

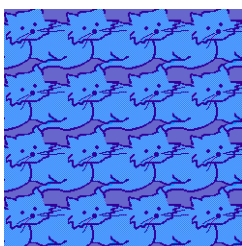
Kursus i at tessellere:

<http://www.geom.uiuc.edu/~demo5337/Group4/Tsslatns.html>

Up: [Home Page](#) *Geometry in Art*

---

# Tesselations



- **Background Information**

If you have ever seen an Escher picture you know what a tessellation is. If not, you can get an idea from the samples at the start of this unit. Their appeal to me is that things that appear as beautiful and complicated are reasonably simple to do. I include them in my Geometry classes because it allows students to show and share talents I never knew they had. And its fun.

- **Assumptions and Definitions**

From the mathematical side all one needs to know about is regular polygons and a few words from tessellations: slide, rotation and reflection, which seem nearly self explanatory .

From the technical side it is necessary to be able to operate on Netscape, which is already a done deal. An important technical requirement is that your computer be loaded with Tessel Mania! from MECC Software and that it be configured to load some Tessel Mania!. These files must end in the suffix **.tsm** because the files are so designated.

To configure Netscape to open these Tesselmania files,

1. Print out these instructions! (unless you have a photographic memory)
2. Choose "**General Preferences**" from the **Options** menu
3. Choose "**Helpers**"
4. Click "**new**"
5. Enter:
  - **Mime Type** application

- **Mime Subtype** tsm
6. Click "Okay"
  7. Click "**Browse**" button
  8. Locate "Tessel Mania!"
  9. In box called "**Extensions**" type "tsm"
  10. Under "**Action**" select "Launch Application"
  11. Click "**Apply**"
  12. Click "**Okay**"

- **Examples**

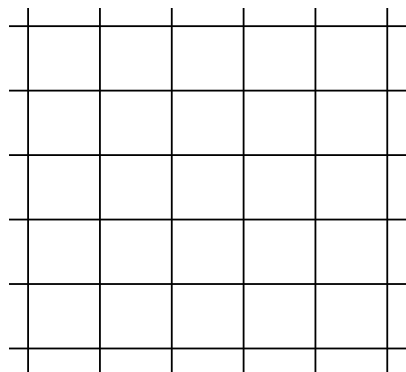
This project starts with ten examples.

For my project, to collect what I had learned this Summer at The Geometry Center, I chose Tesselations because I know a bit about paper and scissors methods and because I wanted to do some of the fancy designs without all the work.

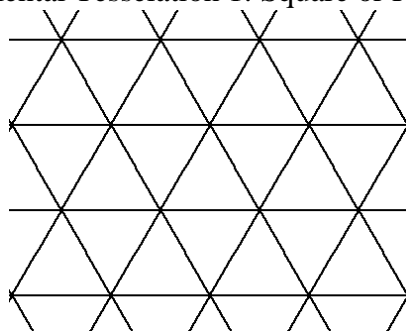
This project is also a record of my progress through the three weeks of the Geometry Institute. Except for some of the fundamental procedures of tessellating, what is seen is what I have learned in the last three weeks

What are Tesselations? Let me show some samples, starting with very fundamental polygons and advancing to some very complicated results of "Orbifold" applications.

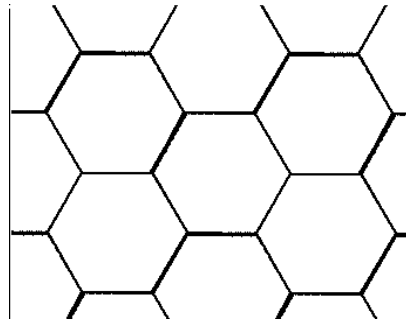
#### Examples of Tesselations



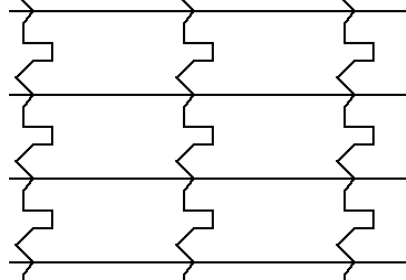
Fundamental Tesselation 1: Square or Rectangle



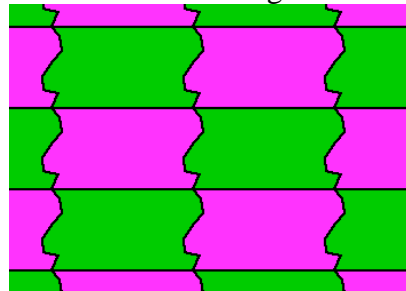
Fundamental Tesselation 2: Equilateral triangles



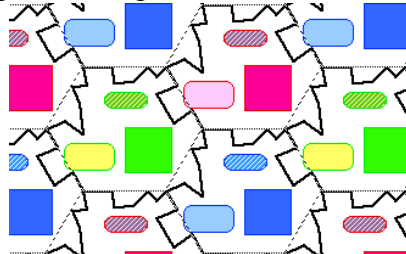
Fundamental Tessellation 3: Regular Hexagons



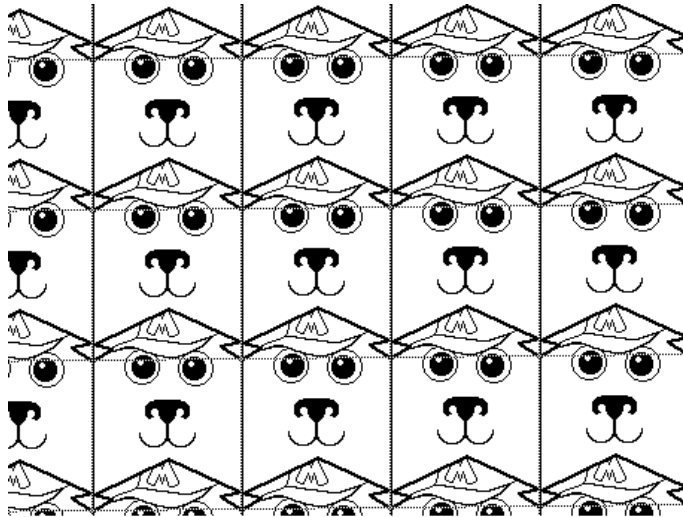
Simple Tessellation: Rectangle--Slide one side



Simple Rectangle Tessellation-Decorated



Simple Hexagon Tessellation with Grid Lines--Decorated



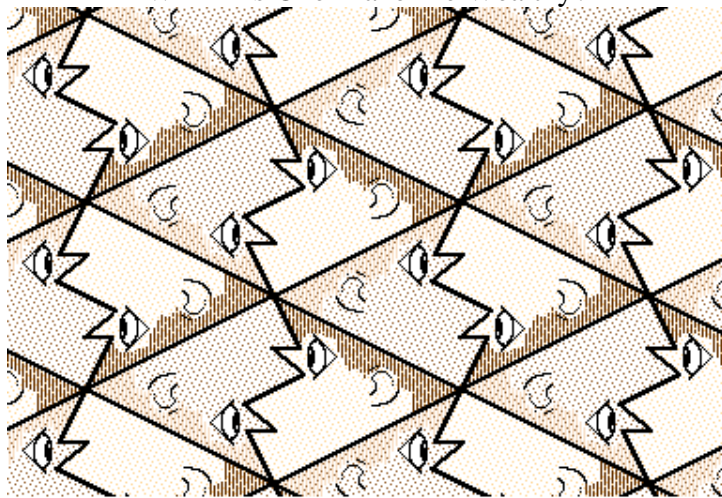
Copyright © 1996, Richard R. Dehlinger, All Rights Reserved.

### My First Product on Tessel Mania



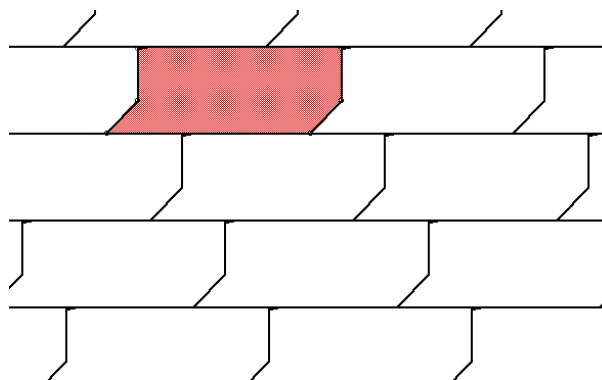
Copyright © 1996, Richard R. Dehlinger, All Rights Reserved.

### Will This One Make Me Wealthy?



Copyright © 1996, Richard R. Dehlinger, All Rights Reserved.

This is TRIANGLE MAN. The top of his face is a rotation of the lower half.



This is a good one for beginners to start on.

## • Student Activities

There are a few suggestions within the examples and demonstrations of Tessel Mania! If you have access to computers and the Tessel Mania! program there are already many lesson possibilities. If you do not, then the suggestions coming up will be a start. I have not, however, included any documents for your immediate use with your students.

## How to Tessellate

In what follows I hope to explain how each of several methods can be applied to create tessellations, starting with pencil and paper and ending with computer software.

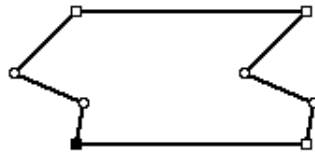
### A. FUNDAMENTAL POLYGONS

It is not too difficult to find pages with squares, equilateral triangles, or hexagons tessellating the page. One good source is Graph Paper Masters from Dale Seymour Publications . The book is a source of black-line masters and comes with permission to copy for classroom use. Students can be invited to create their own schemes for coloring the figures. Before the four-color map theorem has been learned a challenge might be made to used the fewest number of colors to color all the regions.

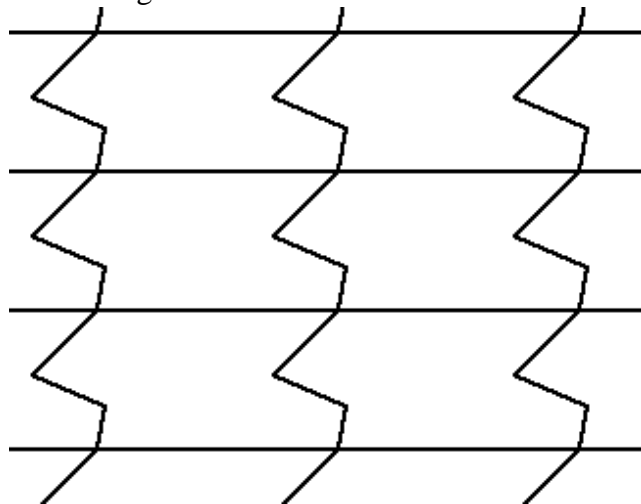
### B. SIMPLE TRANSFORMATIONS

Now a few simple tessellation patterns will be shown that can be done with paper, pencil, and scissors.

To tessellate a field of rectangles, start with a rectangle drawn on a page. Replace one side with some simple design.

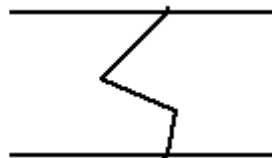


Rectangle with one PAIR OF NEW SIDES.

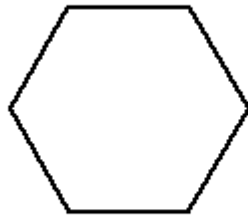


This figure can be reproduced to fill the whole plane.

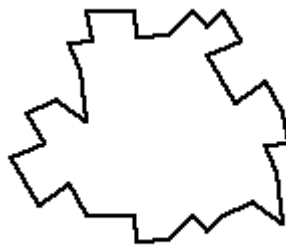
When doing this by hand, it is handy to start with a rectangle, draw your pattern down the middle, then cut along that pattern, and join the parallel end segments.



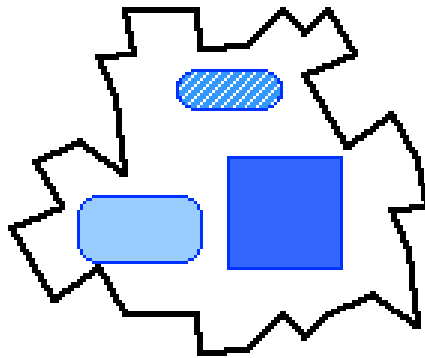
Using the same method, a slightly more advanced SLIDE tessellation can be made using the three pairs of opposite sides in a regular hexagon



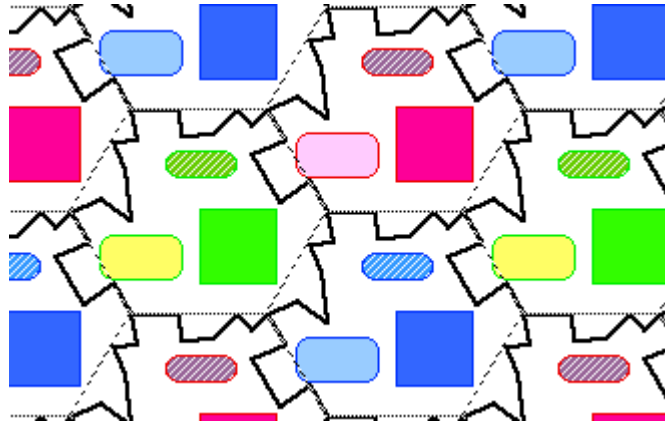
A regular hexagon.



Regular hexagon with sides transformed



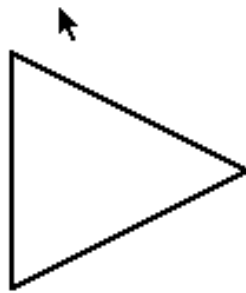
Regular hexagon decorated



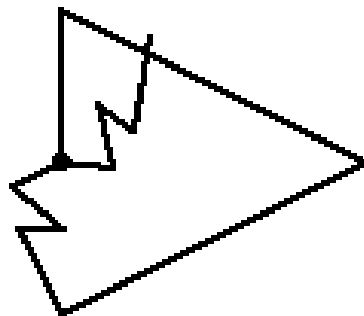
Regular hexagon decorated, tessellated, and with grid lines showing

This production took just a few minutes, once I spent an hour carefully reading the instructions and playing with the program.

ROTATION is another technique. It is shown here using an equilateral triangle.

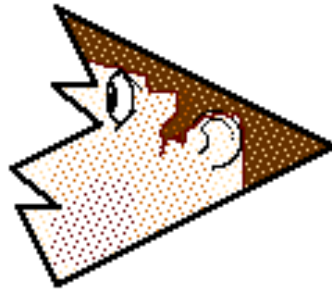


Equilateral Triangle--plain

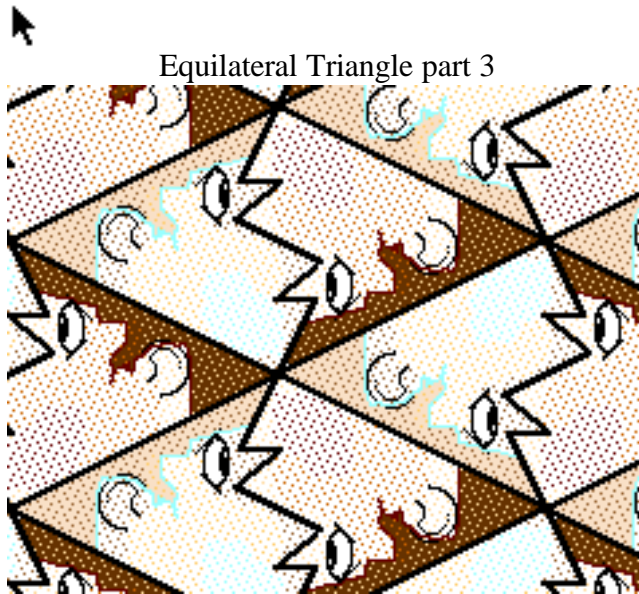


Equilateral Triangle transforming by rotation on Tessel Mania





Equilateral Triangle part 3



Equilateral Triangle- part 4

### C. WORKING WITHIN TESSELMANIA

Tessel Mania must be on your computer for this to work.

Furthermore it must be configured to be able to upload the software. The fundamental figure I chose is one that can transform by Slide (top-to-bottom) and by Rotation about the midpoints of sides.

This is what the TM commands can do.



EDIT TILE (1) will work with or view a single tile.

TESSELATE is (2)

MAGNIFIED VIEWS is (3)

TILE MAGIC (4) shows how a tile was created

TESSELLATION MAGIC (5) Shows how a tile moves to create the tessellation.

METAMORPHIC MAGIC (6) shows the entire tessellation transformed from the original tile to the final product.

When (4) or (5) or (6) are chosen a sub-menu appears which controls speed and the direction of morphing.

[Tessel Mania-- You can do it.](#)

To begin transforming click on the thumbtack. Observe that the midpoints (of rotation) appear.

Next, move the TACK to any edge and click on it anywhere to create a point. While holding down, the TACK will transform the side as it is dragged around. Do this a few times and then get ready to Tessellate.

To TESSELATE click on COMMAND 2.

To STUDY the process of transformation click on COMMANDS 4, 5, or 6. to STOP the action, click on the picture.

GET BACK to the single polygon by clicking on COMMAND 1.

DECORATE by clicking on the STAMP. A menu of objects will appear at the bottom. Select one by clicking, then move the arrow to the interior of the figure. The selected decoration will now be in the figure. Click if you want it to be applied there.

APPLY COLOR by clicking on the PAINT BUCKET. Then select a color by clicking. A texture, from below the colors, can also be selected. Then move to the region of the figure to be colored and click. If there is a second region it should be colored differently.

FINALLY TESSELATE. Click on COMMAND 2. The computer will select a second set of colors for decorating alternating figures.

Next are links to come Sample Tessellations from the supply within Tessel Mania. Be sure to close the screen when finished.

[Tessel Mania GIRL](#)

[Tessel Mania ELF GUY](#)

[Tessel Mania CUPIDS](#)

Web Sites, just a few, with Tesselations.<BR

These are four web sites of hundreds that deal with TESSELATION.

[Quilt Gallery of Debby Kratovil](#)

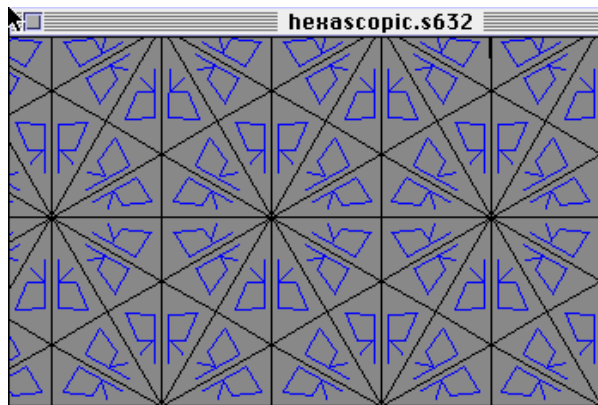
[Paper Piecing Patterns for Macintosh Users](#)

[Fun Stuff](#)

[Examples of tesselations with triangles](#)

[Tesselations](#)

Finally, when you get bored,....



A Tesselation I did on KALI. The triangle is 30-60-90 and can be printed with or without the lines. See any Reflections?

### • Bibliography

Graph Paper Masters from Dale Seymour Publications, 1979

Send comments to: [Richard Dehlinger](#) Created July 1996 Updated: 24 July 1996 A.D.

Copyright © 1996 by Richard R. Dehlinger. All rights reserved.