

SUSAN GEROFSKY, MATHEMATICS EDUCATION, UNIVERSITY OF BRITISH COLUMBIA

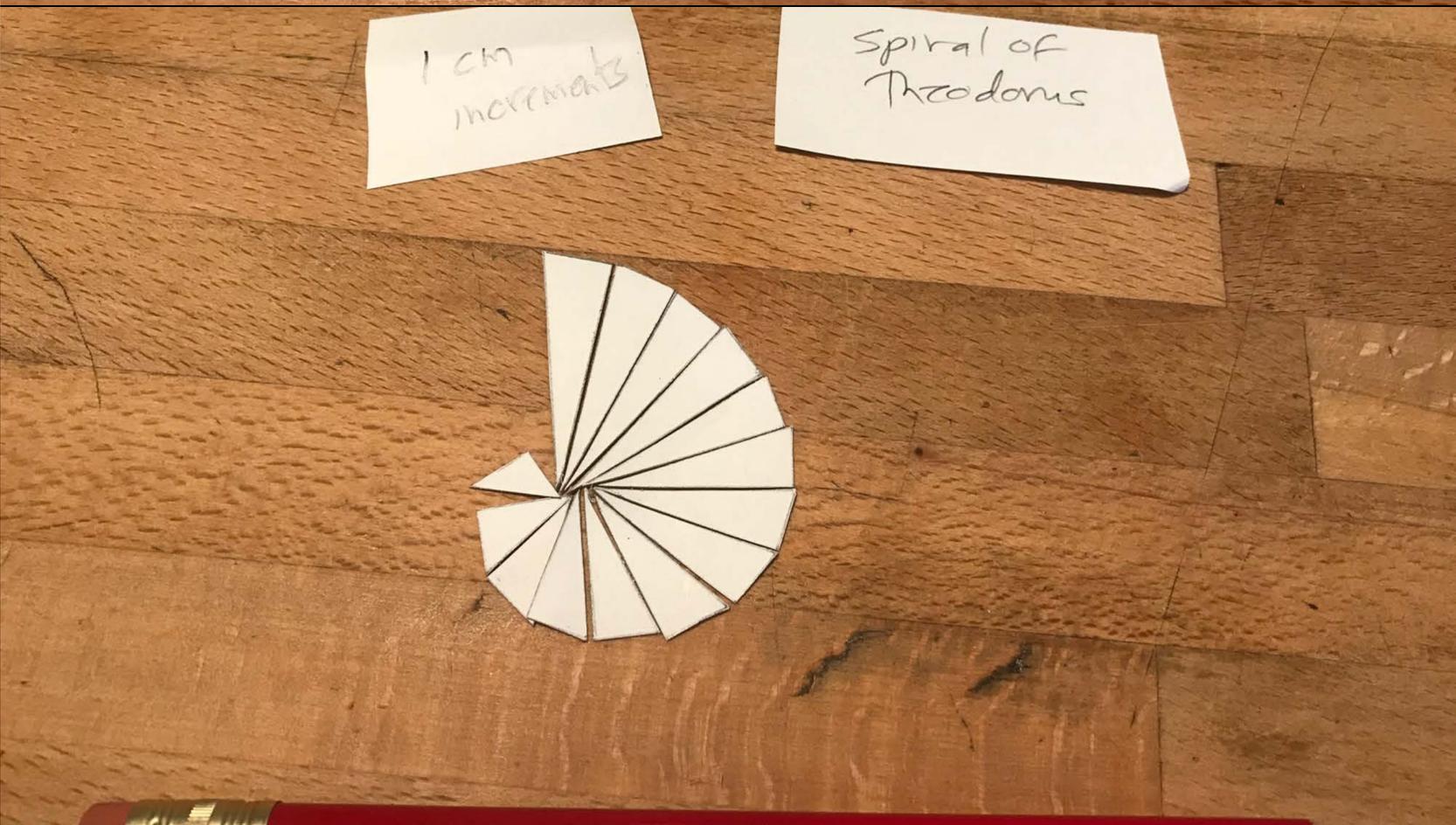
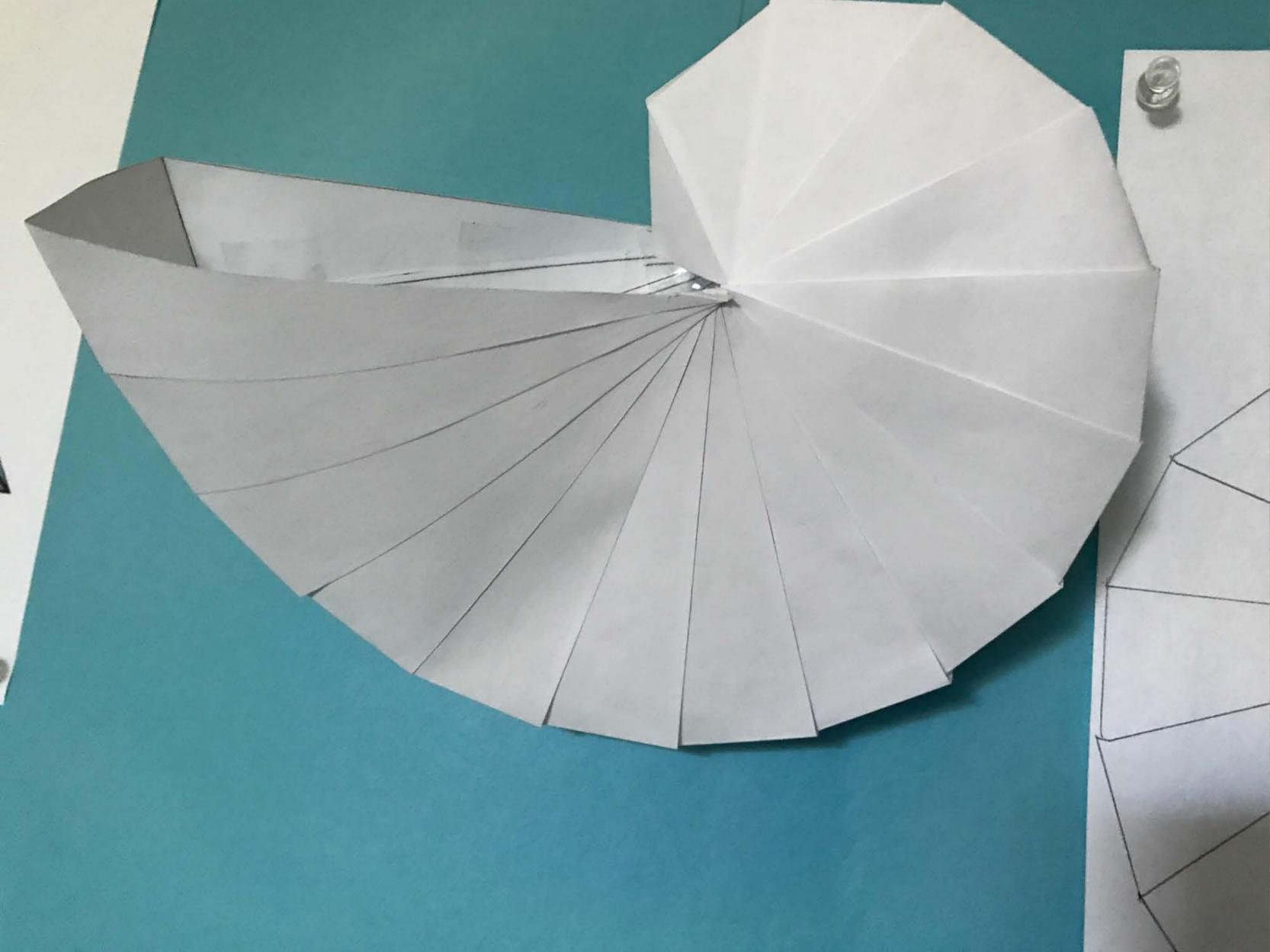
# THE WURZELSCHNECKE: UNDERSTANDING NUMBER AND CREATING GEOMETRIC DESIGN



Wurzel (root) + Schnecke (snail, spiral)



AKA Spiral of Theodorus, Pythagorean spiral



First introductions  
via Bridges Math and Art,  
Bernhard Rietzl (2016)

# THEODORUS OF CYRENE (465-399 BCE)

- Pupil of Protagoras, tutor of Plato and Theaetetus, member of Society of Pythagoras
- Plato writes in the Theaetetus: "Theodorus was proving to us a certain thing about square roots, I mean the side (i.e. root) of a square of three square units and of five square units, that these roots are not commensurable in length with the unit length, and he went on in this way, taking all the separate cases up to the root of seventeen square units, at which point, for some reason, he stopped." Why?

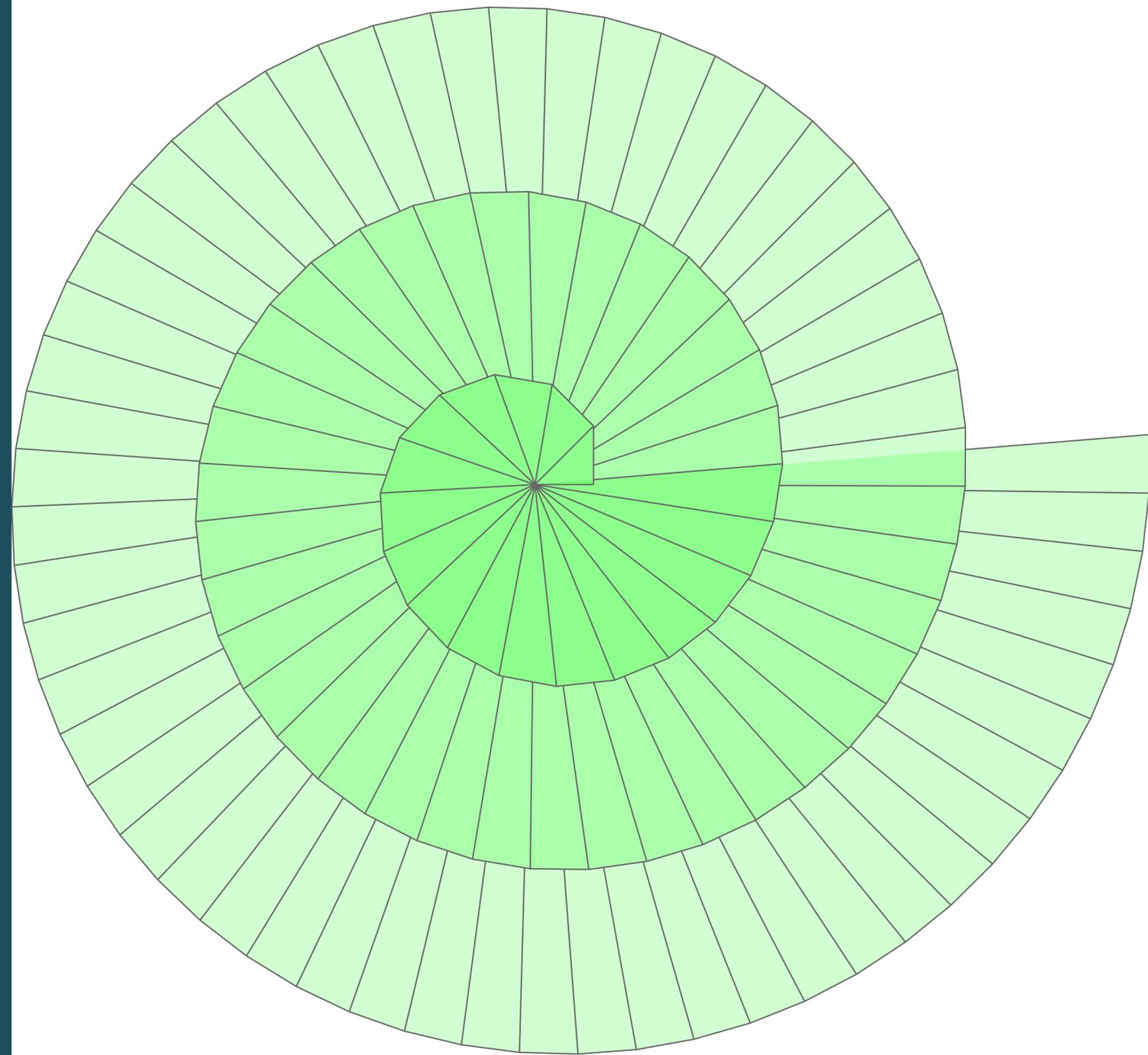


Image credit: Extended spiral of Theodorus by Pbroks13 - Own work, CC BY-SA 3.0, <https://commons.wikimedia.org/w/index.php?curid=5136236>

# MAKE A WURZELSCHNECKE!

- *Need paper/ cardboard, straightedge ruler, right angle, pencil or pen, scissors*
- (1) Draw an isosceles right triangle, base and leg 1 unit
- (2) Build on another right triangle with base =1, leg = hypotenuse of previous triangle.
- (3) Continue iterations with each new base 1 unit. How many can you make? (Add on paper or cardboard with tape if needed.)
- (4) What numbers are you constructing geometrically?
- (5) Try labelling & cutting out the triangles.

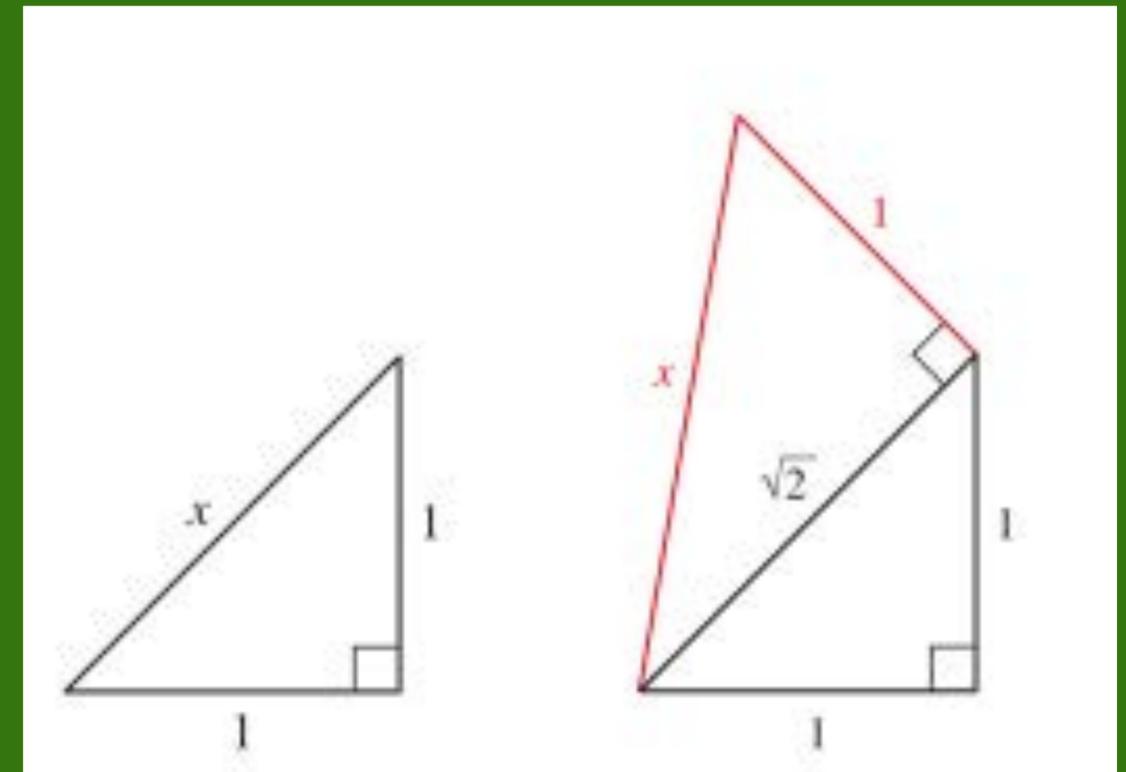


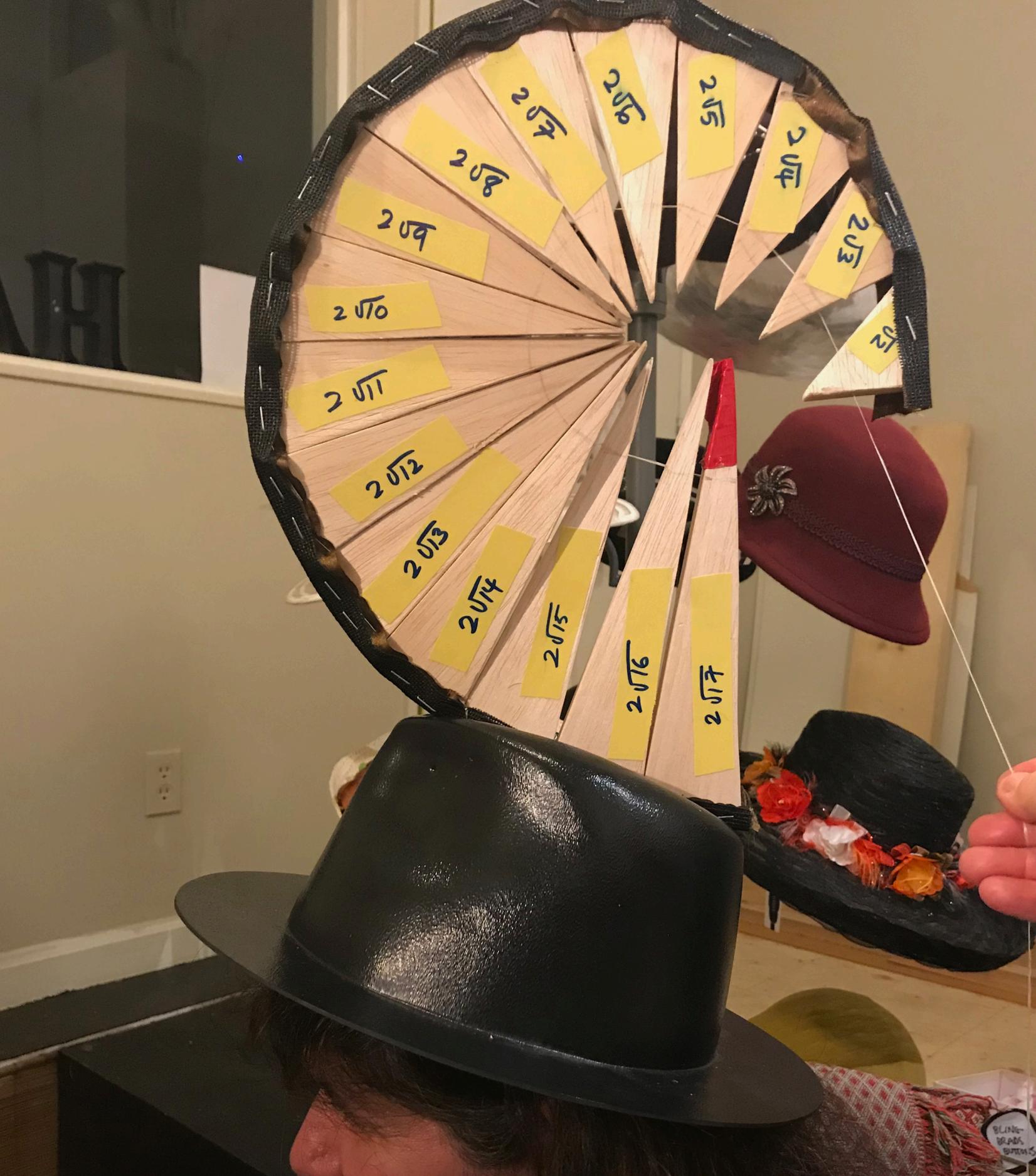
Image credit: <https://tex.stackexchange.com/questions/155087/the-spiral-of-roots-in-tikz>

# Baking Wurzelschnecke (How are the triangles numbered?)



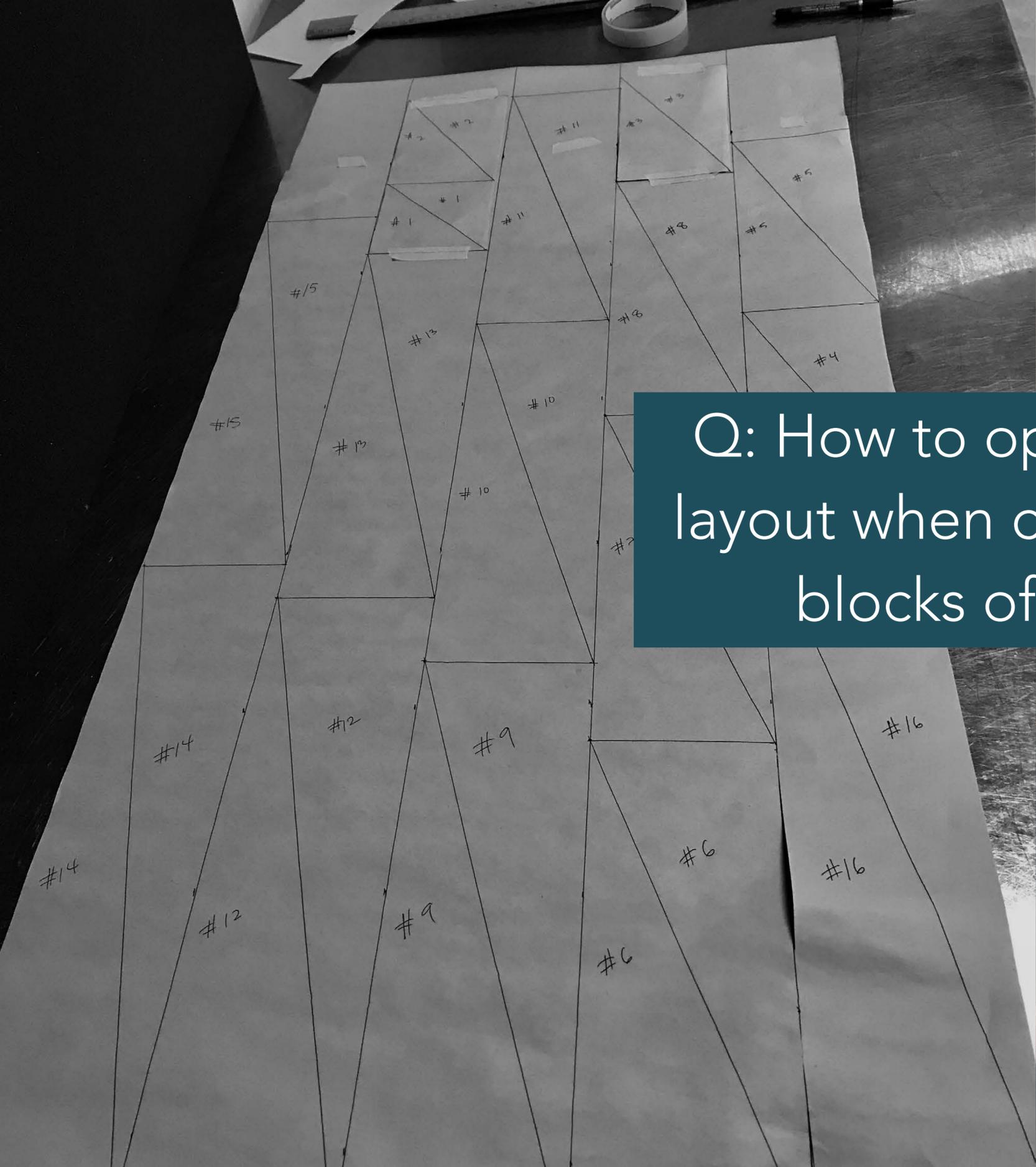
The finished products!  
(Now we'll take them apart and  
play with our food, for the sake of  
geometric exploration.)





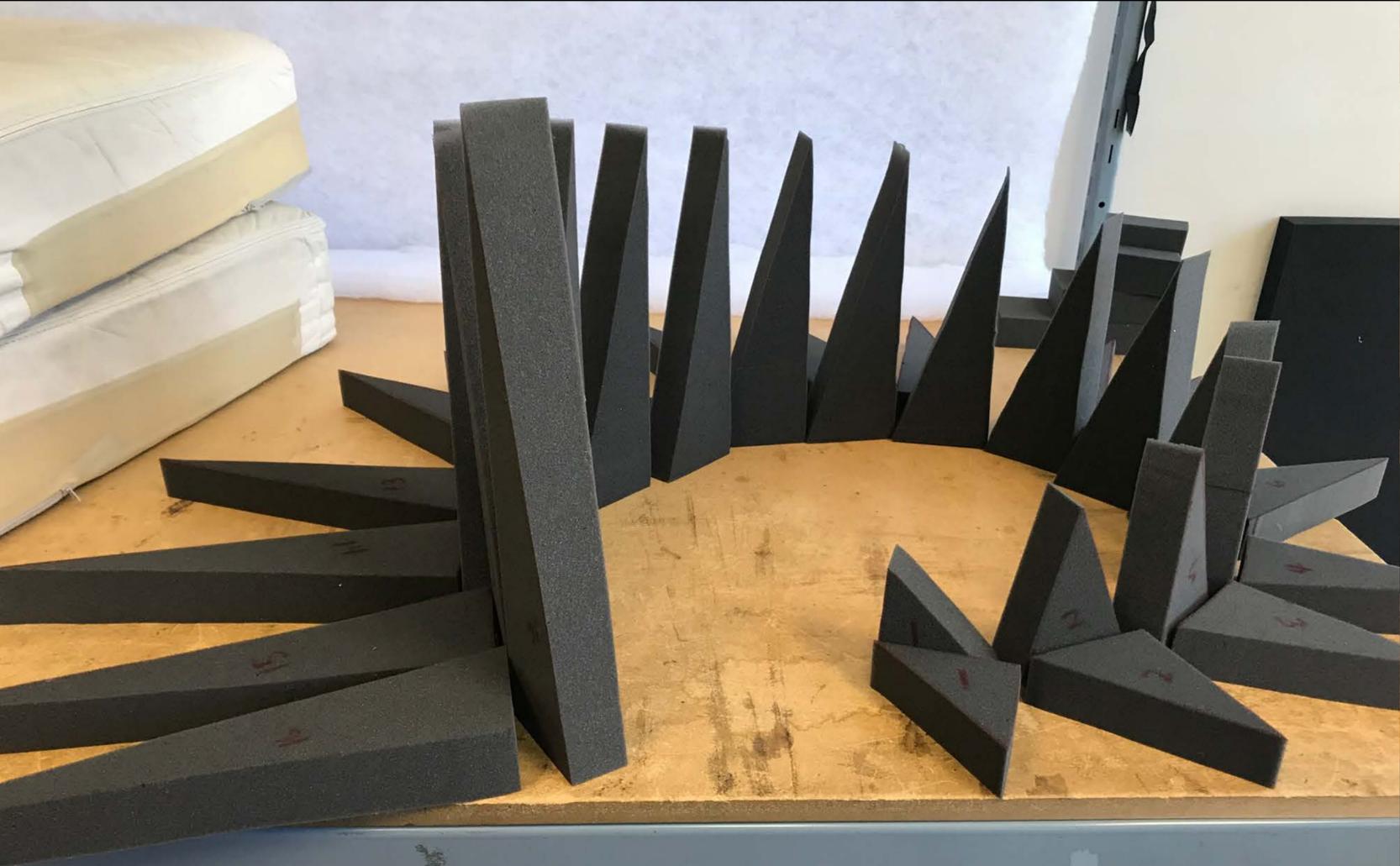
Kinetic  
geometric  
millinery:  
Fedoras of  
Theodorus  
(with Marcia  
Martinez)





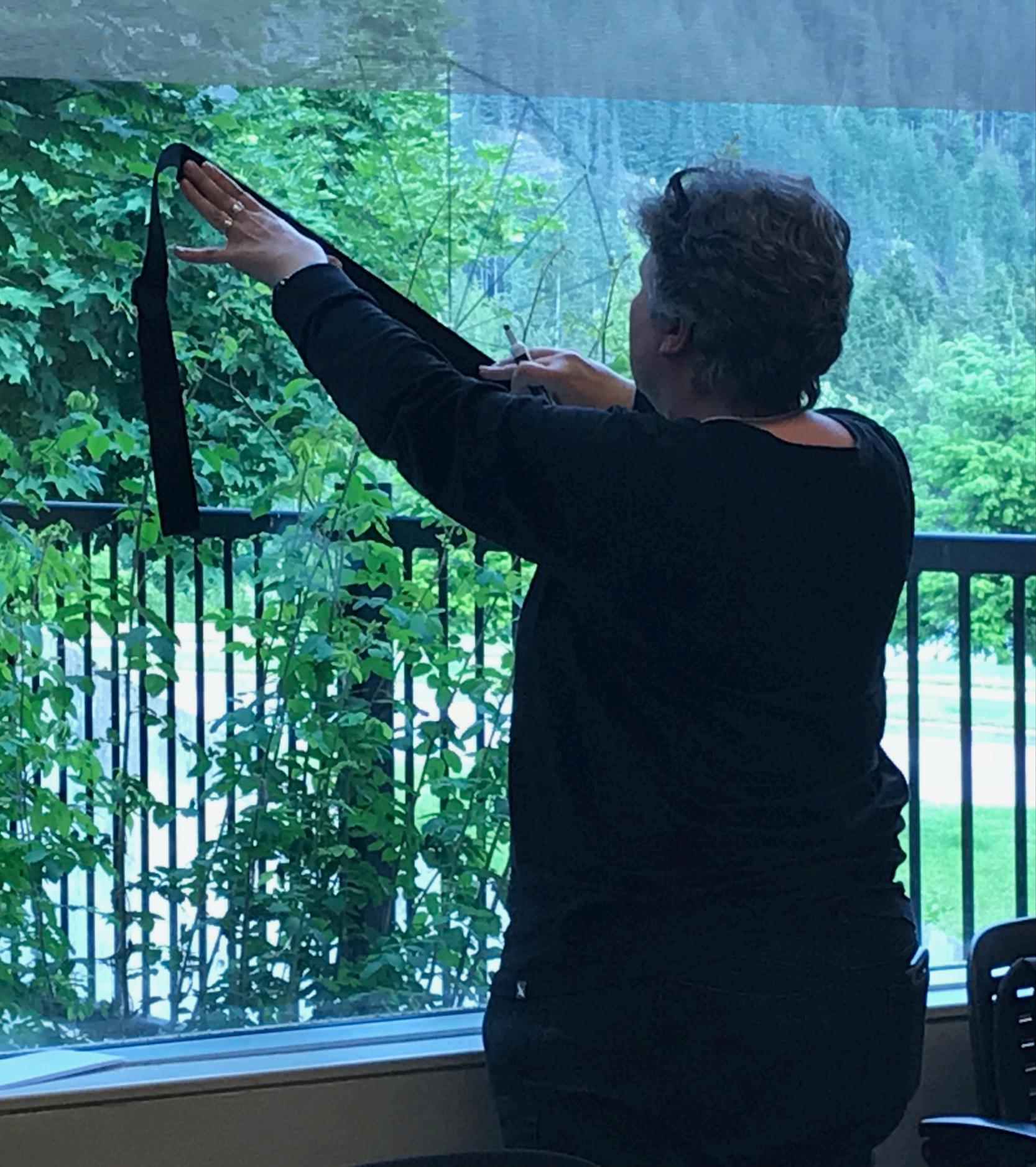
Q: How to optimize the layout when cutting from blocks of foam?

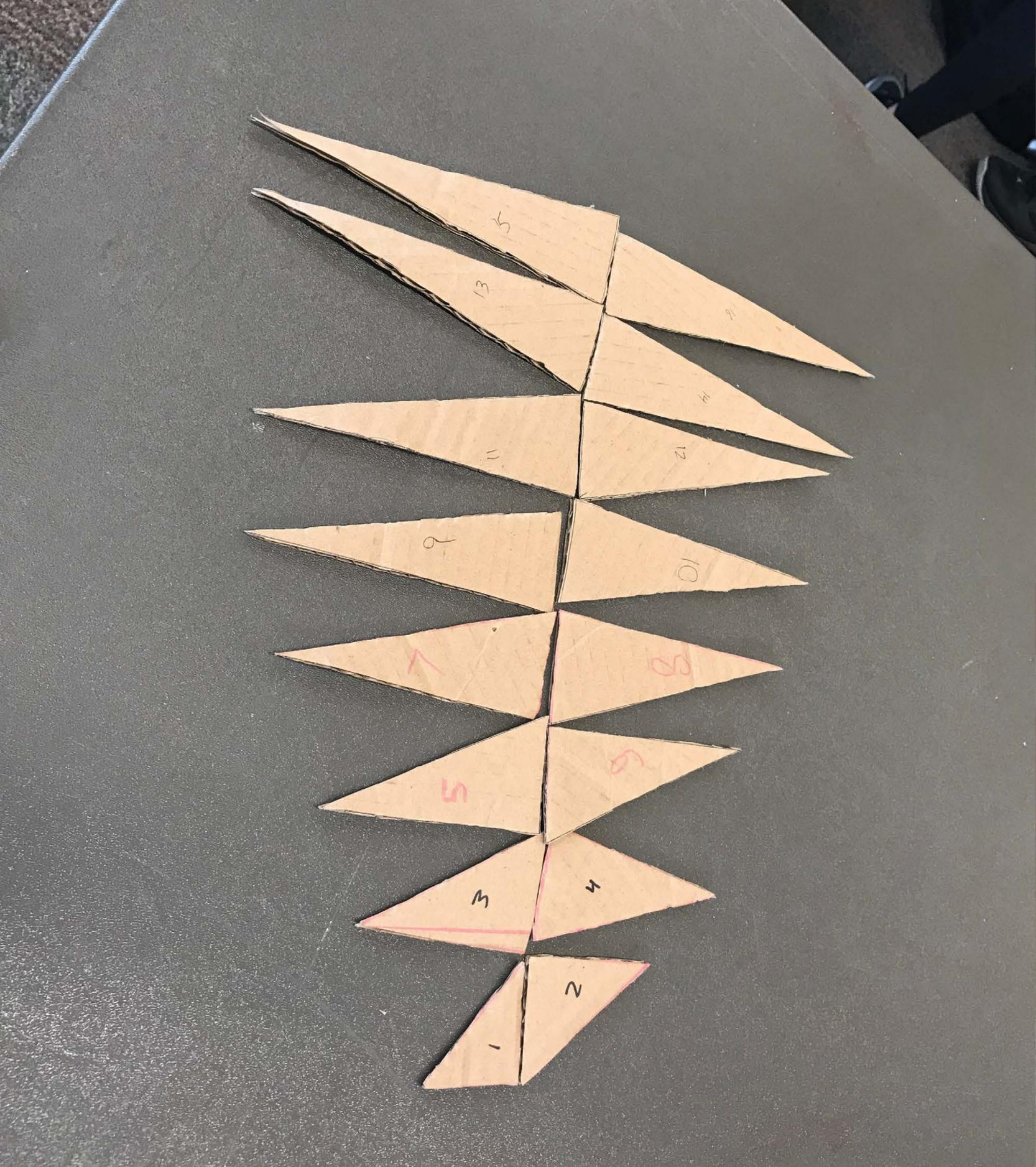


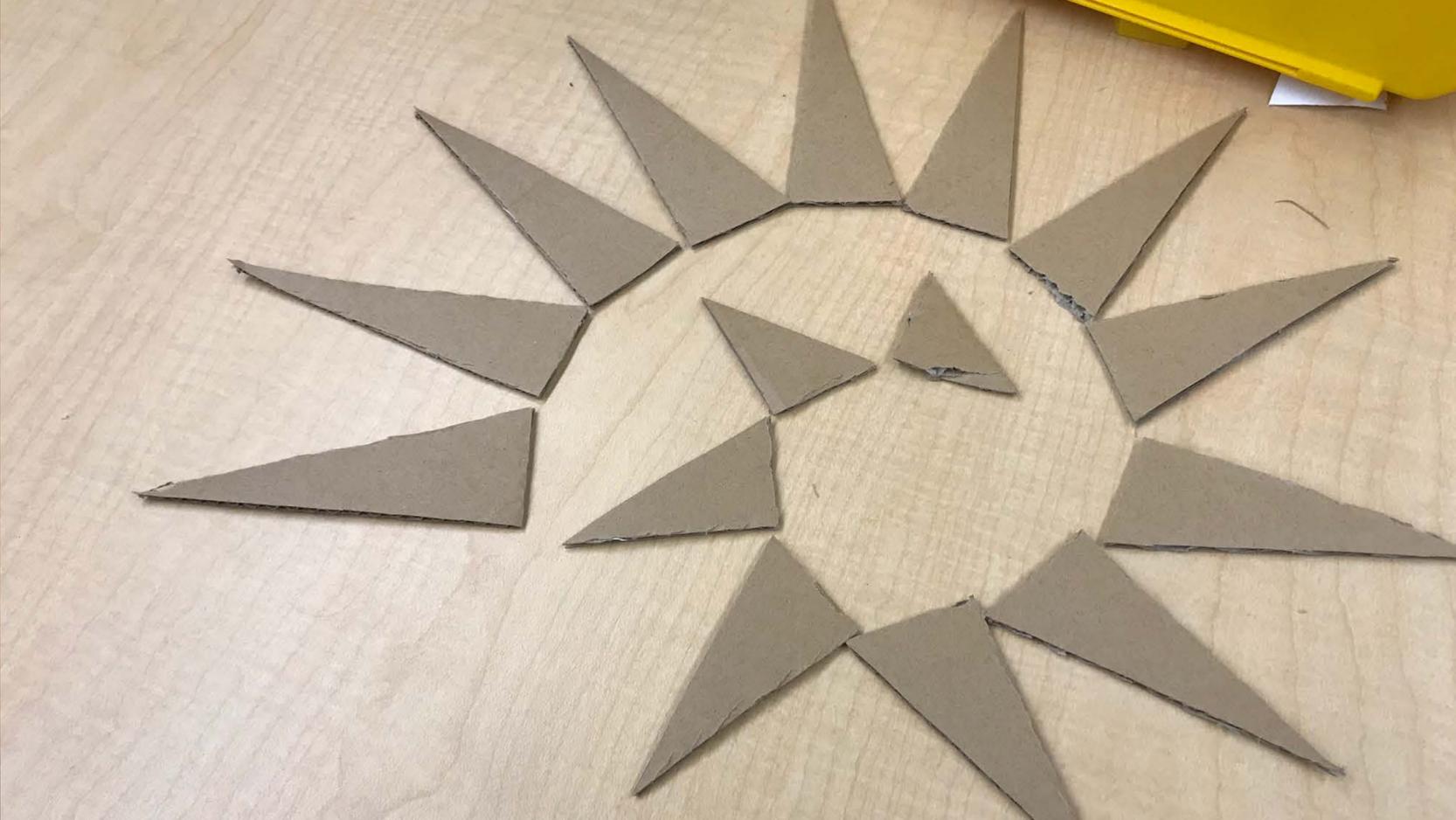
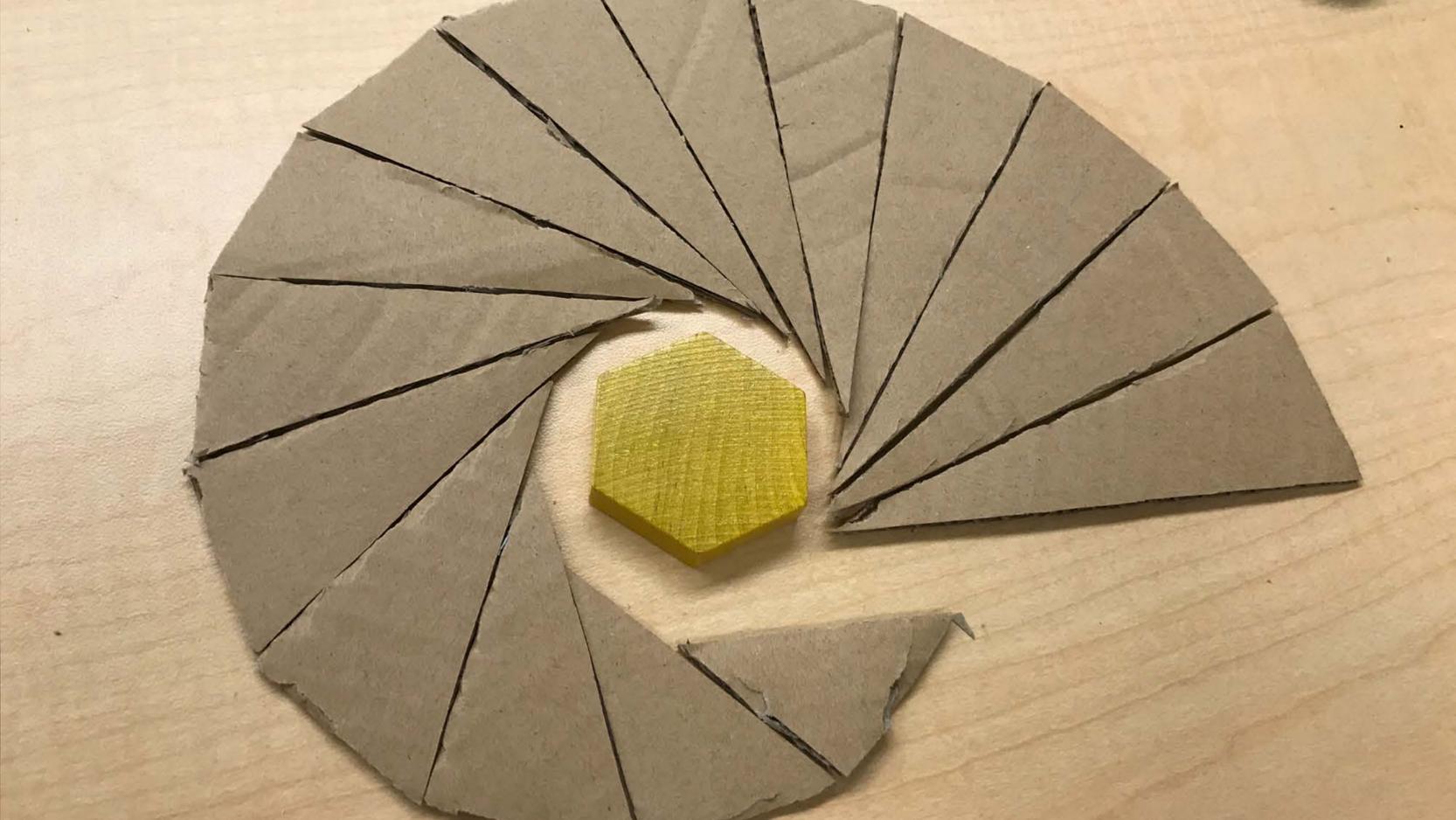


Playing with affordances of  
3D materials









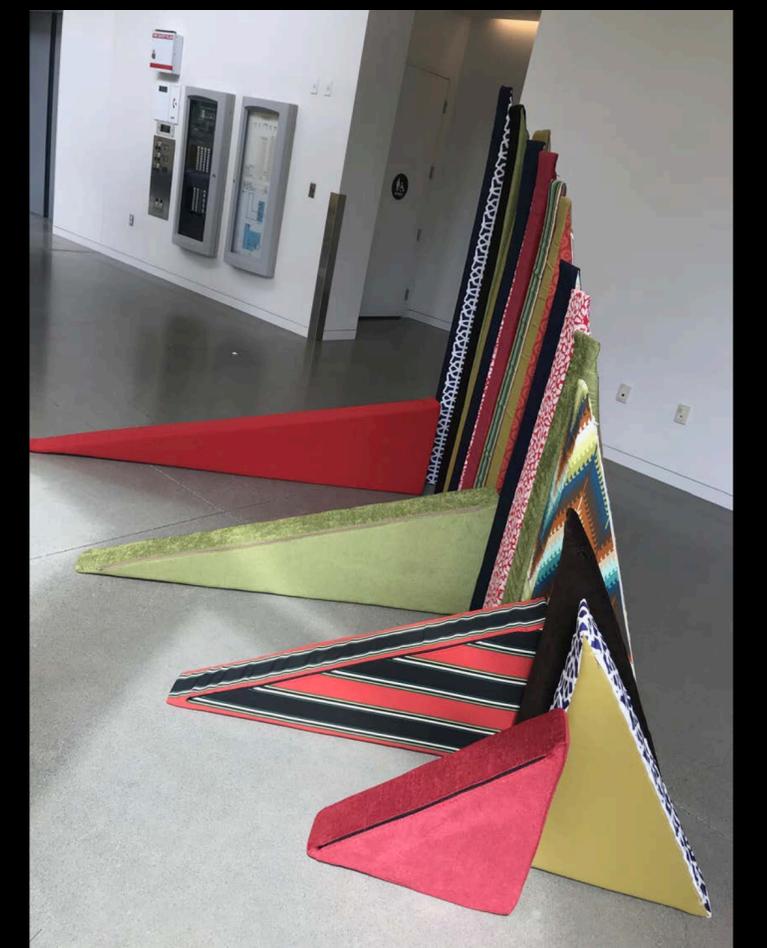




Metal, cloth, jewelry?



What is the profile of all the triangles lined up in order of size?



# SOME OPEN QUESTIONS:

- How to know where to start the first triangle so they all fit on the page?
- Why does the 'reverse spiral' have a hole in the middle? What shape is that hole?
- Is there a pattern to the angles of successive triangles?
- How to optimize layout on a flat piece of foam, fabric, metal, etc.?
- Design question: How could this shape be used for a 'learning architecture' or sculpture — for playgrounds, buildings, etc.? How could it make kinetic jewelry?
- Materials question: What material makes a good base for an unfurling Wurzelschnecke on a hat or costume?



Thank you! Please keep in touch with new  
Wurzelschnecke ideas and discoveries.

[susan.gerofsky@ubc.ca](mailto:susan.gerofsky@ubc.ca)