Resilients'
Mathematickal Arts Workshop
Splinterfields
FoAM

"To me the simple act of tying a knot is an adventure in unlimited space. A bit of string affords the dimensional latitude that is unique among the entities [...] another dimension is added which provides an opportunity that is limited only by the scope of our own imagery and the length of a ropemaker's coil."

--Clifford W Ashley, The Book of Knots.

Tim Boykett, Carole Collet, Nik Gaffney, Dave Griffiths

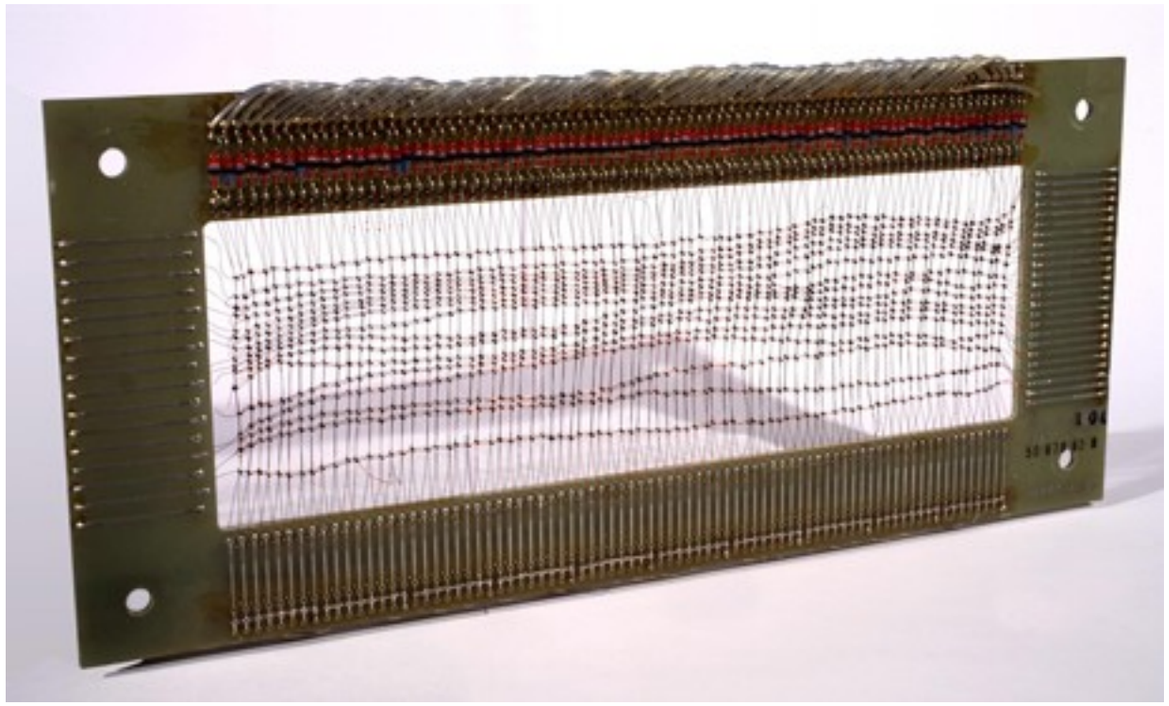
Objectives:

to intertwingle a traditional craft, an abstract description and a contemporary practice to enhance mutual understanding

to produce a series of theoretical and physical experiments that explore the connections between mathematics and textiles

to produce a map of possibilities

things that think:

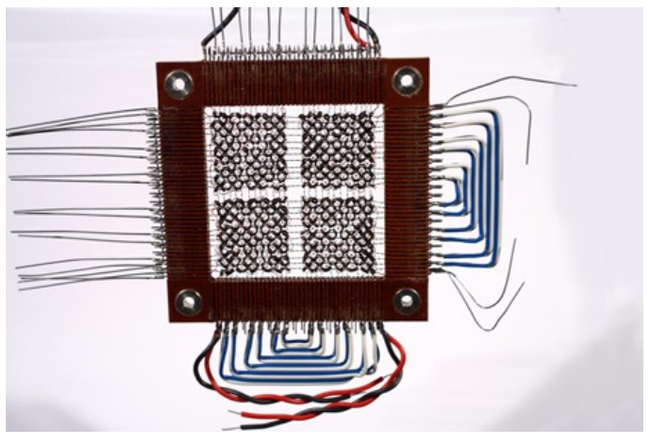


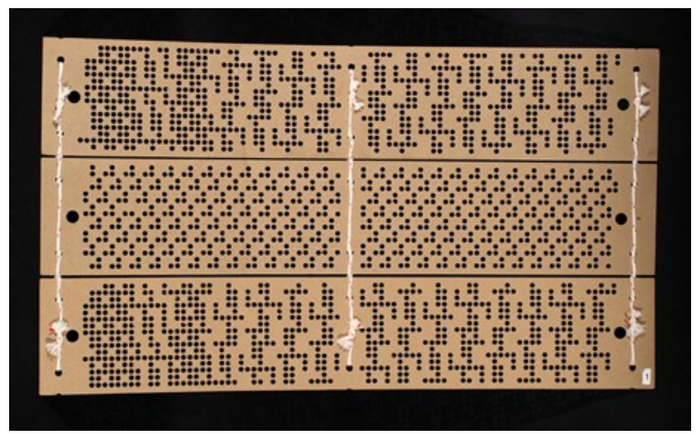
Institute For Figuring

Materialising Memory:

Things That Think:
An Interview with Computer Collector Nicholas Gessler
By Margaret Wertheim

http://www.theiff.org/publications/cab21-gessler.html





Images: Core memory and jacquard card

weaving memory and narratives: double ikats

image source unknown

knots

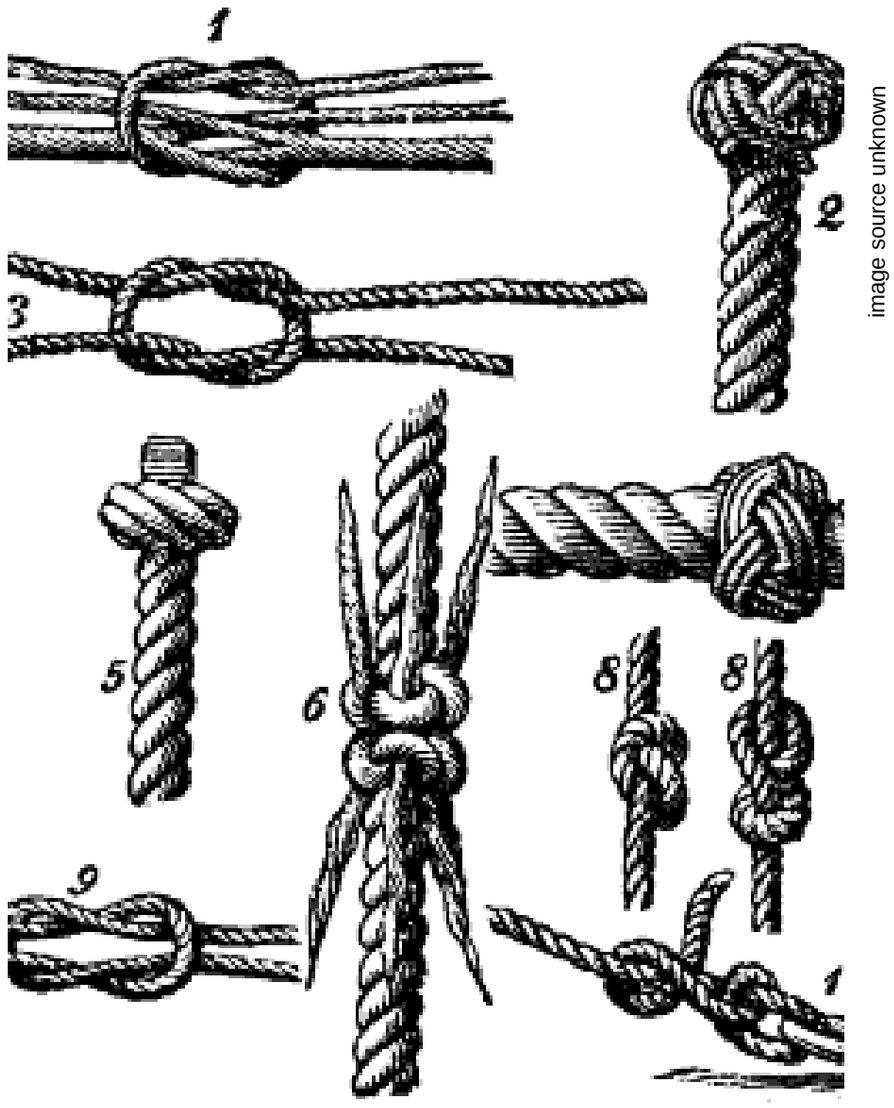
unknot

loops

links

mirror images

splicing and symmetry



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braids

top to bottom
Braids generalise symmetric groups to include memory.
All knots can be made as closed braids.

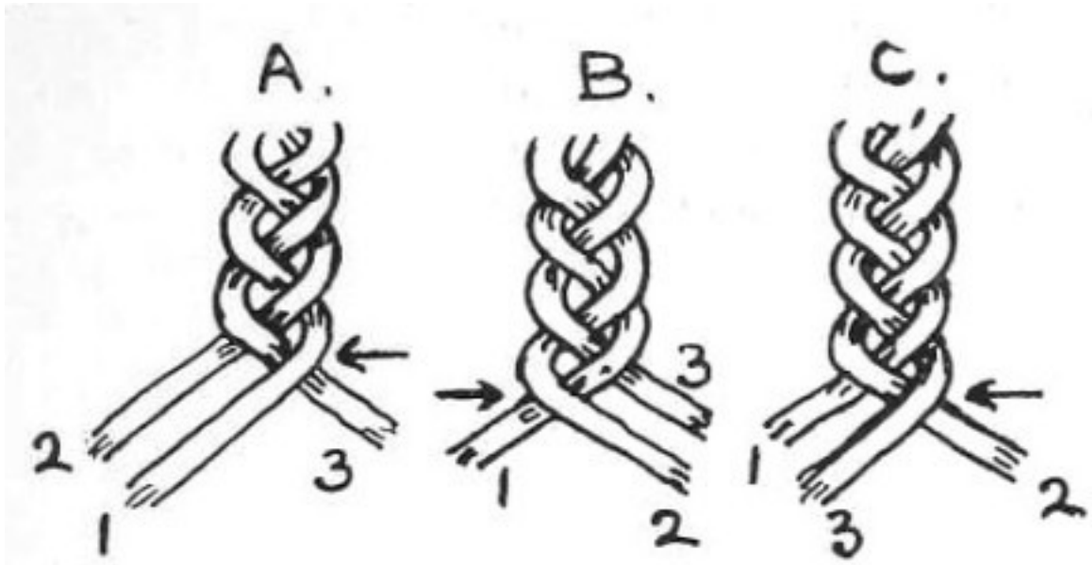
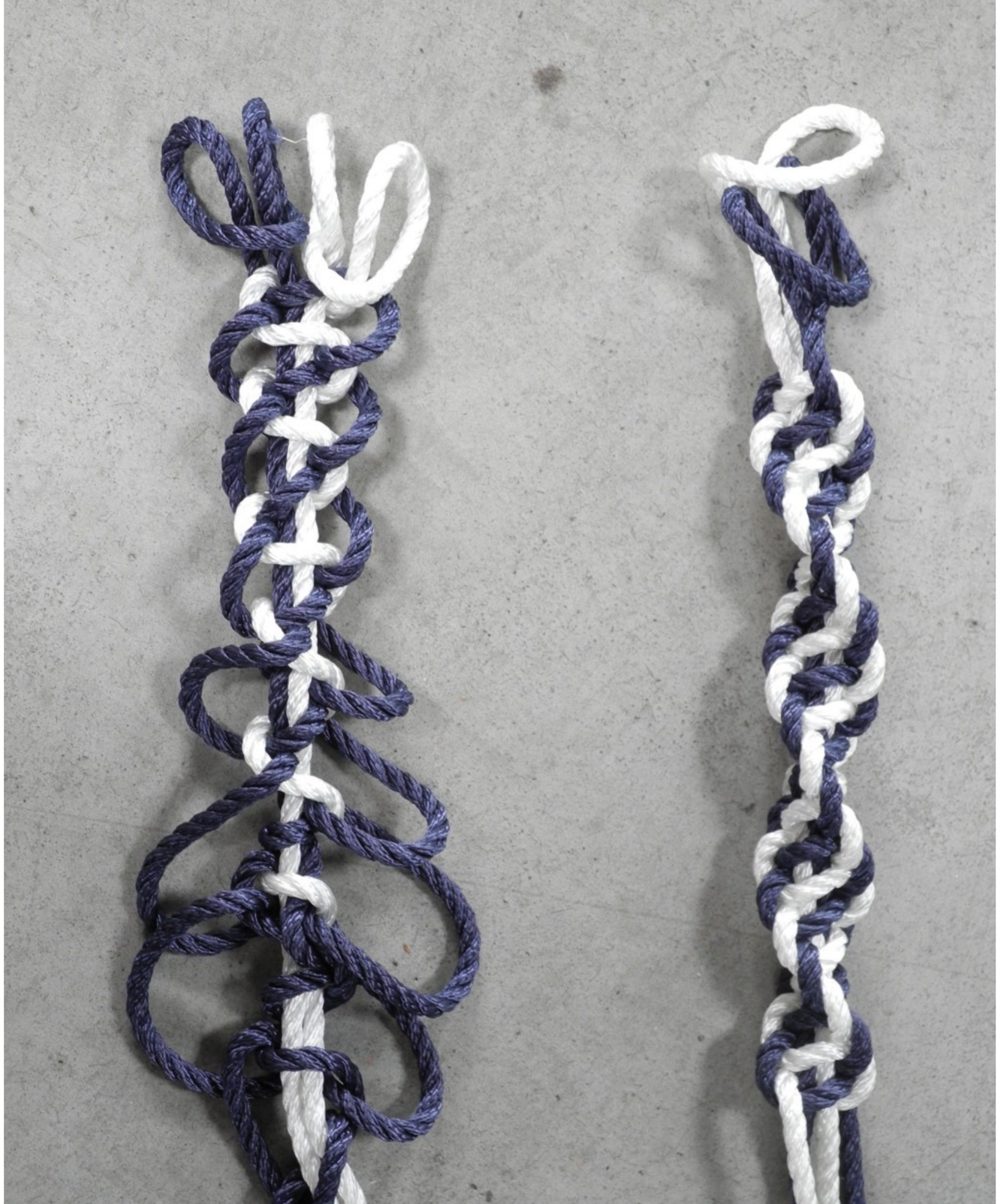


FIGURE 66.
Plaiting a three-ply braid rope.

image source unknown

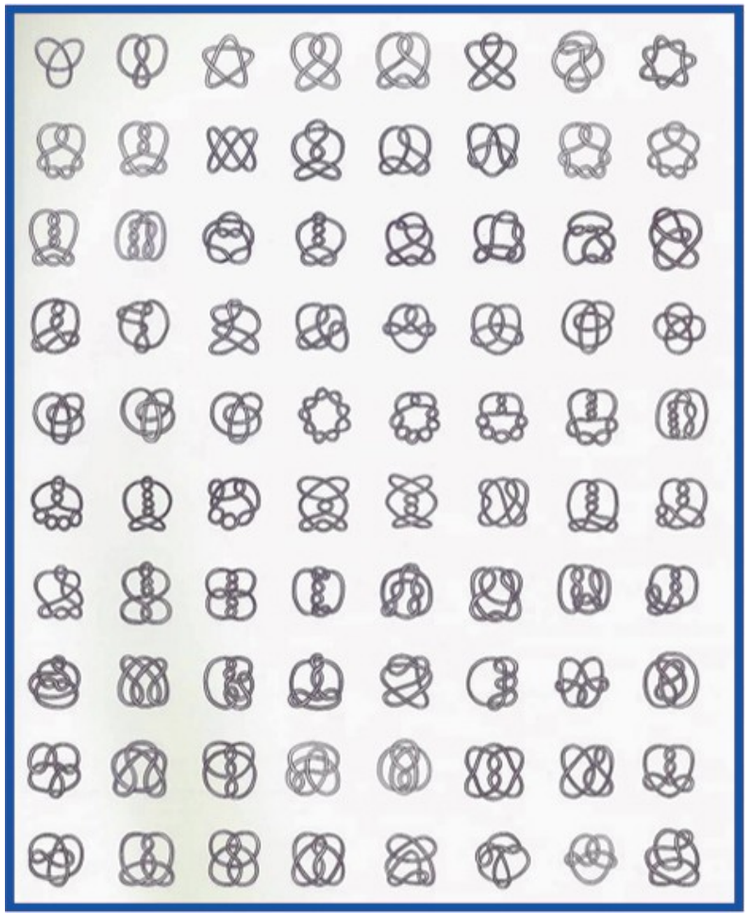
macramé

Images:: Macrame Pouf, Carole Collet



knot and math

Unique up to deforming them.
Topological ideas.
How many knots are there?
Alternating knots as woven tangles.



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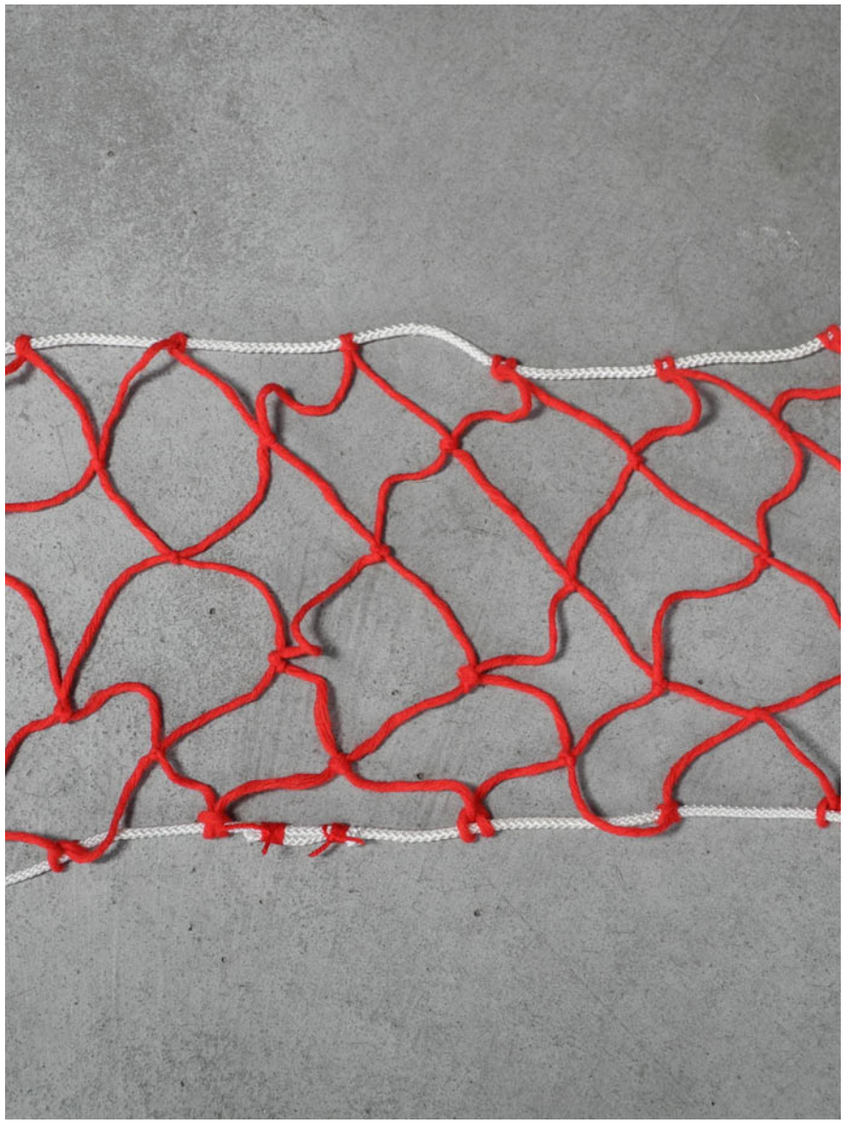
net knot

Anchor hitches at the boundary.
Sheet bends elsewhere.
Emergent shape from length changes.
Hyperbolic, conic and other shapes.



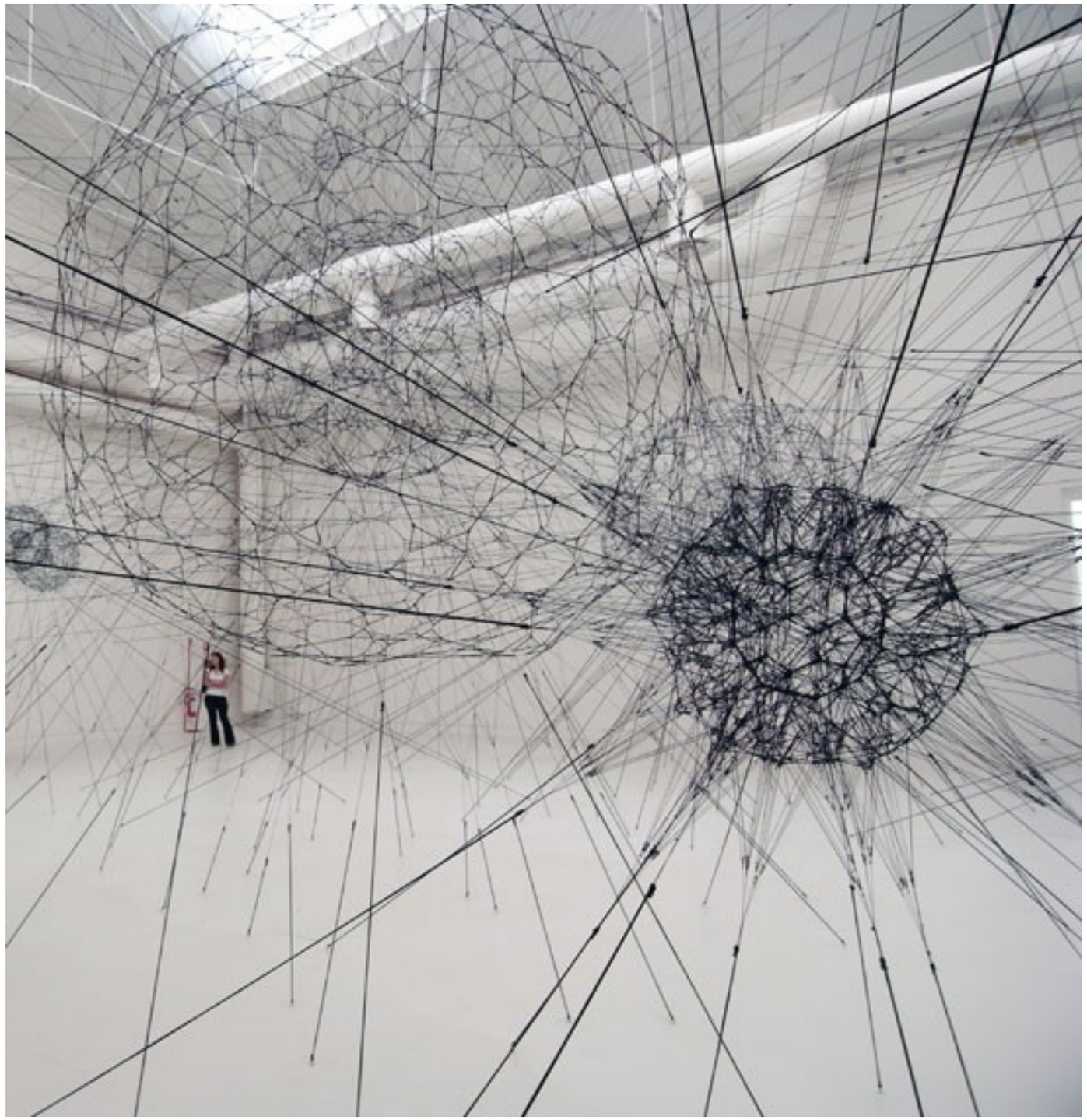
Mind the Gap, 2005 Sheila Pepe

Brainforest
21st Century Museum of Contemporary Art, Kanazawa (Japan), 2004

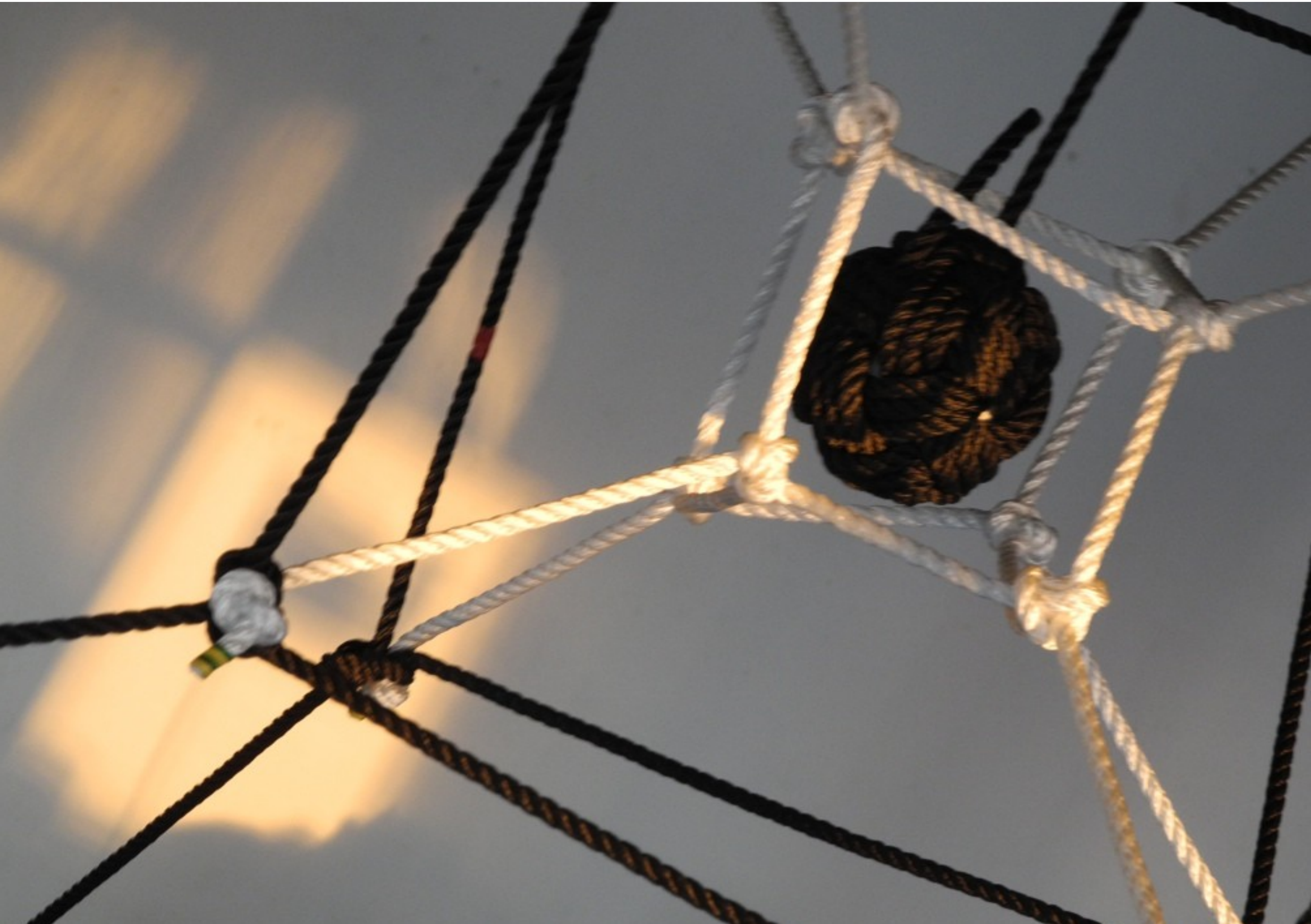
Brainforest
21st Century Museum of Contemporary Art, Kanazawa (Japan), 2004

GERDA STEINER & JÖRG LENZLINGER

Antony Gormley

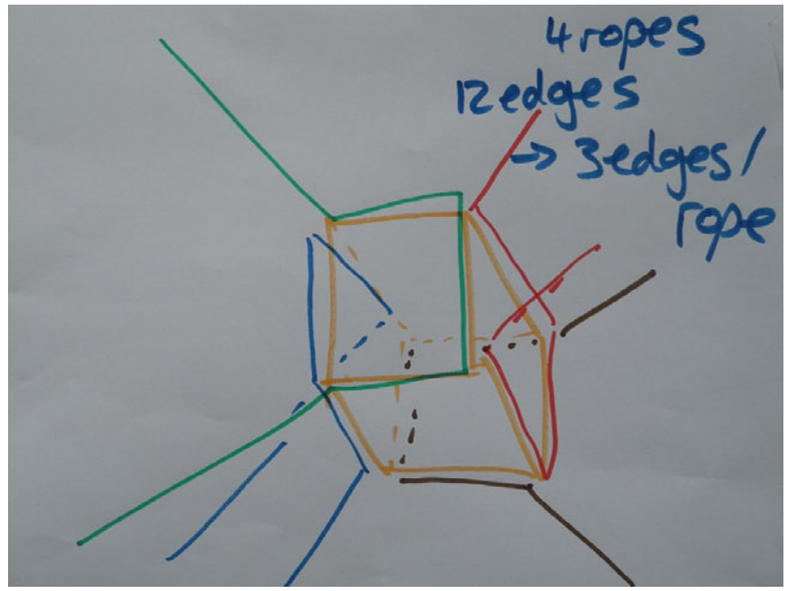


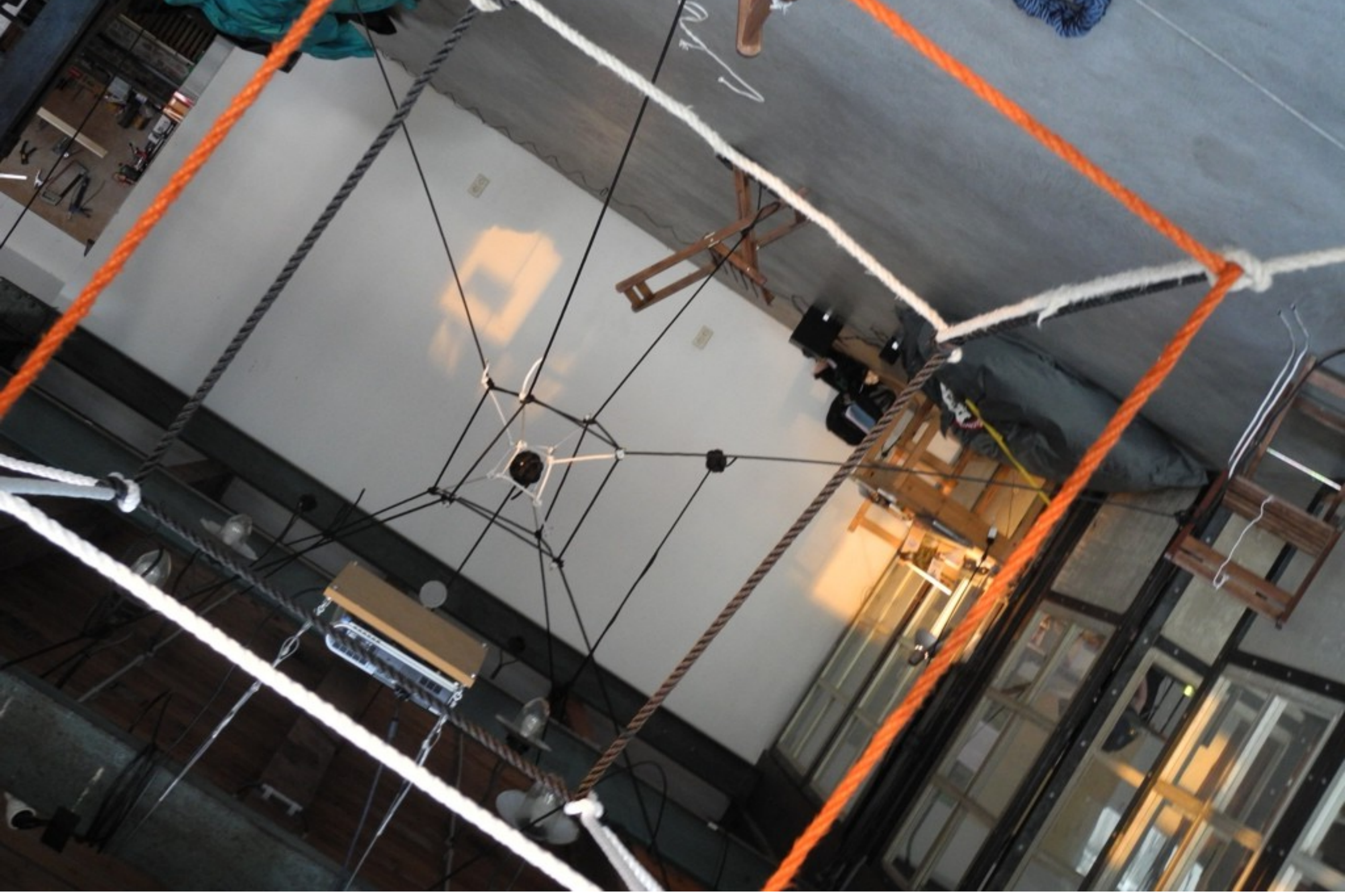
Tomas Saraceno "galaxies forming along filaments, like droplets along the strands"



suspended cube

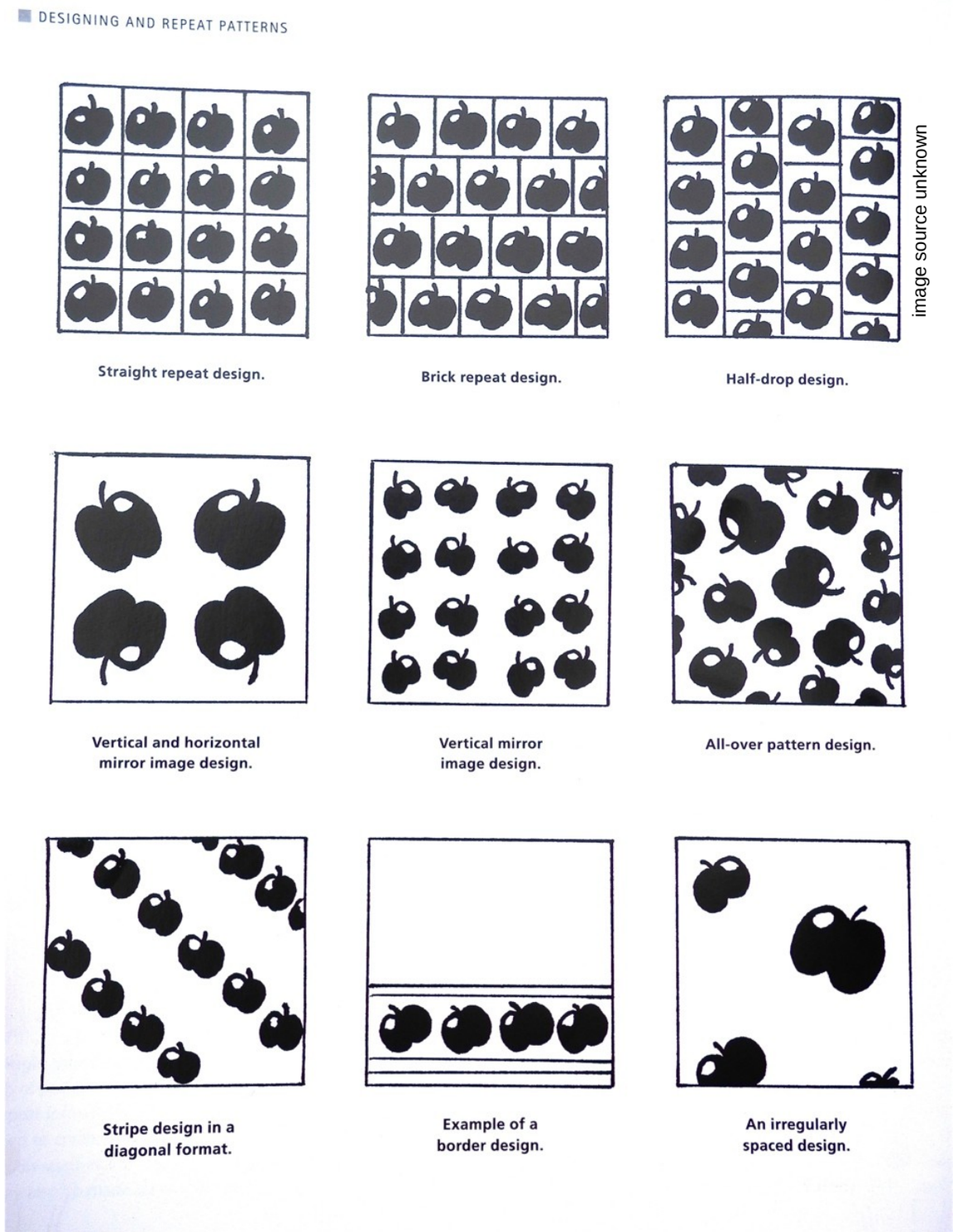
net knot, scalable geometry,
minimum rope length,
symmetries of Platonic solids
give structural impetus.
Octohedron is difficult...





repeat

periodic and non periodic,
recurring and non recurring



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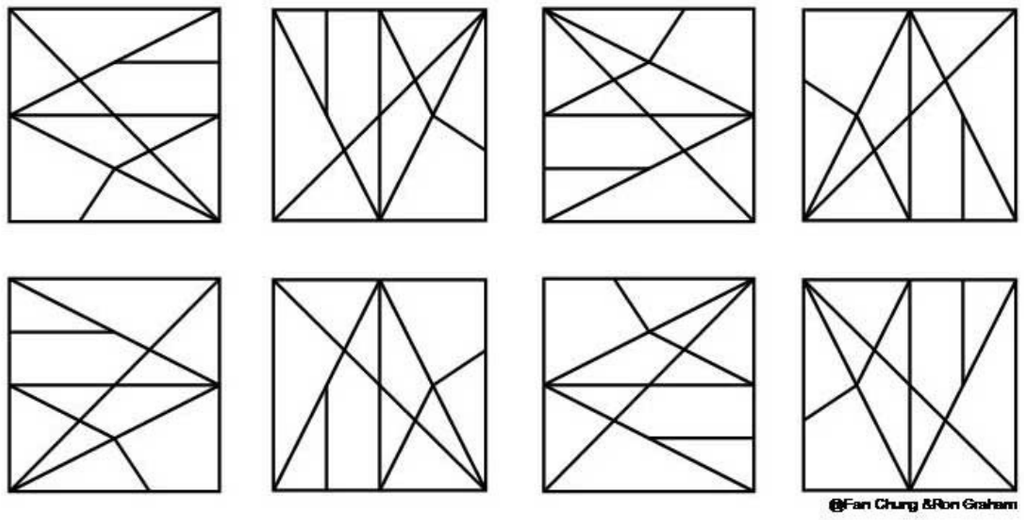
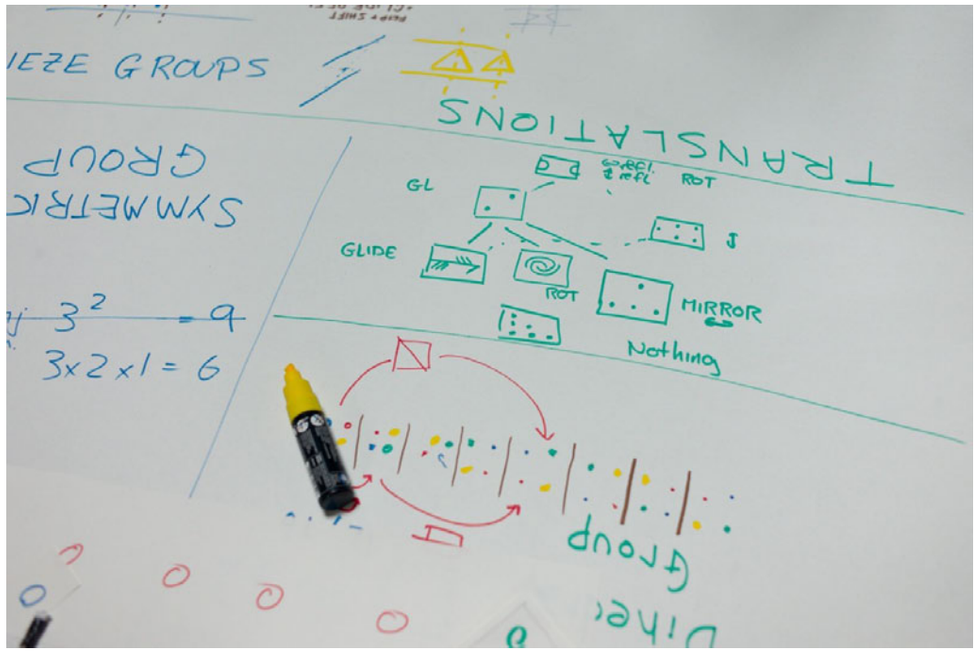
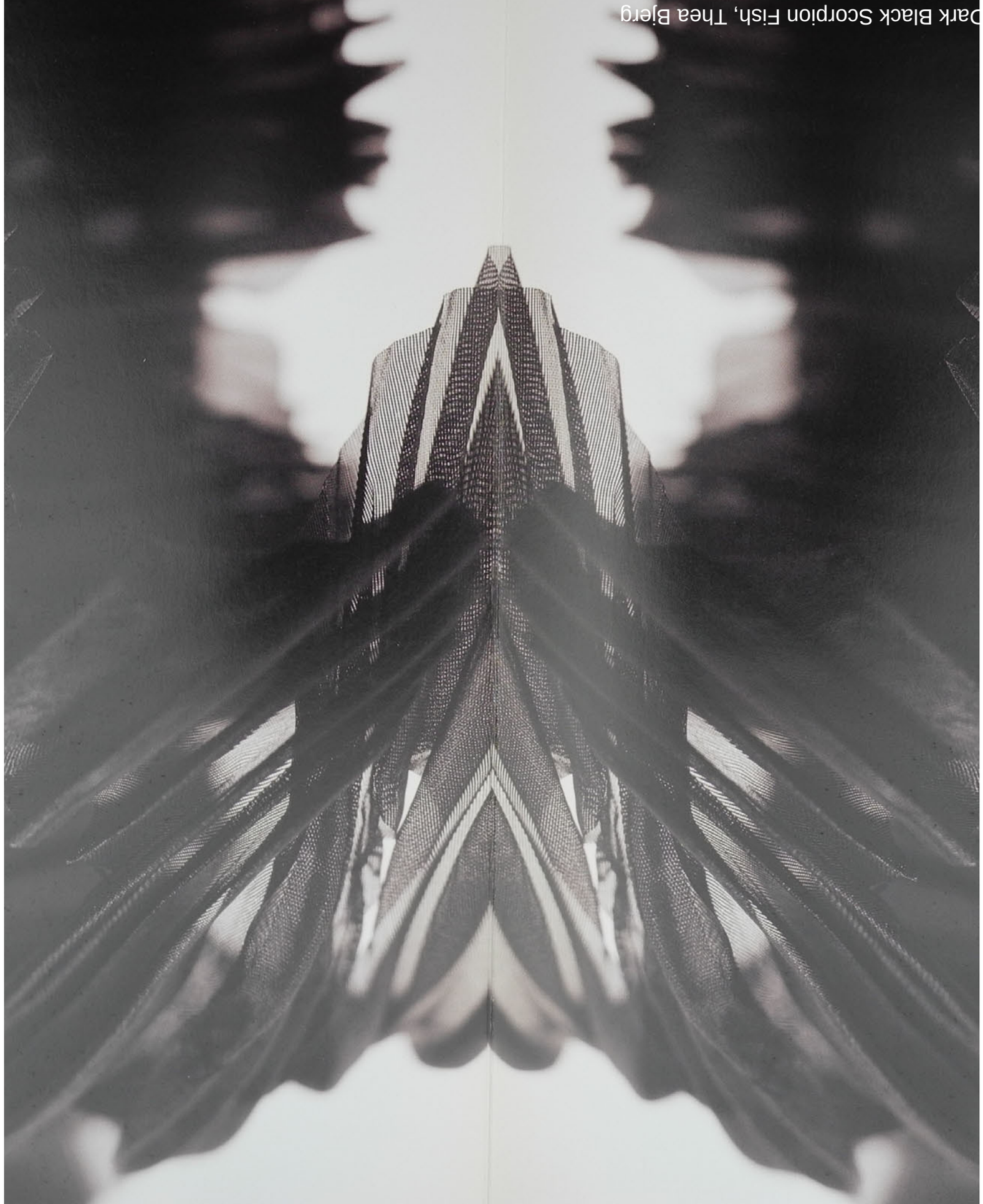
group theory

the symmetric group
the symmetry of triangle and square - dihedral groups
translations

frieze and wallpaper groups
Can we make aesthetic examples of all?







Dark Black Scorpion Fish, Thea Bjerg

tessellation

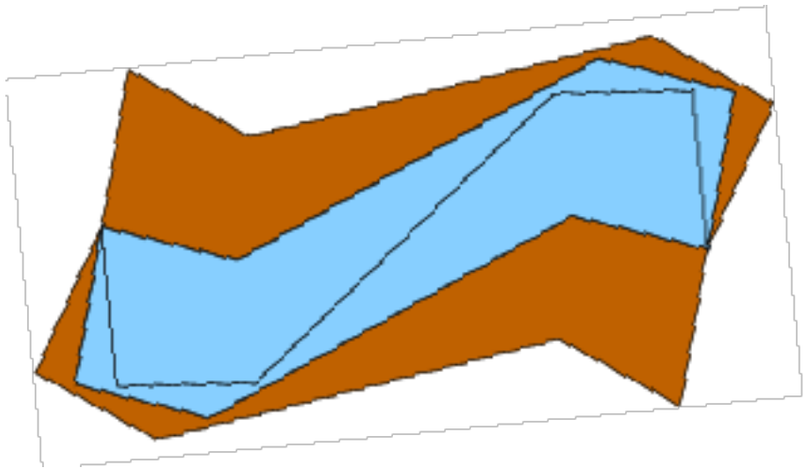
planar groups
tilings
exactly 17 possibilities

image source unknown

voderberg tiling

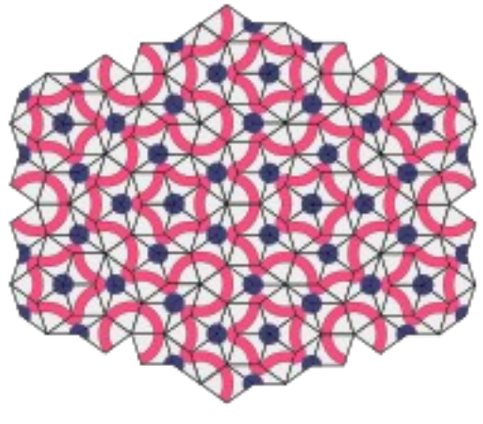
multiple tilings
surrounds itself (except at 2
points) and multiple copies of
itself, with two.
the first spiral tessellation

image source unknown



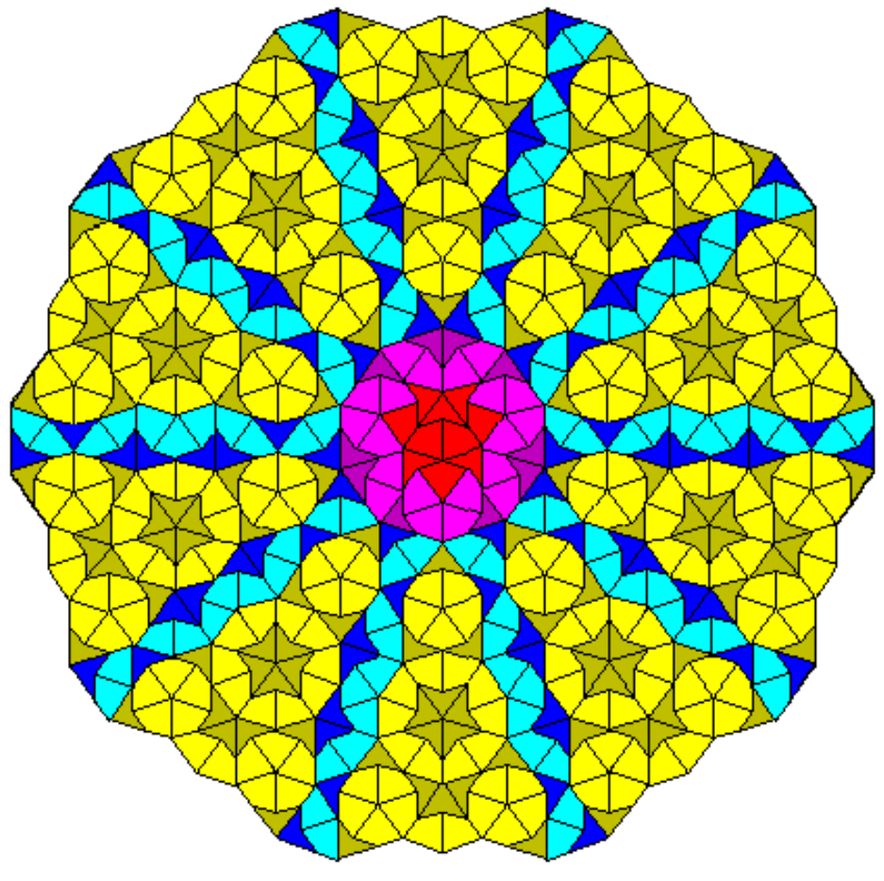
penrose tilings

irregular
five fold rotational symmetry
aperiodic penrose



QuickTime™ and a
GIF decompressor
are needed to see this picture.

image source unknown

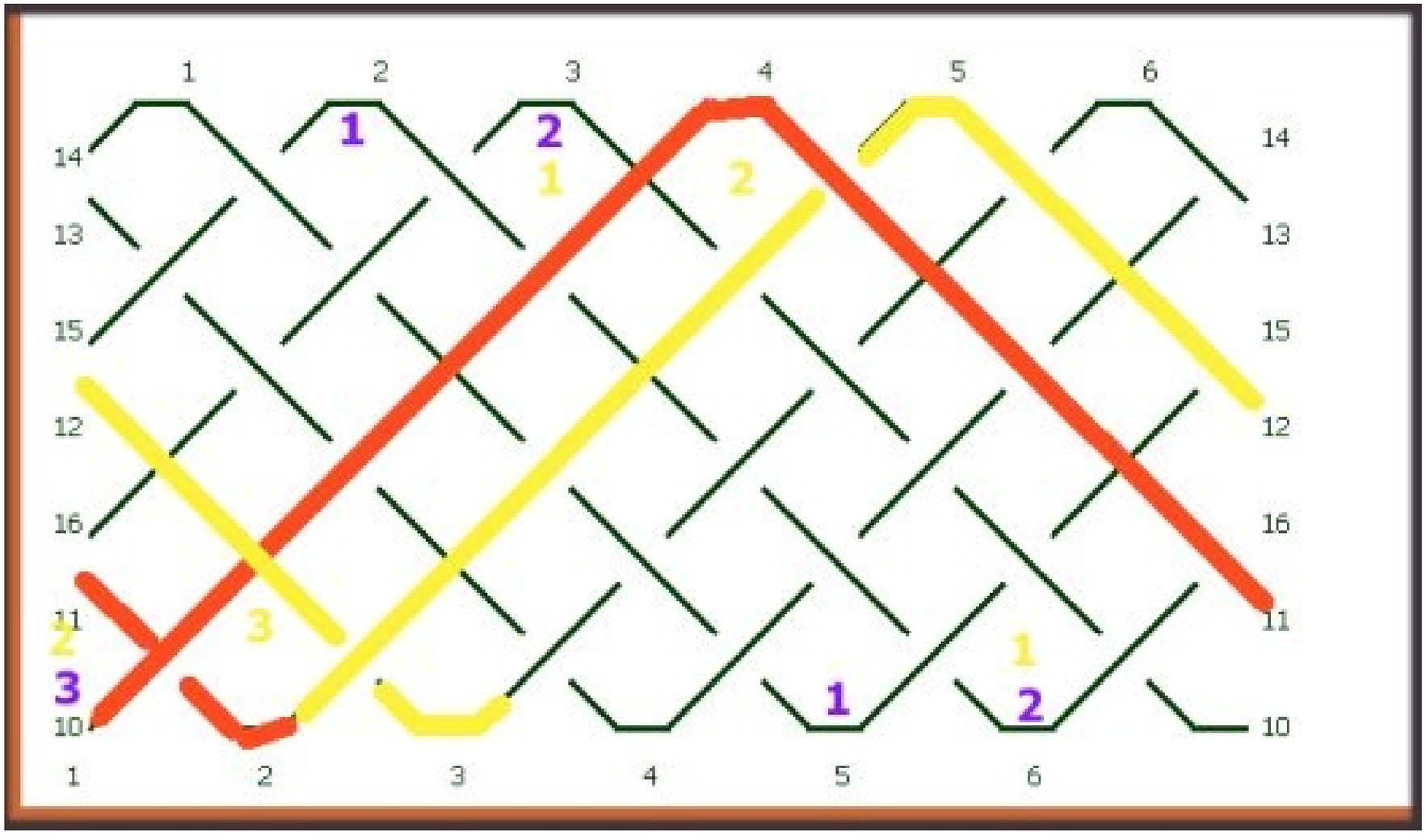


turk's head
turk's head

decorative knot work
number of bights and leads
example: 3 leads x 4 bights
greatest common divisor
Tools for making reflect mathematical structures.

FIG. 136.—Turks' heads.

image source unknown



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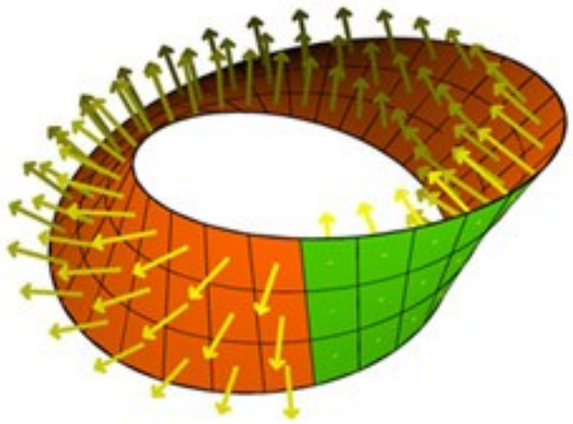
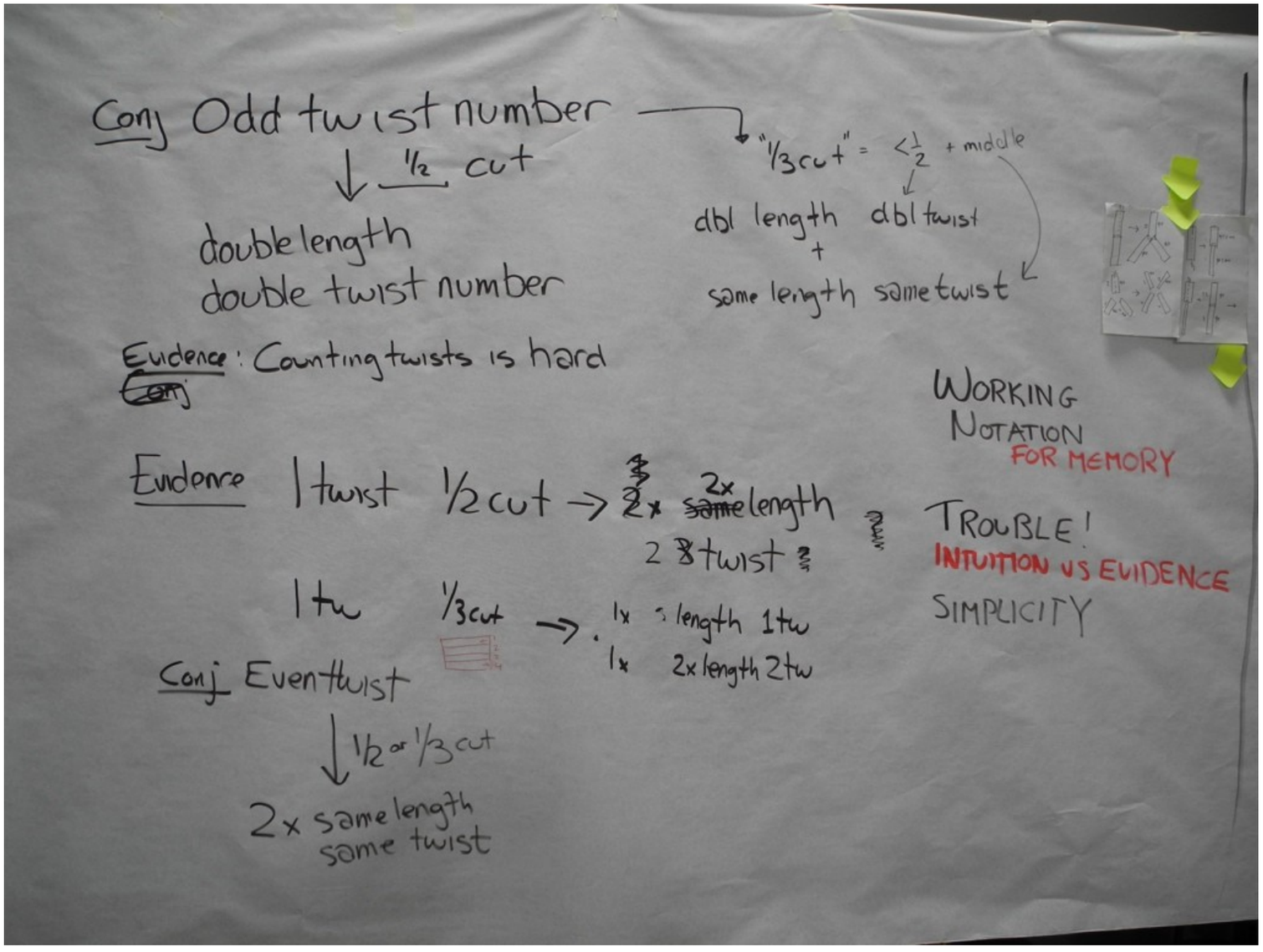
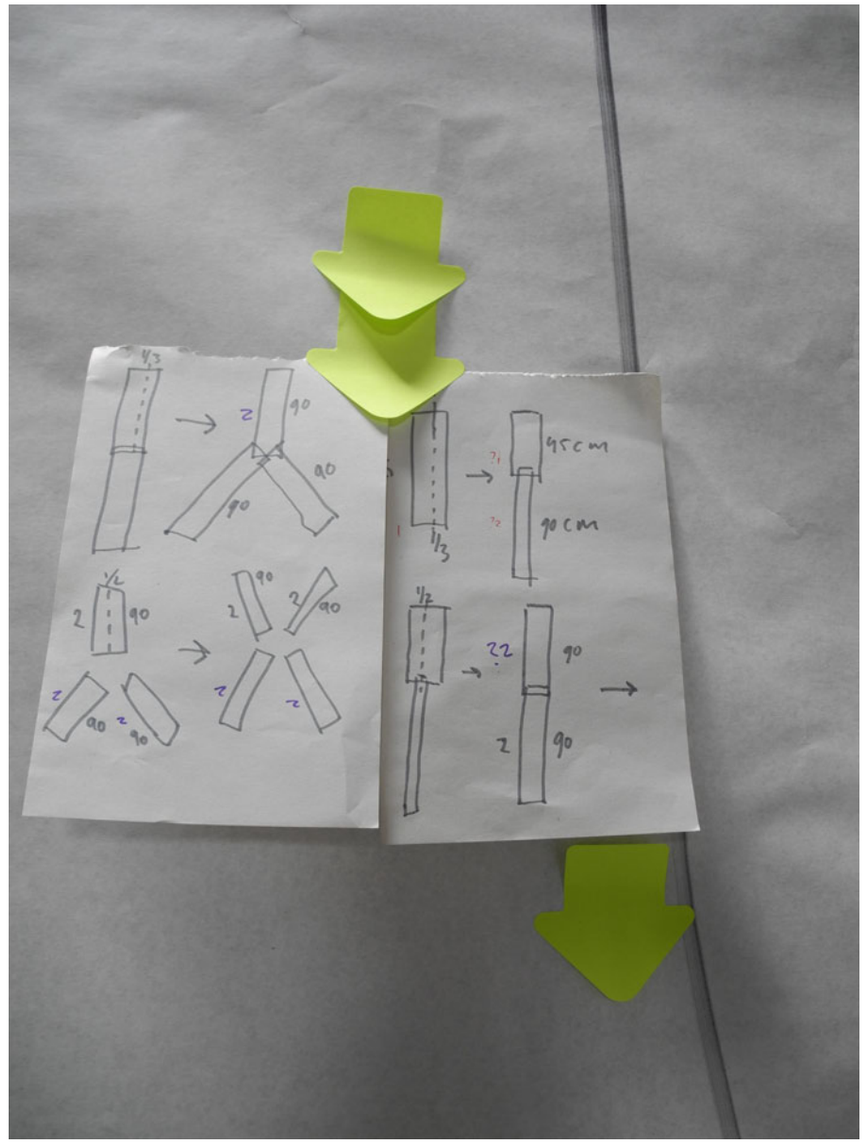
möbius plane



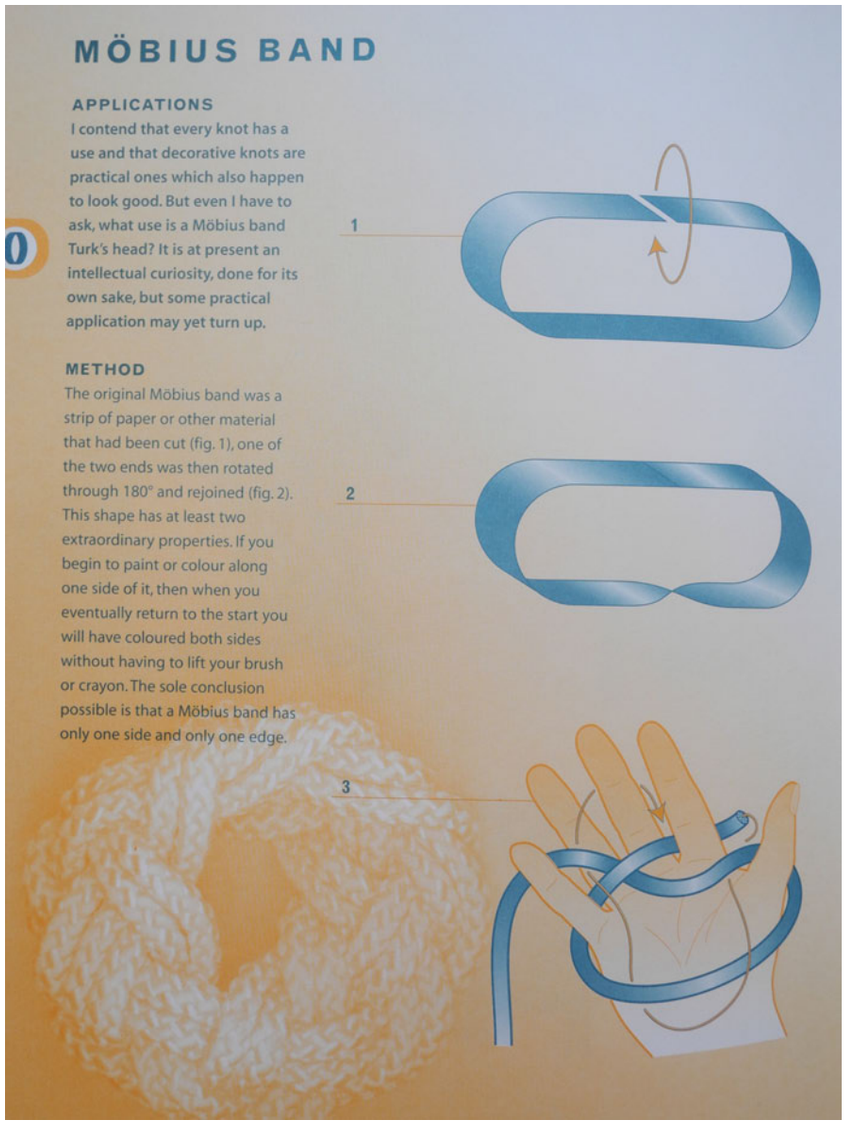
simple model
no up - only one side
double möbius etc...
Cut gives what results?
Conjectures, Notation, Intuition,
Complexity


Conj Odd twist number
½ cut
double length
double twist number
"⅓cut" = <½ + middle
dbl length dbl twist
+
same length same twist
Evidence: Counting twists is hard
WORKING NOTATION FOR MEMORY
Evidence 1 twist ½ cut → 2x same length 2 twist
TROUBLE!
INTUITION VS EVIDENCE
SIMPLICITY
1tw ⅓cut → 1x length 1tw
1x 2x length 2tw
Conj Even twist
½ or ⅓ cut
2x same length
same twist


90
90
90
90
45 cm
90 cm
90
90

möbius turk's head

Now that's just silly...



MÖBIUS BAND

APPLICATIONS

I contend that every knot has a use and that decorative knots are practical ones which also happen to look good. But even I have to ask, what use is a Möbius band Turk's head? It is at present an intellectual curiosity, done for its own sake, but some practical application may yet turn up.

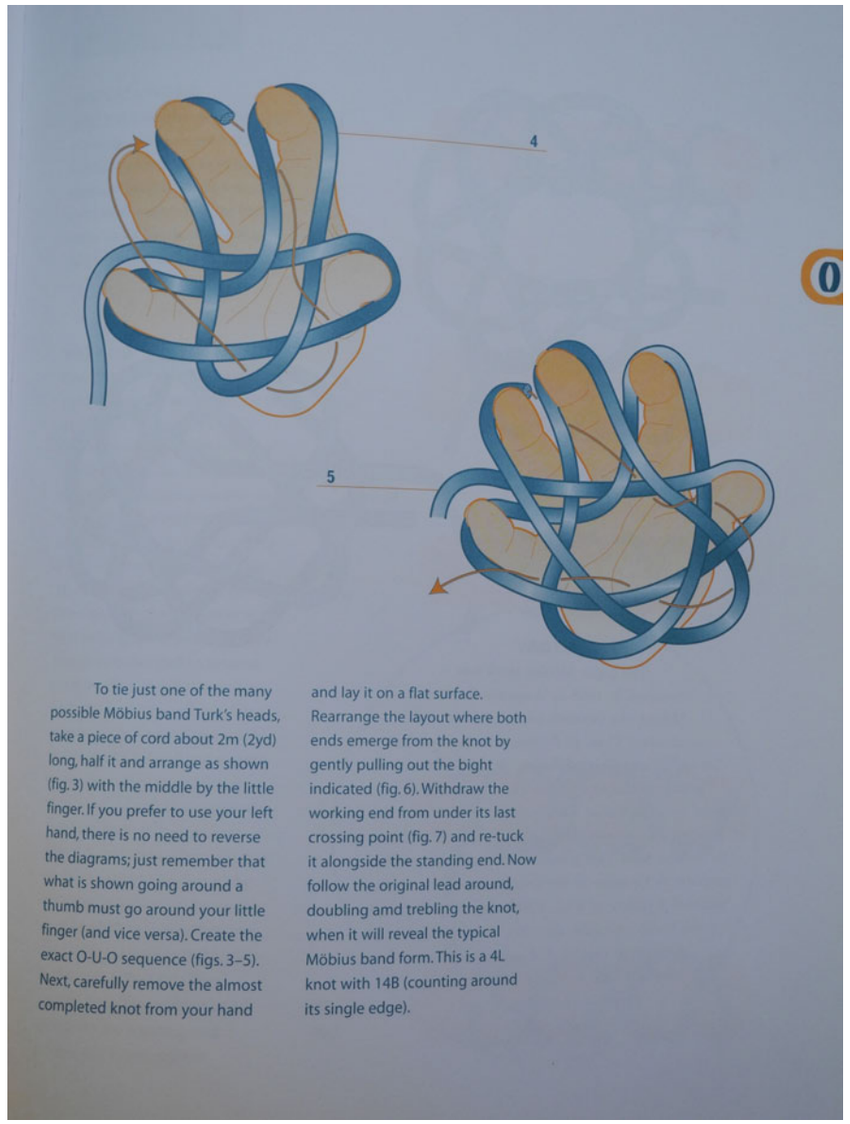
METHOD

The original Möbius band was a strip of paper or other material that had been cut (fig. 1), one of the two ends was then rotated through 180° and rejoined (fig. 2). This shape has at least two extraordinary properties. If you begin to paint or colour along one side of it, then when you eventually return to the start you will have coloured both sides without having to lift your brush or crayon. The sole conclusion possible is that a Möbius band has only one side and only one edge.

1

2

3



4

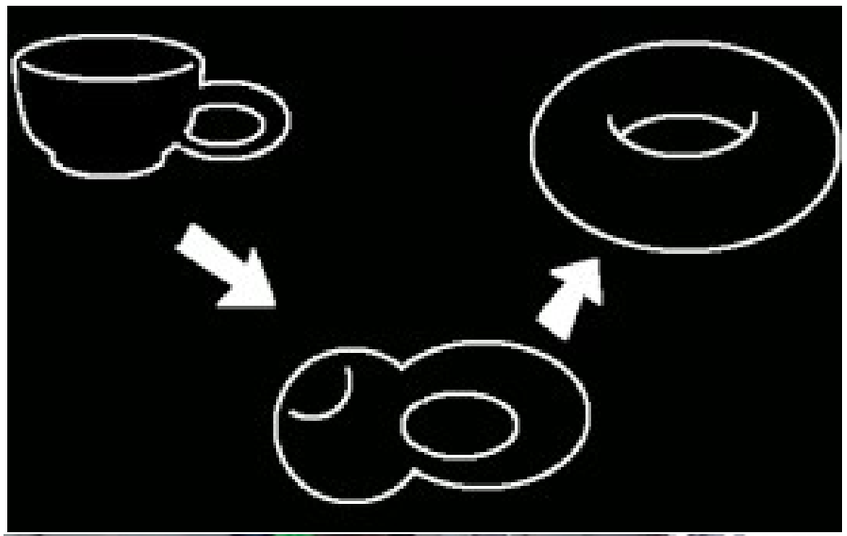
5

To tie just one of the many possible Möbius band Turk's heads, take a piece of cord about 2m (2yd) long, half it and arrange as shown (fig. 3) with the middle by the little finger. If you prefer to use your left hand, there is no need to reverse the diagrams; just remember that what is shown going around a thumb must go around your little finger (and vice versa). Create the exact O-U-O sequence (figs. 3–5). Next, carefully remove the almost completed knot from your hand and lay it on a flat surface. Rearrange the layout where both ends emerge from the knot by gently pulling out the bight indicated (fig. 6). Withdraw the working end from under its last crossing point (fig. 7) and re-tuck it alongside the standing end. Now follow the original lead around, doubling amd trebling the knot, when it will reveal the typical Möbius band form. This is a 4L knot with 14B (counting around its single edge).

The complete Book of Decorative Knots, The Lyons Press, Octopus Publishing 1998

a doughnut is the same as a teacup

topology
no cutting
continuous deformation



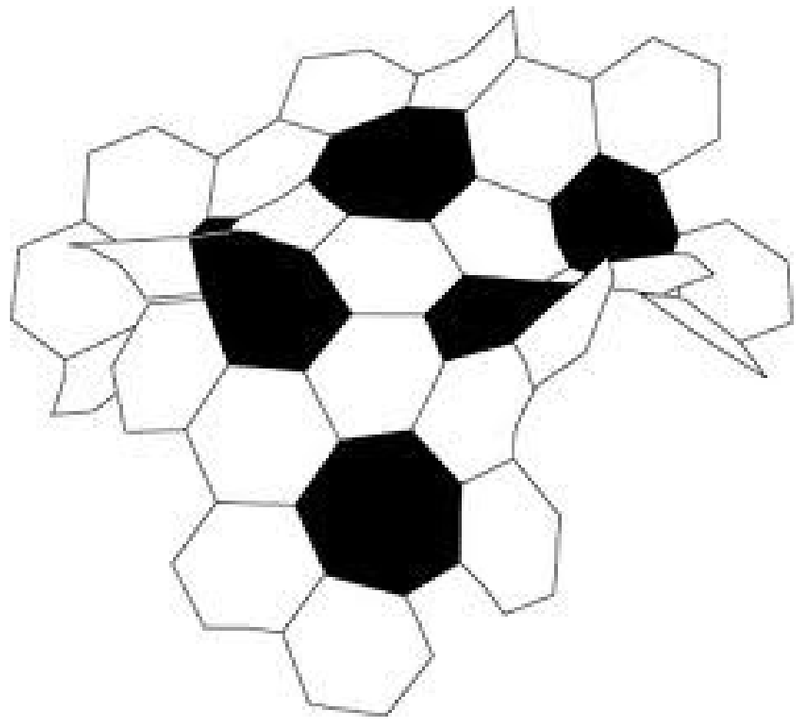
topology:

deconstructing poincaré

compactness
connectedness
connectivity
decoding
reverse engineering

Topologies, begun 2002 (detail), Anne Wilson

hyperbolic planes



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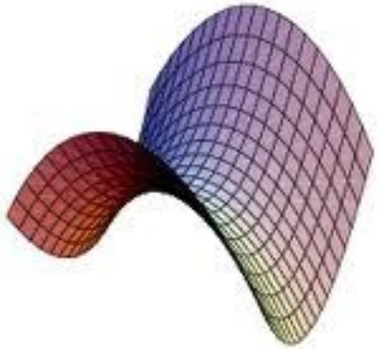
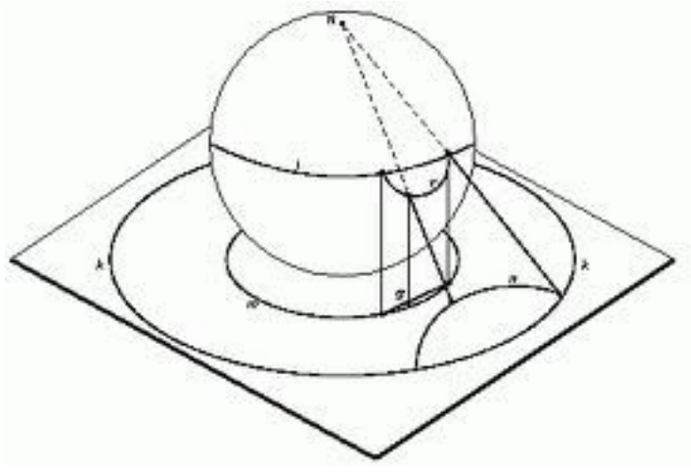
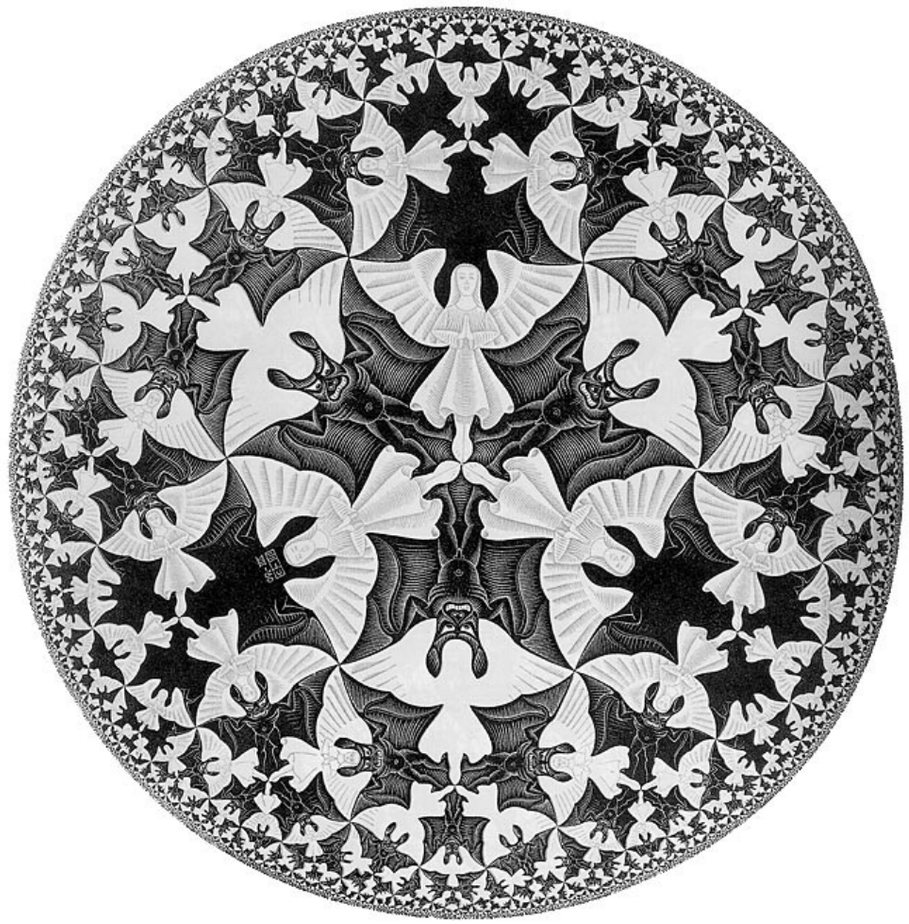
hyperbolic paraboloid





hyperbolic and crochet



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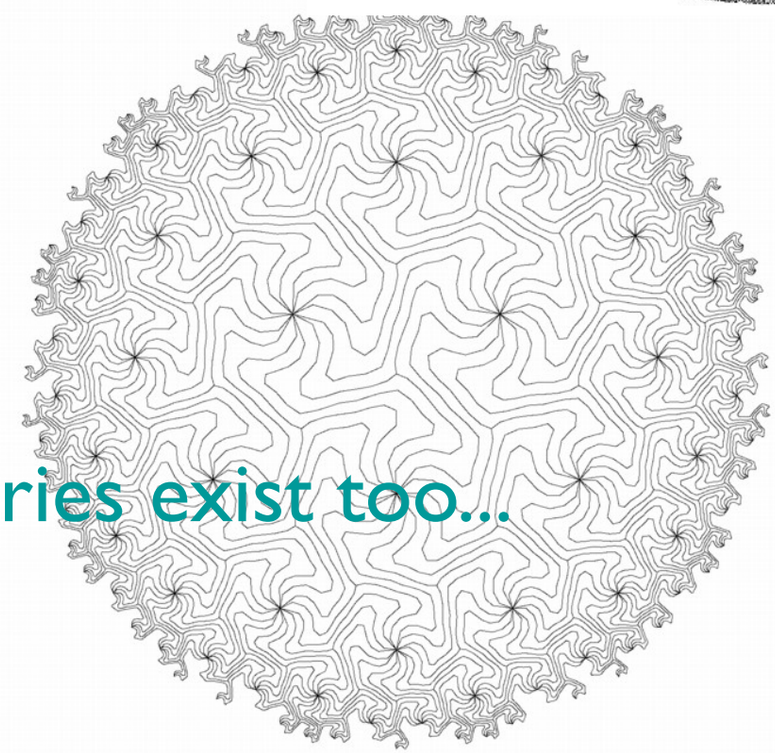
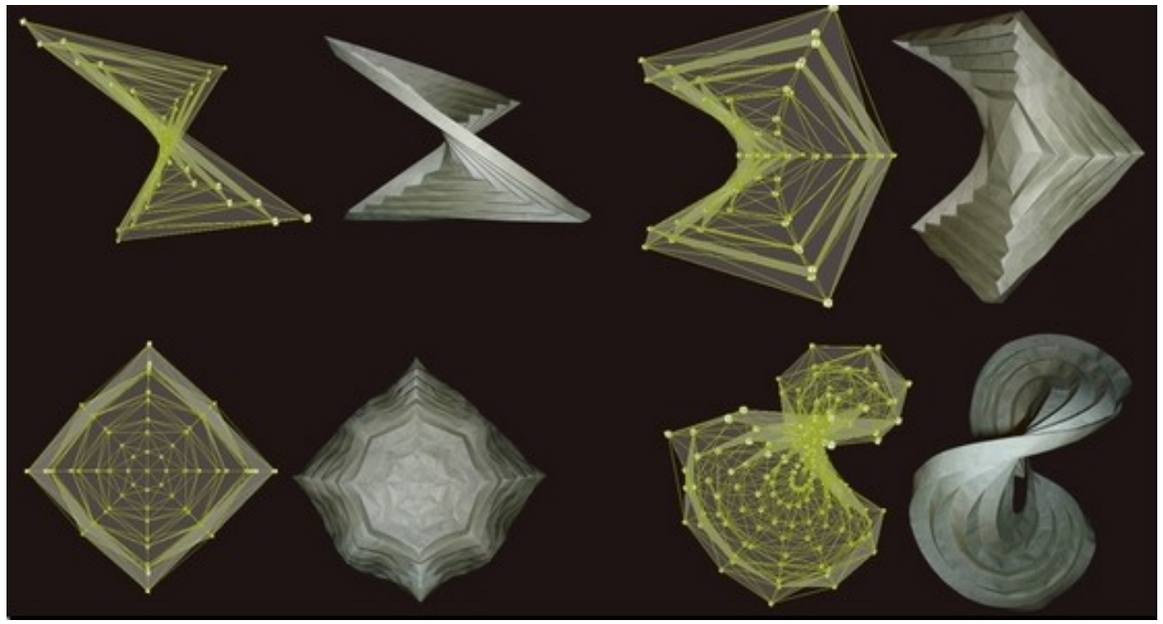
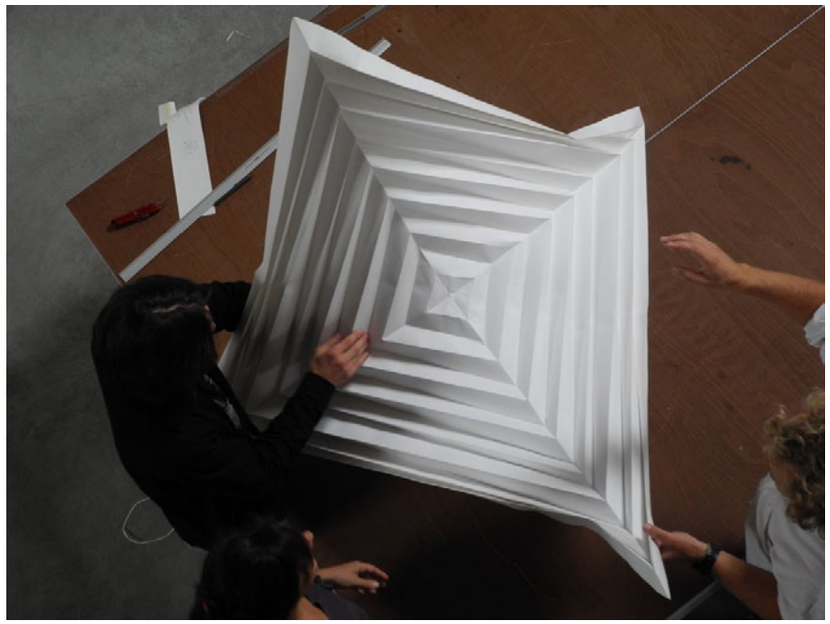
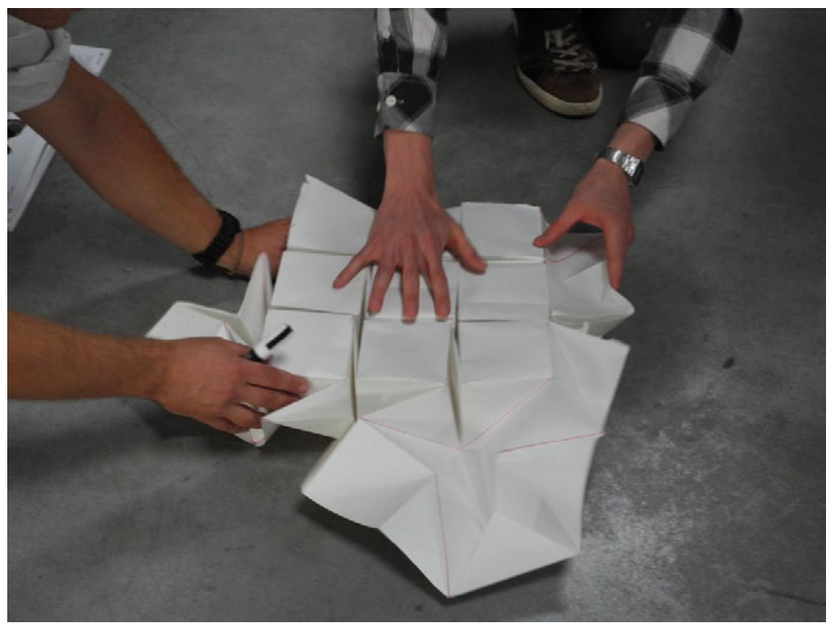
2 parallel lines never meet
euclidian geometry
BUT
spherical and hyperbolic geometries exist too...



the fold, the crease, origami







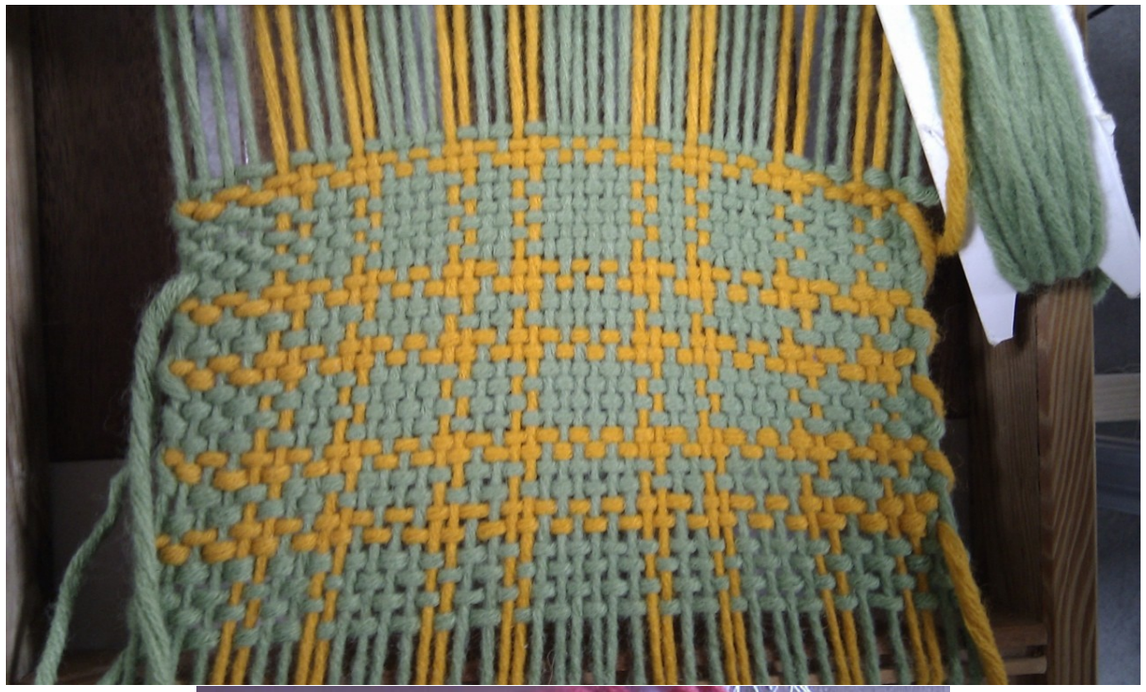
algorithmic weaving

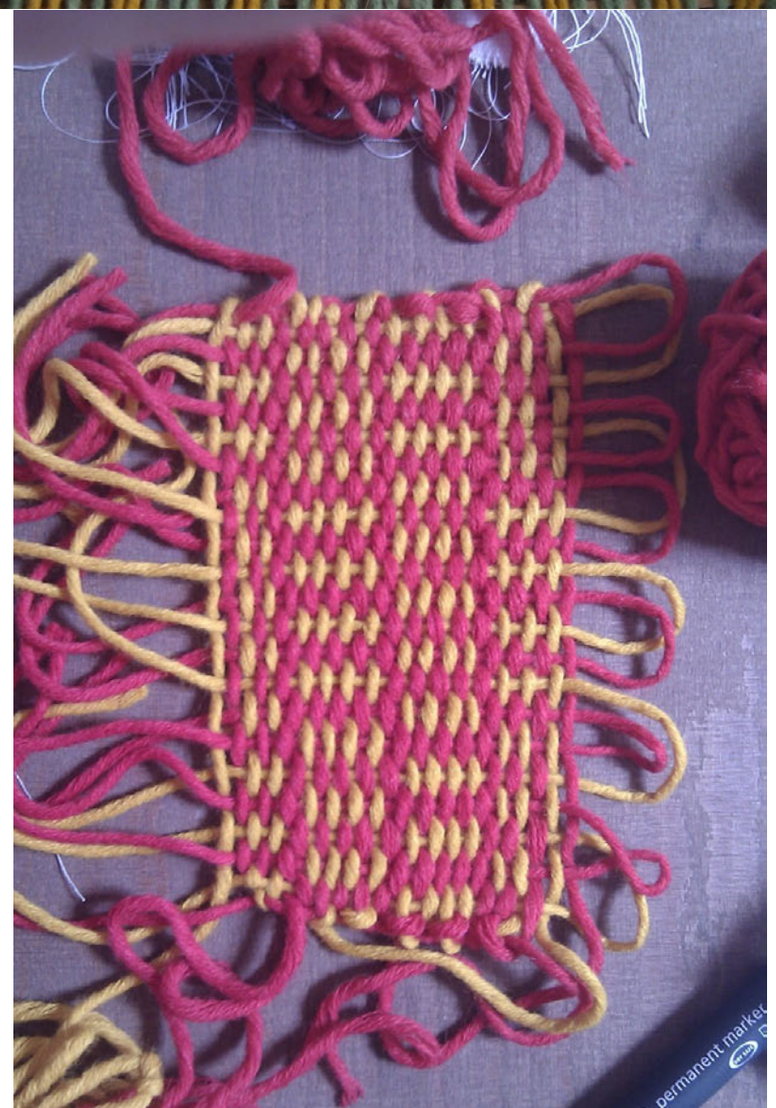
making a warp and weft sequence,
only plain weave allowed

start with one colour: yellow
replace yellow with:
green yellow yellow green

repeat this 4 times:

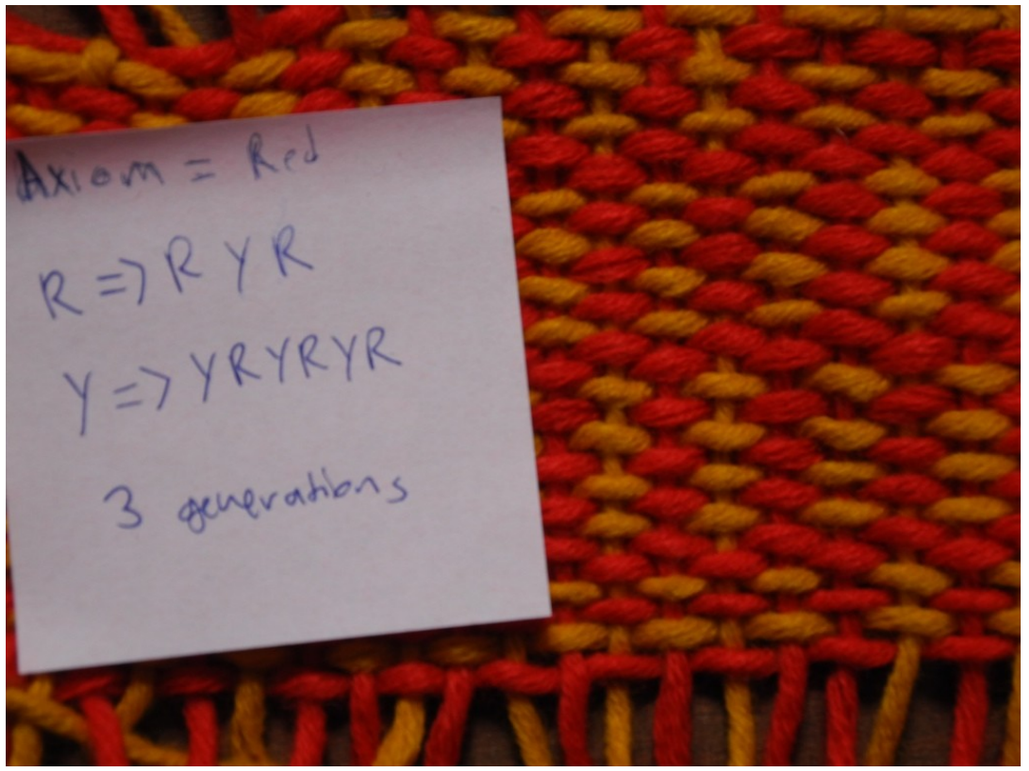
ggggyyggyyggggyyggyyggggggg...





coding and weaving

Ascii weaving



the hairy ball theorem

and pompom making
hairy doughnut
hairy eight-infinity

image source unknown