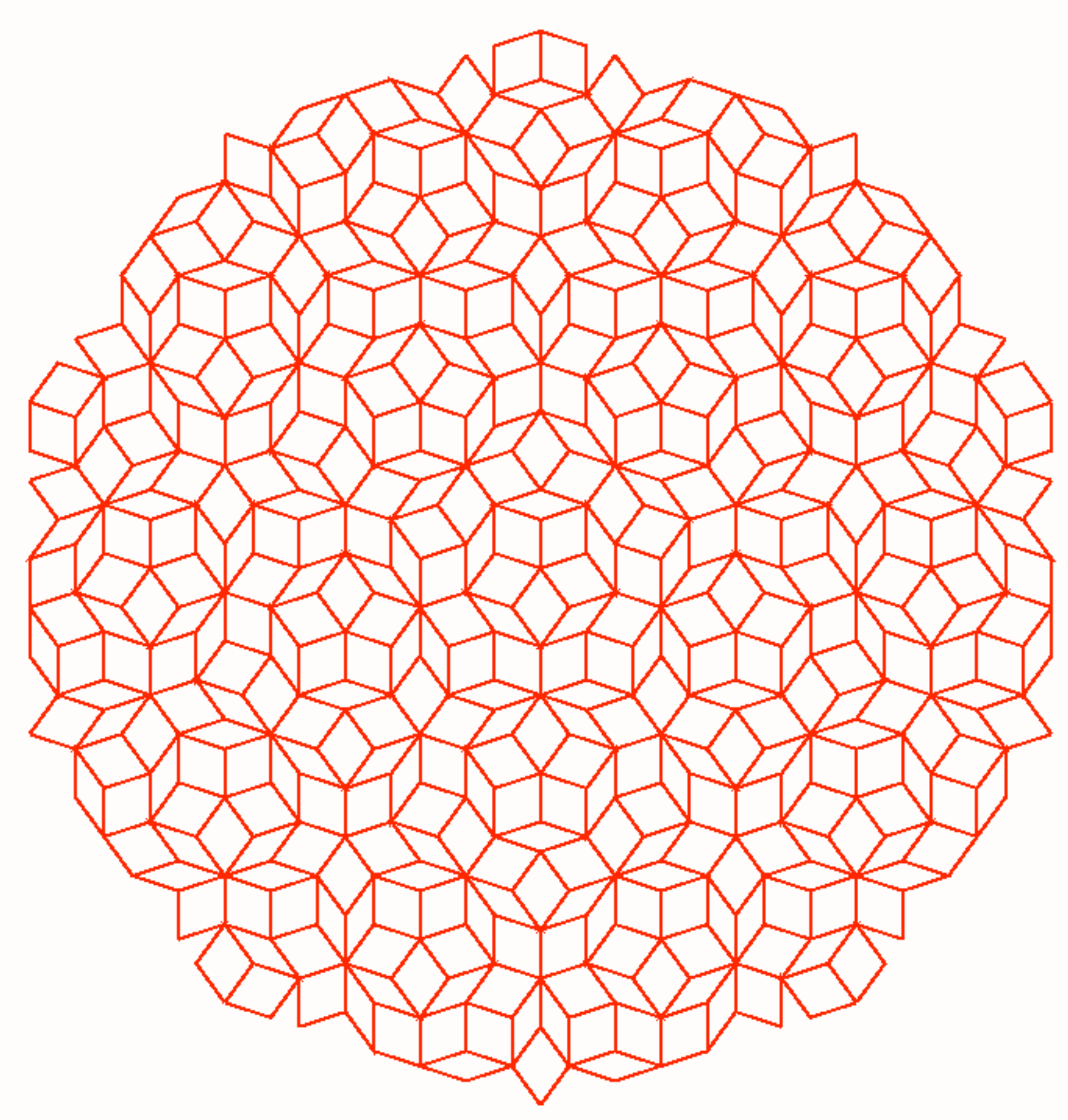
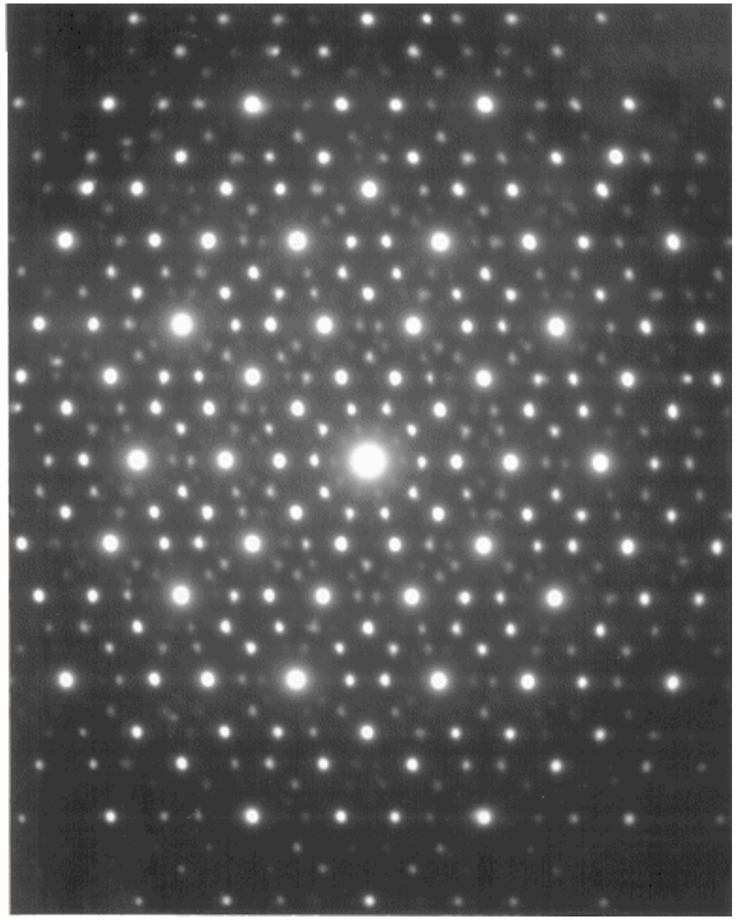
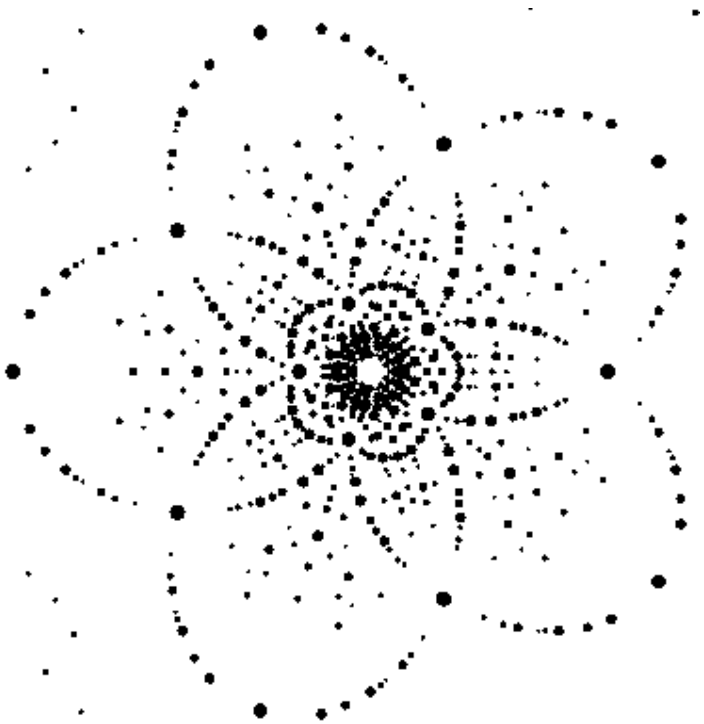
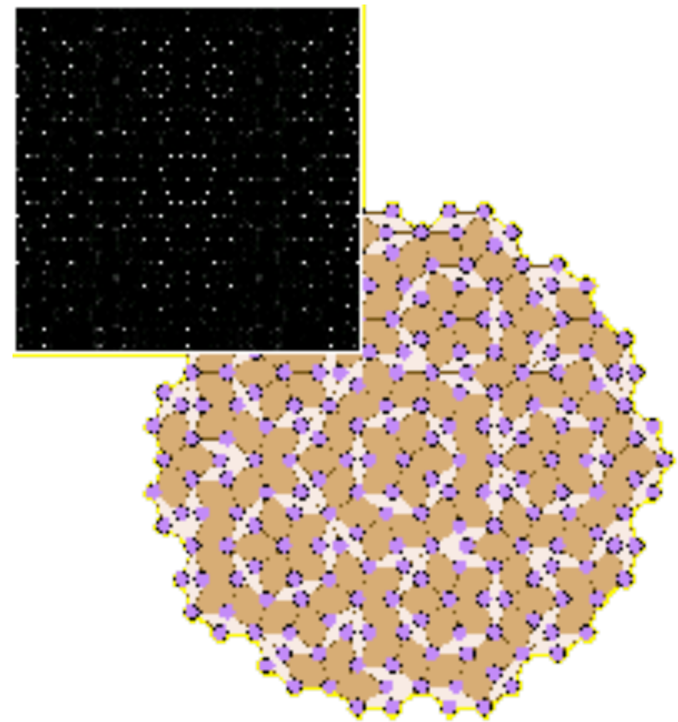


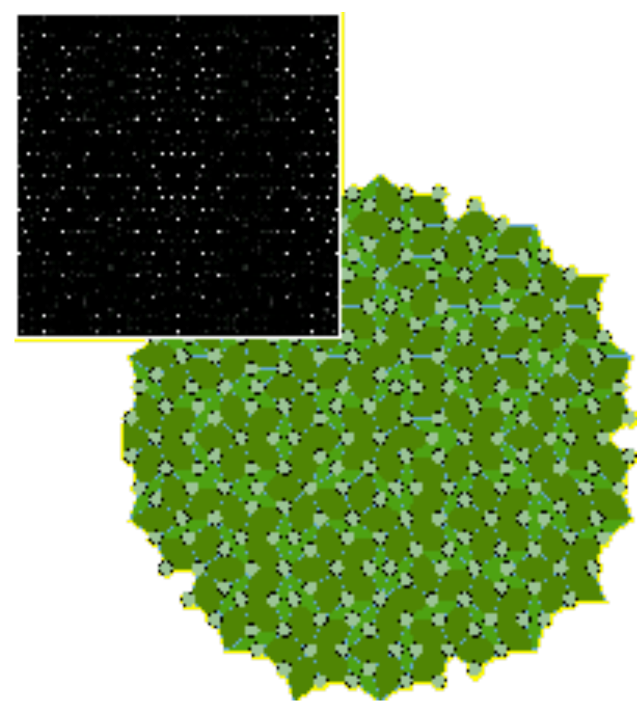


Penrose tiling and diffraction pattern by Ron Lifshitz
Cornell University Laboratory of Solid State Physics

George Francis
Quasicrystals
ITG Forum
Beckman Institute
6 February 2007

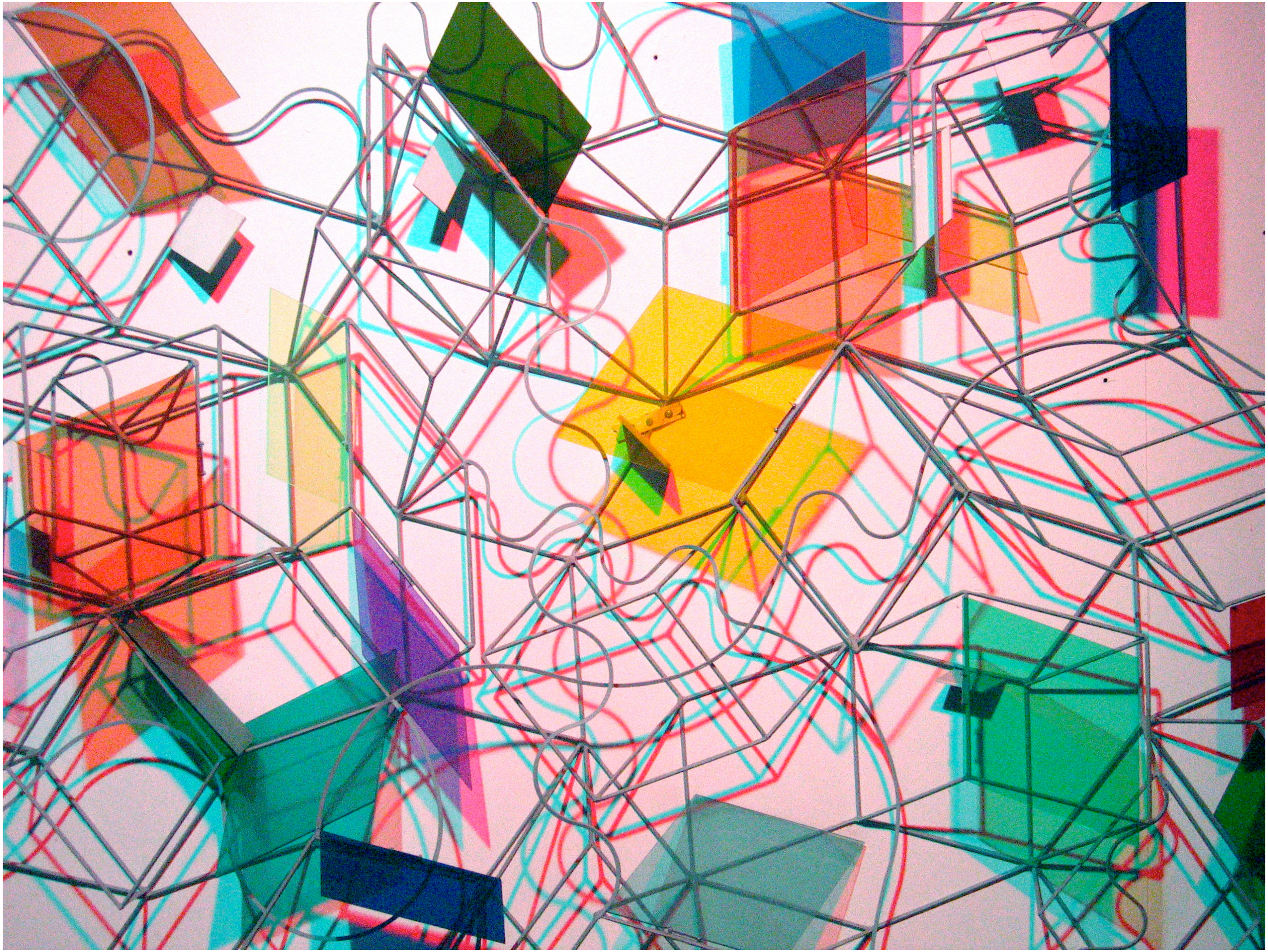


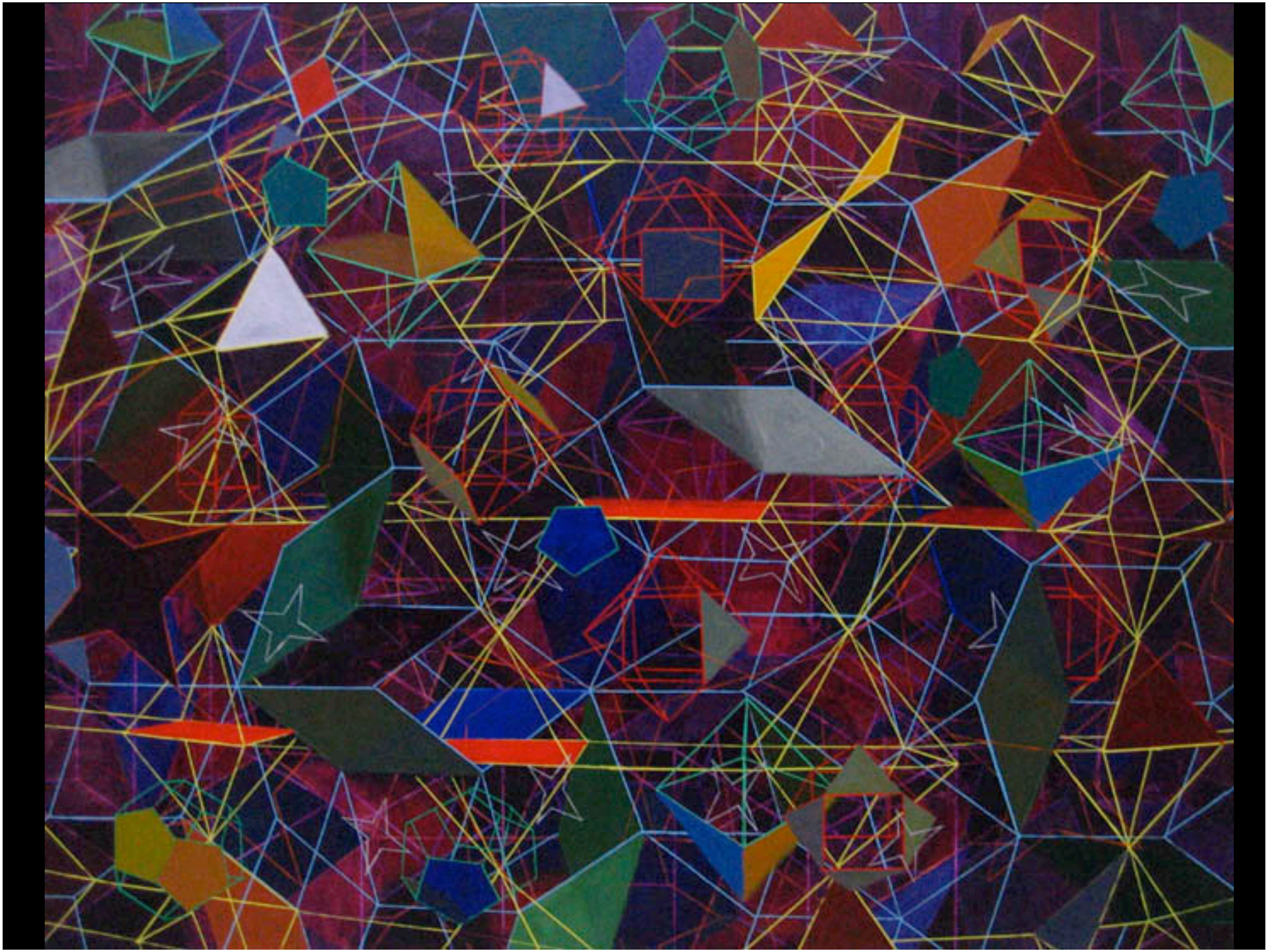


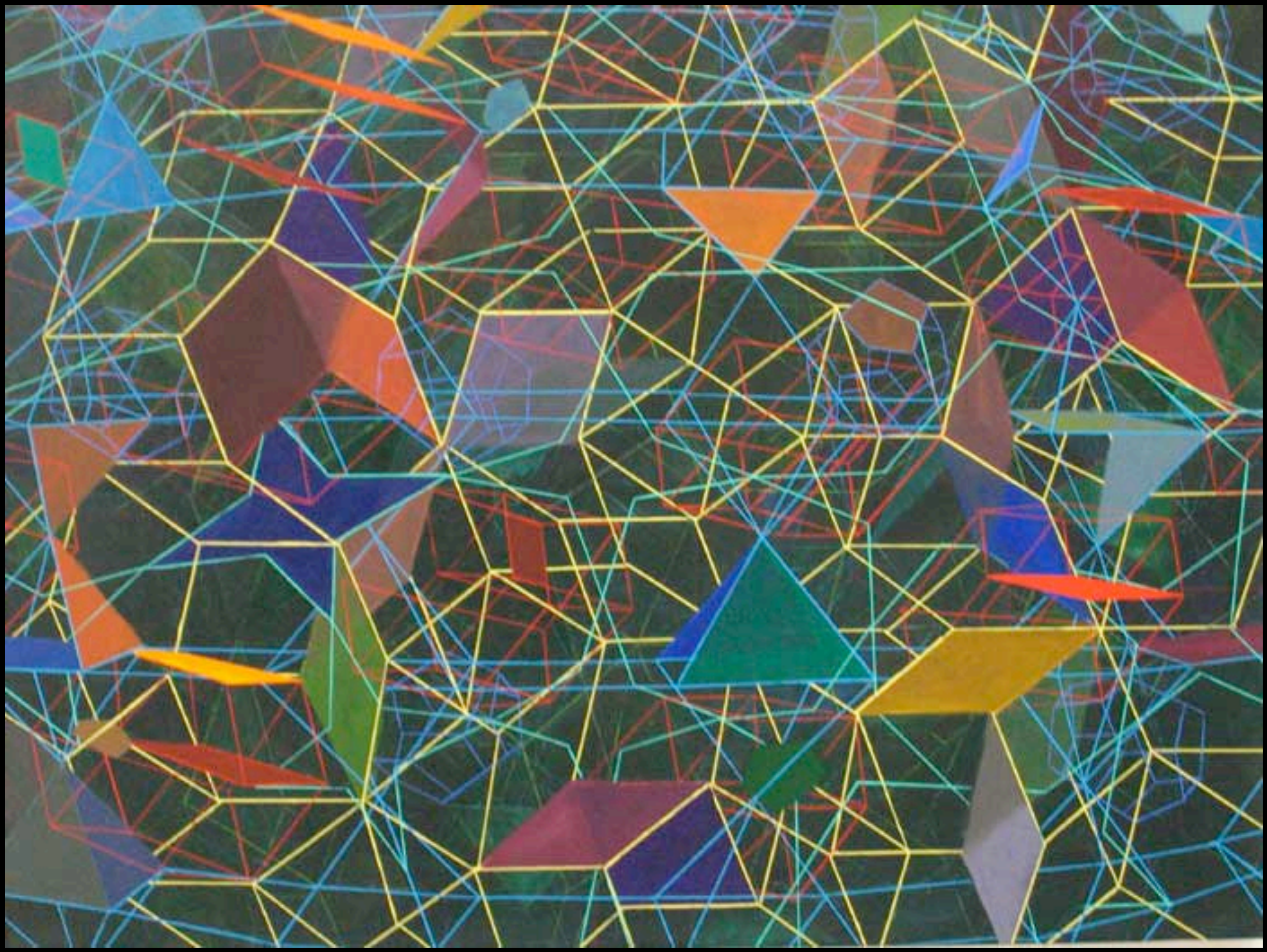


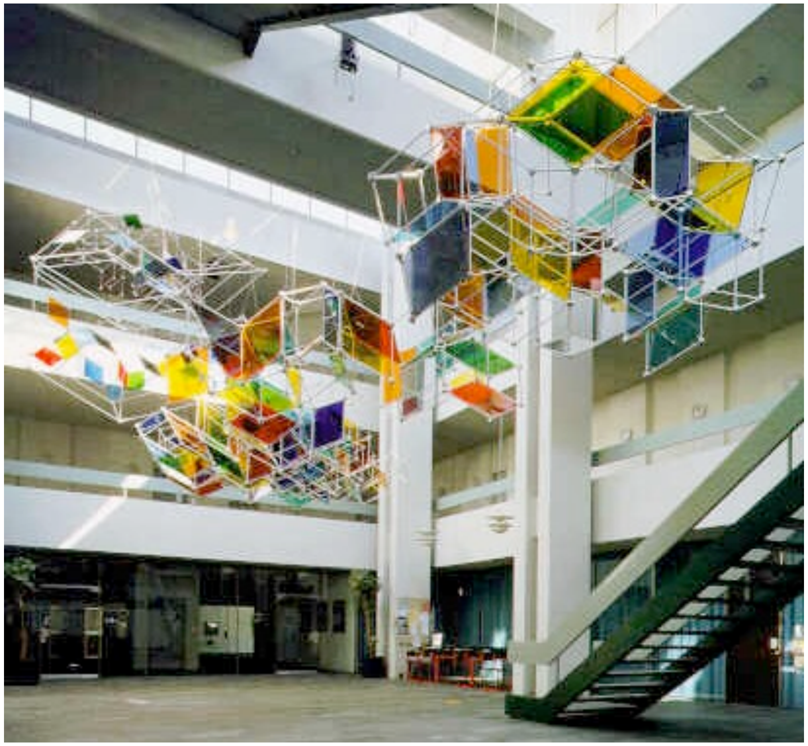
Steffen Weber
JFourier3 (java program)
www.jcrystal.com

LOBOFOUR 1982 by Tony Robbin

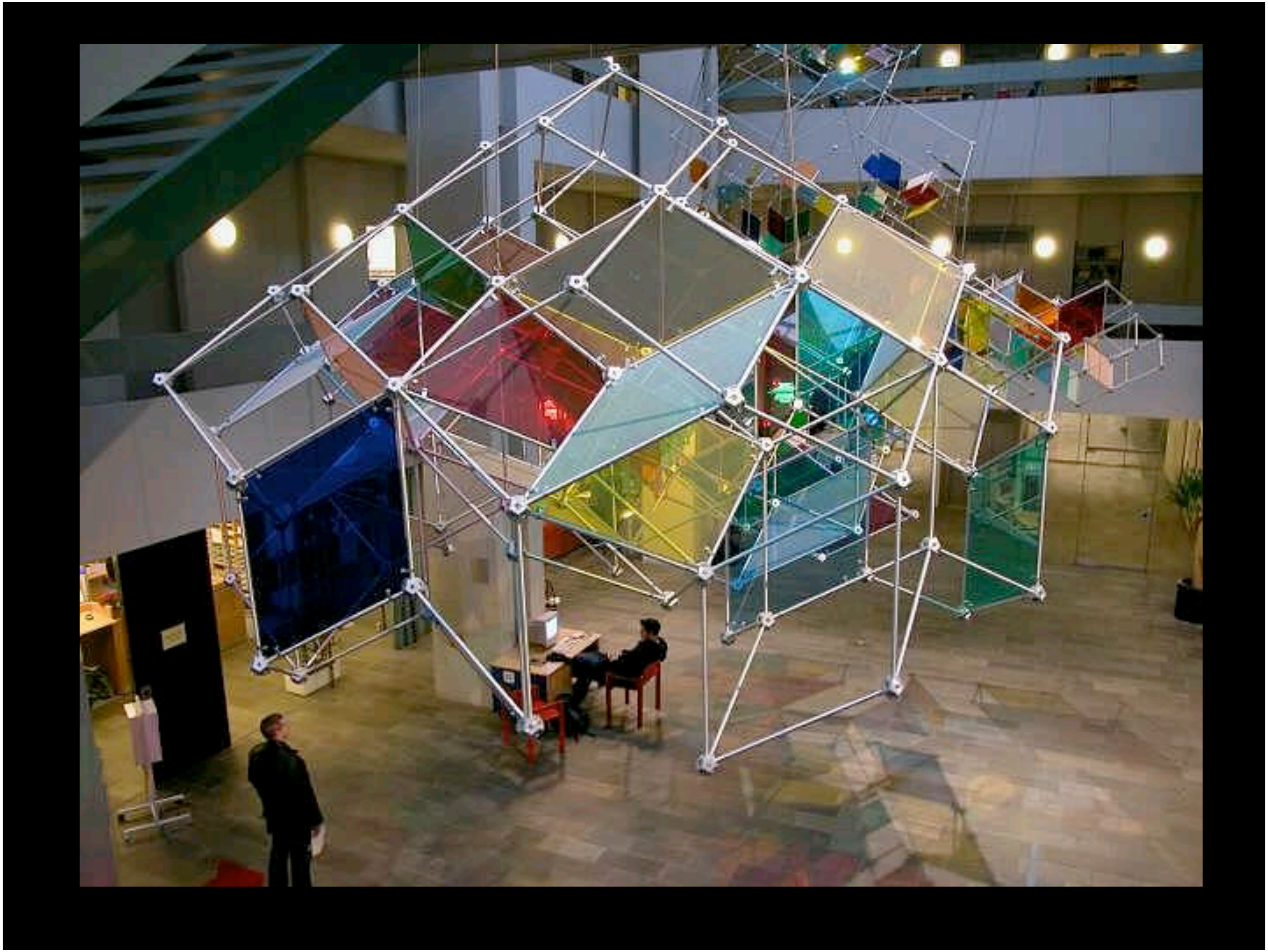


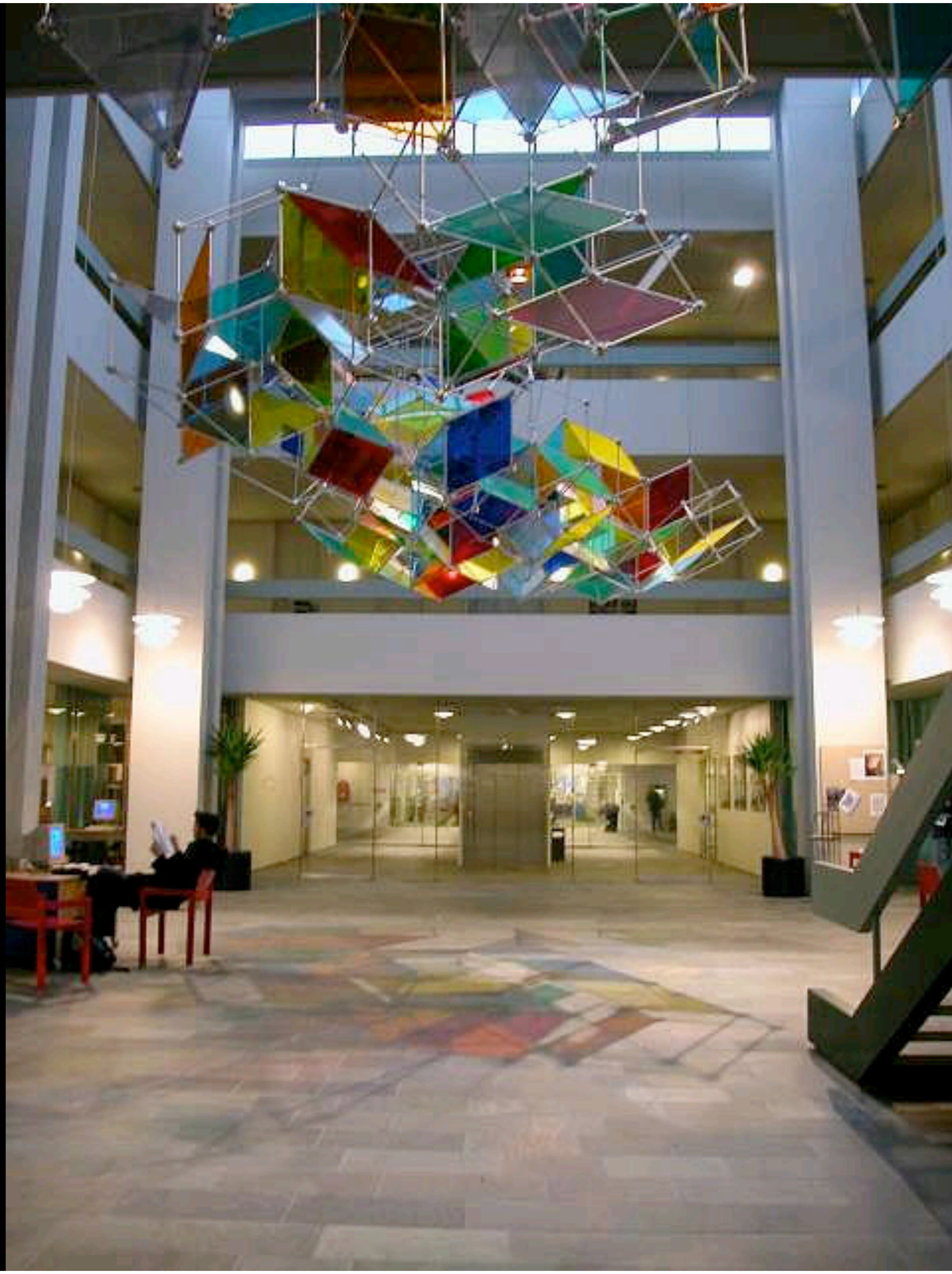


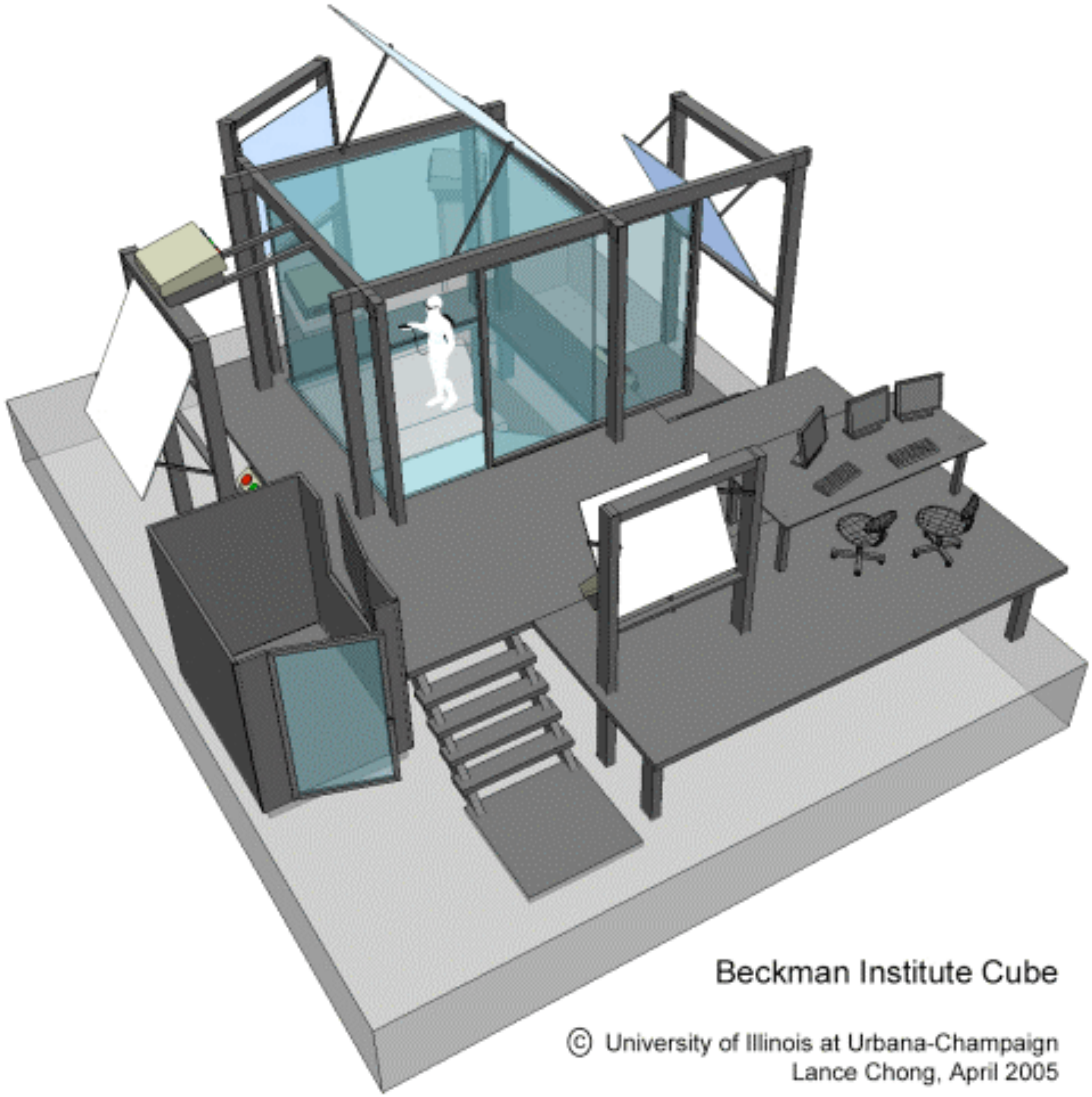




COAST
Tony Robbin 1994
Danish Technical University
Erik Reitzel - engineer
RCM Precision - fabrication
Poul Ib Hendriksen - photos

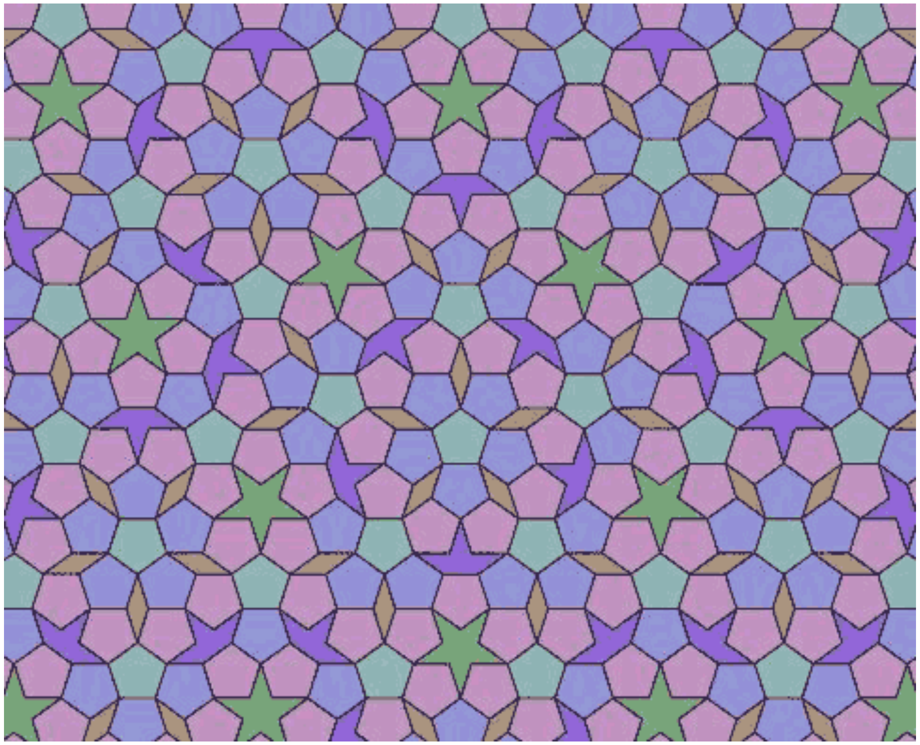




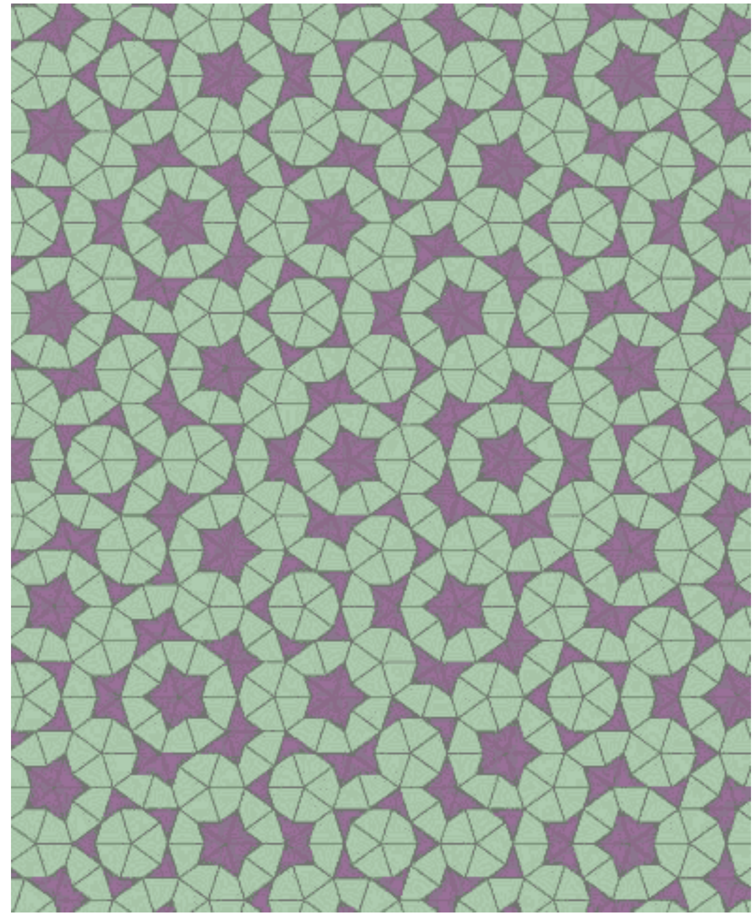


Beckman Institute Cube

© University of Illinois at Urbana-Champaign
Lance Chong, April 2005

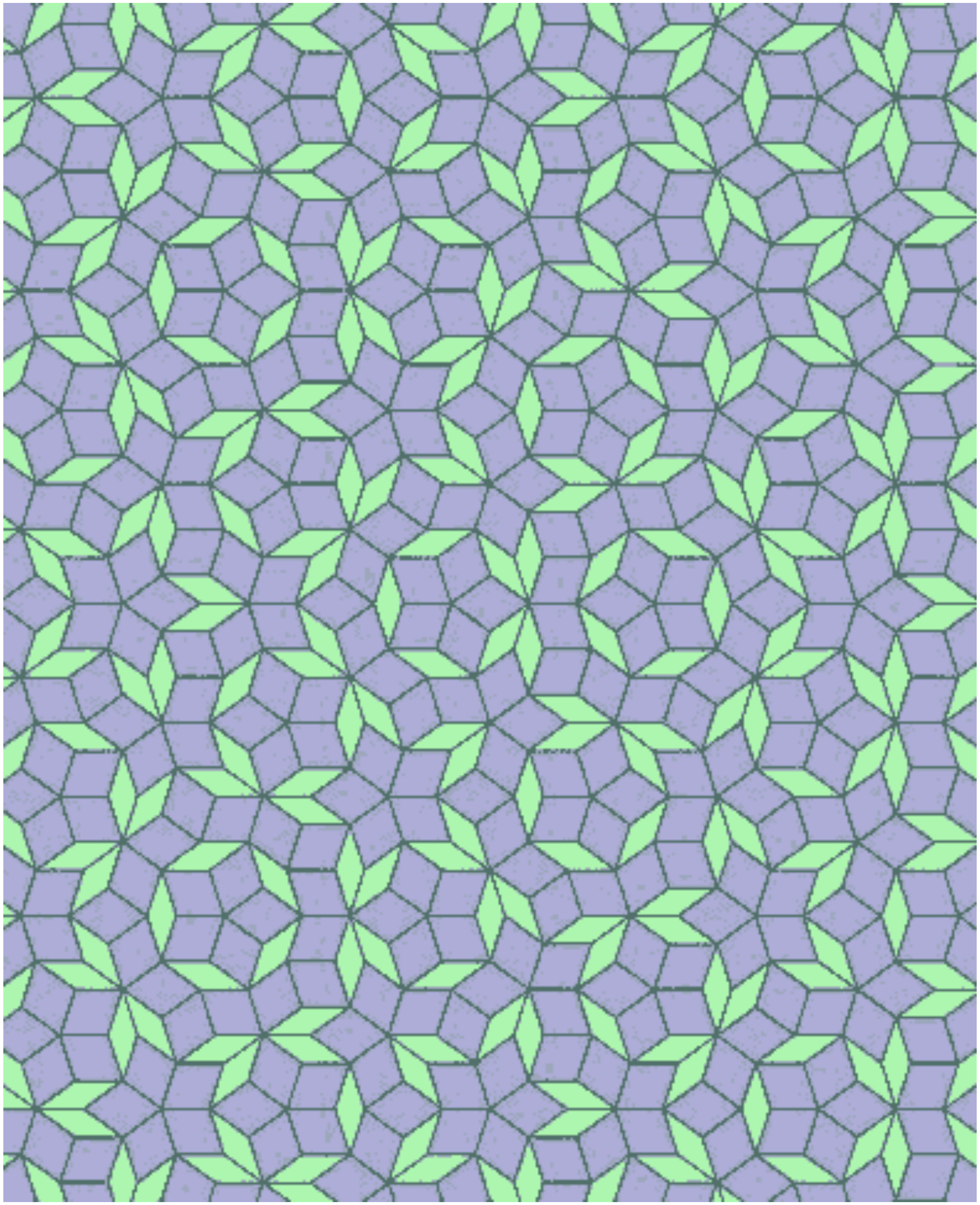


Early Penrose Tiling



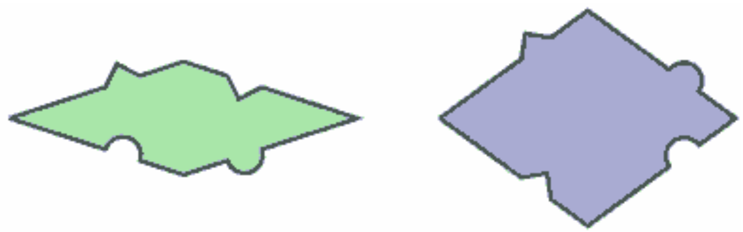
Later Penrose Tiling

David Austin, “Penrose Tiles Talk Across Miles” AMS 2005

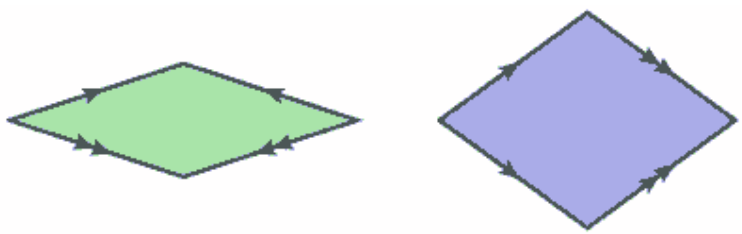


Penrose Tiling
with fat and skinny
rhombi

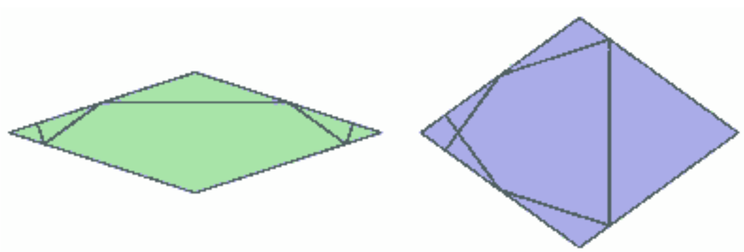
Skinny and Fat Rhombi



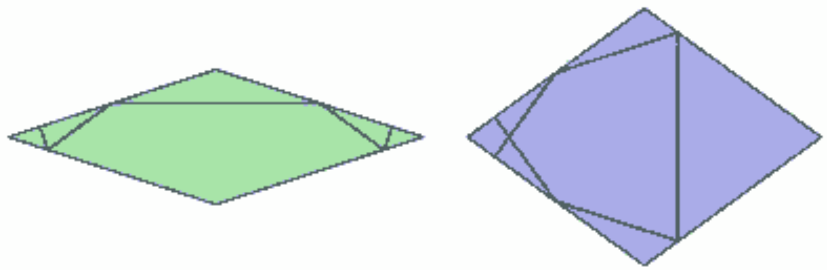
With decorations permitting only certain fittings



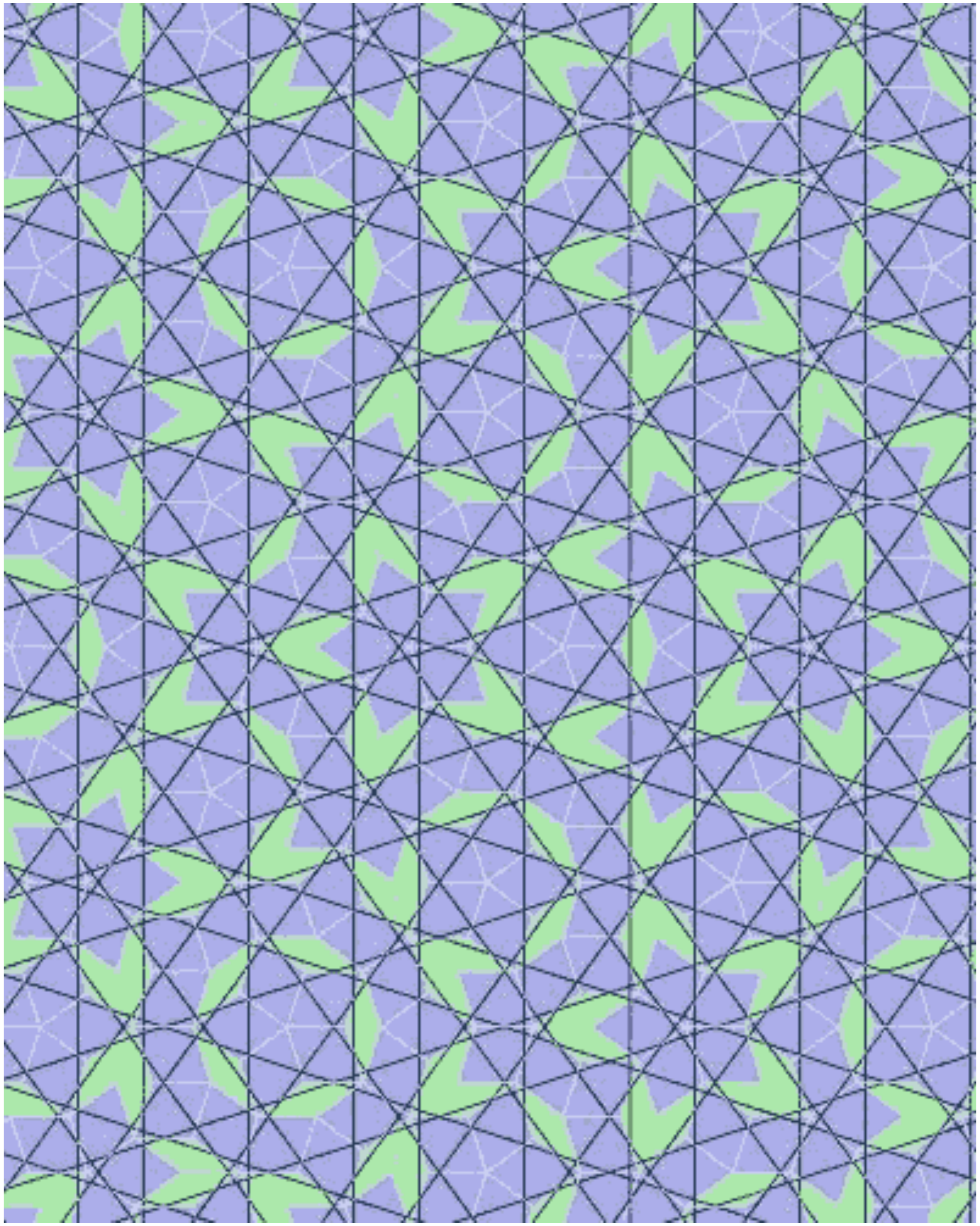
Easy to draw decorations



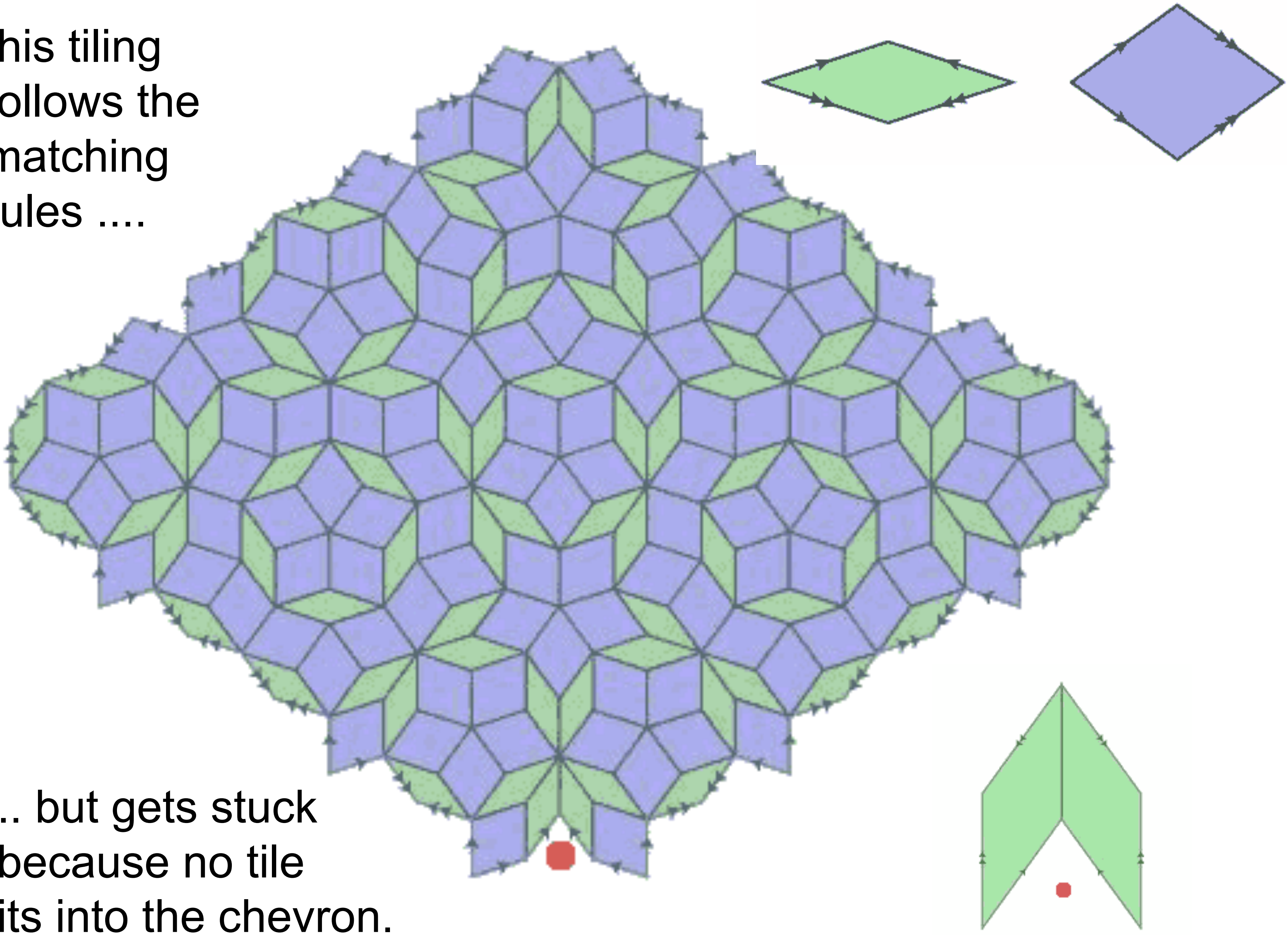
Ammann’s decorations



Robert Ammann's Decorations

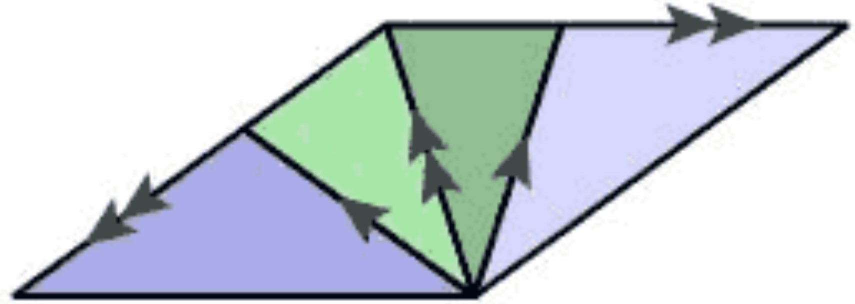


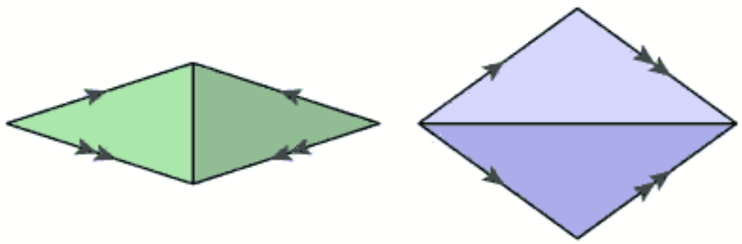
this tiling follows the matching rules ....

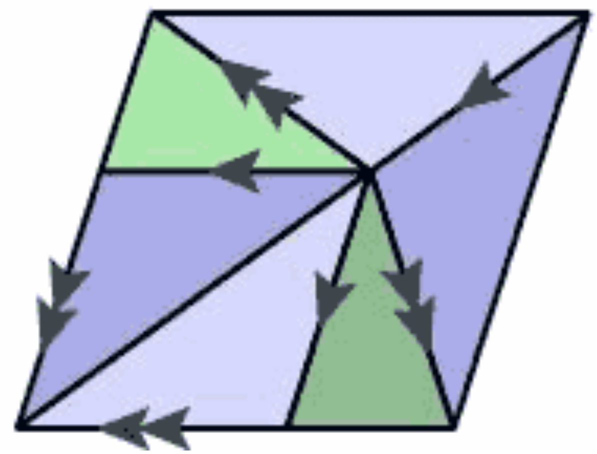


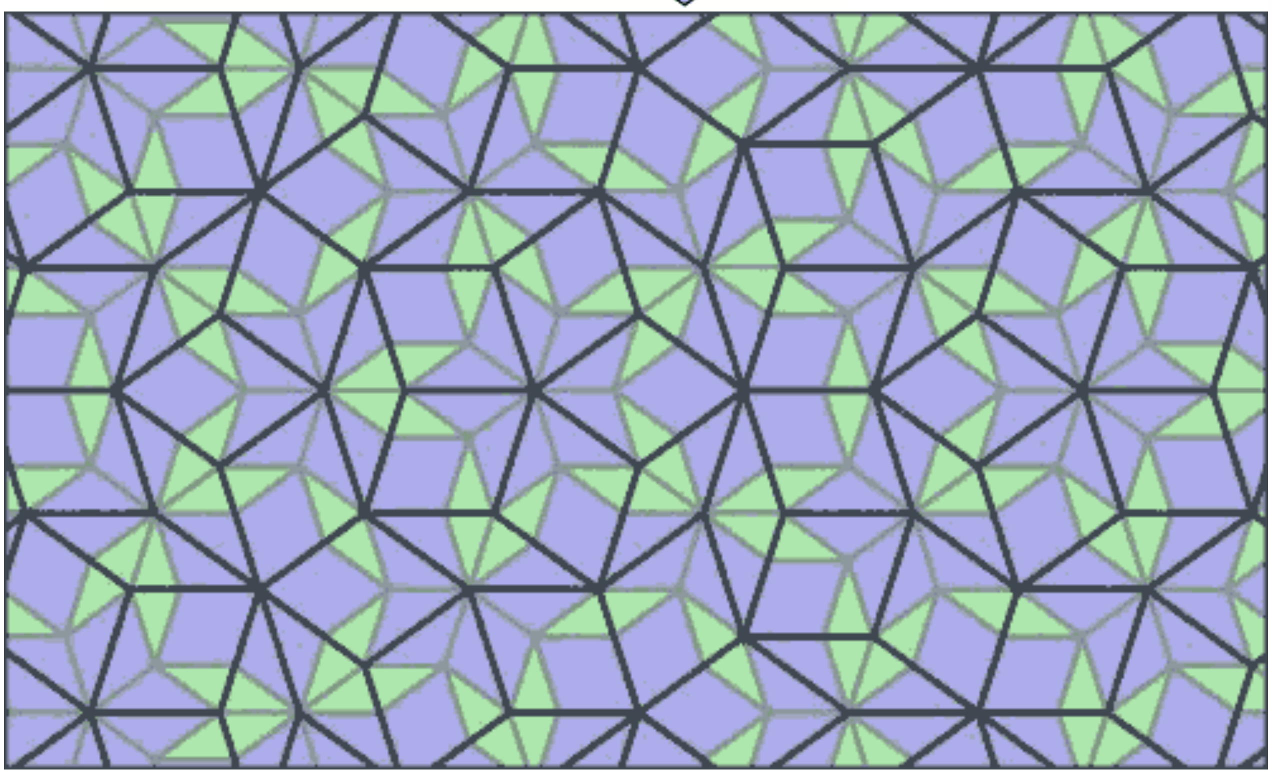
... but gets stuck because no tile fits into the chevron.

Inflation: half rhombi fit together into enlargements of the rhombi which fint into enlargements of the rhombi....

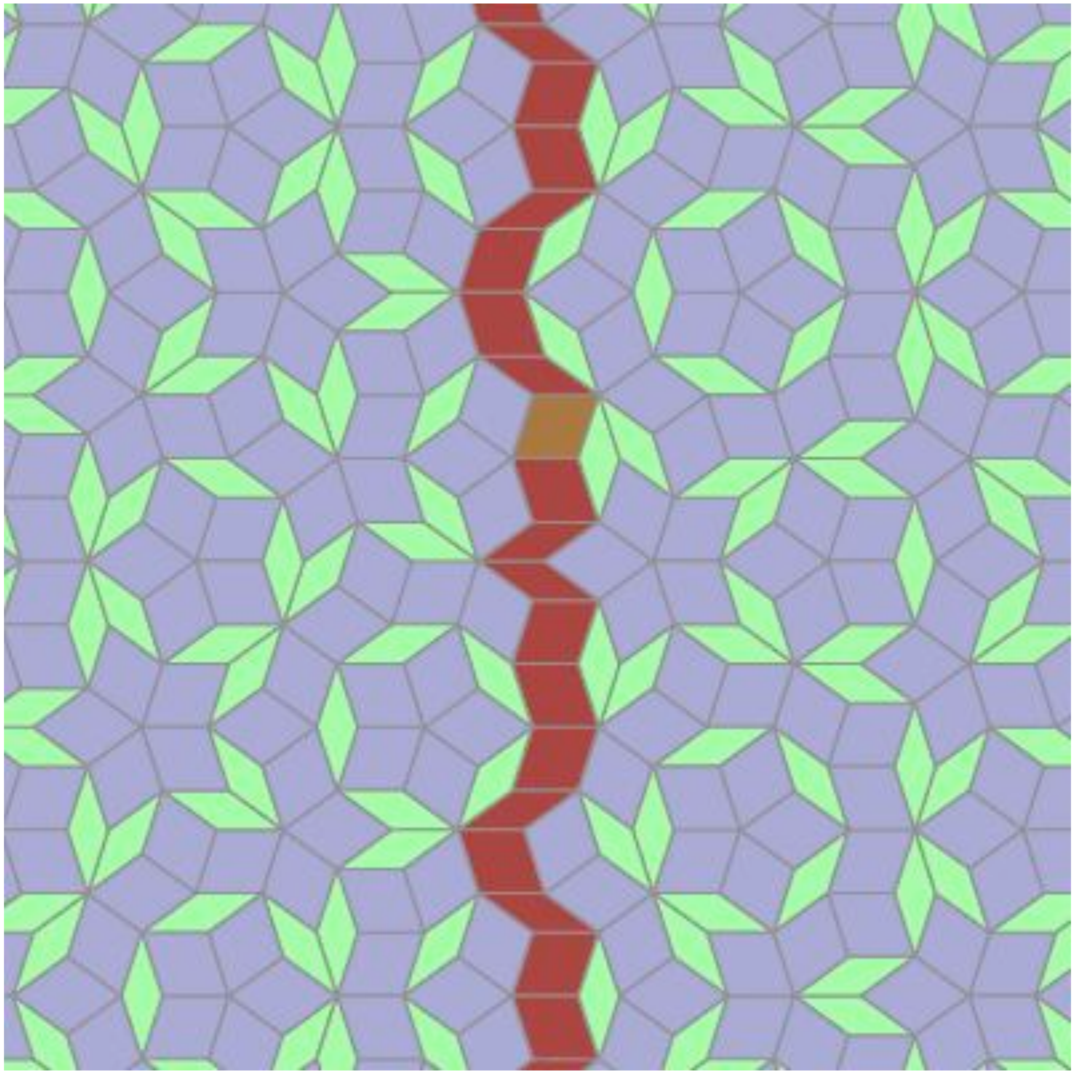


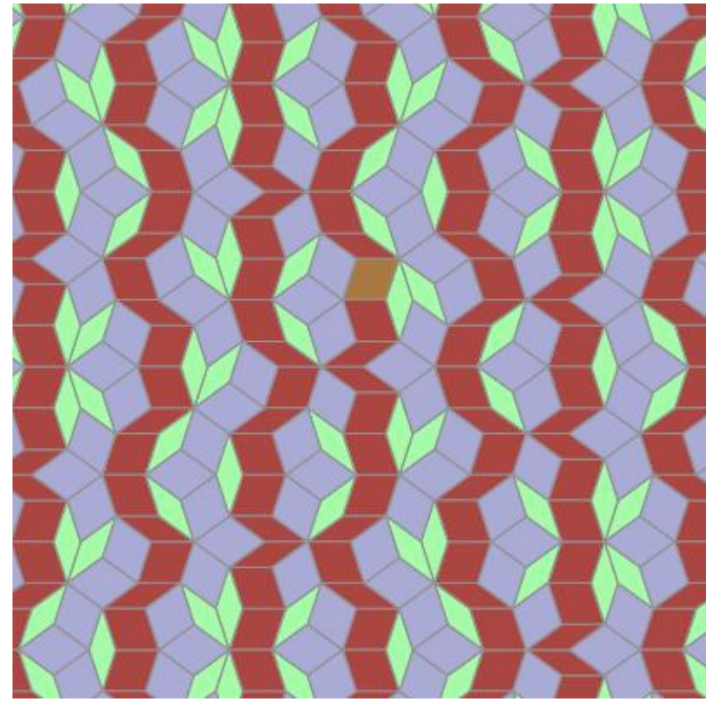


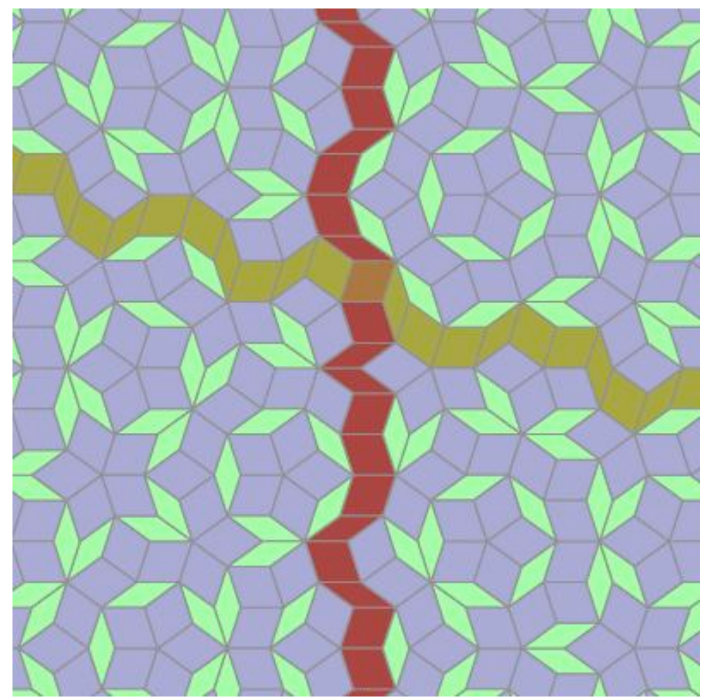




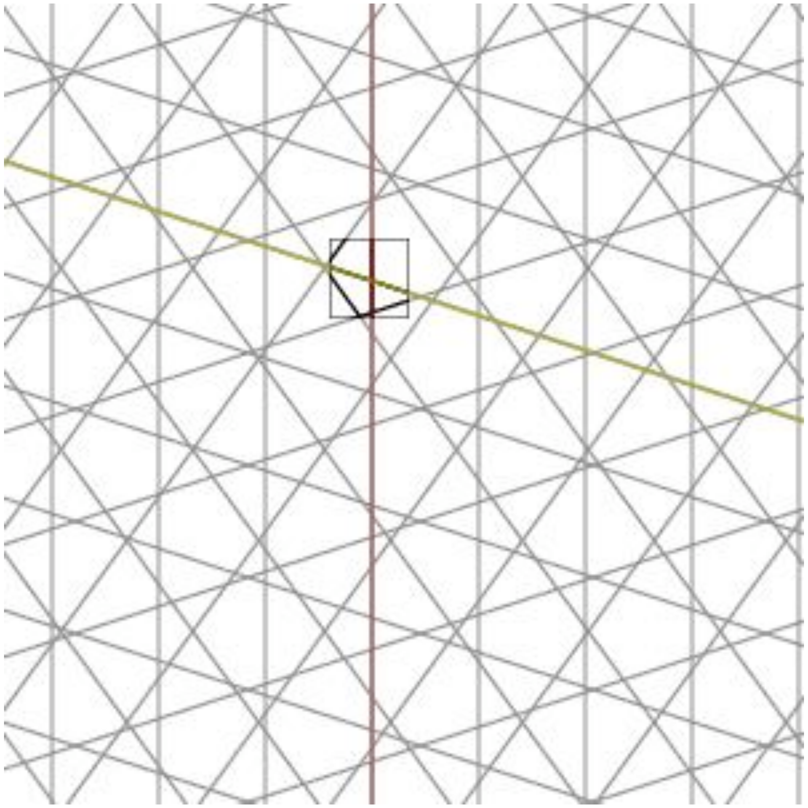
...yielding a hierarchy of inflations.

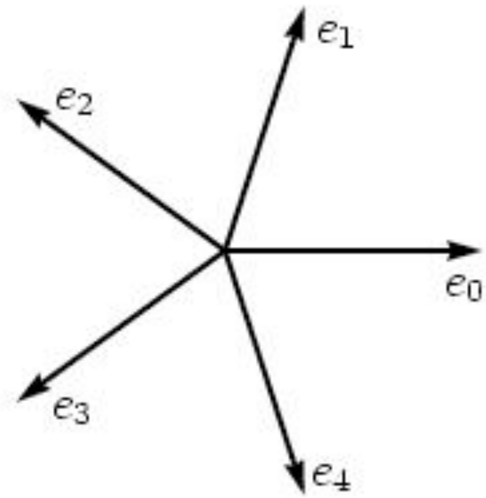


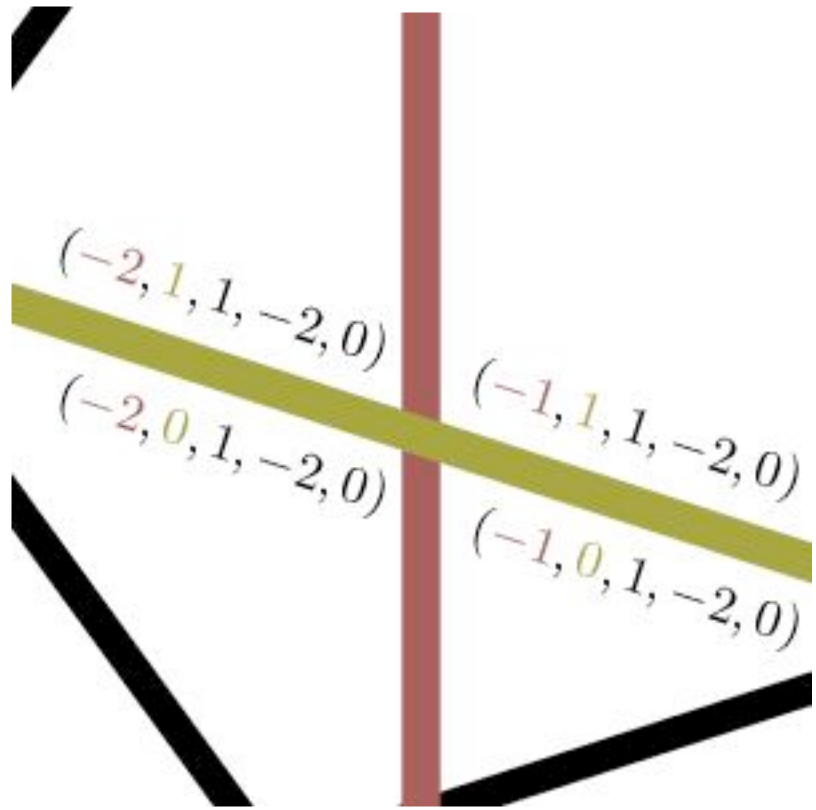




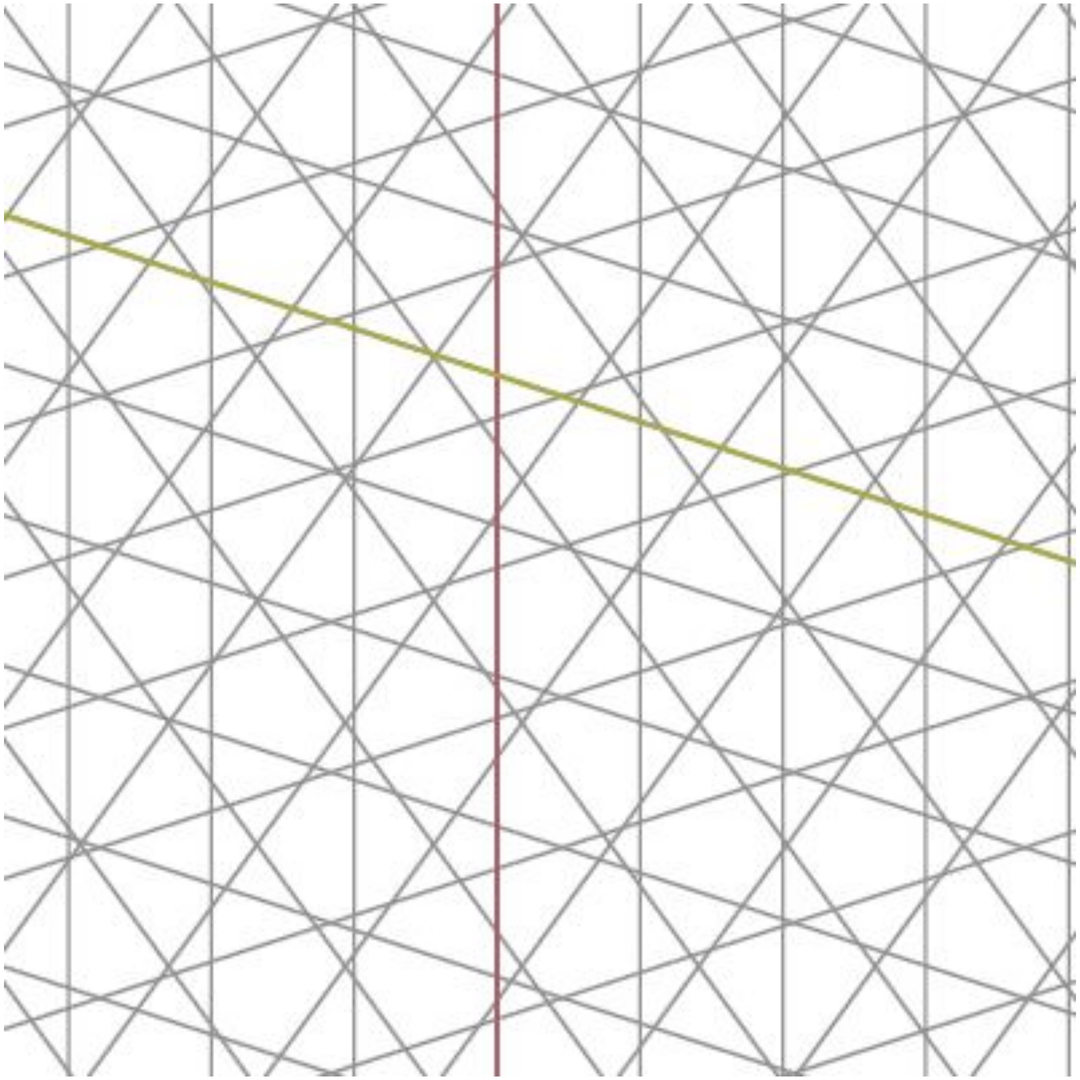
Follow a ribbon
(tapeworm?) with
all ties parallel.



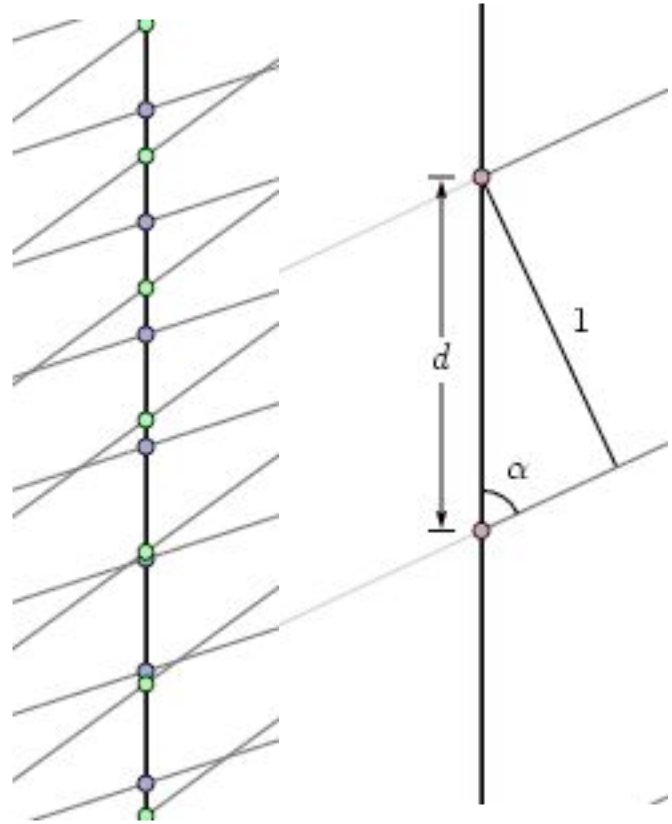




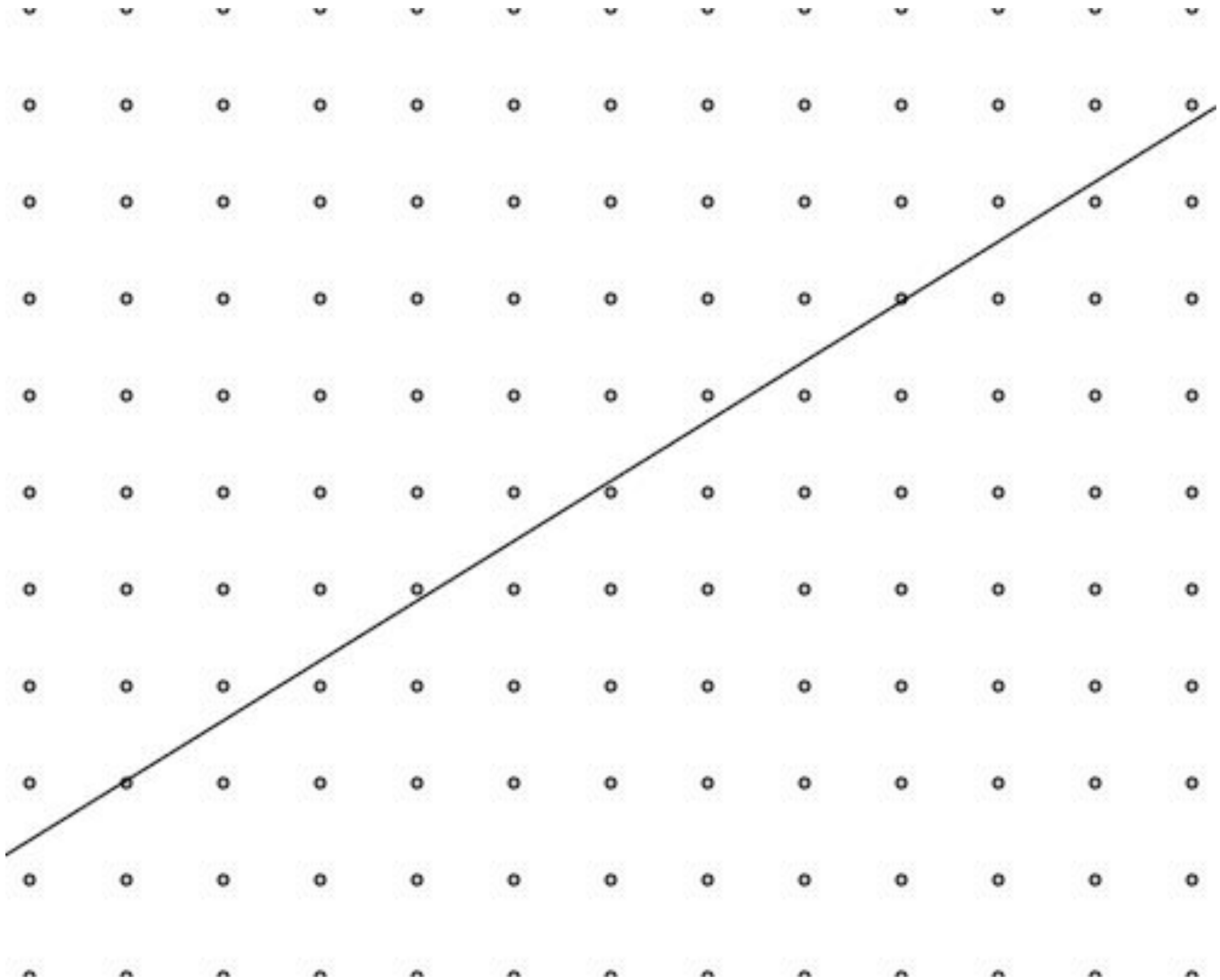
DeBruijn's Pentagrid

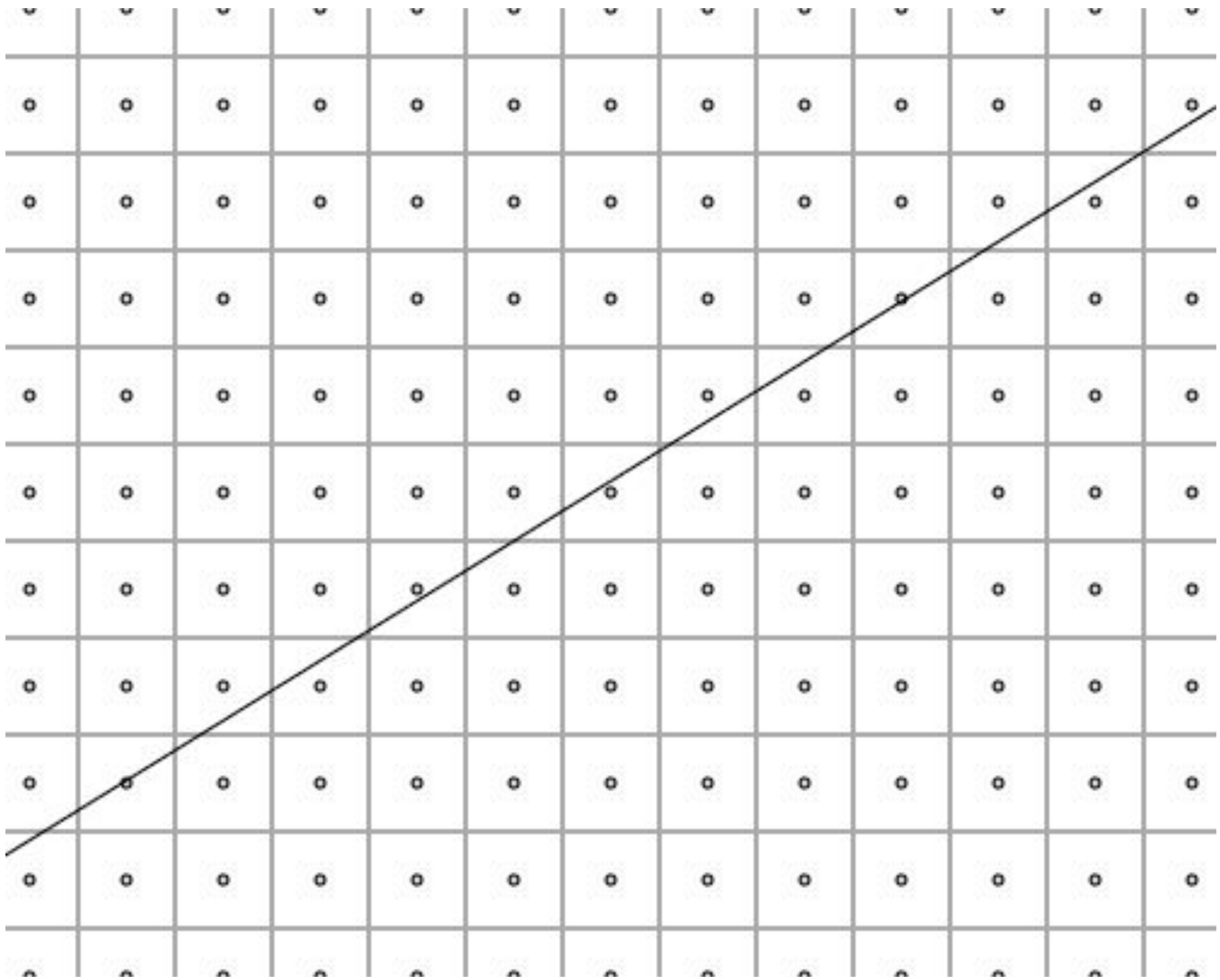


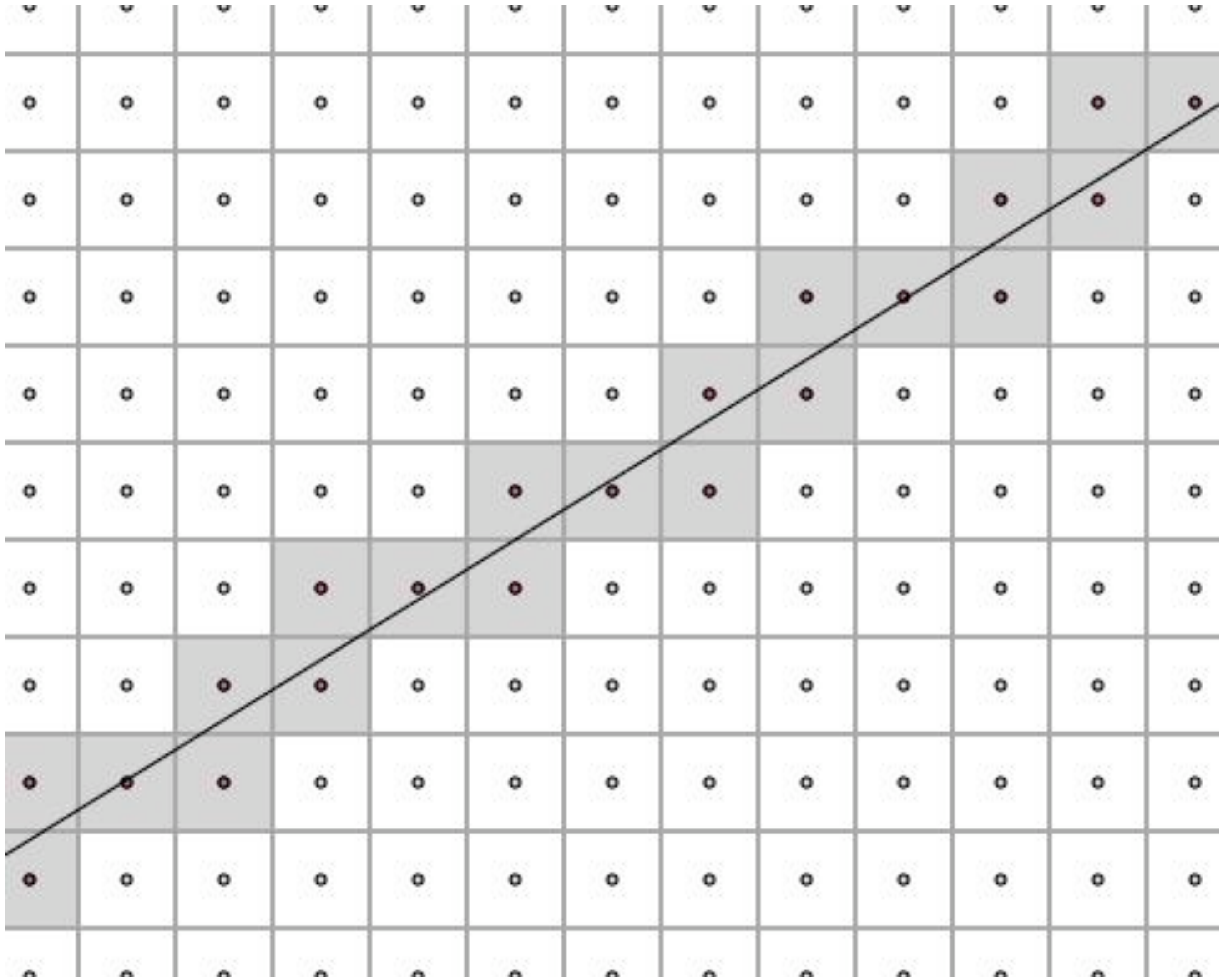
DeBruijn’s Pentagrid with ribbons.

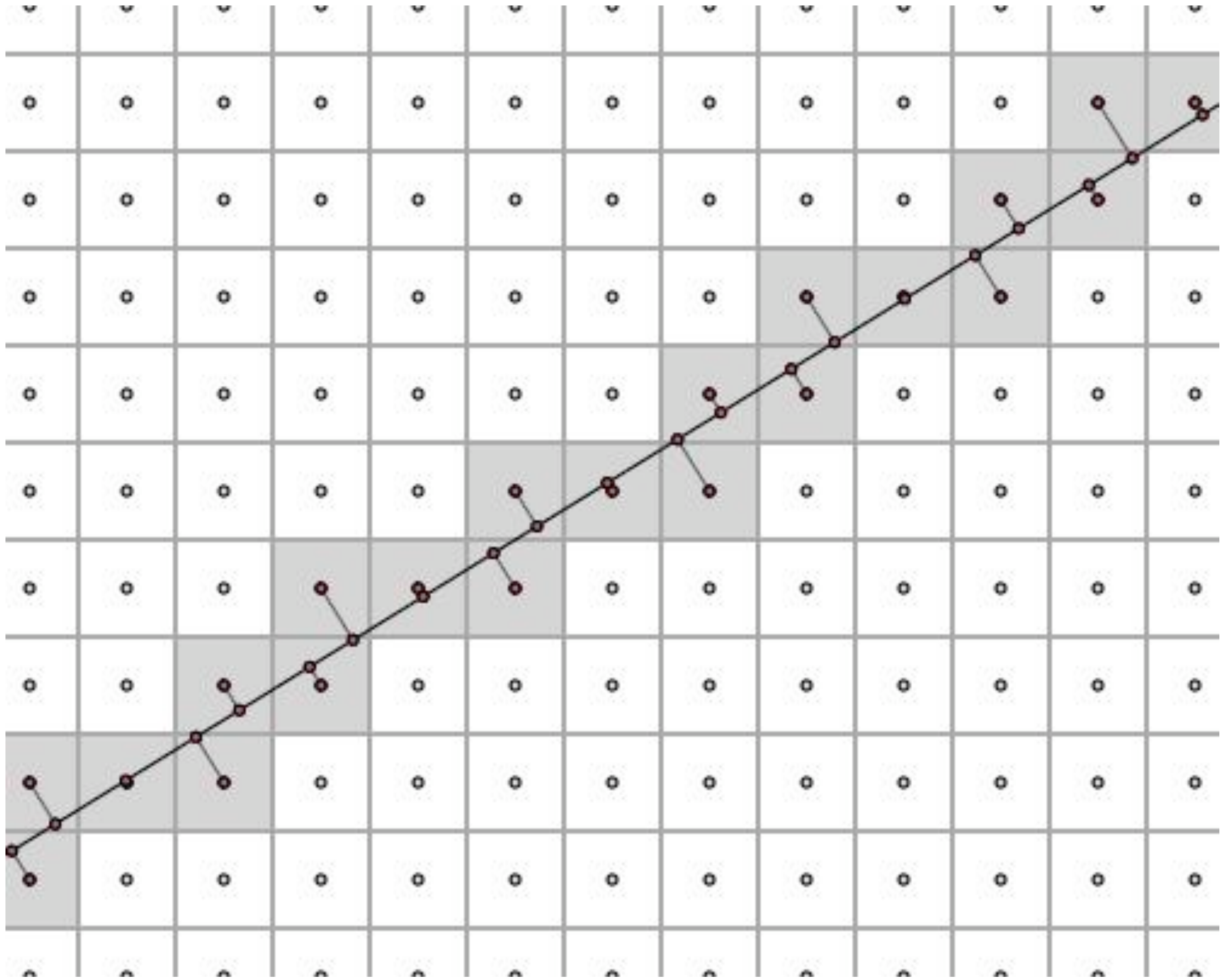


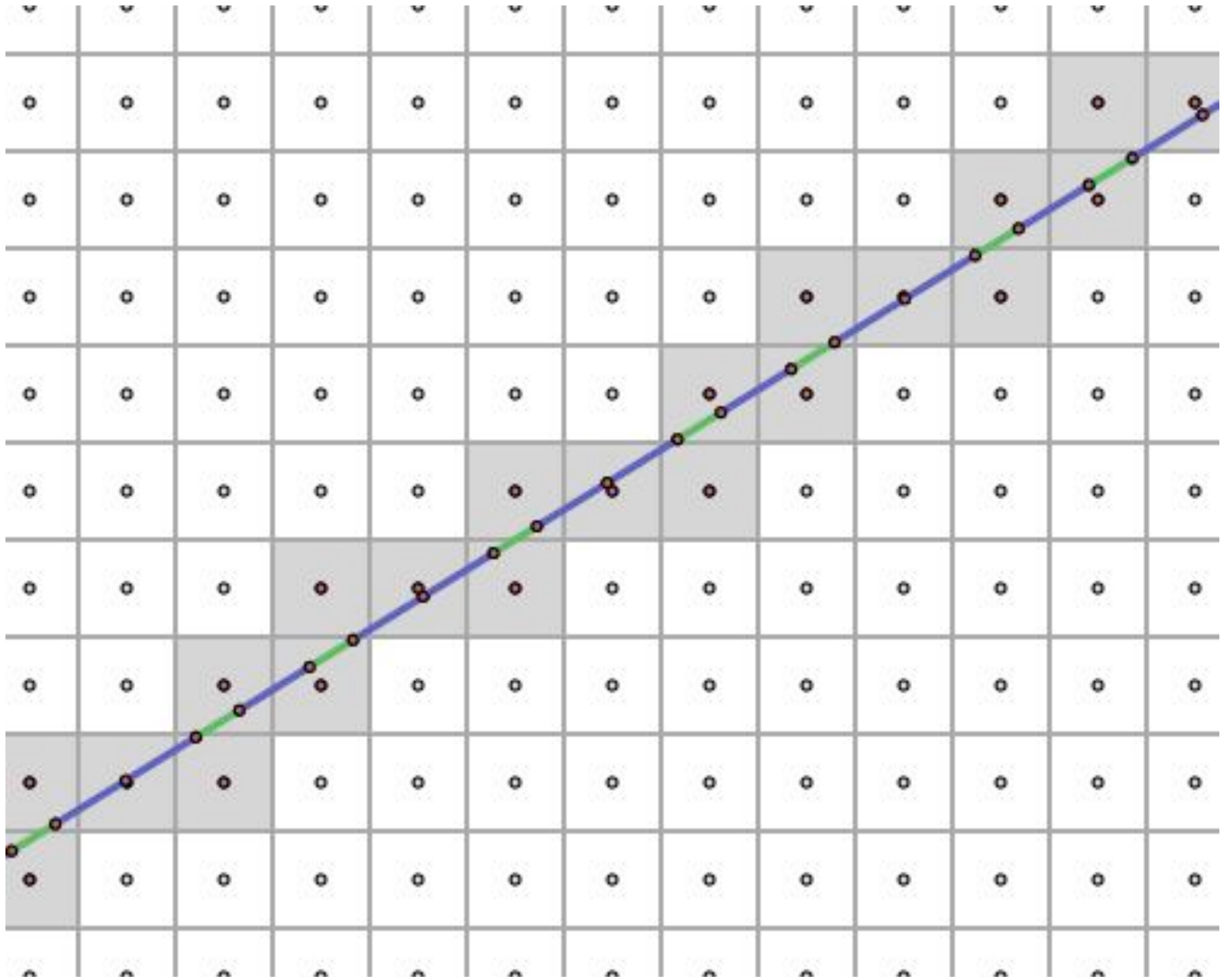
Frequence of skinny
to fat ribbons is golden

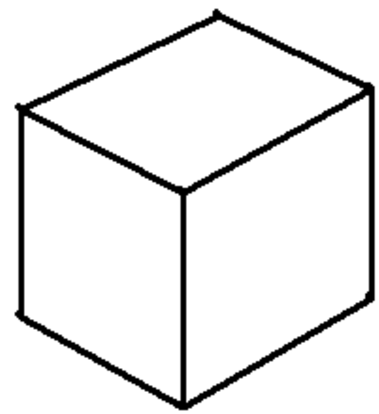


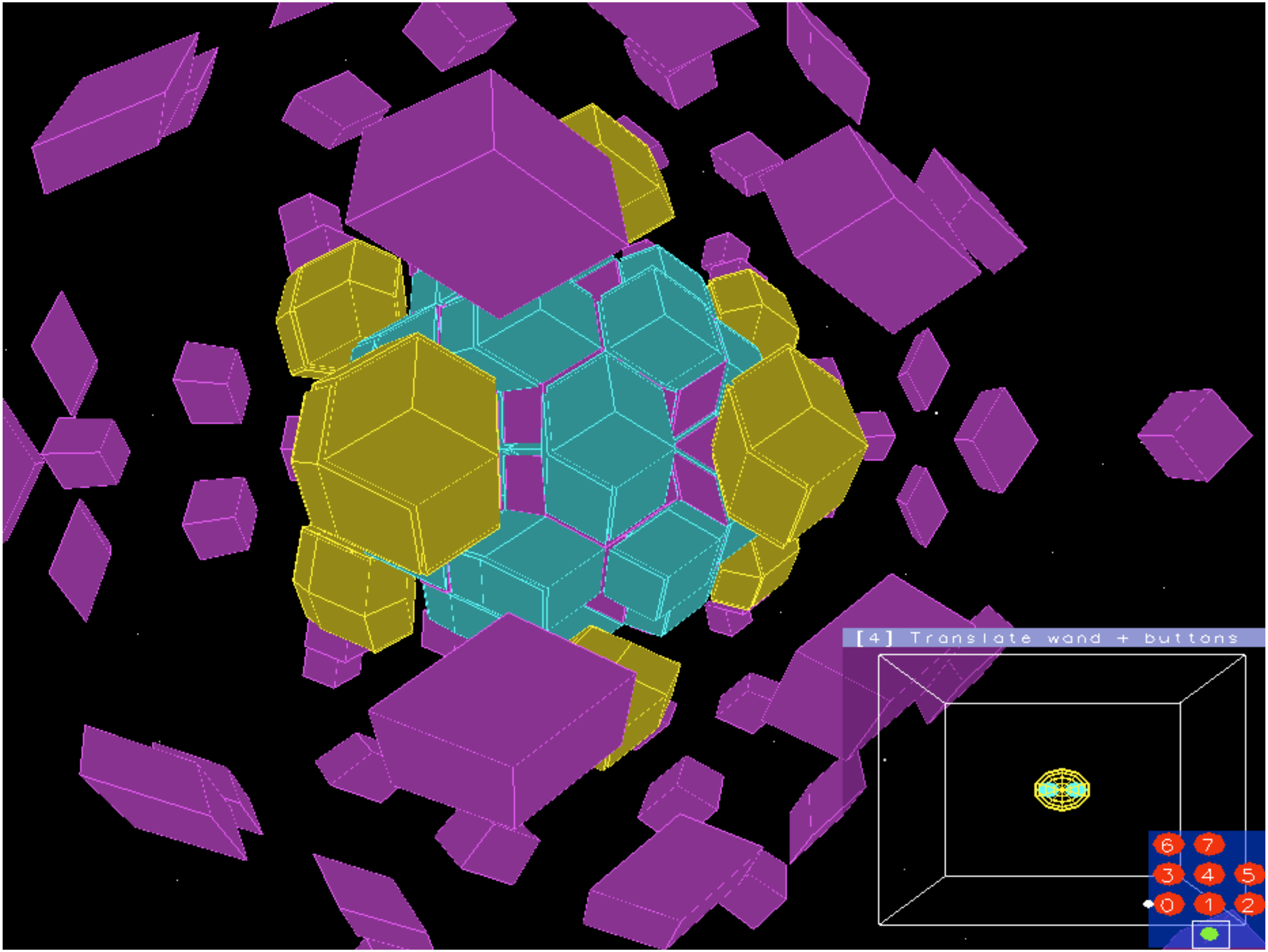











[4] Translate wand + buttons
6
7
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1
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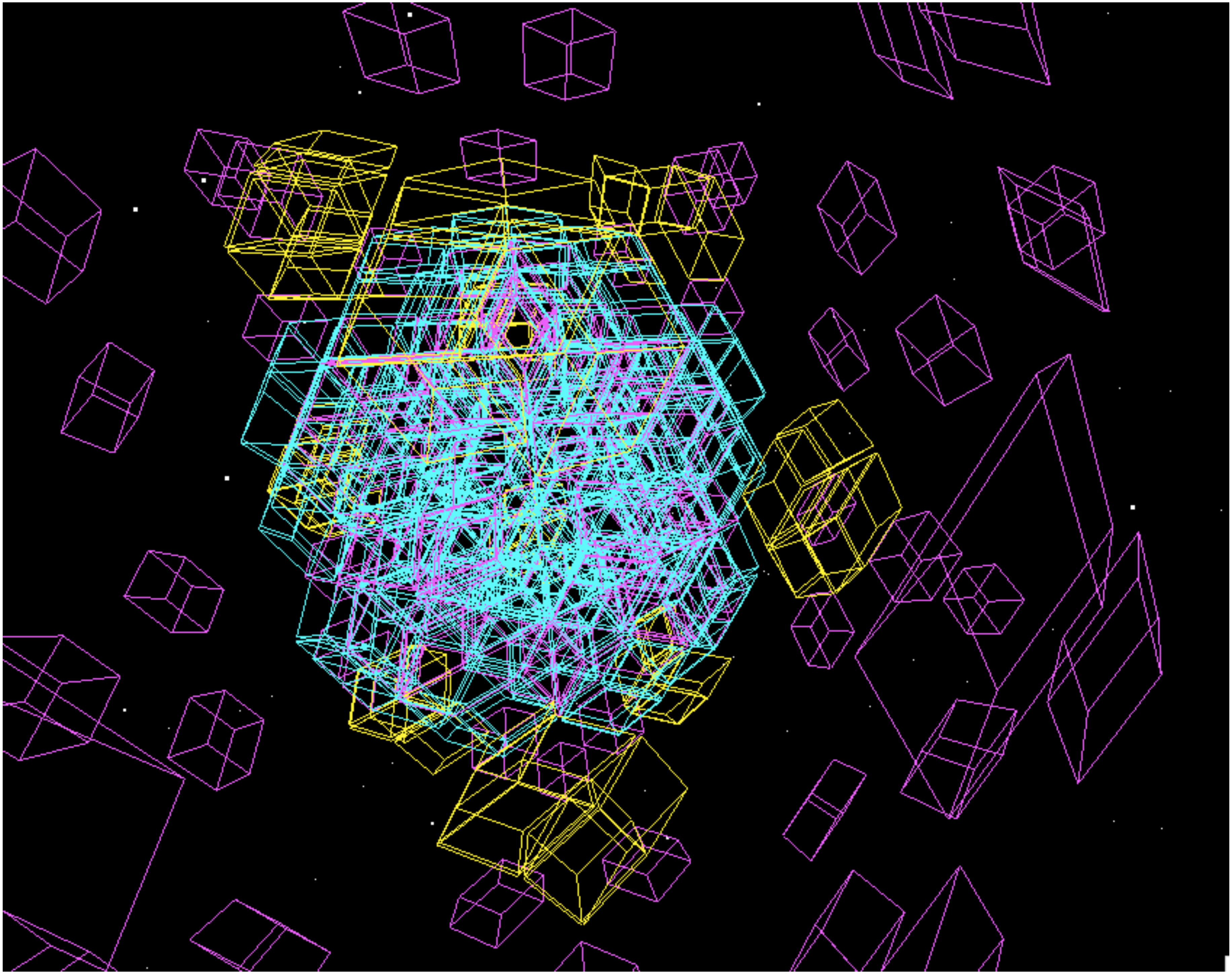
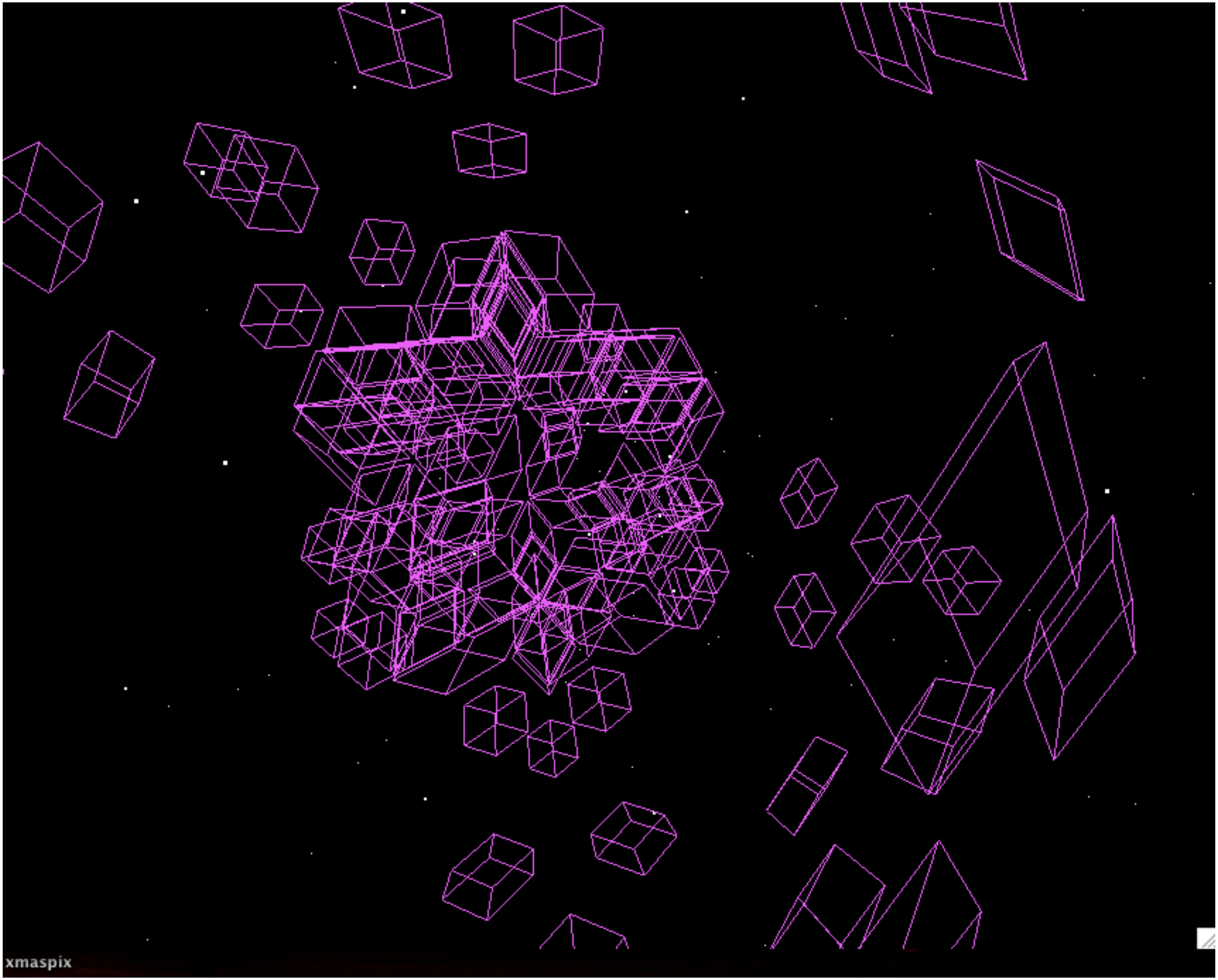
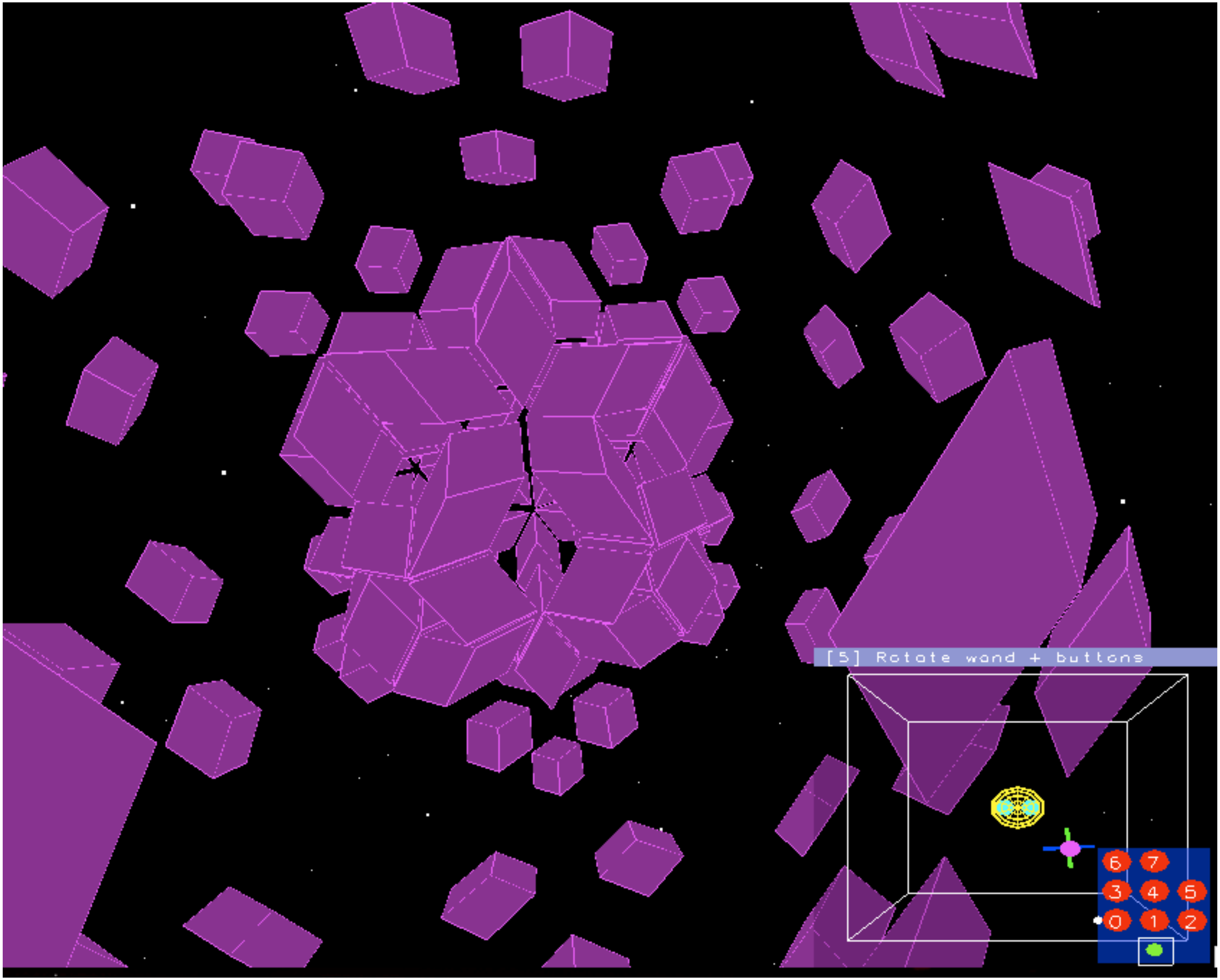


Quasipy MattGregory oct2006



Quasipy MattGregory oct2006



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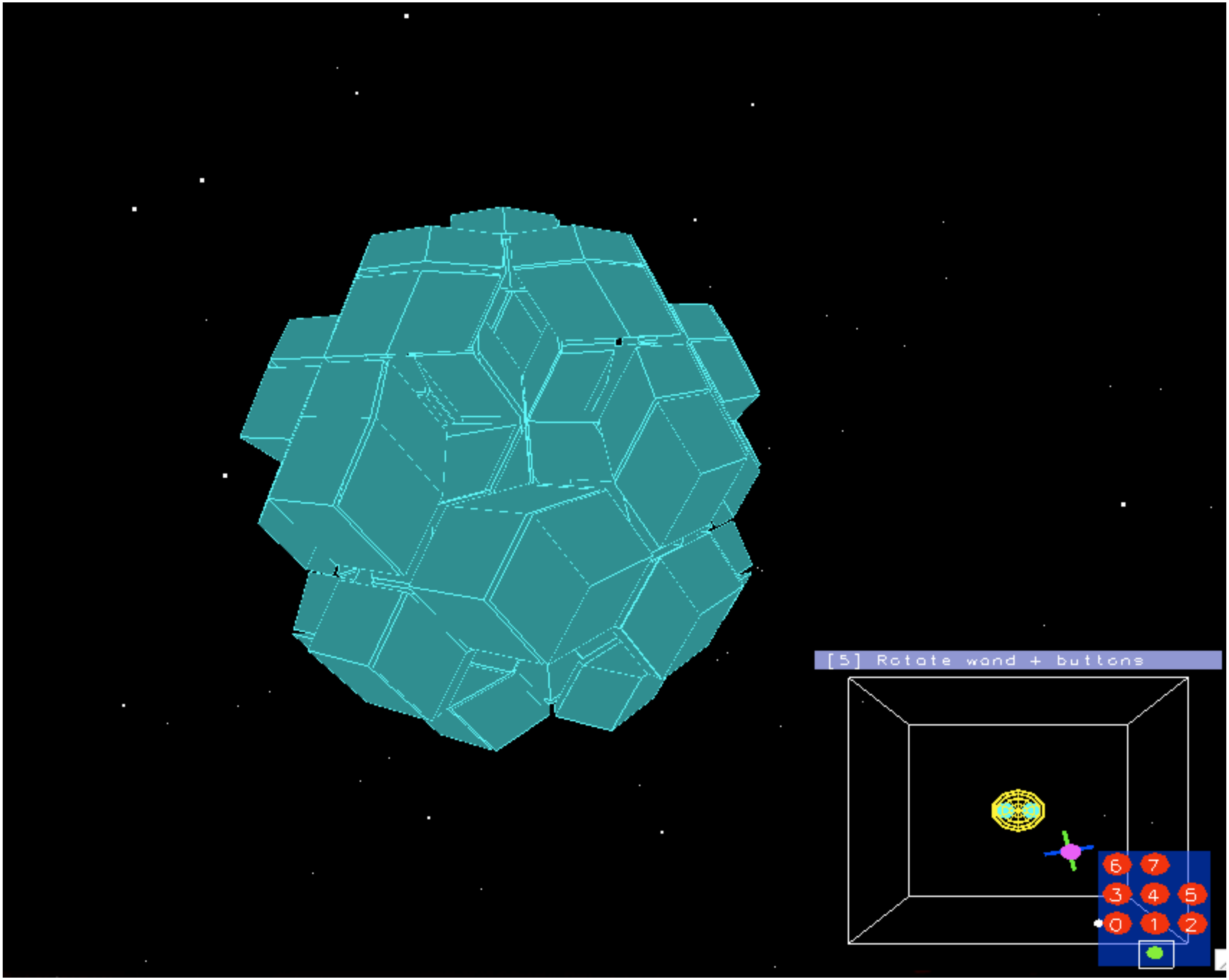
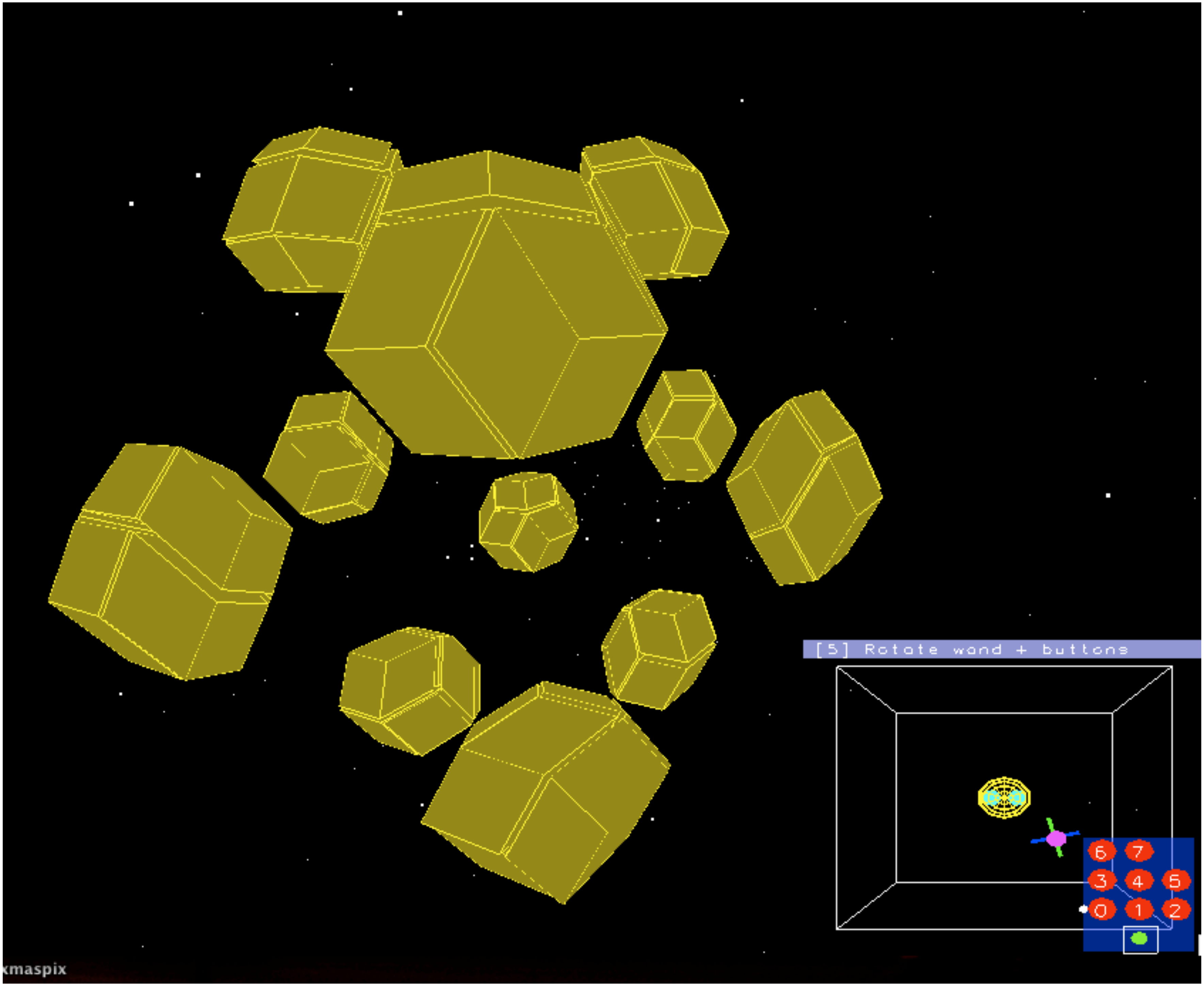


Quasipy MattGregory oct2006



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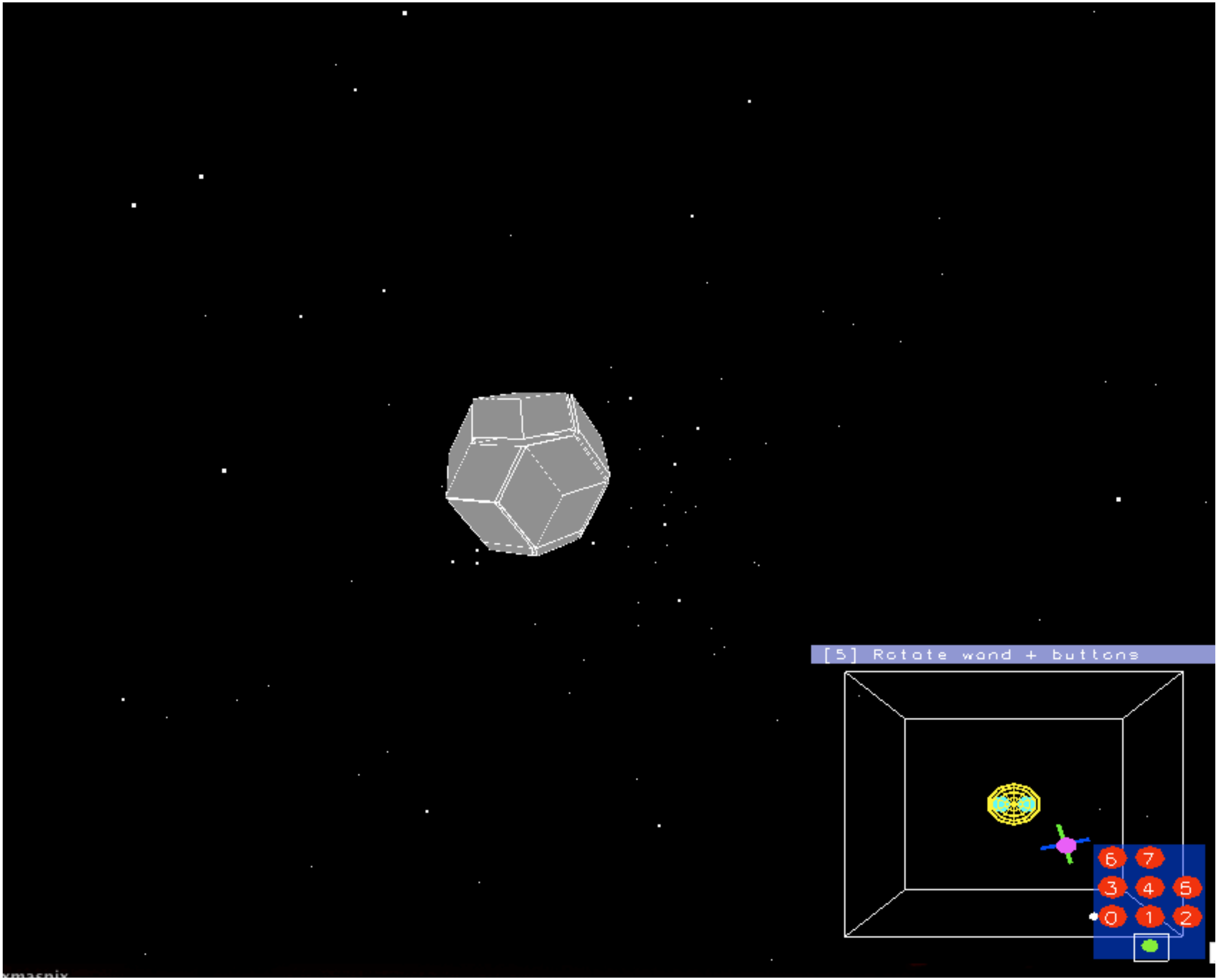
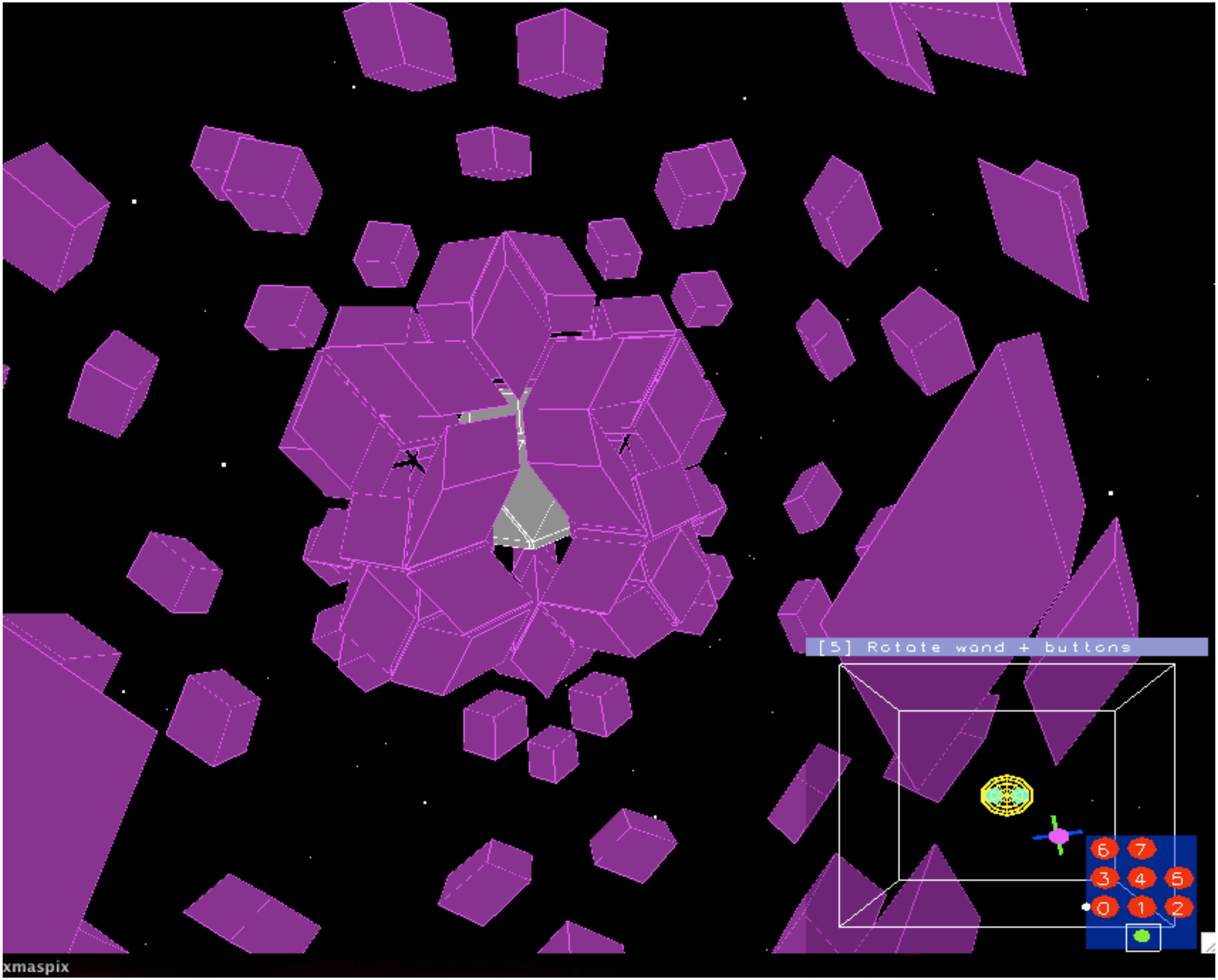


Quasipy MattGregory oct2006

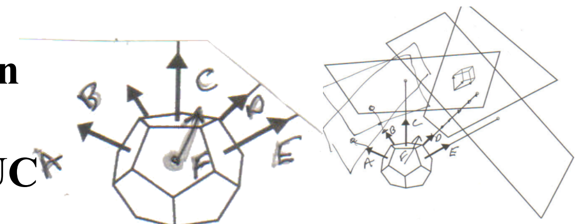


Quasipy MattGregory oct2006

Our Goal:

Quasi.py: A visualization of quasicrystals in PC cluster based virtual environments

By: Matthew Gregory, Sophomore, CS, UIUC



email Sketch, Robbin, 7/22/2006

http://tonyrobbin.home.att.net

- Abstract /

  - This collaboration with Tony Robbin realizes his 3D quasicrystal artwork in a fully immersive PC cluster-based distributed graphics system (Syzygy). We continue previous work by Adam Harrell, who realized DeBruijn's first method of projecting selected cells in a 6D lattice to 3D, and Mike Mangialardi's incomplete realization of DeBruijn's dual method in a Python script for Syzygy. Our project corrects errors in the previous projects and will provide a tool for Robbin to design new quasicrystal installations in virtual environments such as the CUBE and CANVAS at the UIUC.

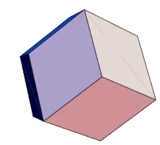
- Background Information
  - Quasicrystals are the three-dimensional analogue of the Penrose tiling of the two-dimensional plane.
  - Specific given sets of different cell types are used to tile three-dimensional space without generating a global symmetry.
  - DeBruijn's dual method creates two cell types, the "fat" and "skinny" golden rhombohedra, whose volumes are in the golden ratio.

- DeBruijn's Dual Method

1. Draw unit normals through each of the faces of a regular dodecahedron. This creates six "axes". Select a set of discrete points along these "axes", this program uses unit distances.
2. For each of the (6 choose 3 = 20) combinations of "axes", pick one of the points along each chosen "axis" that is in the previously selected set. Find the intersection of the planes perpendicular to the chosen "axes" which pass through the appropriate picked points.
3. Project this intersection point onto each of the "axes" and truncate it to the next lowest of the points in the discrete set. This gives a lattice point in six-dimensional space.
4. Beginning from this point, use a systematic method to find the remaining 7 points of a three-dimensional face of a six-dimensional hypercube.
5. Using the original matrix of six axis vectors, project this face into three-dimensional space.

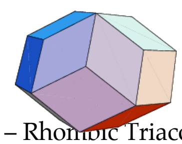
Exception: When 4 or more of these projections fall into the discrete set, it indicates the construction of a more complex cell, which is composed of smaller cells. These special cases are as follows:

4 – Rhombic Dodecahedron (12 sides, 4 cells)



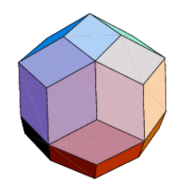
Picture taken from Wolfram Mathworld

5 – Rhombic Icosahedron (20 sides, 10 cells)

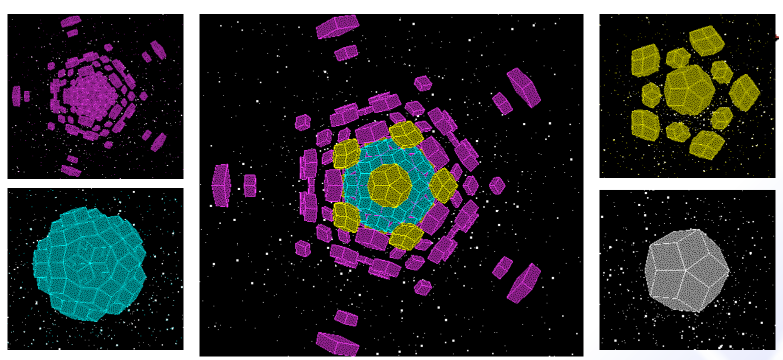


Picture taken from Wolfram Mathworld

6 – Rhombic Triacontahedron (30 sides, 20 cells)



Picture taken from Wolfram Mathworld



Our Results:

- Done correctly, cells pack without intersection, forming a quasicrystal.

http://new.math.uiuc.edu/im2006/gregory

[redacted]