Turtle Art Tiles Project Guide

The Maker Project that Changed the World

Adapted from:

The Invent to Learn Guide to Fun

by Josh Burker

Get ready to experience the ultimate STEAM project that has taken classrooms and makerspaces by storm! Josh Burker's famous Turtle Art Tiles project, first introduced in his best-selling book *The Invent to Learn Guide to Fun*, has now been remixed and reimagined to bring you an all-new and exciting experience.

This incredible hands-on project seamlessly blends coding, culture, design, and mathematics—using a 3D printer, laser cutter, or vinyl cutter—making it the perfect activity for all students.

This project has travelled around the world and now you have this exclusive Turtle Art Tile Project Guide that features updated step-by-step instructions and fresh new challenges.

LEARN TO MAKE

3D PRINTED STAMPS

LASERCUT STAMPS

VINYL STICKERS

1 CODE

Use the block-based coding language Turtle Art to create patterns.

2 MAKE

Create 3D objects using digital fabrication tools.

3 LEARN

Express mathematical ideas in beautiful creations.
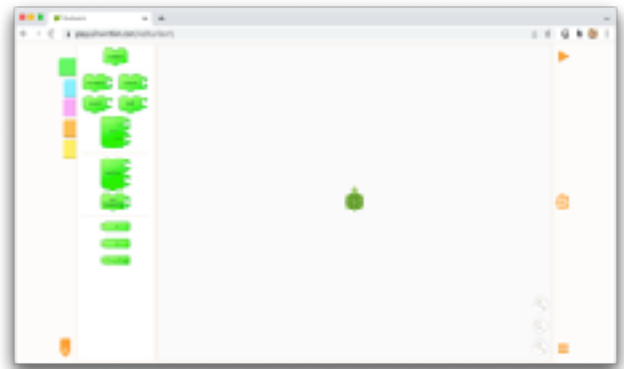
Turtle Art Tiles

TurtleArt is a programming language well-suited to exploring geometric art.

Why not take computer code out of the digital world and transform it into 3D objects? Follow the steps in this guide to transform a TurtleArt program into stamps that you can use to create beautiful ceramic tiles. Each tile represents a mathematical idea in tangible form! Whether you stamp Play-Doh or clay that is fired in a kiln, this project is a fantastic way to explore programming, digital fabrication, ceramics, symmetry, repetition, patterns in art and architecture, and mathematics.

Overview

While this is a multi-step project, it is quite simple and very fun!

1 Program patterns in Turtle Art. You can make your Turtle Art program as simple or complex as you are able.

2 The resulting patterns are used to create stamps with a 3D printer or a laser cutter, or stickers and paper craft with a vinyl cutter.

3 Use your stamps to imprint clay. The tiles you create might be temporary, or permanent, depending on your ability and access to materials, equipment, glazes, and ceramic firing.

Start with Turtle Art

Turtle Art is a free, web-based programming language. Open your Chrome browser to: playfulinvention.com/webturtleart

Drag the blocks on the left towards the turtle. You are teaching the turtle how to move and draw by giving it directions.

TEACH YOUR TURTLE TO MAKE A SQUARE

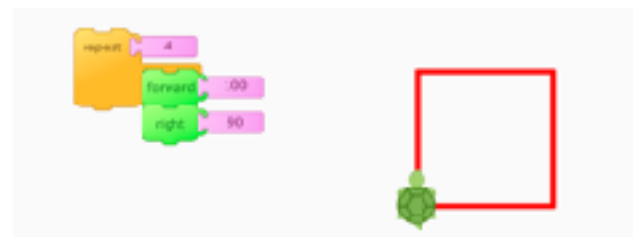We can teach the turtle how to draw a square by snapping the right blocks together.

Start with a **forward** block. The **forward** block has a number connected to it; you can make the number smaller or larger depending on how long a line you want.

Next drag out a **right 90** block and place it under the **forward** block so they snap together and make a stack.

Double-clicking the stack makes the turtle draw a line then turn 90° to the right.

Put the forward and right blocks in a **repeat** block, so the turtle will repeat those two moves. Repeating four times will draw a square.

NAME YOUR WORK

Once you have taught the turtle how to draw a square you can name this stack, or **procedure**, by putting a **hat** block on top of the stack and typing a name for the procedure.

TurtleArt will create a new block with that name on it. Now you have all those moves condensed into a single block to use in other procedures.

SAVE YOUR WORK

You need to save and download your work to keep it around. Click the **Save** button in the lower left side of the window and give it name you will remember.

Make More Squares

You can use the block you created in other procedures. For example, you could draw a square and turn a little bit, then repeat that until the turtle has turned a full 360°. We call this the **Total Turtle Trip Theorem**.
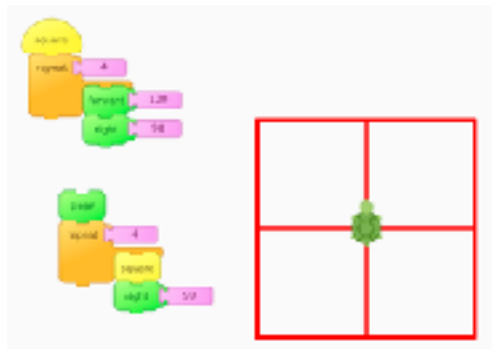

Using the **Total Turtle Trip Theorem**, you can make radial patterns by programming repeats and turns of the square that total 360°.

12 turns of 30°

36 turns of 10°
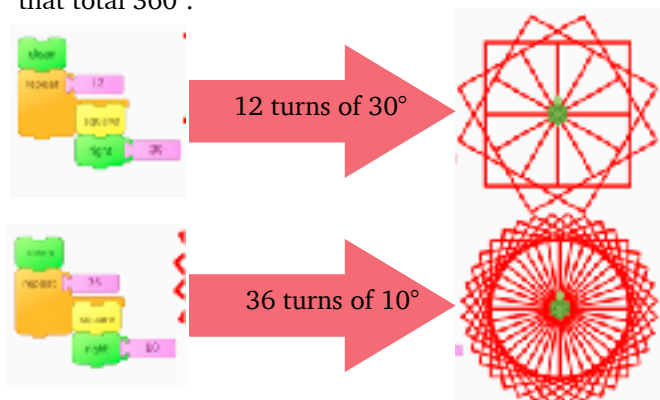
Polygon Maker

You could spend the day programming different polygons, but wouldn't it be wiser to program a tool that could draw any shape polygon for you?

Start with a **forward** block and a **right** block. Instead of defining how far right the turtle should turn, we are going to have the turtle turn 360° divided by a **variable**, which in Turtle Art are called **boxes**.
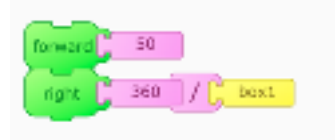
Likewise, we are going to have the turtle repeat this move **box1** times.
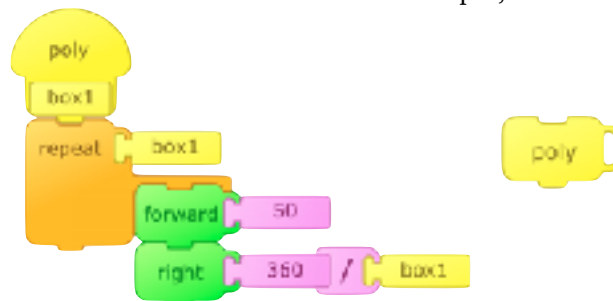

Name the procedure with a **hat** block.

To give the procedure an **input**, you will drag and drop the **box1** block onto the **hat** block.

When you let go you will see that there is now a **box1** added under your procedure's name. The procedure block will also have a bracket for an input, too.
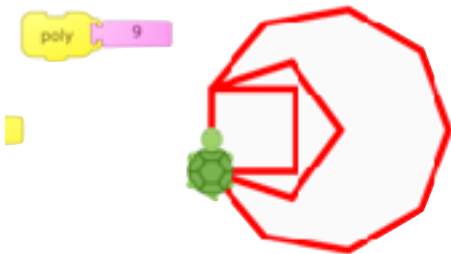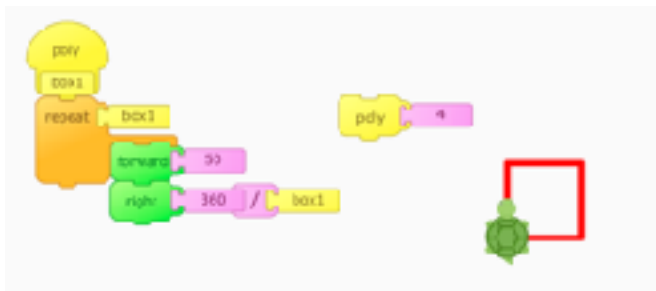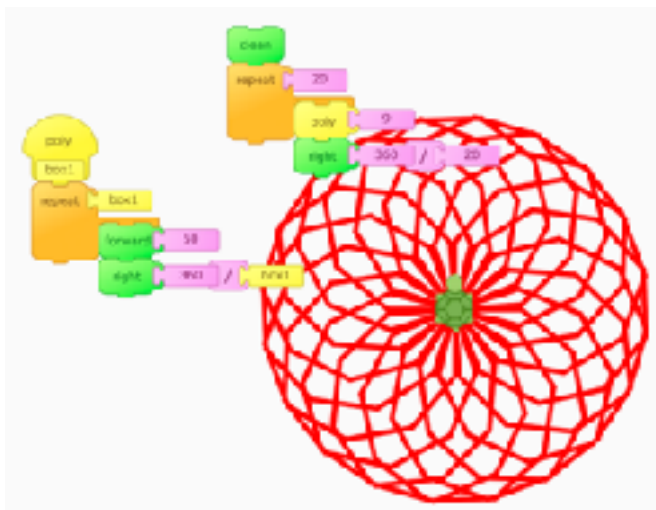
MAKE POLYGONS WITH ANY NUMBER OF SIDES

Now you can use your **poly** block to draw a polygon with any number of sides.

Tell the turtle how many sides of the polygon to draw by adding a number block to your **poly** block and double-clicking the block.

You can use your **poly** block in other procedures, allowing you to create complex designs with simple code.

Now the computer can do the work for you. Make sure you save your work!

STEAM CONNECTIONS

Turtle Art code can be simple or complex, and may reflect patterns found in art, architecture, cultural objects, nature, or your own imagination.

S SCIENCE
Material science, chemistry

T TECHNOLOGY
Digital fabrication, coding, design apps

E ENGINEERING
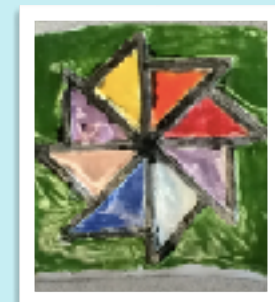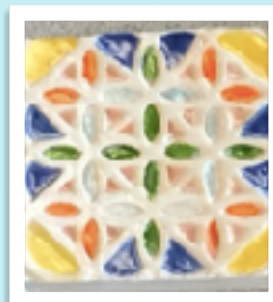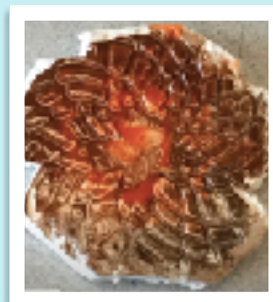Design, mechanical structures

A ART
Patterns, balance, color, ceramics

M MATH
Geometry, variables, angles, scaling, measurement, repetition, symmetry

The Project that Changed the World!

Invent to Learn: Making, Tinkering, and Engineering in the Classroom, often called the "bible" of the classroom maker movement, offers a practical vision of how to reconnect schools to our collective, deeply-felt human impulses to create, invent, and shape the world.

One story in *Invent to Learn* has enjoyed a particularly vibrant life of inspiring projects around the world. The story begins in 2012 at the Constructing Modern Knowledge Summer Institute. Kate Tabor, a middle school teacher, was working on a program to reproduce Islamic tile patterns from her vacation photos in Southern Spain. Also attending CMK that year was Josh Burker, an elementary classroom specialist, supporting teachers with technology and making.

Back at school, Josh took the idea of Islamic tiles a step further, literally into another dimension. Fourth graders studying Islamic tiling patterns in a World Culture unit were asked to design their own patterns in Turtle Art, 3D print the designs, stamp them into clay tiles, and hand-paint them. The result–beautiful tiles that represent their understanding of real-world, integrated mathematics,

Josh documented this project in his book, *The Invent to Learn Guide to Fun*. The project has been remixed and reused many times since using different materials, different patterns, and with different software at various grade levels. The resulting variations celebrate the ingenuity of educators to take good ideas and make them work for their own classrooms.

The project begun with Kate's desire to program recreations of vacation photos is likely to be remixed and reinvented well into the future.

Tiling

Our designs so far have been made by rotating a polygon or an arc through 360°. Another technique to program a complicated design is to tile it—meaning to use it in a repeating pattern. We are going to use our **poly** procedure to create a tiling design. Open the **poly** procedure you previously programmed and saved into TurtleArt. This example will use a pentagon, a five-sided polygon.
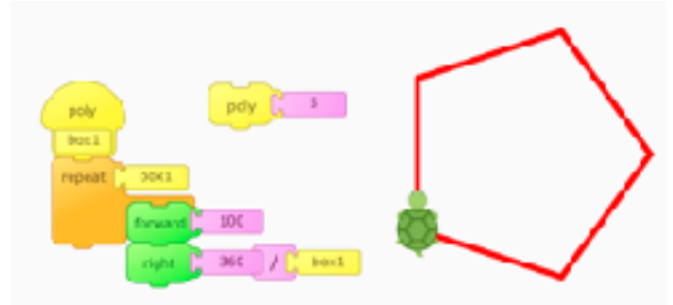
After we draw the pentagon we will move to the right on the **x axis** and stay on the same **y axis**. You can play around with how far right the turtle moves between pentagons.

When the turtle gets to the right side of the screen we tell it to go back to the left side and move down on the **y axis**.
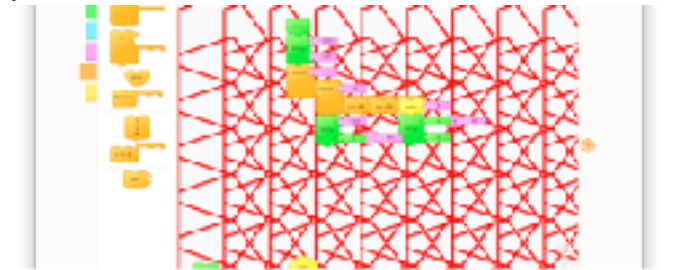

Finally, you can play around with where the left is (this procedure used -350) so the pattern fills the entire screen. Make sure you save your work!

Fabricate Your Design

Once you have a design you like you can prepare it to be fabricated. Your design will be transformed into a stamp to impress the design in clay. The SVG file you save can be used in many different fabrication machines such as a 3D printer, a laser cutter, or even a vinyl cutter.

CLEAN IT UP

It is good programming practice to start with a clean screen. Add a clean block at the top of your main procedure. Set the pen size to 10 so the fabrication machine cuts or prints clean lines.
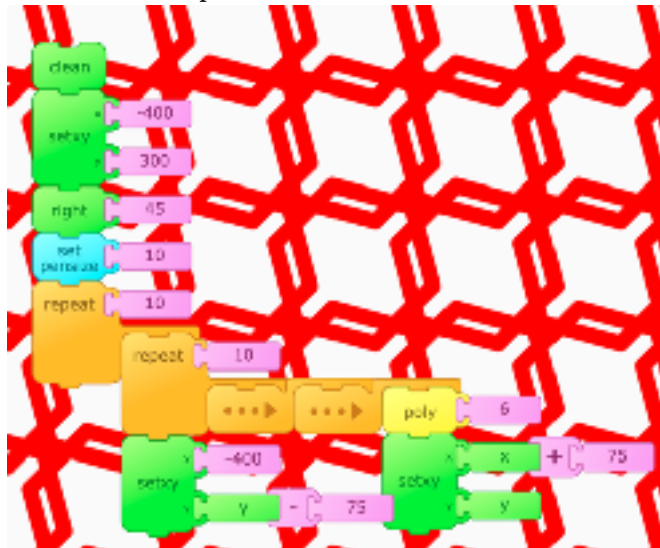
Next, click on the 3 bars at the bottom right of the window and select **save as svg**.
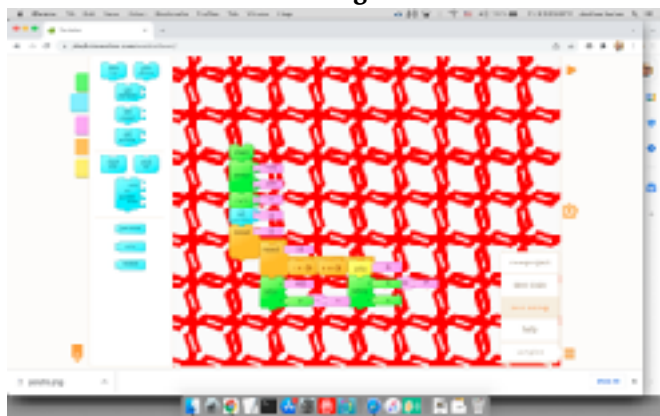
Select outline.

Select framed.

Once the file renders, click the Save SVG button.

You can use the SVG to laser cut your design. Refer to your particular laser cutter's directions on how to process the SVG for cutting. The same SVG can be used to create a model for 3D printing! Laser cutting the design takes much less time than 3D printing.

Make Your Turtle Art Tiles

Once the stamps are fabricated, use them to imprint clay tiles. Depending on the clay used, these tiles can be glazed and fired, or simply dried as is.
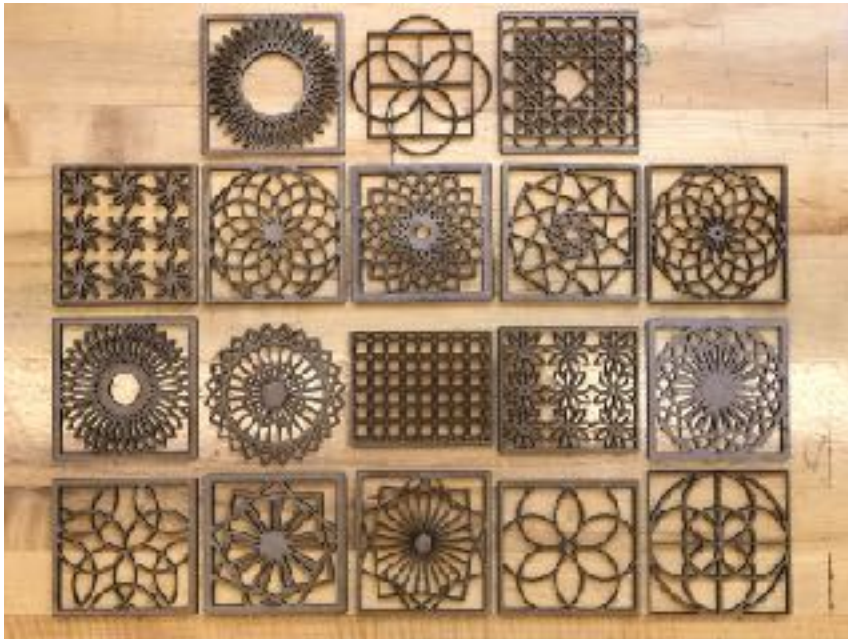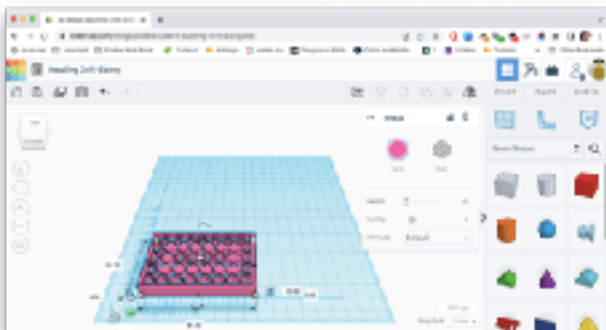
3D Print Your Tile Stamps

To 3D print your stamps, import the SVG file into Tinkercad to create a model that can be 3D printed. Login to tinkercad.com and create a new design. Start by dragging a ruler to the workplane.
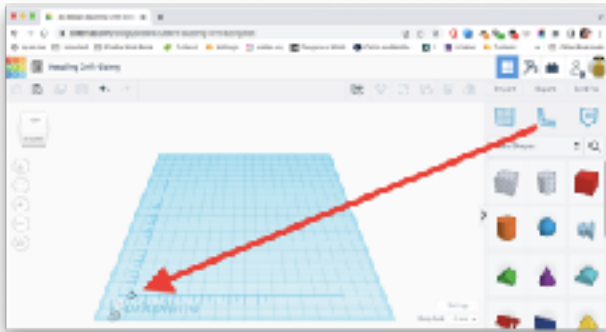
Click the Import button and navigate to your saved SVG file. Select the file and change the Scale to 10%.
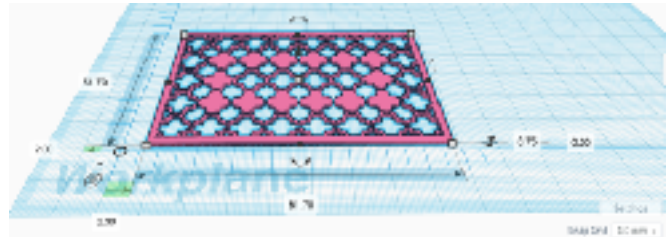

The design imports into Tinkercad. At 10% scale the tile should be about the right size for you to use as a stamp. You can adjust according to your own needs.
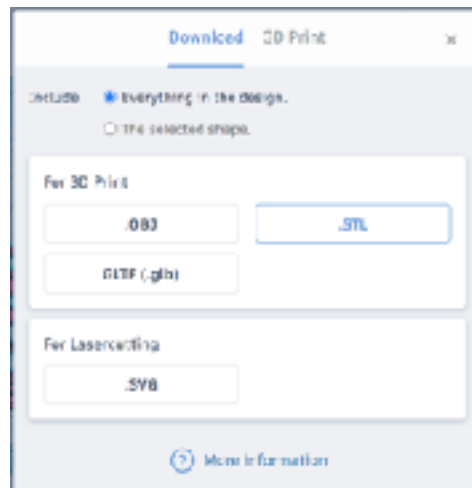

MAKE IT 3D

Up to this point, your design has been two dimensional. To 3D print the stamp, you need to give your design some height. Adjust the height of the model to .75mm.

This height has been tested in multiple settings and is enough to create a great impression, and will save on print time.

Click the **Export** button in Tinkercad. Select .STL as the file format.

Load the STL into your 3D printing software and slice the model for 3D printing. You can slice and print it in the lowest resolution. Once printed, you can use either the textured top side of the stamp or the smoother surface that was in contact with the print bed. These will give different effects to your final tile.

Taking It Further

INVENT NEW SHAPES

These programming instructions only use polygons. What designs can you program using arcs? They make interesting designs, too.

MULTIPLE STAMPS

Use multiple stamps that are programmed with complimentary designs. Show off a tile that uses a rotated polygon at the center and an arc design that encompasses it. You would press the clay twice, once with the poly stamp, once with the arc stamp.
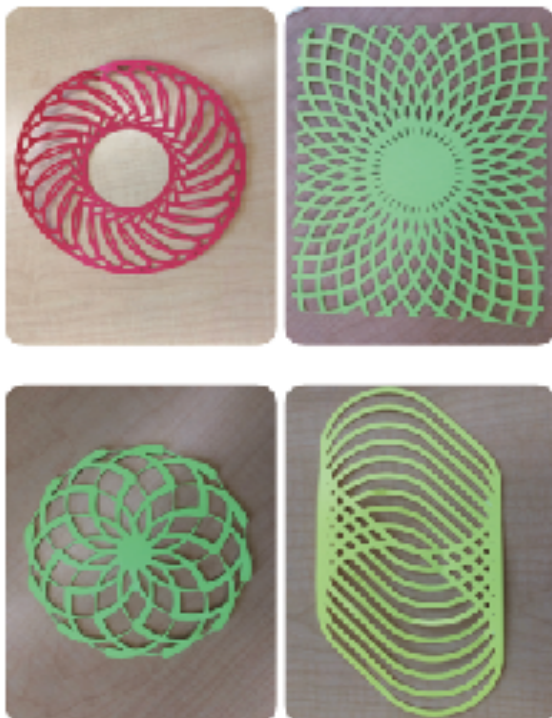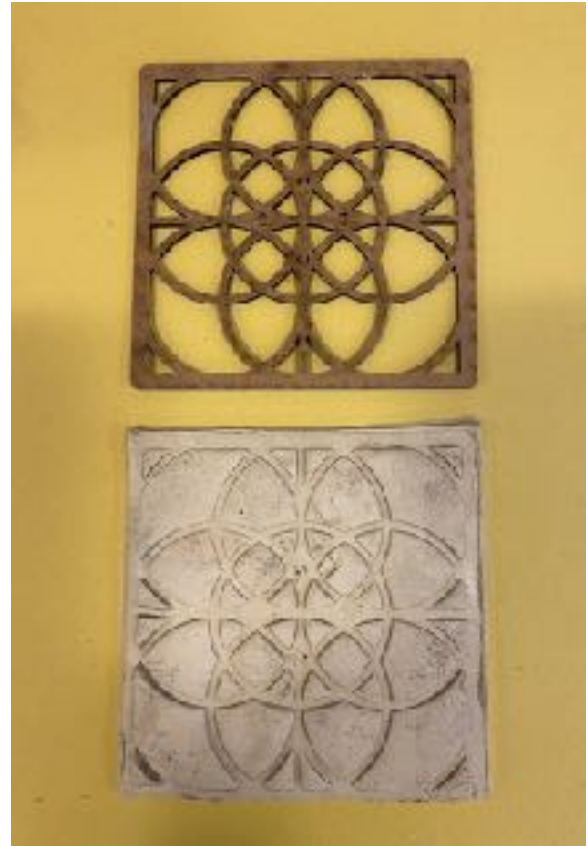
GILD AND GLAZE

Try gilding the dried clay tile, or use a combination of glaze/paint and gilding.

VINYL AND PAPER CRAFT

The same SVG file can be used with a vinyl or craft cutter such as a Cricut or Silhouette to cut designs from vinyl or paper. Make stickers, t-shirt transfers, or even temporary tattoos with your patterns.

Summer Professional Development for Educators

Join educators from around the world for the **The Language of Computation - Constructing Modern Knowledge in Reggio Emilia**, June 15-19, 2026 in "The City of Children," Reggio Emilia, Italy.

CMK is a minds-on institute for educators committed to creativity, collaboration and computing. Participants have the opportunity to engage in intensive computer-rich project development with peers and a world-class faculty including the atelieristas and pedagogistas of Reggio Emilia.

Don't miss out! Register today at reggio.constructingmodernknowledge.com!