Workshop Esculturas Generativas

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Workshop Esculturas Generativas

PROGRAMA:

Space, the final frontier: o que é o espaço volumétrico abstracto computacional.

O que é o Voxel. Exemplos de Técnicas de poligonização tridimensional.

Instalação e uso das bibliotecas de código s373.net/x *ofxMarchingCubes* e *s373.marchingcubes* para openFrameworks e Processing.

Análise e uso de programas exemplo de Modelação de Volumes Tridimensionais com o som, gestos, sensores, câmaras, algoritmos generativos.

Criação de retratos 3D com a aplicação Eu-Abstracto. (http://s373.net/folio/projects/eu-abstracto/)

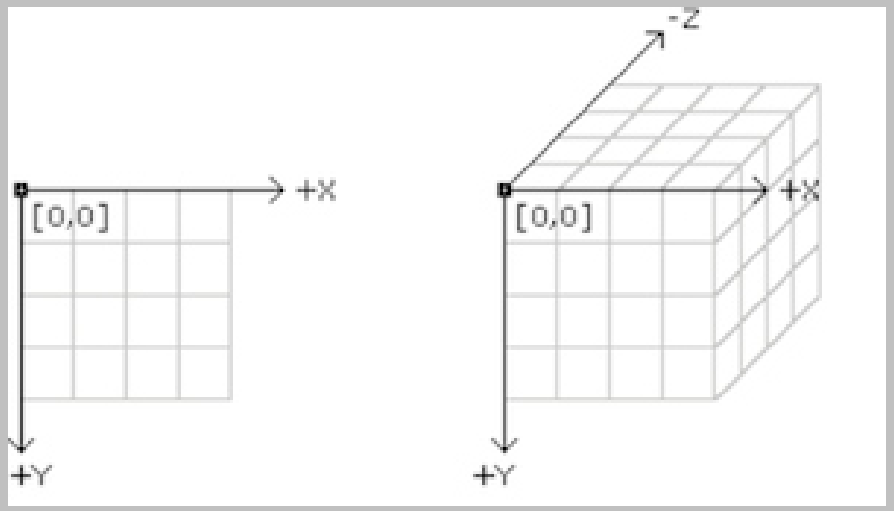
Gravação de ficheiros .stl.

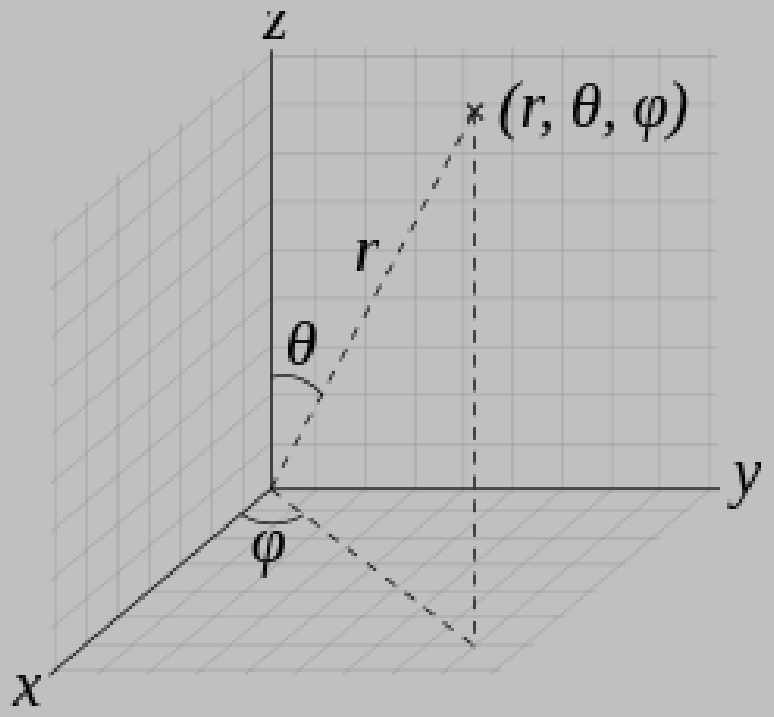
Limpeza e escala do .stl no Blender e preparação no Cura para a impressão 3d.

Impressão 3D de objectos criados pelos participantes.

Space, the final frontier

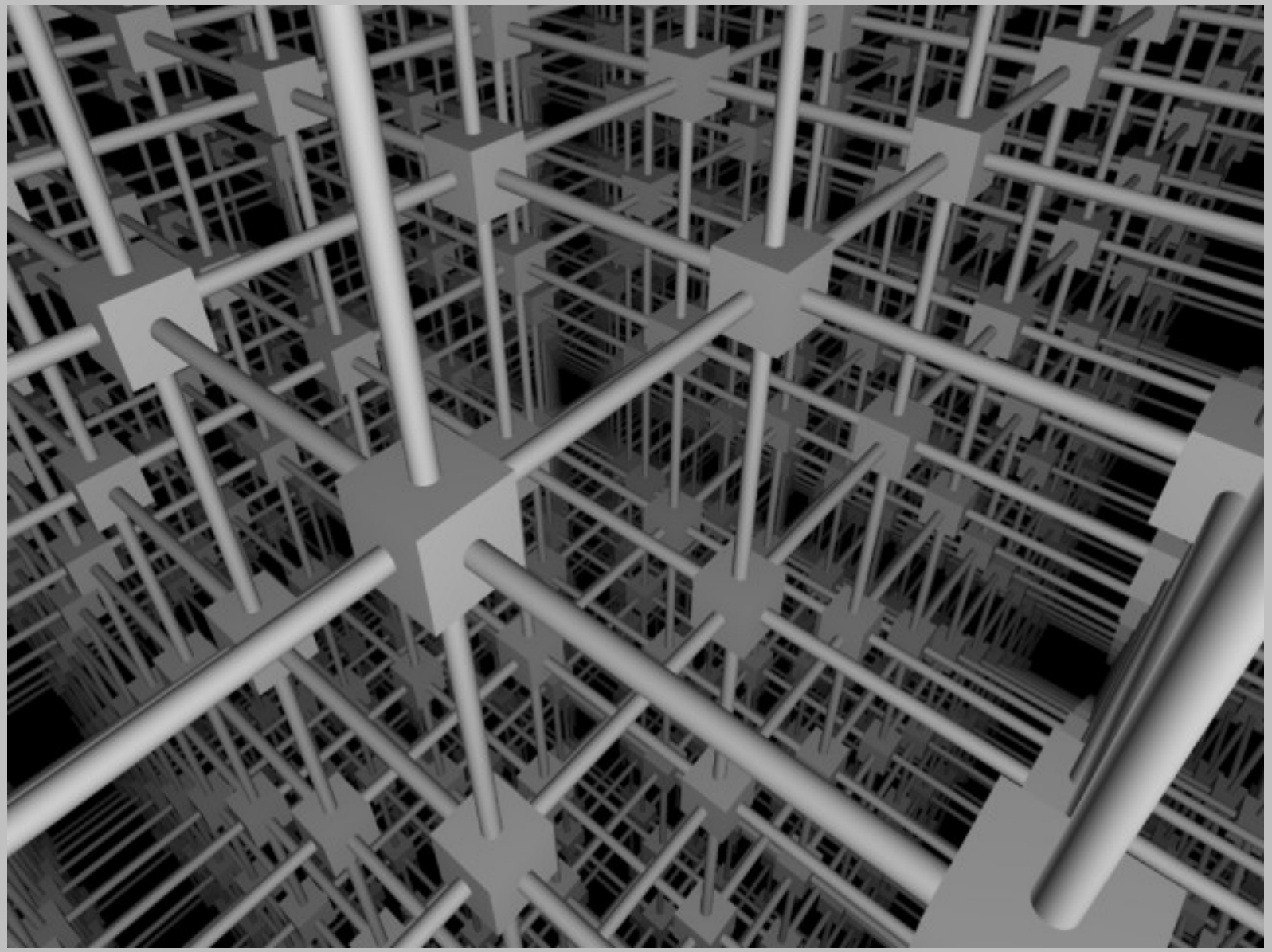
- Sistemas de coordenadas cartesiano e polar





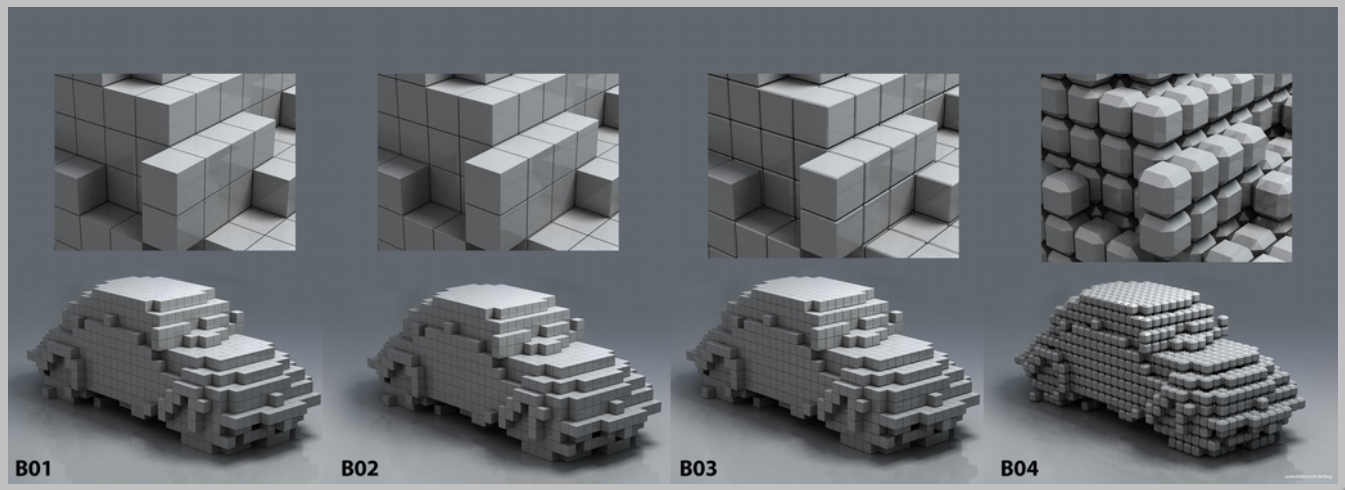
Imagens processing.org e wikipedia

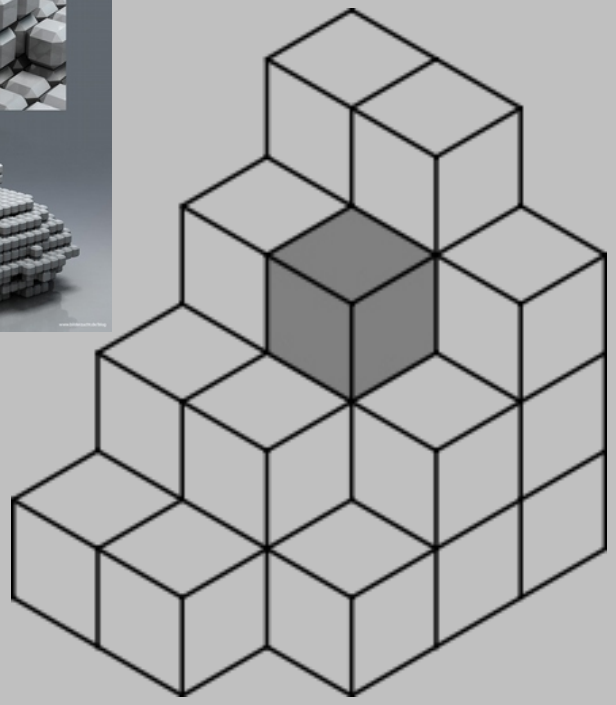
Space, the final frontier



Voxel

- A voxel represents a value on a regular grid in three-dimensional space.
- Voxel is a portmanteau for "volume" and "pixel" where pixel is a combination of "picture" and "element".





Polygonizing a scalar field

- Paul Bourke, 1994
  http://paulbourke.net/geometry/polygonise/
- Also known as: "3D Contouring", "Marching Cubes", "Surface Reconstruction"
- Based on tables by Cory Gene Bloyd

Polygonising a scalar field

Also known as: "3D Contouring", "Marching Cubes", "Surface Reconstruction"

Written by Paul Bourke
May 1994

Based on tables by Cory Gene Bloyd along with
additional example source code marchingsource.cpp

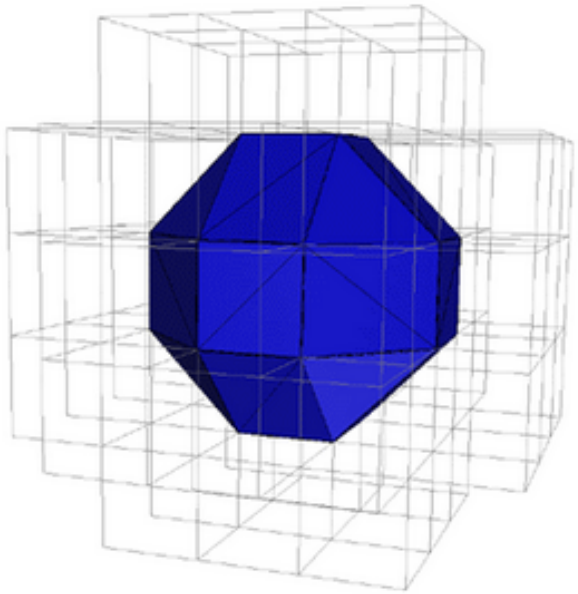
An alternative table by Geoffrey Heller.

rchandra.zip: C++ classes contributed by Raghavendra Chandrashekara.

OpenGL source code, sample volume: cell.gz (old)

volexample.zip: An example showing how to call polygonise including a sample MRI dataset.

Qt_MARCHING_CUBES.zip: Qt/OpenGL example courtesy Dr. Klaus Miltenberger.



Polygonising a scalar field

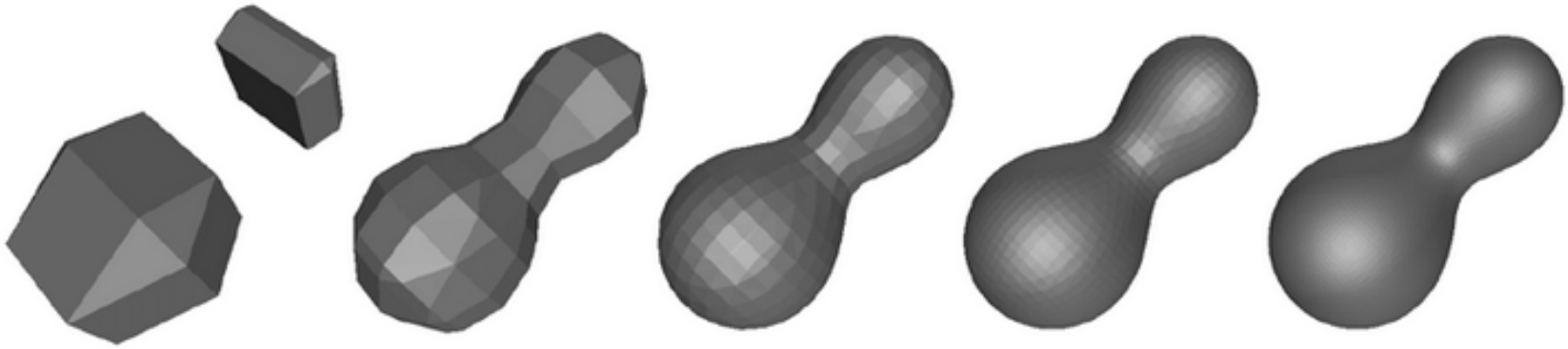
- There are many applications for this type of technique, two very common ones are:
  - Reconstruction of a surface from medical volumetric datasets. For example MRI scans result in a 3d volume of samples at the vertices of a regular 3D mesh.
  - Creating a 3D contour of a mathematical scalar field. In this case the function is known everywhere but is sampled at the vertices of a regular 3D grid.

Another example

Lets say vertex 0 and 3 are below the isosurface. cubeindex will then be 0000 1001 == 9. The 9th entry into the egdeTable is 905_{hex} == 1001 0000 0101 which means edge 11,8,2, and 0 are cut and so we work out the vertices of the intersection of the isosurface with those edges.
Next, 9 in the triTable is 0, 11, 2, 8, 11, 0. This corresponds to 2 triangular facets, one between the intersection of edge 0 11 and 2. The other between the intersections along edges 8 11 and 0.

Grid Resolution

One very desirable control when polygonising a field where the values are known or can be interpolated anywhere in space is the resolution of the sampling grid. This allows course or fine approximation to the isosurface to be generated depending on the smoothness required and/or the processing power available to display the surface. The following example is of two "bobby molecules" as specified by Blinn, generated at different grid sizes.



Grid size=10
70 Facets

Grid size=5
220 Facets

Grid size=2
1700 Facets

Grid size=1
6800 Facets

Grid size=0.5
27000 Facets

Source code

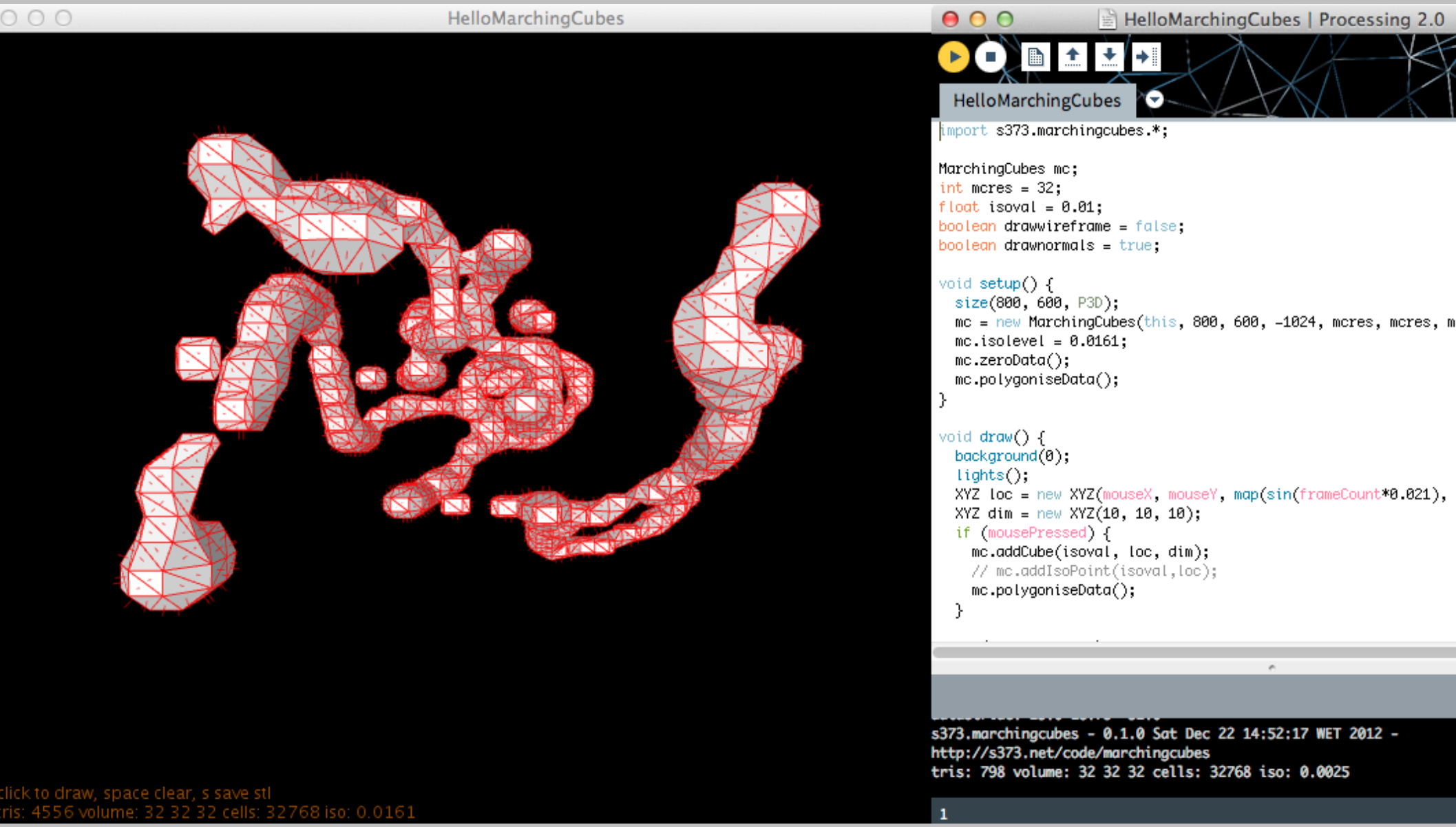
```
typedef struct {
   XYZ p[3];
} TRIANGLE;

typedef struct {
   XYZ p[8];
   double val[8];
} GRIDCELL;
```

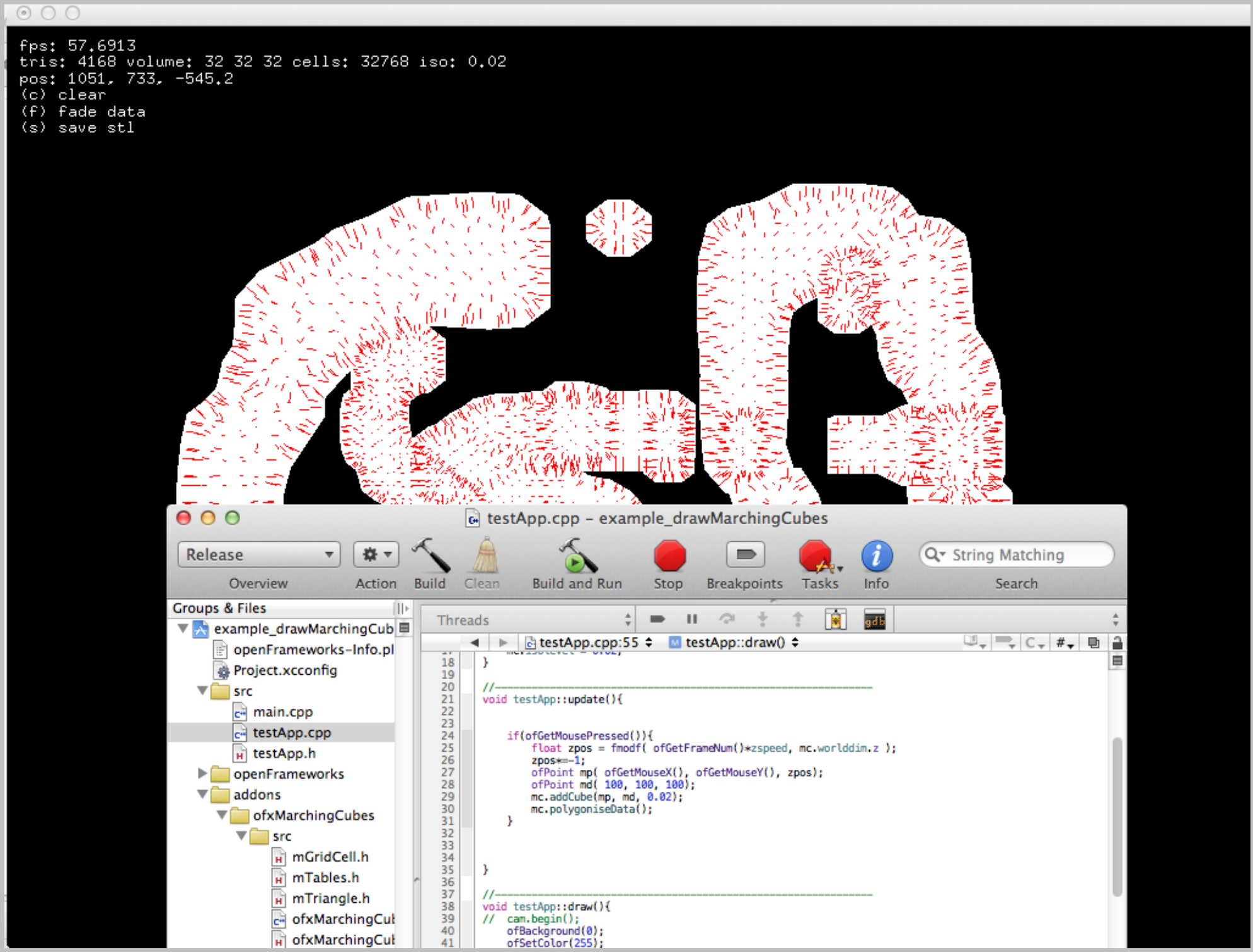
s373.MarchingCubes

- André Sier, 2009/10
  http://s373.net/code/marchingcubes
- Processing, openFrameworks

- import s373.marchingcubes.*;
- #include “ofxMarchingCubes.h”

s373.marchingcubes




fps: 57.6913
tris: 4168 volume: 32 32 32 cells: 32768 iso: 0.02
pos: 1051, 733, -545.2
(c) clear
(f) fade data
(s) save stl
testApp.cpp – example_drawMarchingCubes
Release
Overview
Action
Build
Clean
Build and Run
Stop
Breakpoints
Tasks
Info
String Matching
Search
Groups & Files
example_drawMarchingCub
openFrameworks-Info.pl
Project.xcconfig
src
main.cpp
testApp.cpp
testApp.h
openFrameworks
addons
ofxMarchingCubes
src
mGridCell.h
mTables.h
mTriangle.h
ofxMarchingCub
ofxMarchingCub
Threads
testApp.cpp:55
testApp::draw()
}
//--
void testApp::update(){
if(ofGetMousePressed()){
float zpos = fmodf(ofGetFrameNum()*zspeed, mc.worlddim.z);
zpos*=-1;
ofPoint mp(ofGetMouseX(), ofGetMouseY(), zpos);
ofPoint md(100, 100, 100);
mc.addCube(mp, md, 0.02);
mc.polygoniseData();
}
}
//--
void testApp::draw(){
// cam.begin();
ofBackground(0);
ofSetColor(255);

s373.marchingcubes

- Main functions
  - Construct (java) / setup (c++)
    - mc = new MarchingCubes(this, 1000, 600, -1000, mcres, mcres, mcres * 2);
    - mc.setup(1000, 1000, -1000, 64, 64, 64);
      - MarchingWorldDim x, y, z + MarchingGridResolution x, y, z
  - marchingcube.zeroData();
    - Clears / zero's values from voxel data grid
  - marchingcube.addCube(float val, XYZ ptpos, XYZ ptdim);

s373.marchingcubes

- Main functions
  - marchingcube.addIsoPoint(float val, XYZ ptpos);
  - marchingcube.polygoniseData();
    - Transforms current data voxels into 3d polygons
  - marchingcube.draw();
  - marchingcube.writeStl(String filestr);

k. - André Sier - 2007

k.

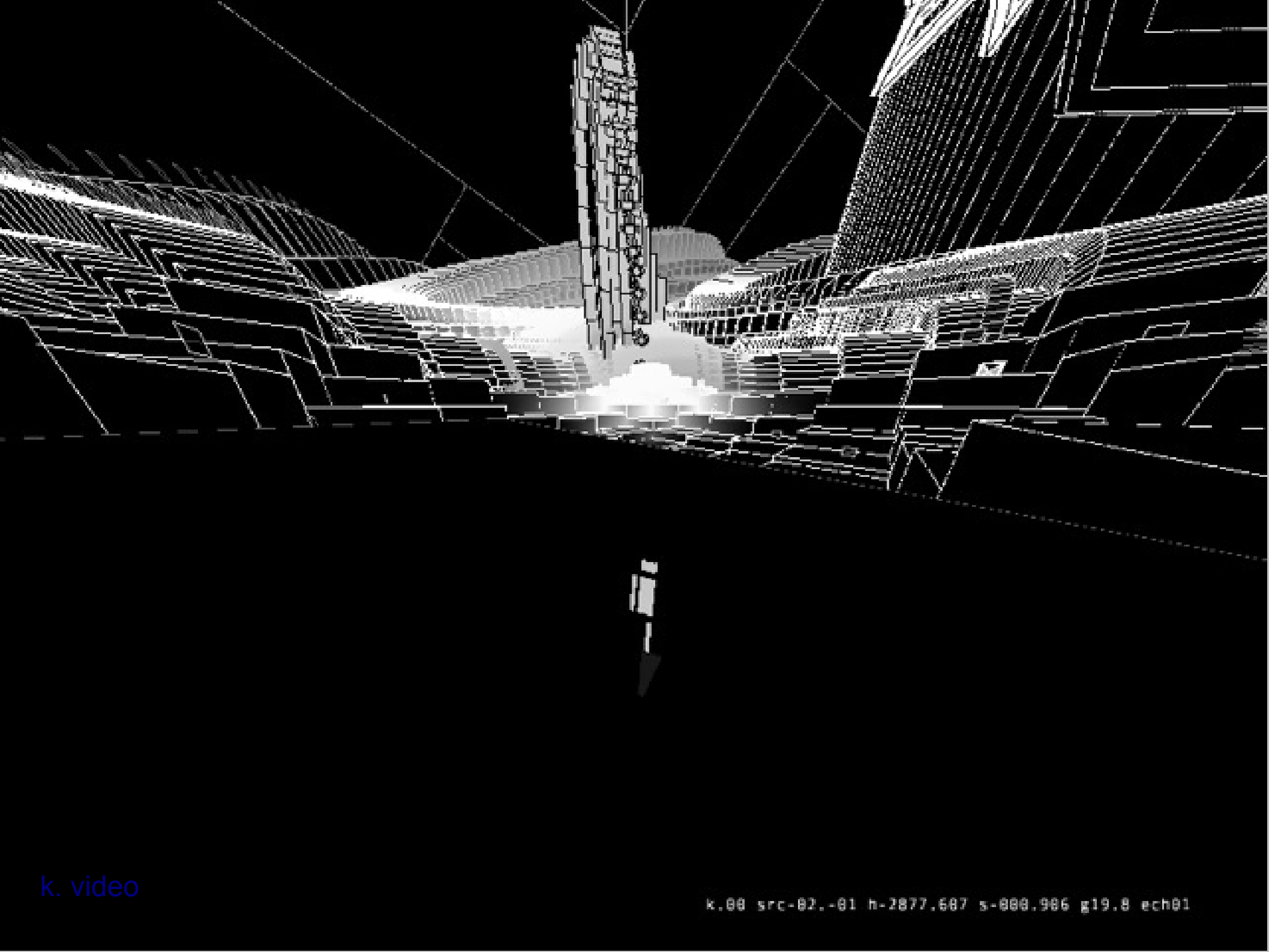
http://s373.net/projectos/k

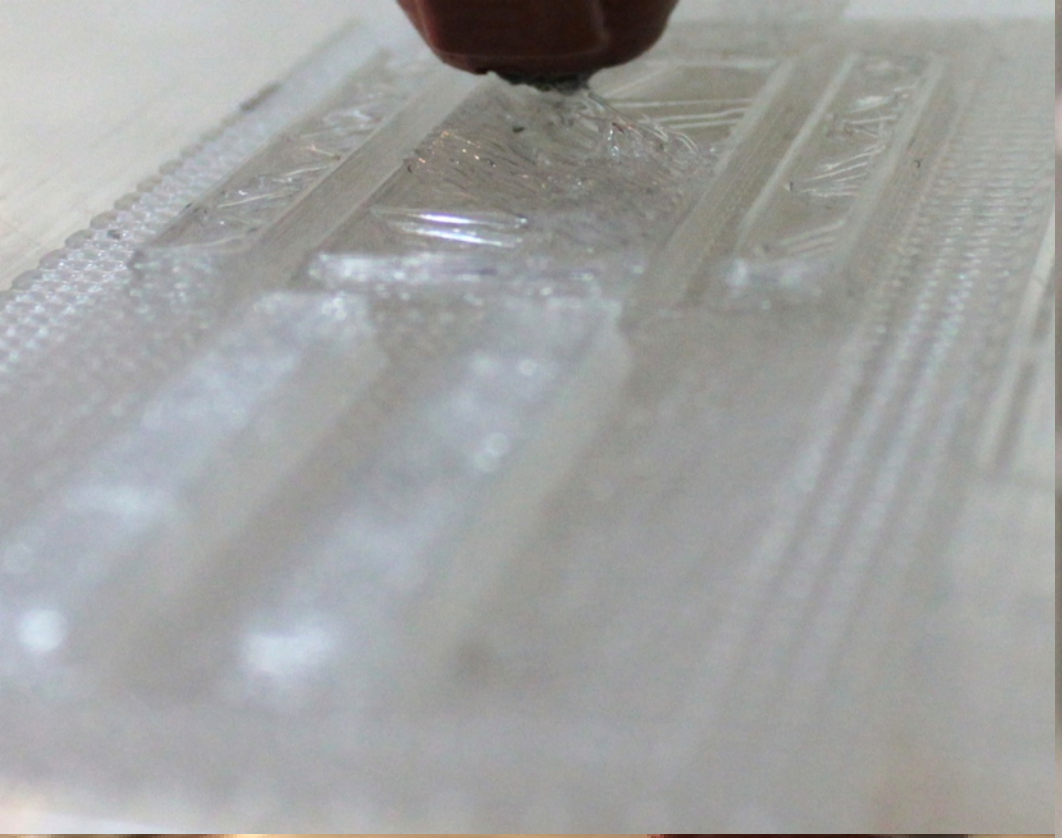
http://s373.net/folio/k/k/

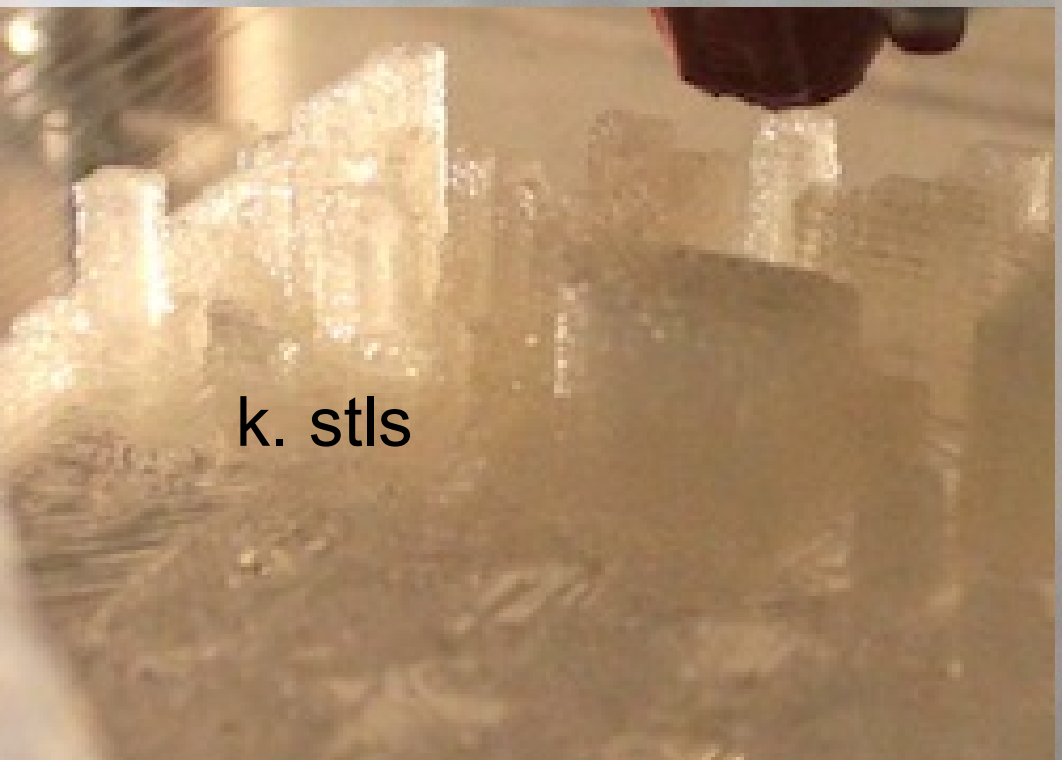
k. é uma adaptação livre do imaginário experimentado por K. n'*O Castelo* de Franz Kafka (1924),que transporta o utilizador através de uma viagem vertiginosa pelos meandros da abstracção espacial.

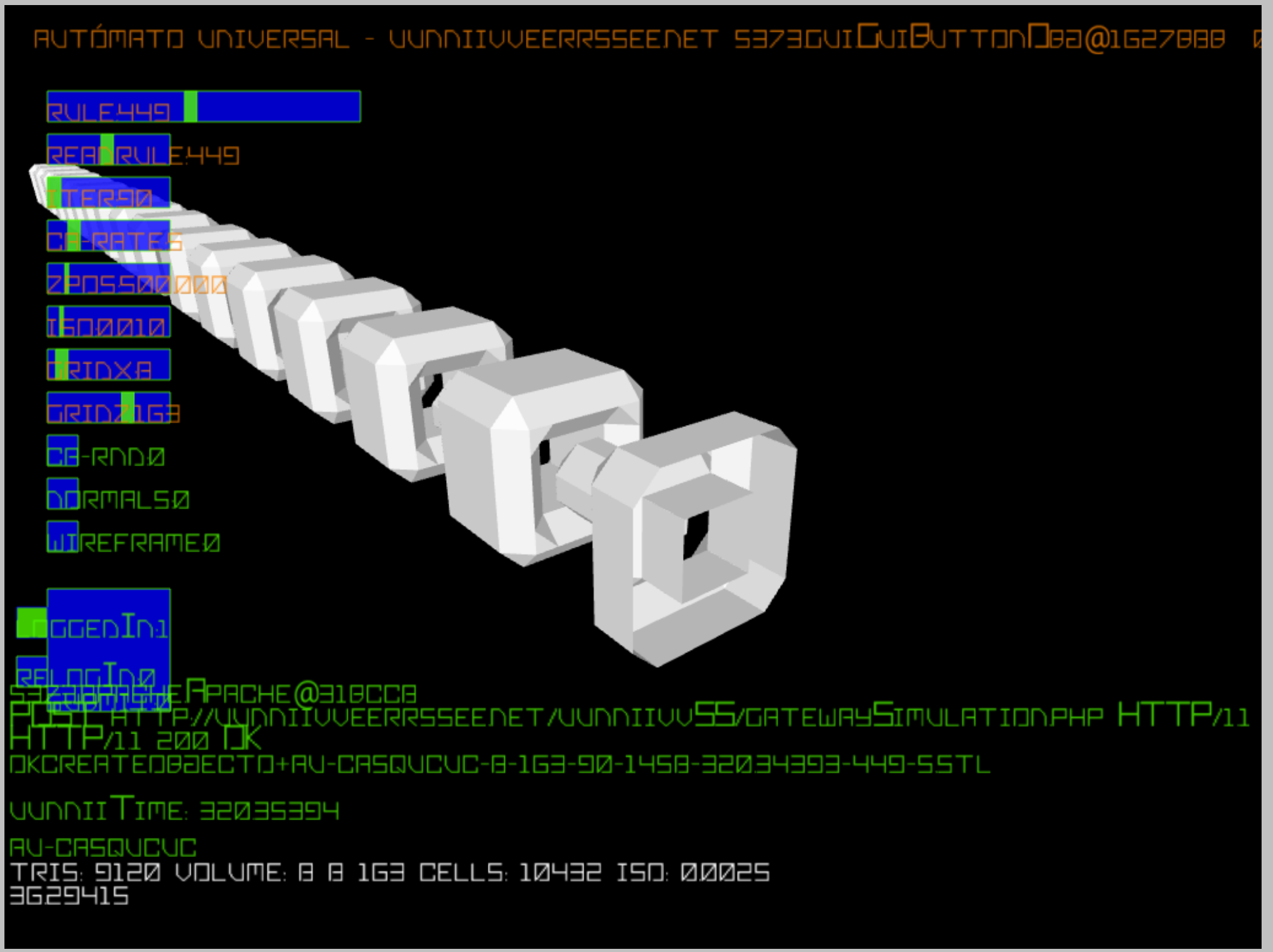
ambiente labiríntico tridimensional indeterminado navegável

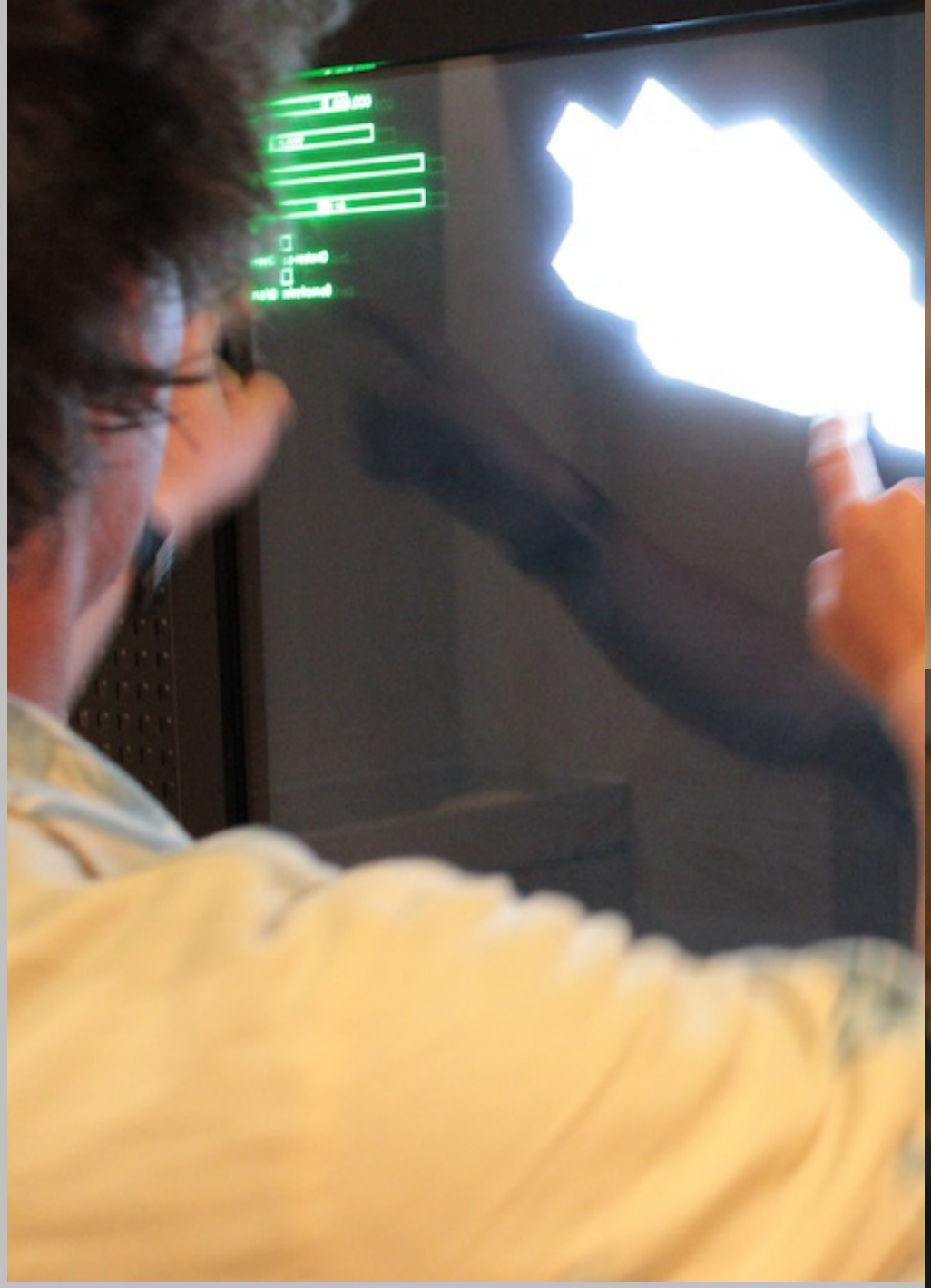
aberto contínuo complexo cíclico

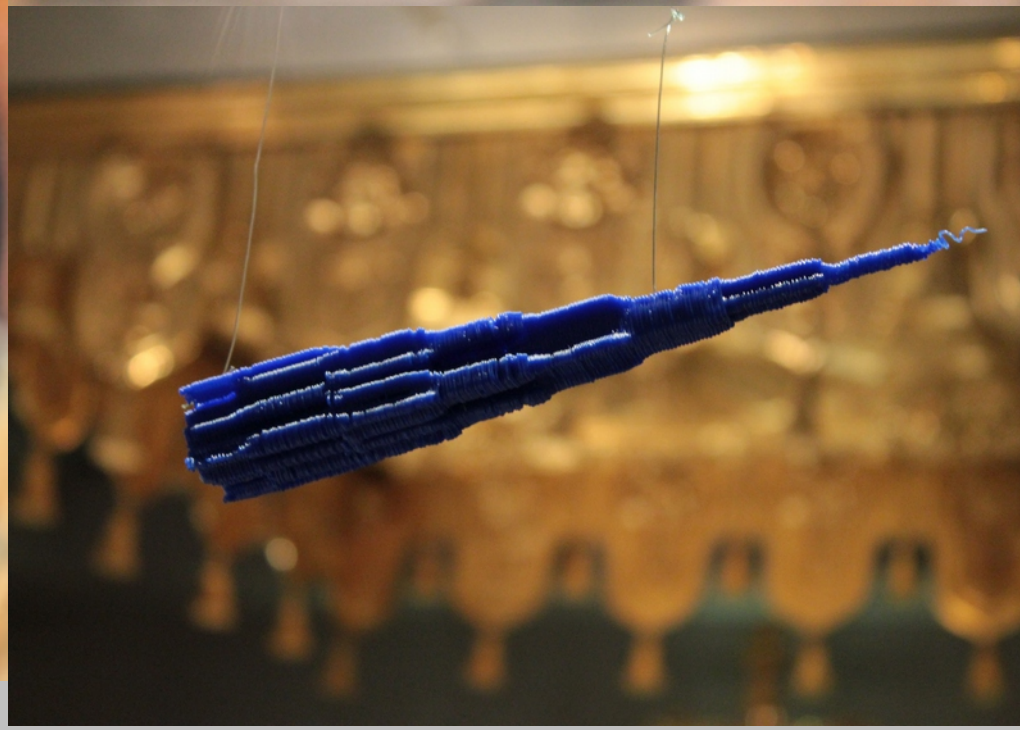

k. video
k.00 src-02,-01 h-2877.687 s-000.986 g19.8 ech01

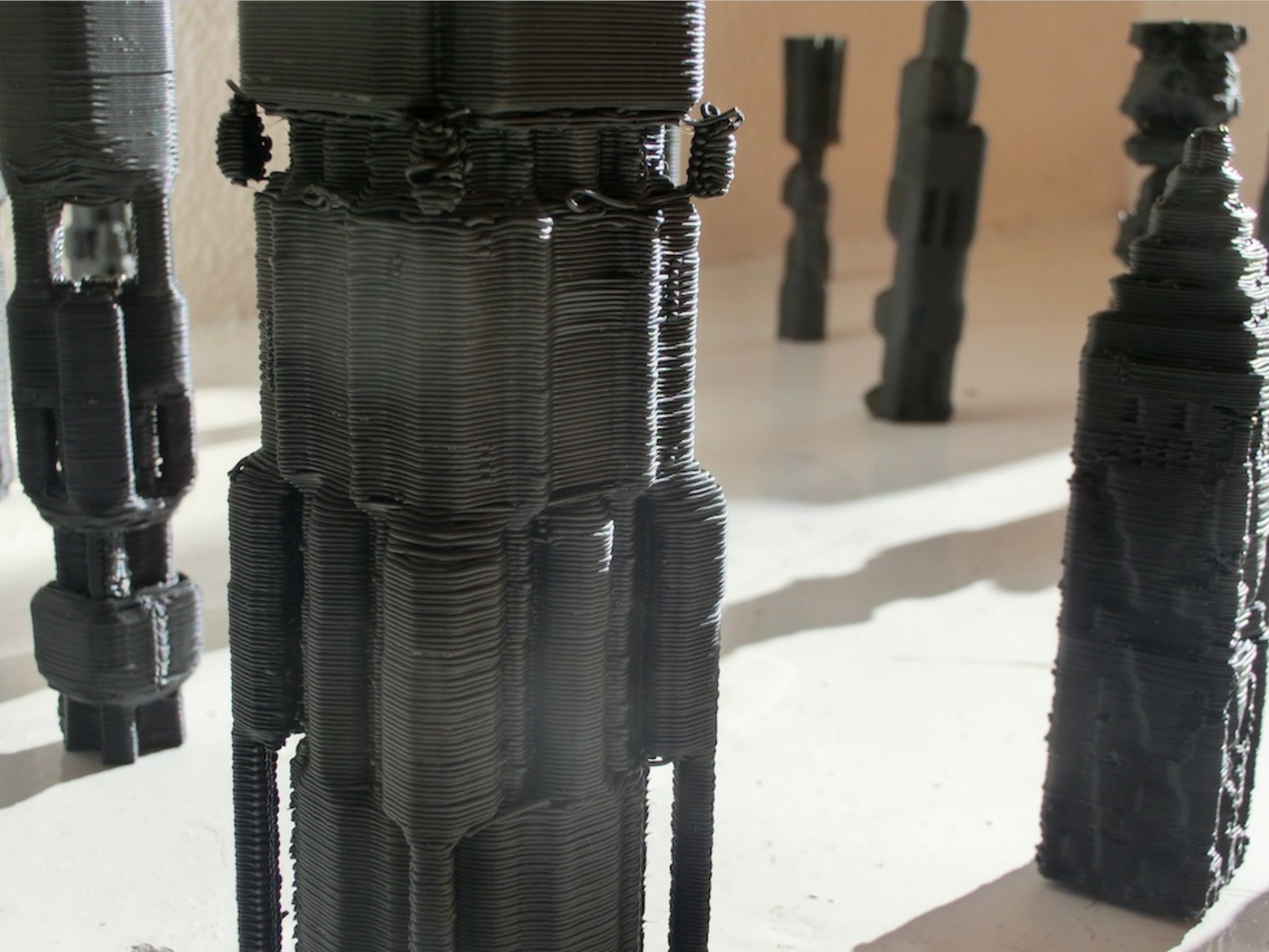



k. stls

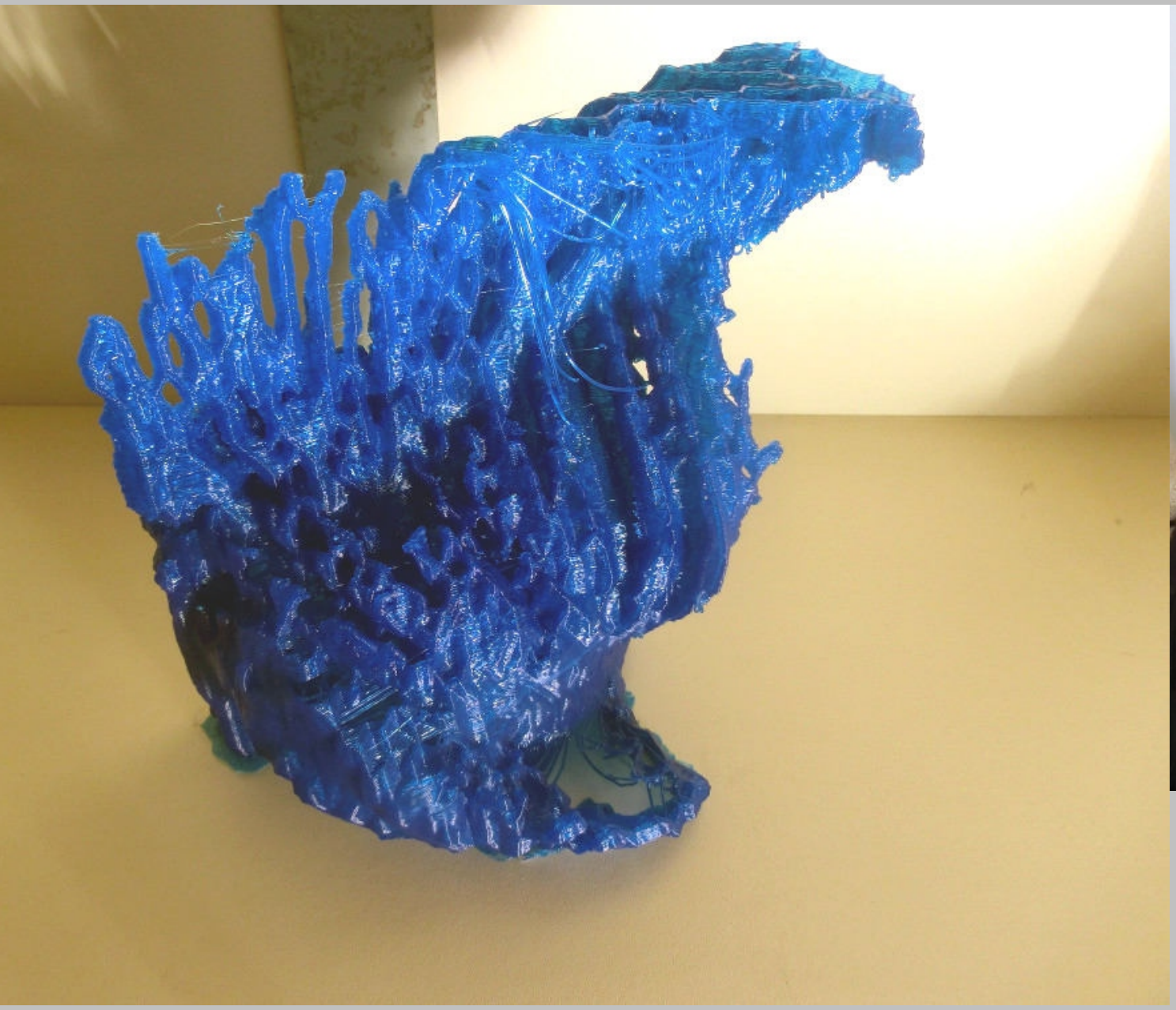

AUTÓMATO UNIVERSAL - UUNNIIVVEERRSSEENET 5373GUIGUIBUTTONOBA@1G27B8B
RULE449
REANRULE449
ITER90
CA-RATE5
ZPOS500000
I500010
GRIDXA
GRIDZ1G3
CB-RND0
NORMALS0
WIREFRAME0
LOGGEDIN1
RELOGIN0
HTTP/11 200 OK
OKCREATEOBJECTO+AV-CASQUCUC-B-1G3-90-1458-32034393-449-5STL
UUNNIITIME: 32035394
AV-CASQUCUC
TRIS: 9120 VOLUME: 8 8 1G3 CELLS: 10432 ISO: 00025
3G29415



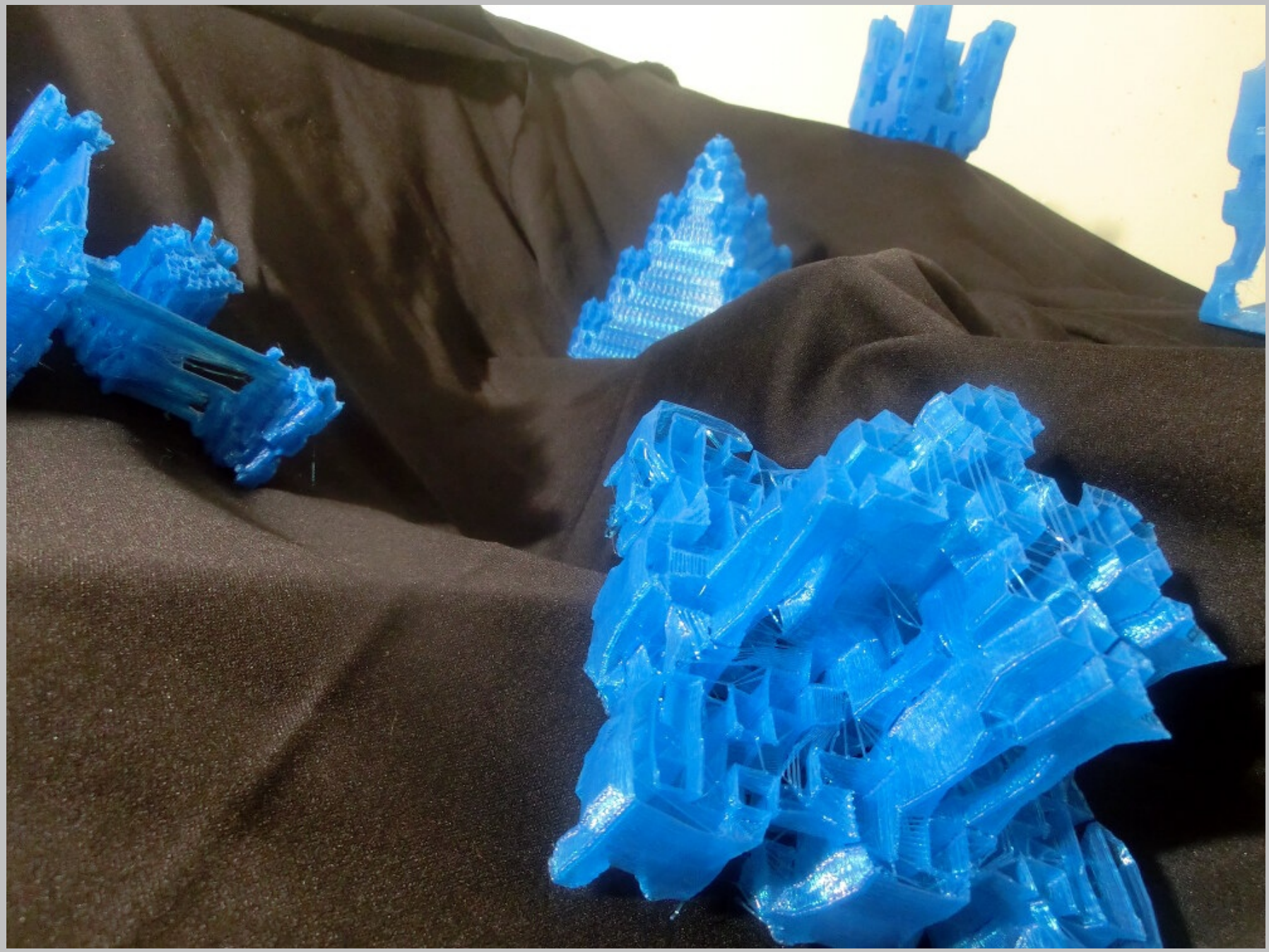




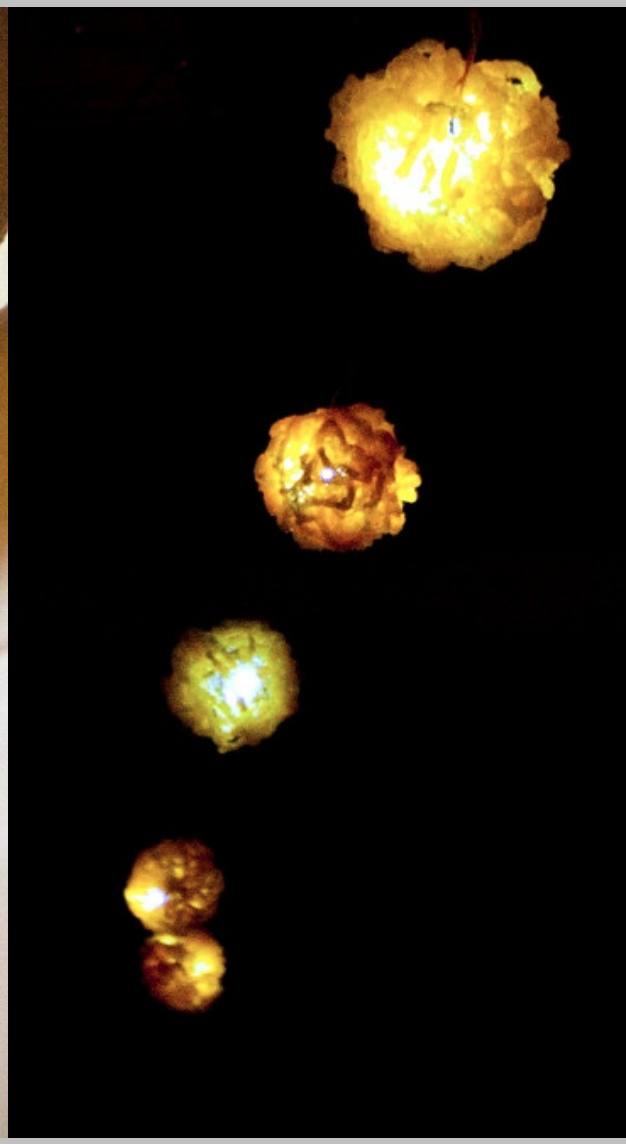
Hyperborea (solids)



Heliades



Sol



Eu-Abstracto

Eu-Abstracto (Skate.Exe Edition)