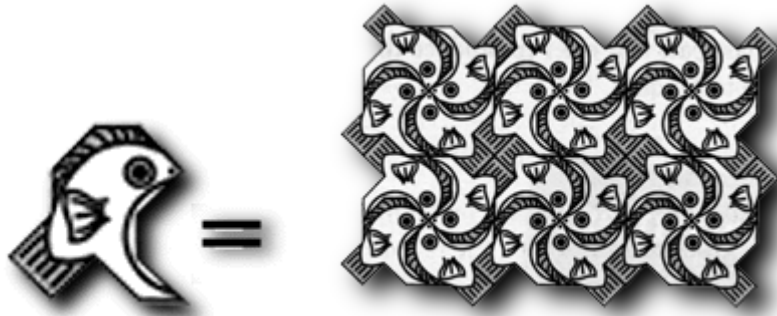
Pavimentação com Simetria



Tessellation Based on an Equilateral Triangle



Tessellation Based on a Square



TESSELLATING TEMPLATES, STAMPS, AND SPONGES

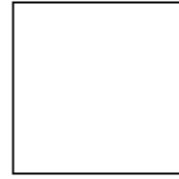
Did you notice the grid of hexagons in the lithograph [Reptiles](#)? All of Escher's tessellating creatures are modifications of tessellating polygons. Consider his tessellation of winged horses (Tessellation 105), a pattern with translational symmetry alone. To find the *parent polygon*, the students are asked to go around a single complete tessellating shape (one pegasus), looking for points at which **more than two** shapes meet. When all such points have been located, they are instructed to join them in cyclic order. A square will be outlined.



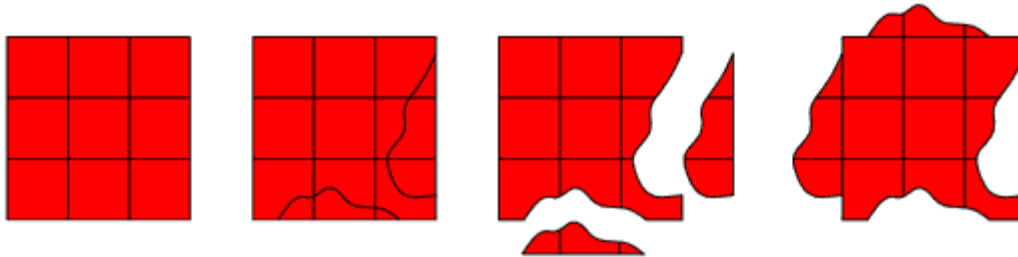
Tessellation 105 - M. C. Escher

EJEMPLOS DE TESELACIONES DE ESCHER

When the students study a pegasus in its parent square, they discover how Escher modified the square to obtain his creature. Each "bump" on the upper/lower side is compensated for by a congruent "hole" on the lower/upper side. The same is true of the left/right sides. Corresponding modifications are related by translation. The area of the parent square is maintained.



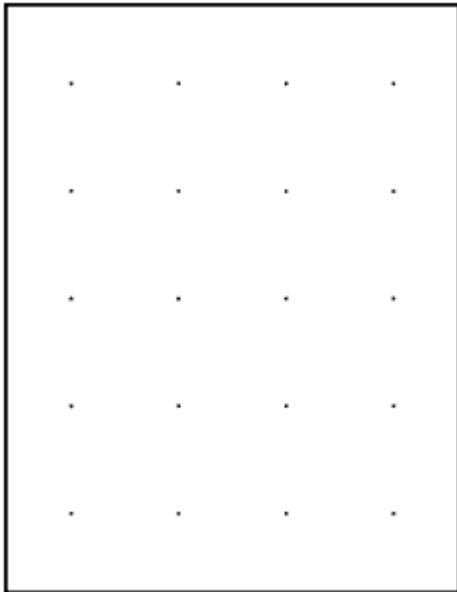
To exercise this modifying rule, each student is provided with a 2-inch cardboard square imprinted with a grid of nine smaller squares. If distinct holes are removed with scissors from each of two adjacent sides (without interrupting the corners of the square), each modification can be translated to the side directly opposite by matching appropriate grid lines, and then taped in position. The result is a tessellating template.



Each student is asked to study the contour of his/her template and to try to give it an interpretation. Studying the shadow produced by an overhead projector can aid the process. (If necessary, the residue between the two holes can usually be turned into a *Muppet* nose.) The student who designed this shape saw both an elephant and an elf.



EJEMPLOS DE TESELACIONES DE ESCHER



Finally the students use their templates to draw their tessellations.

They align the residual square corners of their template with the dots on 2-inch dot paper and trace around the boundary of the template with a sharp pencil. Since the template was created by translation, they slide it to new locations repeating the same translations.

Interior interpreting features can be added by hand or with carbon paper.

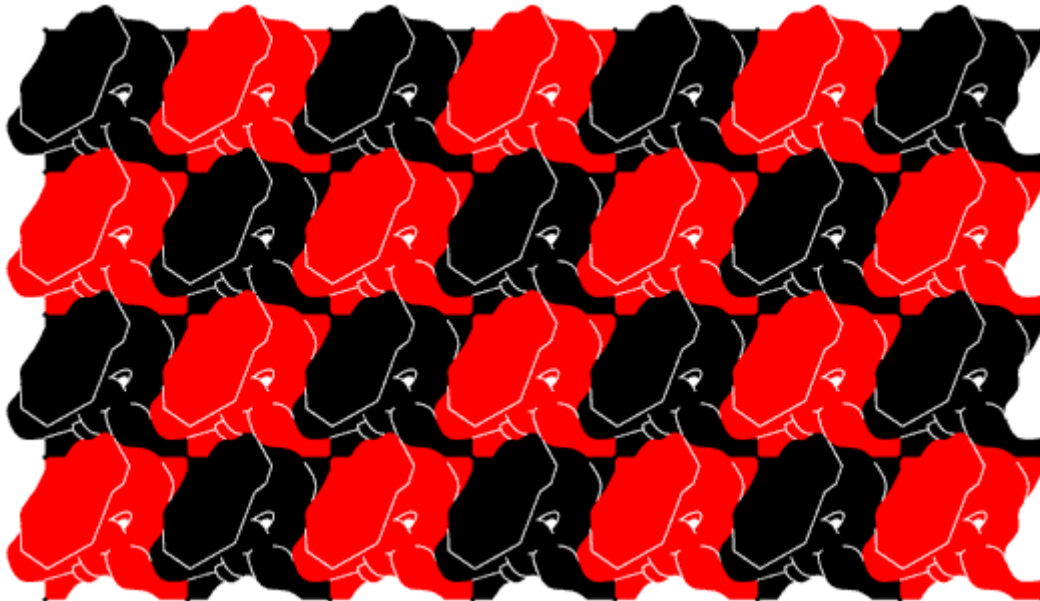
Maurits Escher was a graphic artist, producing lithographs and woodcuts. If students don't try printing their tessellation, then they aren't mirroring Escher's craft.

To create a tessellating stamp, each student needs a transparent stamp mount and a piece of adhesive foam rubber. Both are available from [Ellison](#). They trace around their template on the rubber backing, then cut out the shape. Once the backing is removed, the adhesive rubber is fixed to the mount. Features are added by scoring the rubber with a pencil.

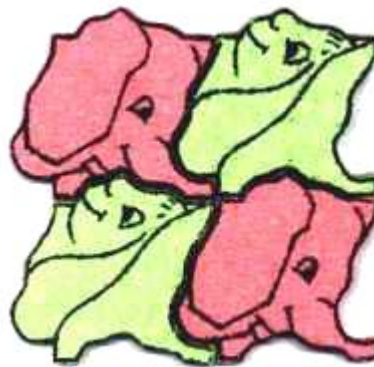


Students ink their individual stamps on stamp pads, then print their tessellations on large ([11" x 17"](#)) sheets of 2-inch dot paper. They print in one color in a checkerboard pattern, carefully aligning the residual square corners of the shape on the transparent mount with the dots on the paper. When done, they clean their stamp with water, dry it, then print in the spaces using a contrasting color of stamp pad ink.

EJEMPLOS DE TESELACIONES DE ESCHER



The tessellating template can also form the basis of a [jigsaw puzzle](#) with only one shape. A medium that is fun to use is compressed or "pop-up" sponge [available from [Ellison](#)]. The border of each sponge shape is outlined and features are added with a waterproof marker. When immersed in water, the material expands to a 1/2-inch thickness. The students squeeze out the excess moisture, then assemble their [jigsaw puzzles](#).



In a cooperative approach to the sponge activity, you can furnish each student with the same tessellating shape. Choose a shape with lots of possibilities. Each student adds his/her interpretation, "pops" his/her sponge, and the class gets to assemble the various pieces.