TESSELATIONS

BIG IDEA: Students will create a representational tessellation composition in the style of M.C. Escher

ESSENTIAL QUESTIONS:

- Why might M.C. Escher think like a mathematician?
- What is the relationship between the artist and the mathematician?
- What may have inspired M.C. Escher to create tessellations?

KEY KNOWLEDGE:

- Students will learn about artist M.C. Escher and discover art techniques through math.
- Students will apply line, space and symmetry to their artwork.
- Students will review color theory through the design process of their artwork.
- Students will review mathematical vocabulary: Reflection, rotation, translation, repetition, geometry
- Math Common Core: Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.

DESIGN PROCESS/GOALS: Credit: Julian Kunstler

1. Create a pattern design based on a tessellation. Start with creating a tessellation shape using the "translation pattern" (see the steps below). Your tessellation should be a recognizable (not abstract) object - animals, birds, insects, fish, etc.

2. Trace your tessellation onto a drawing paper.

3. Draw the details inside each tessellation.

4. Use Prismacolor pencils or watercolors to complete the tessellations. Each shape should be different inside - use different color schemes, designs, details, etc.

5. Apply the coloring technique that would incorporate different shades of a color, color gradations, blending the colors.

MAGNET THEME CONNECTION:

- "We study mathematics for its beauty, its elegance and its capacity to codify the patterns woven into the fabric of the universe. Within its figures and formulas, the secular perceive order and the religious catch distant echoes of the language of creation. Mathematics achieves the sublime; sometimes, as with tessellations, it rises to art." - Julie Dawson
- "Scientists and mathematicians have found more in common with Escher than other artists. This makes sense, considering that Escher's works are firmly rooted in mathematics, particularly in principles of symmetry and geometry. " - Stephanie Watson

WEBSITES:

- M.C Escher Websitehttp://www.mcescher.com/about/biography/
- How to make a tessellation, step by step:
  http://www.juliannakunstler.com/art1_tessellations.html#.VgAcgN9Vikp
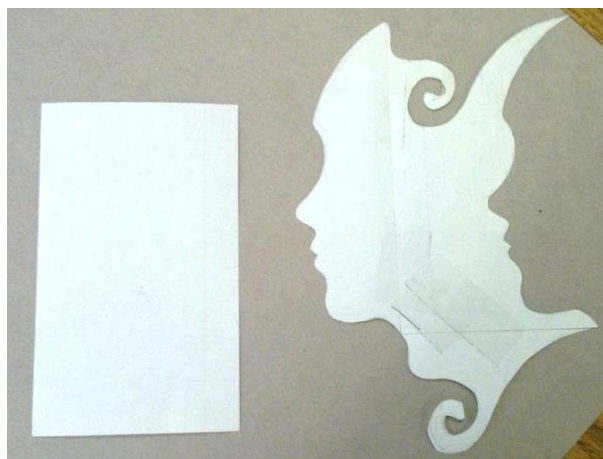
What is a tessellation?

A tessellation is potentially endless repeated pattern made up of one or more shapes that fit together like puzzle pieces with no gaps or overlaps. Squares and other quadrilaterals, triangles and hexagons can be used to design tessellations and they can be modified to create interlocking shapes. The word tessellation is derived from the Latin word tessella meaning TILE.

History of tessellations:

Tessellations have been used for over 600o years by designers and mathematicians. Early tessellations were often mosaic tile designs used to decorate the floors and ceilings of palaces and mosques. The tessellated designs in the Alhambra mosque in Spain inspired Dutch graphic artist M.C. Escher. The contribution of M.C. Escher made to tessellations was to make them out as recognizable figures. Tessellations designs are often seen in quilts, fabrics and wallpapers.

Creating tessellations:

There are many ways to design tessellation patterns using different modified polygons. The three basic types of tessellations that are introduced are: Translation, rotation and reflection. Follow the step by step procedures demonstrated to you and create a representational figure. It is best, however, to start with simple abstract patterns and then develop representational tessellations.

There are few patterns that you can follow to construct a tessellation.

The basic one is **"translation"** pattern - where you attach the cut out pieces to an opposite side of your shape


1.

2.

3.
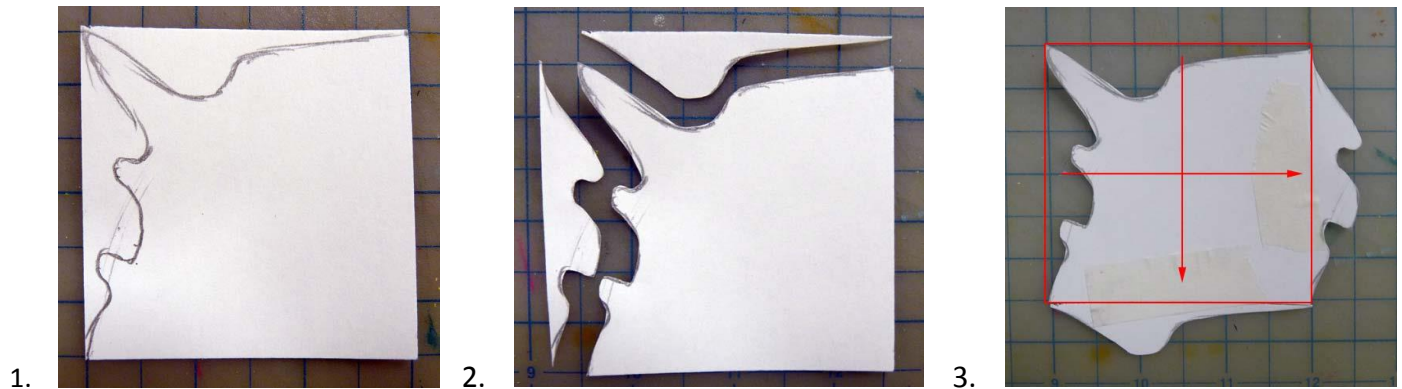
After you sketched the shape - cut out the pieces. Do not ever throw away any cutouts! They should be attached to the opposite sides. Slide down the top piece and tape it to the bottom side of the square. Slide the left cutout to the right side of the square and tape it.
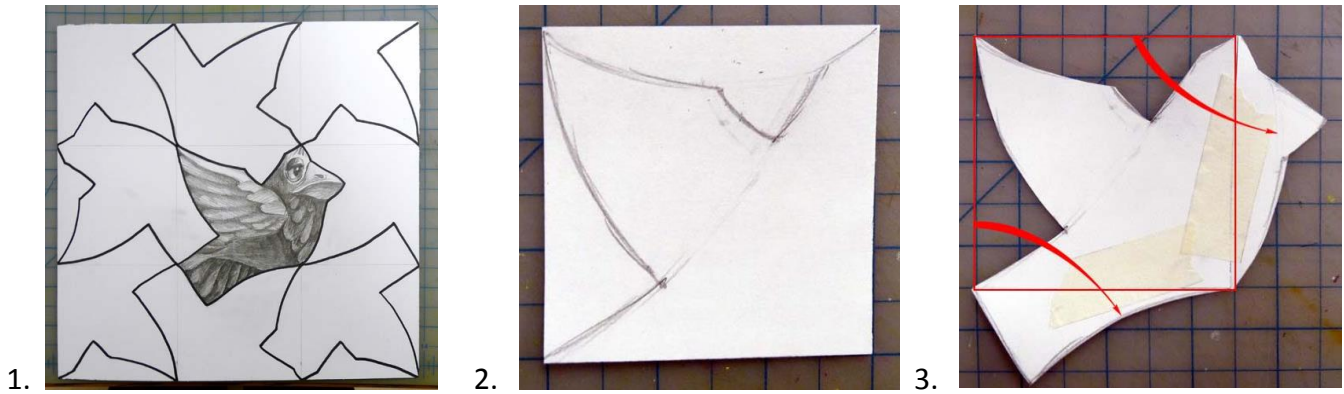

4.

5.

6.
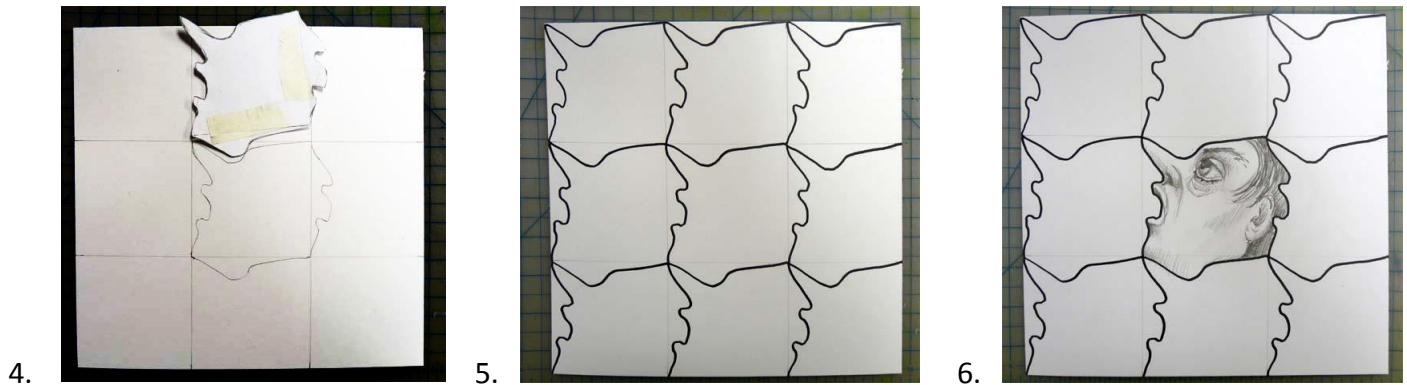
Trace your tessellation onto a drawing paper: Add details!
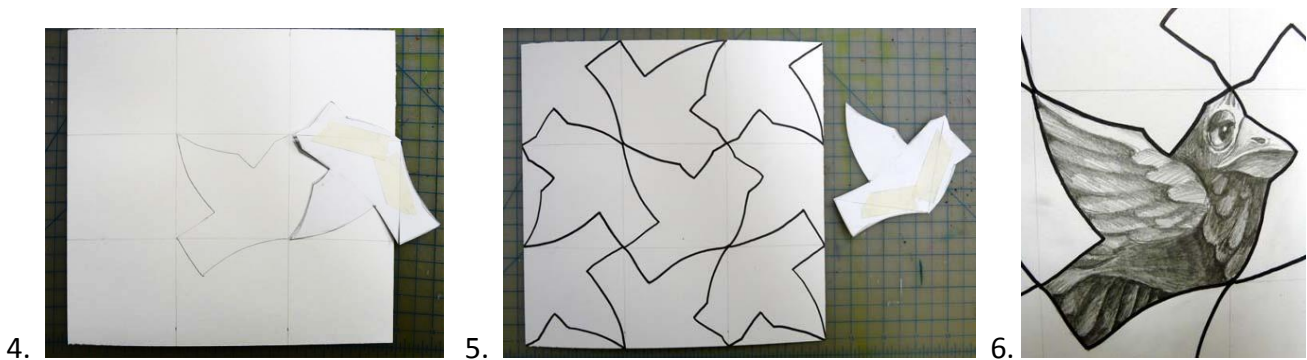
Example below are made from a square (bird) and hexagon (fish)
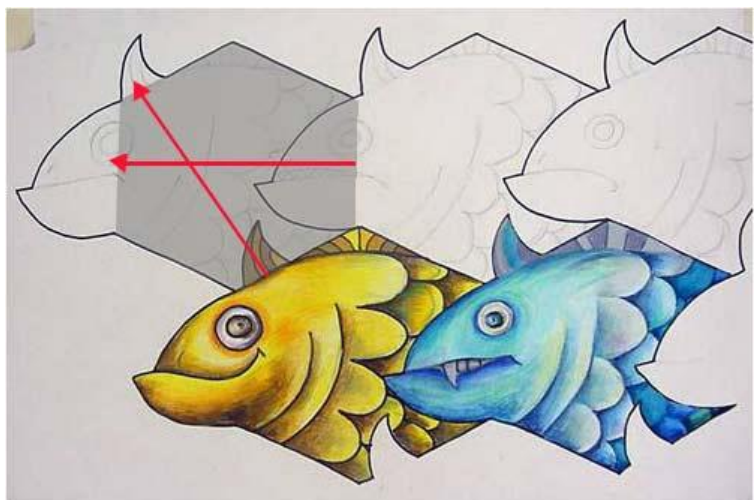
This is an example of a more complex tessellation pattern - **"rotation"** template.

1.

2.

3.

Instead of sliding a cutout to the opposite side - you rotate it.

4.

5.

6.

Trace your tessellation onto a board. Add details to each tessellation.

Glide Reflection Tessellation

For glide reflection tessellations, polygons should have opposite sides that are parallel and congruent – squares, hexagons, parallelograms.

1.
Start with a square.
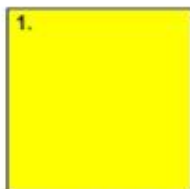
2.
Draw a design on one side of the square.

3.
Cut the design piece out and slide (translation) it across to the opposite side of the square. Flip (reflect) the cut piece on its vertical axis.
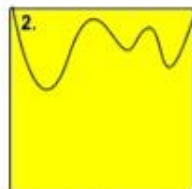
4.
Tape the cutout piece to the opposite side of the square to complete the pattern. This pattern (tile) needs to be rotated or flipped as it is traced.
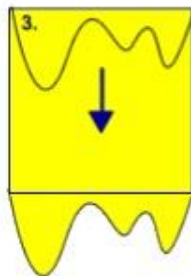
Translation Tessellations

For simple translation tessellations, polygons should have opposite sides that are parallel and congruent – squares, hexagons, parallelograms.
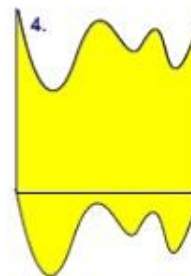
1.
Start with a square

2.
Draw a design on one side of the square.

3.
Cut the design piece out and slide (translation) it across to the opposite side of the square.

4.
Tape the cutout piece to the opposite side of the square to complete the pattern (tile). Slide (translation) the pattern when tracing.

Tessellation created by Rotation

Adjacent sides must be congruent – squares, equilateral triangles, regular hexagons, rhombi

Start with a square.

Draw a design on one side of the square.

Cut the design piece out and turn (rotate) it on an end point until it lies evenly with an adjacent side of the square.

Tape the cutout piece to the adjacent side of the square to complete the pattern. This pattern (tile) needs to be rotated as it is traced.

Suggestions

☐ Try out several designs, by cutting and taping paper together until you find something you like.

☐ When you have decided on a design, create your template on a stiff material – heavy cardstock or a file folder seem to work well for creating a sturdy template that can be traced over and over.

☐ Be creative. Your design should not look like any of the designs in the packet or in this presentation.

☐ Remember: Finding a design online and copying it is plagiarism.

Slide share information from Greg Cross