CULTURAL AUTOMATION WITH MACHINE LEARNING

SESSION 08: GENERATIVE 3D

Parag K. Mital
UCLA DMA

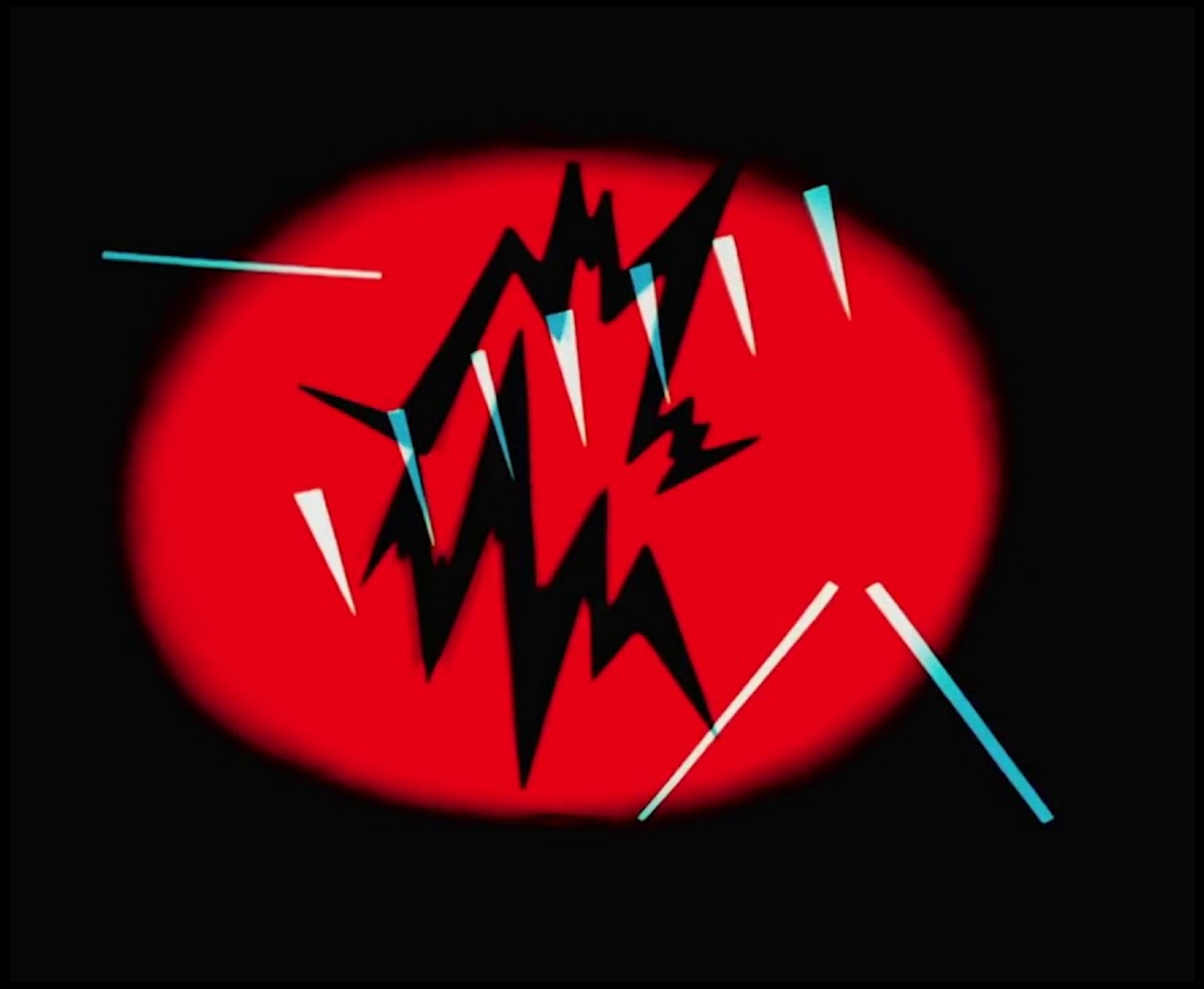
CULTURAL CONTEXT + HISTORY OF GENERATIVE 3D

EARLY WORKS: DEVELOPMENT OF PROCEDURAL GENERATION

Oskar Fischinger (1930's -40's)

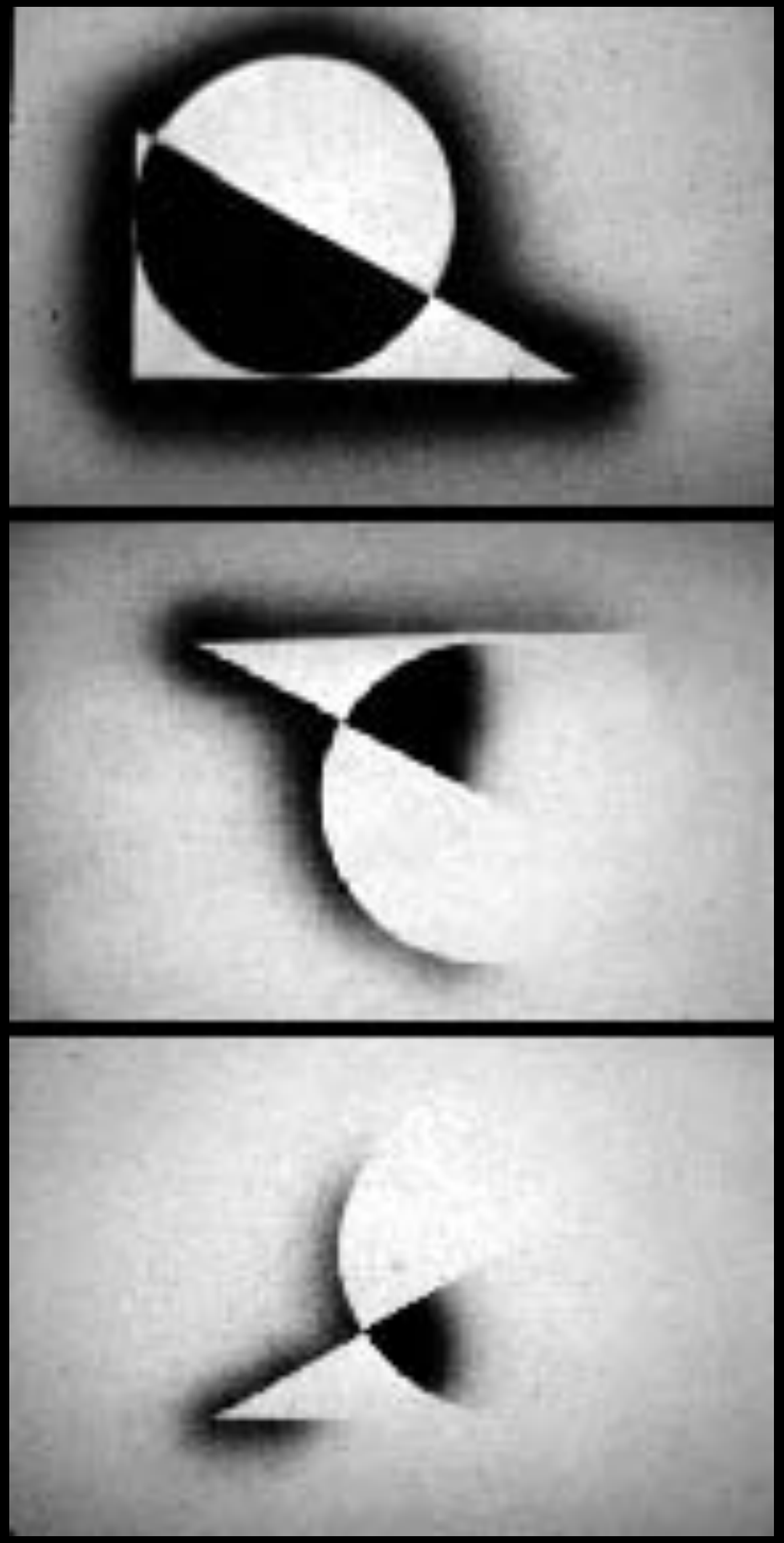
https://www.acmi.net.au/education/school-program-and-resources/the-art-of-visual-music/

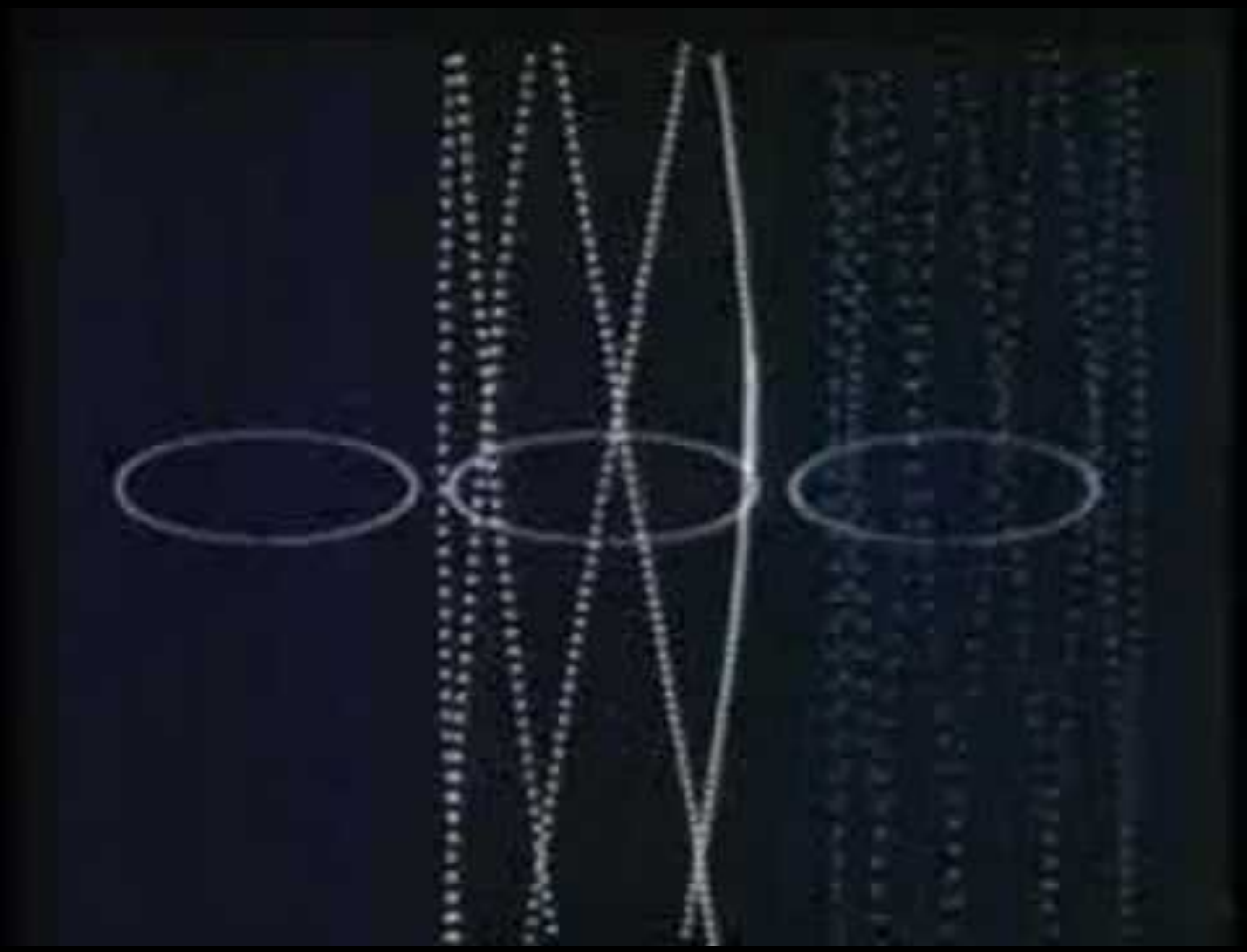
https://www.google.com/logos/2017/fischinger/fischinger17.html

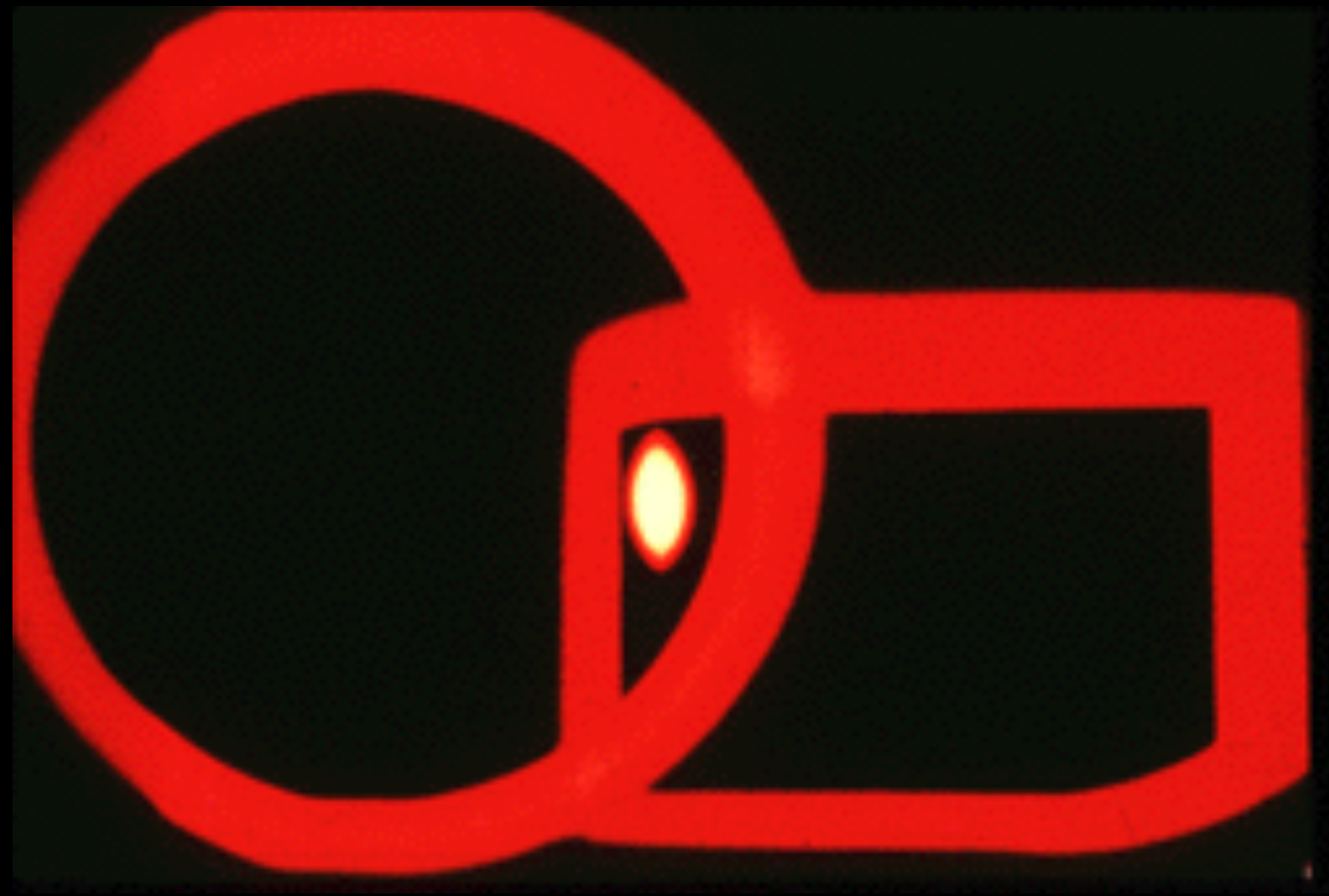
  

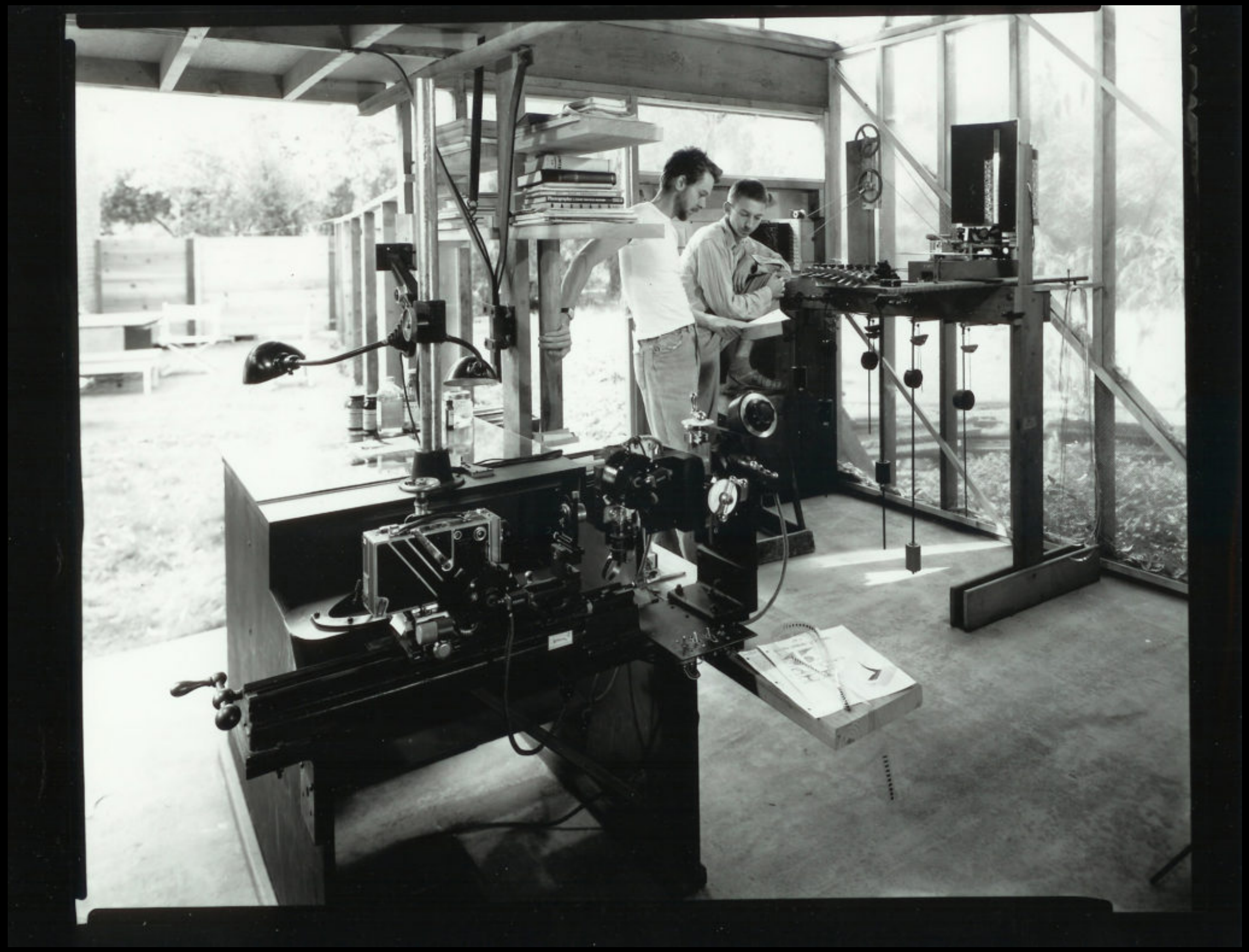
Mary Ellen Bute (1930's - 40's)

Norman McLaren (1940’s -50’s)

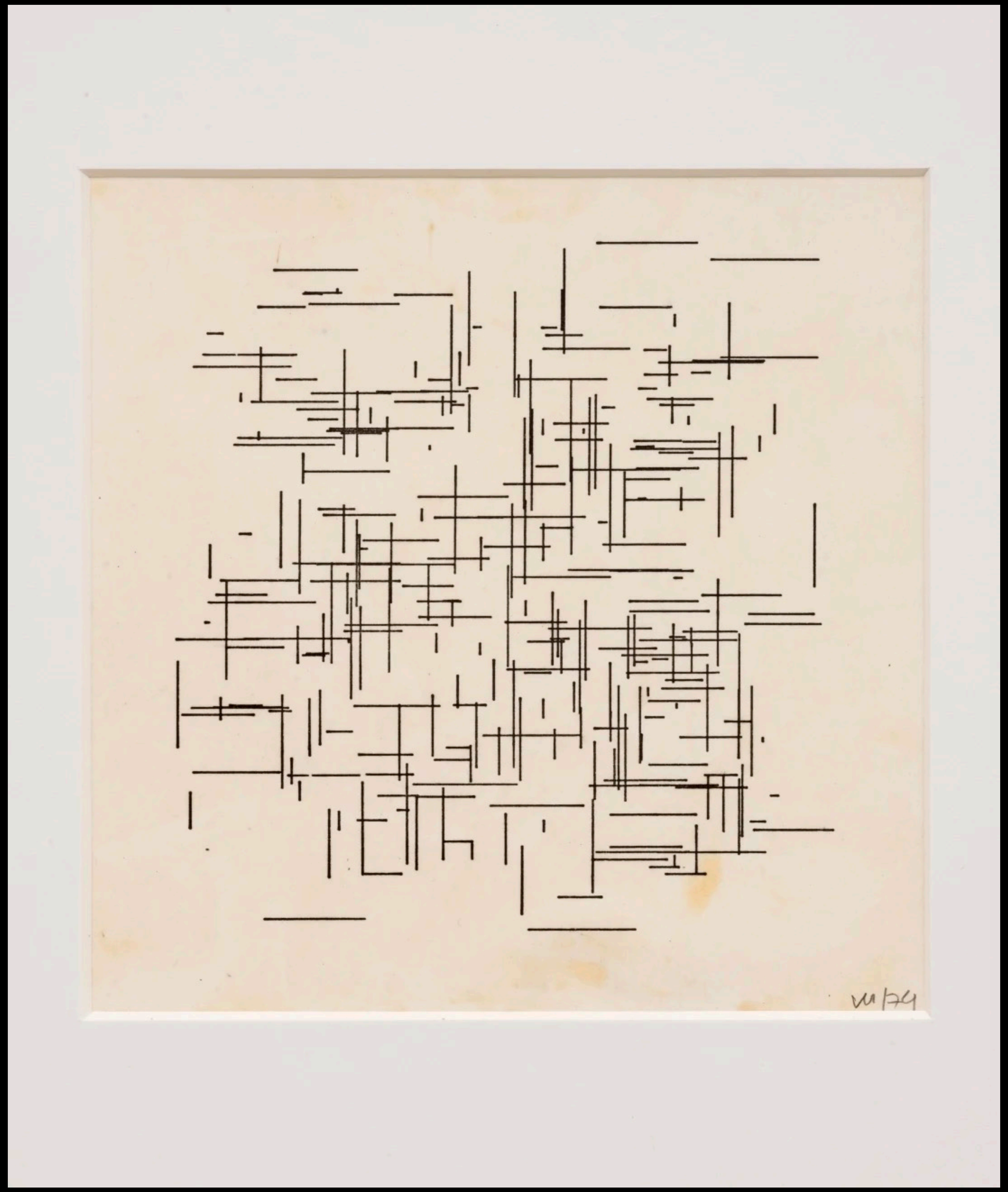
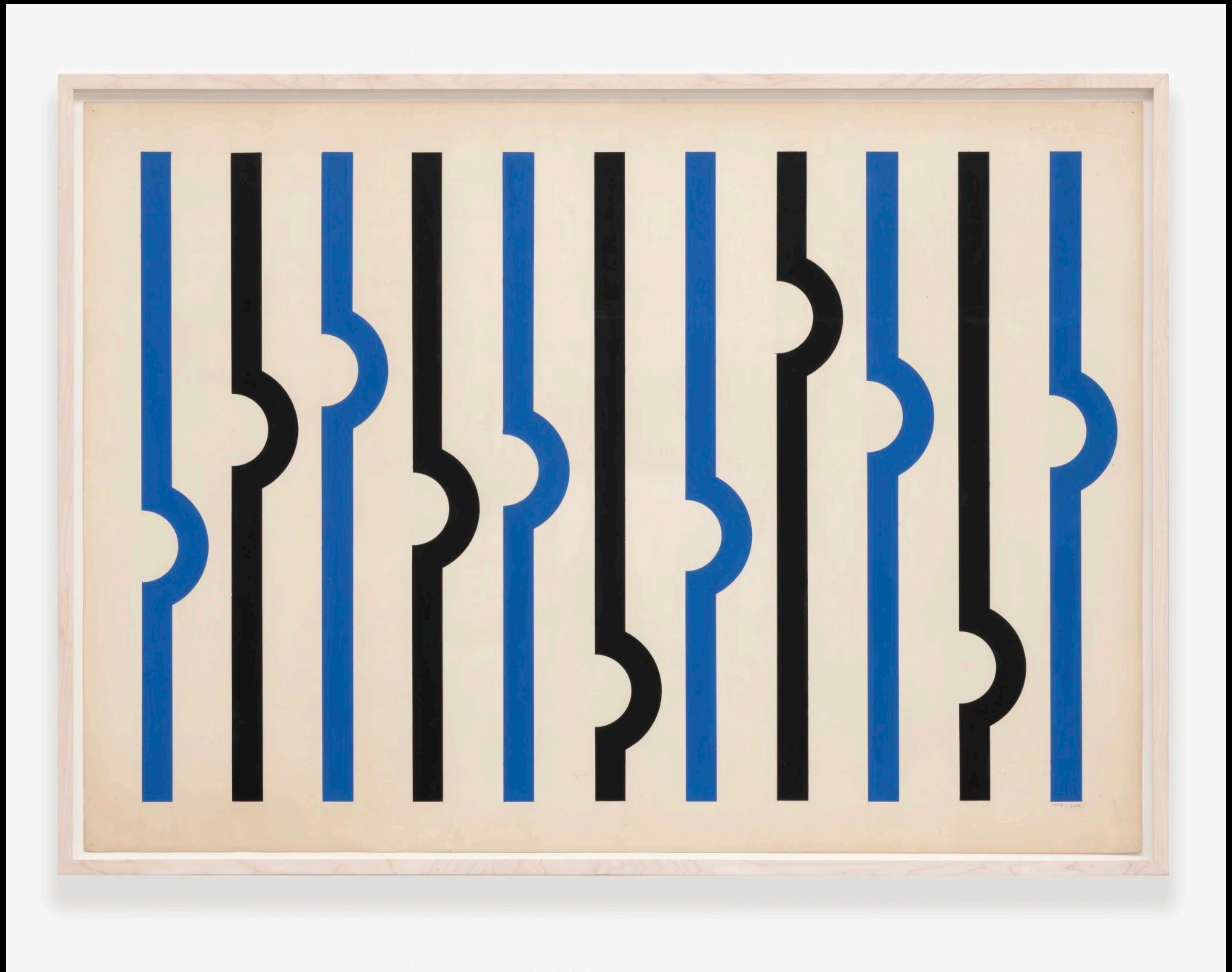




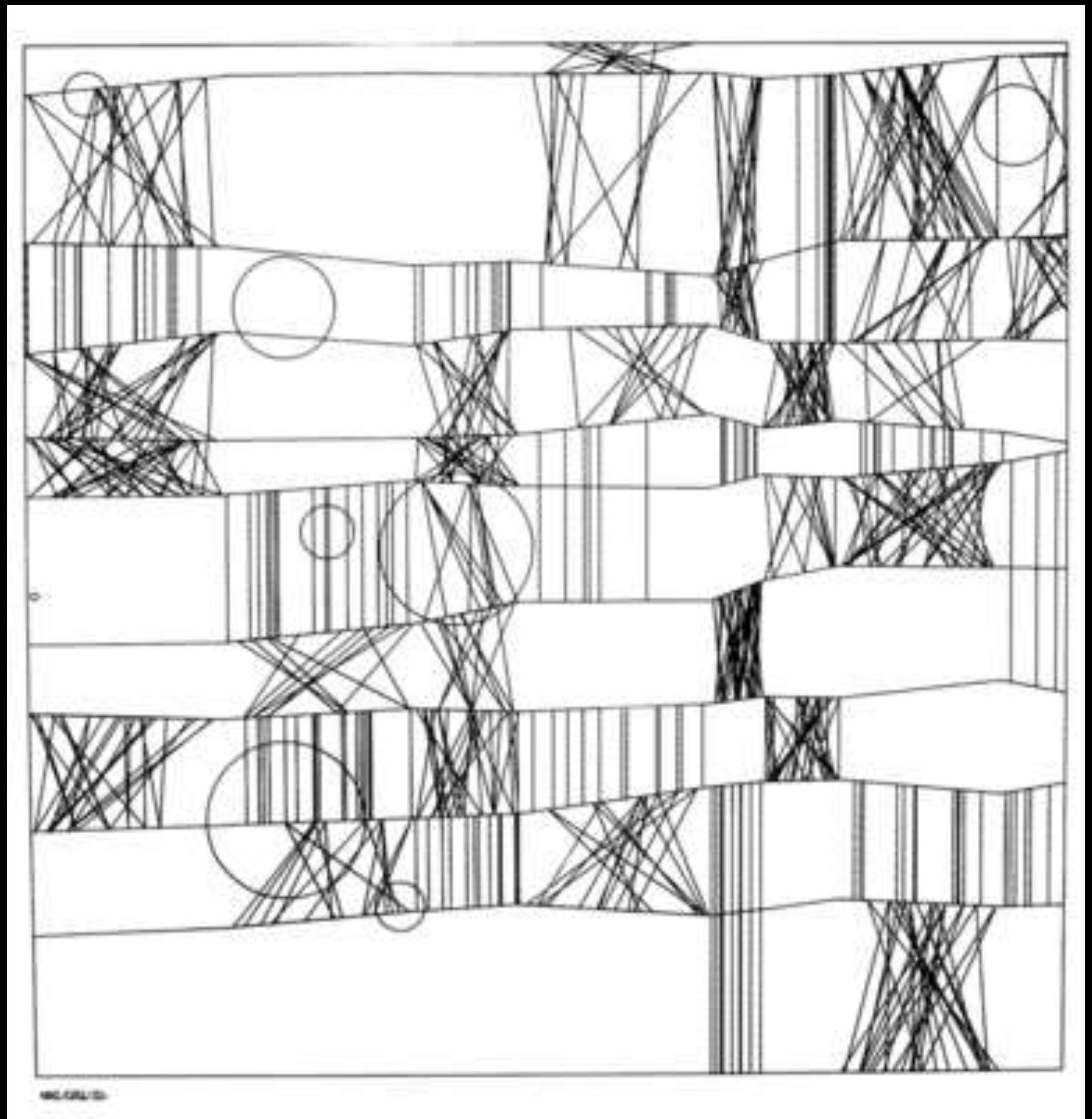
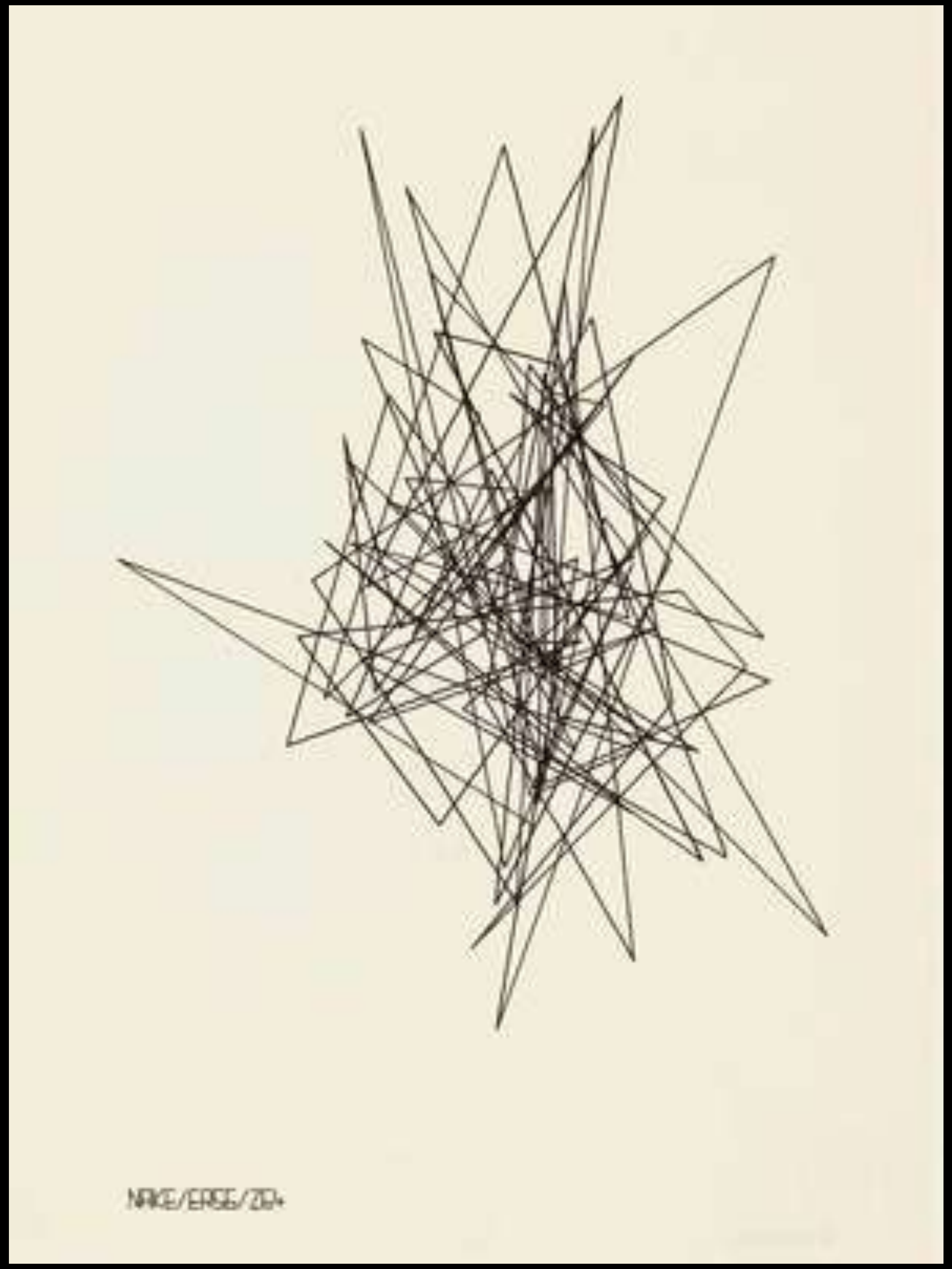
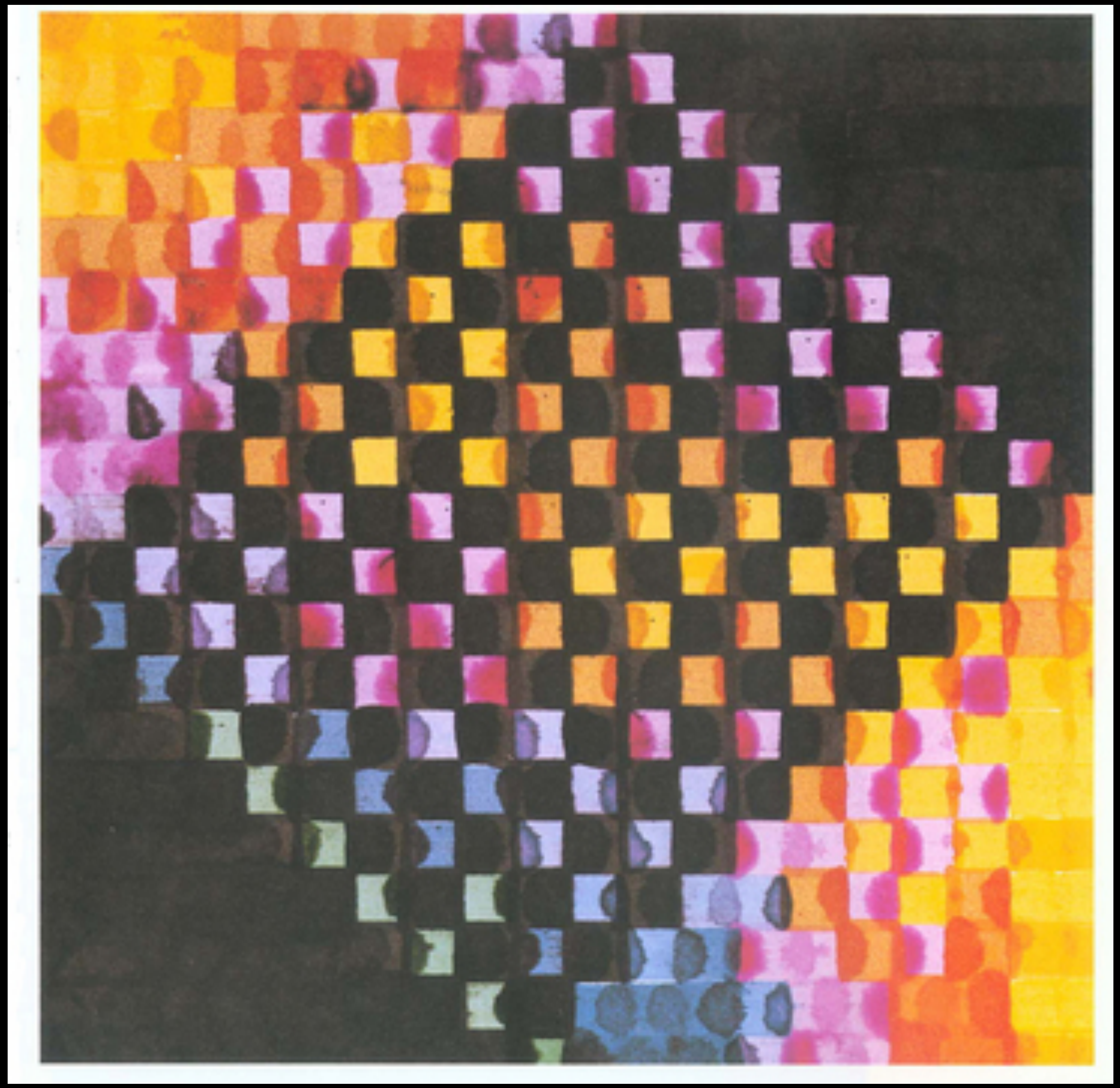




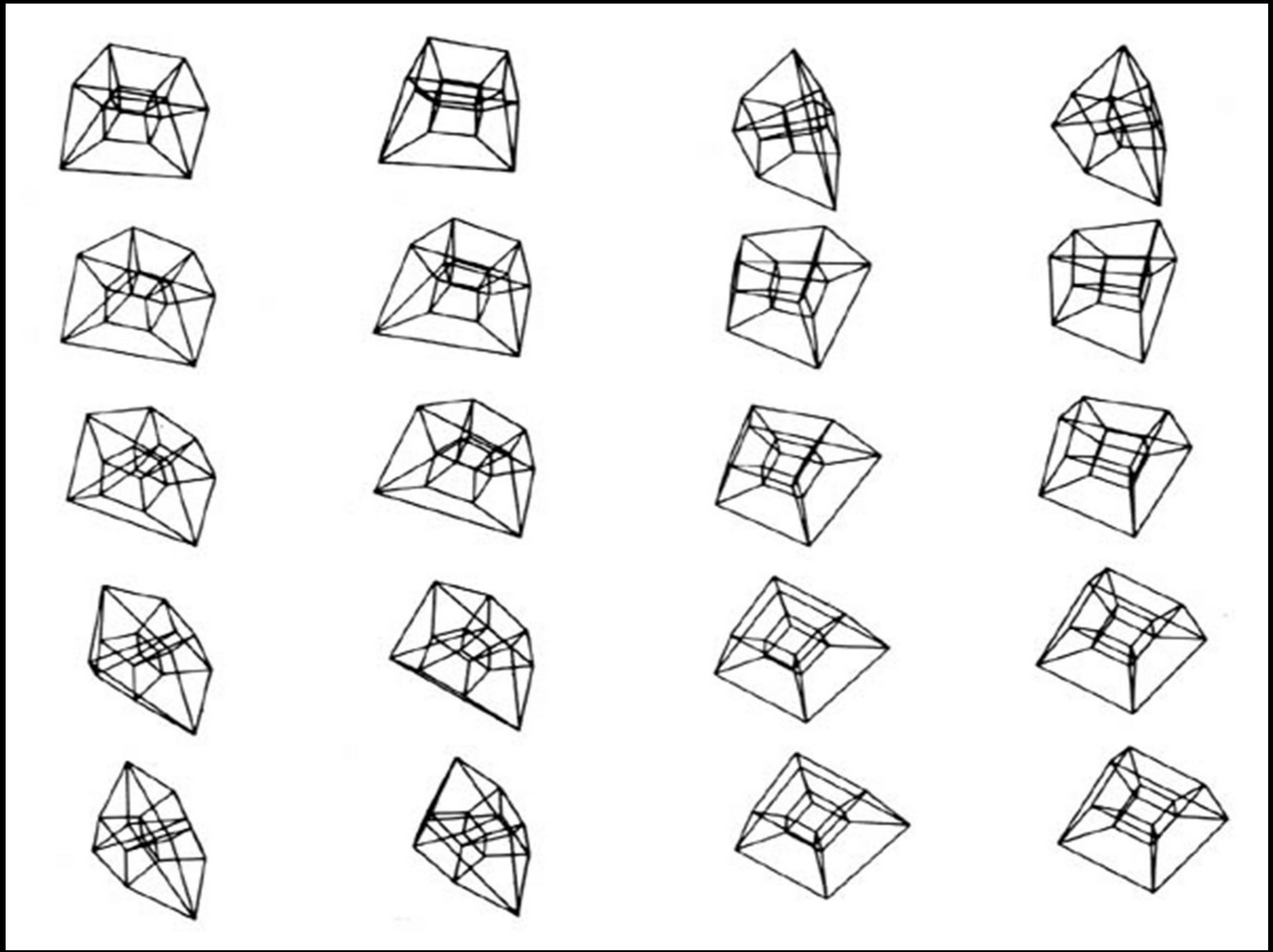
John Whitney (1950's -60's)

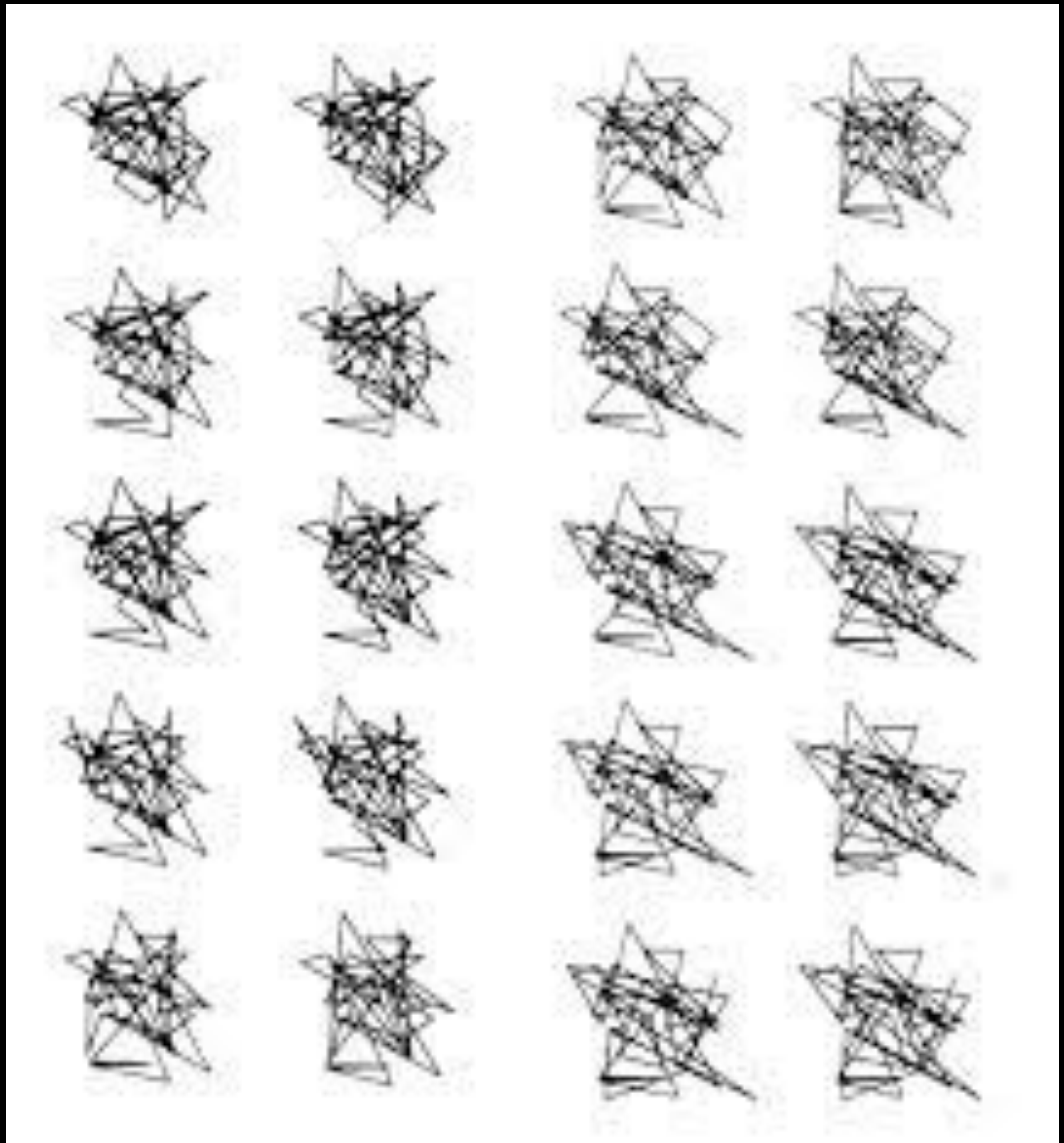




Vera Molnar (1960’s)

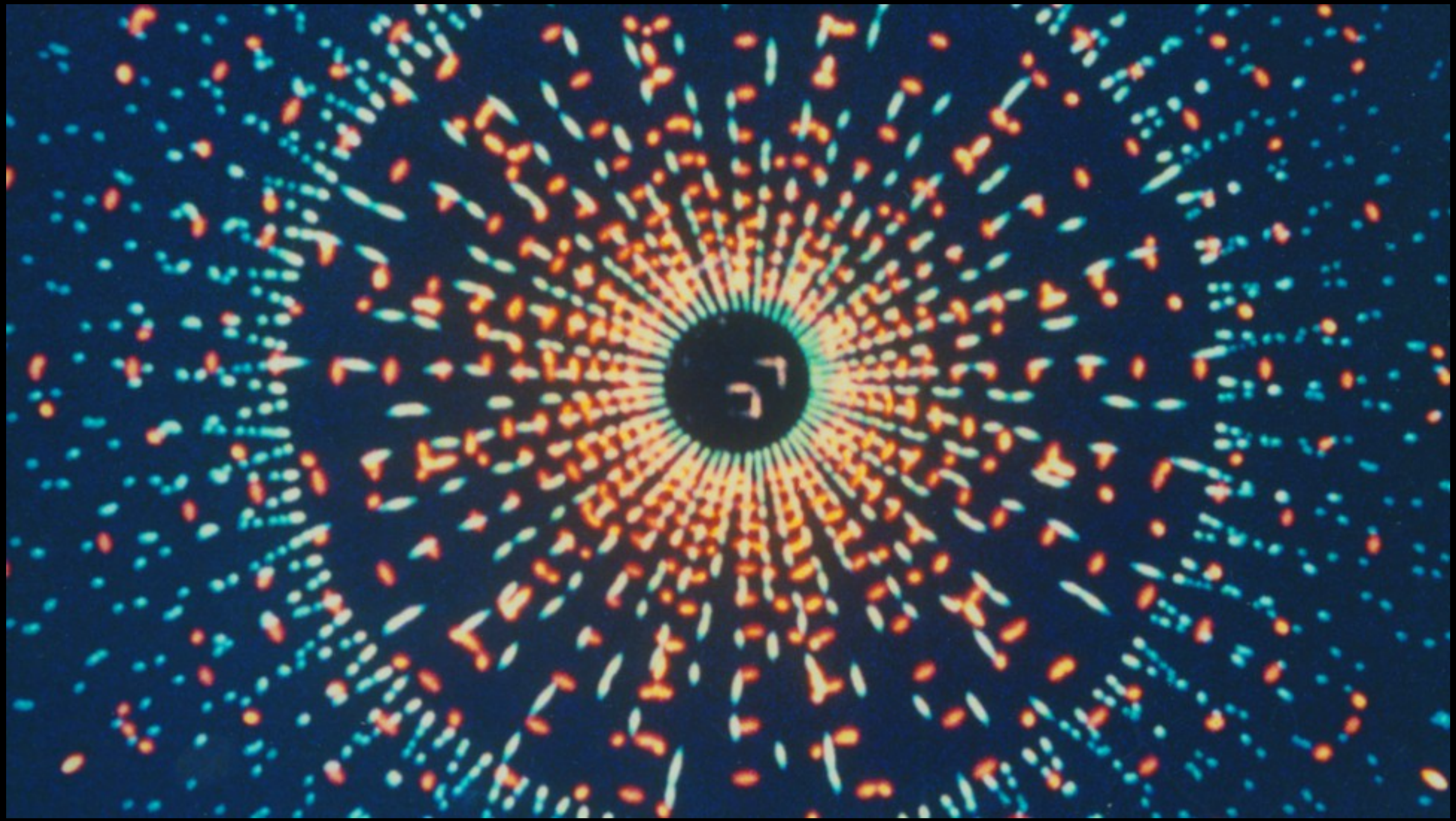




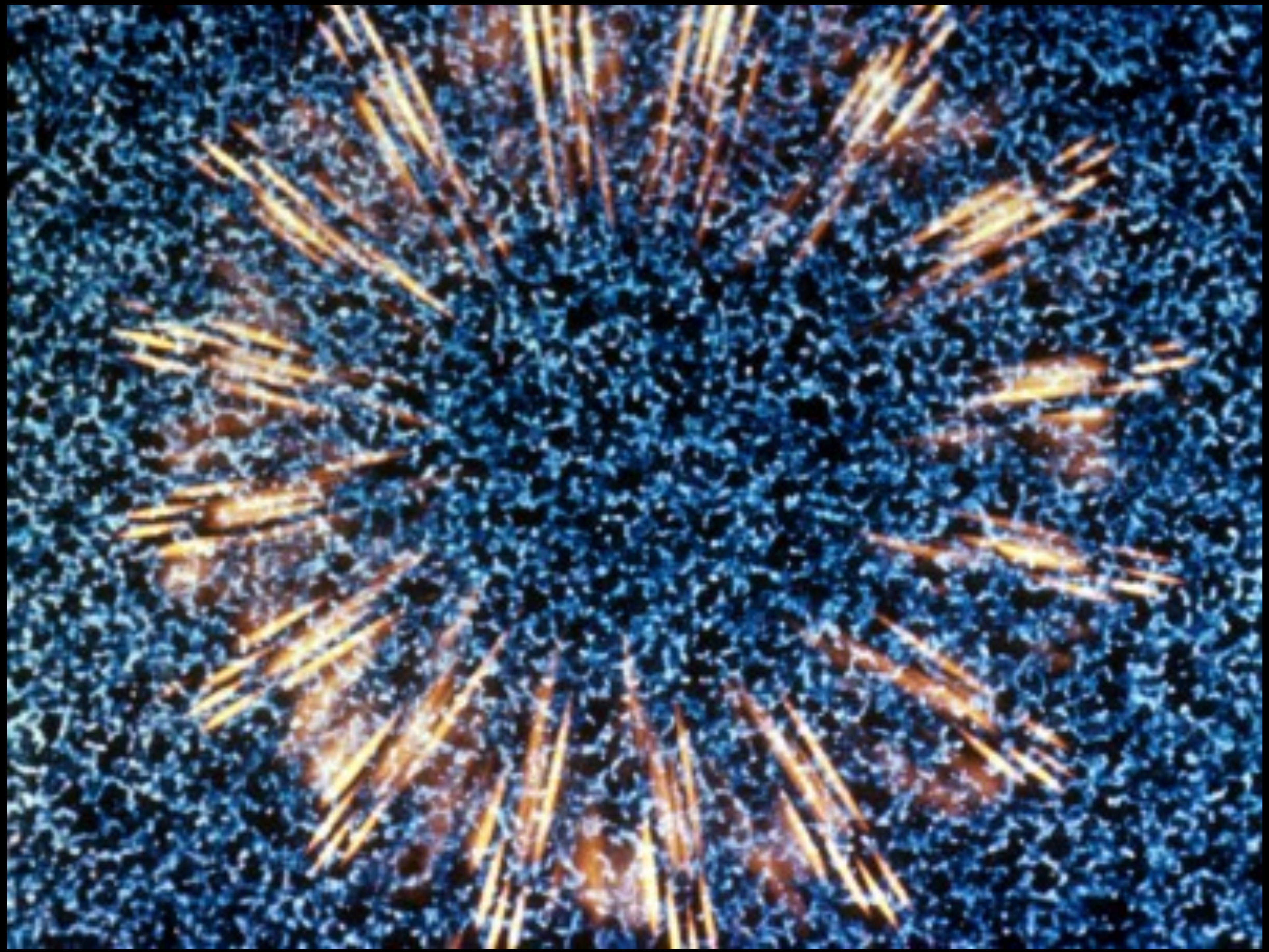
Frieder Nake (1960's)



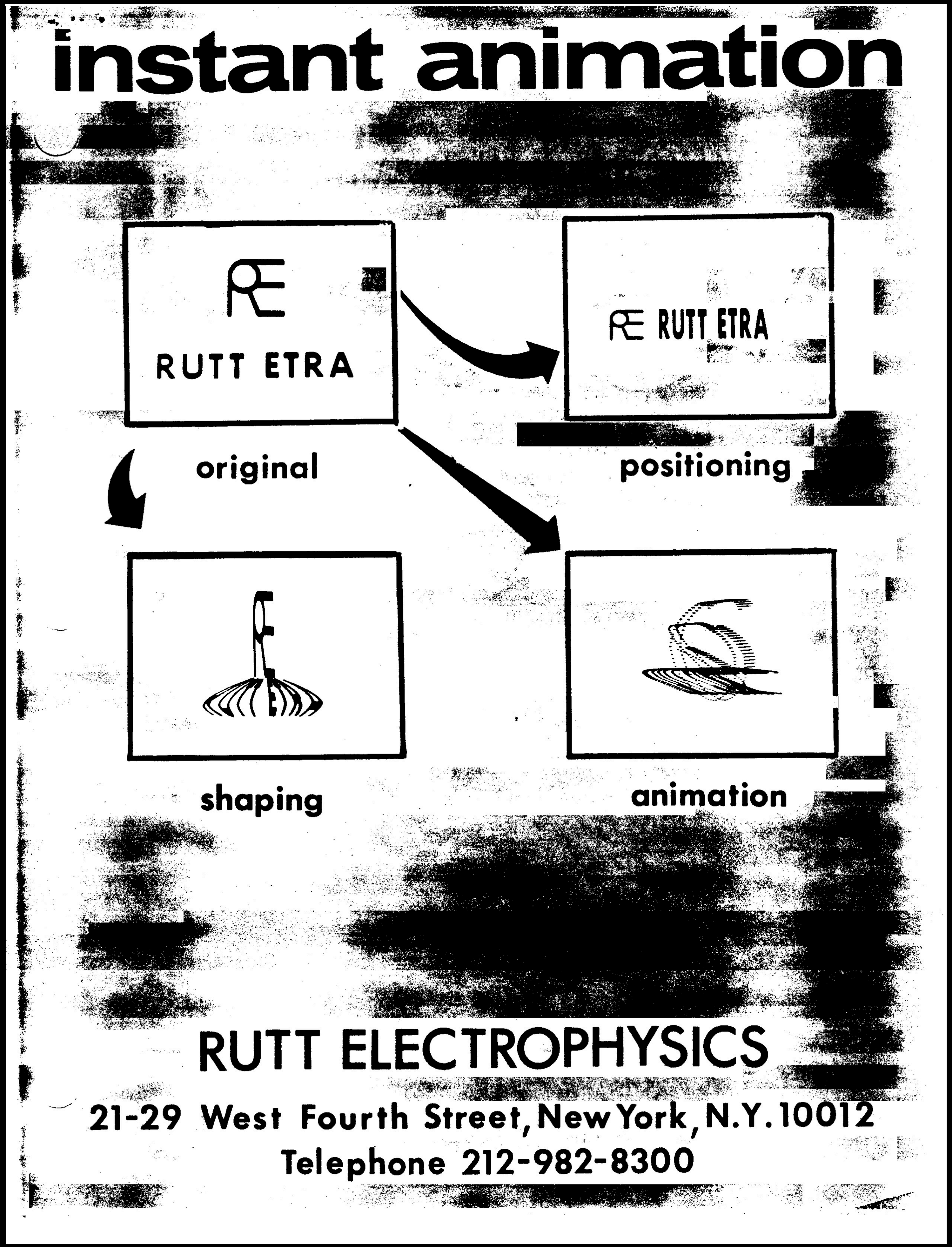


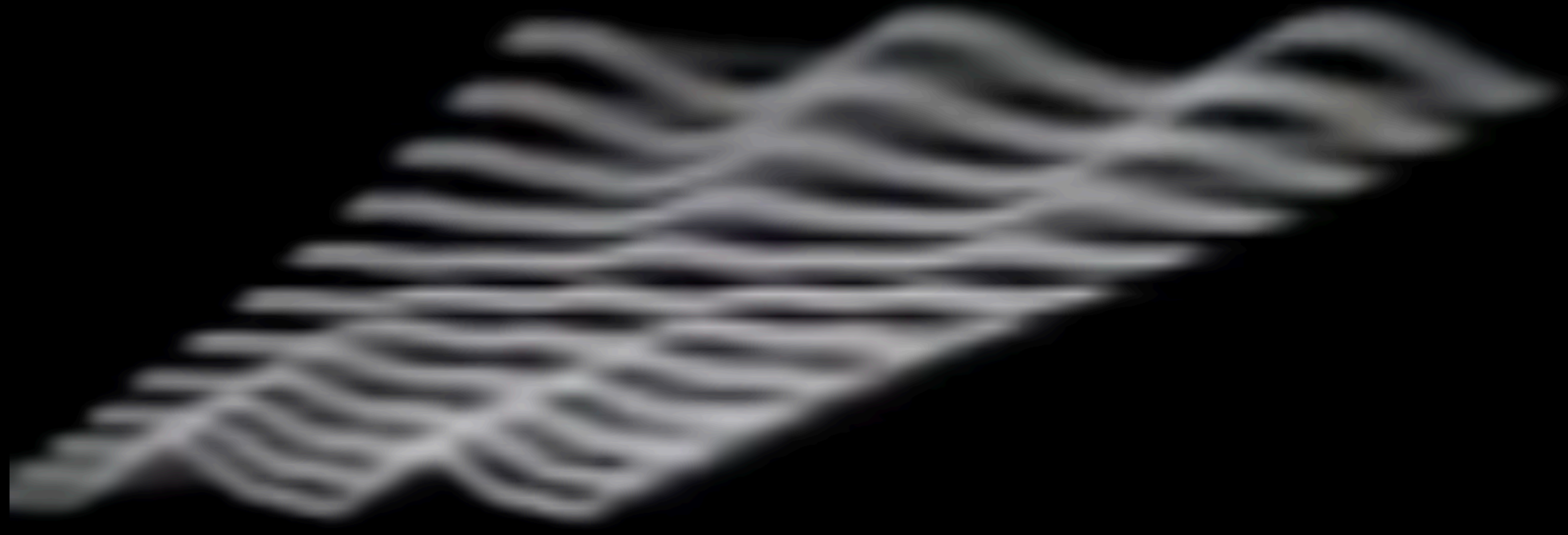
A. Micheal Noll (1960’s)





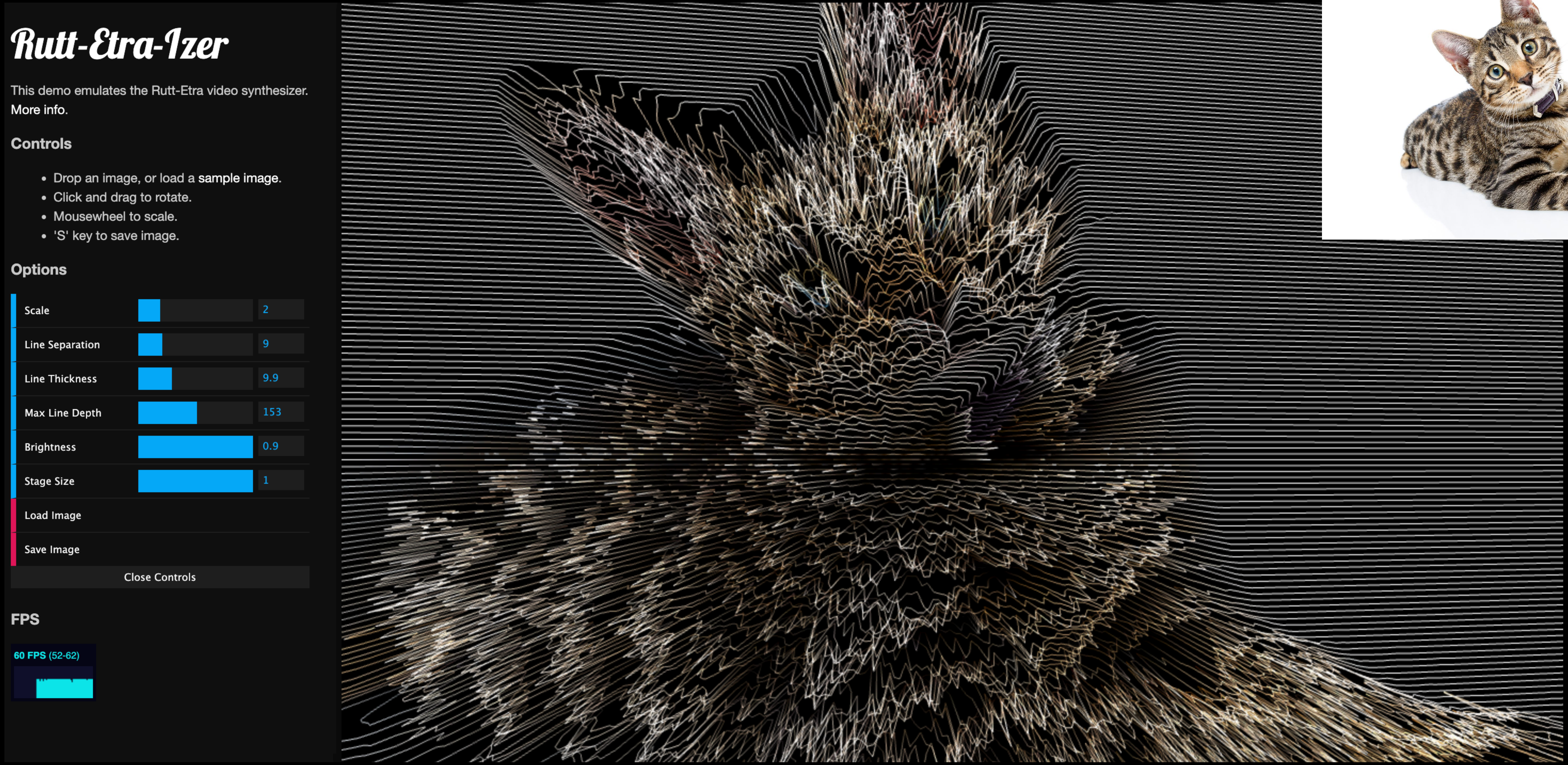
Jordan Belson (1960's -70's)





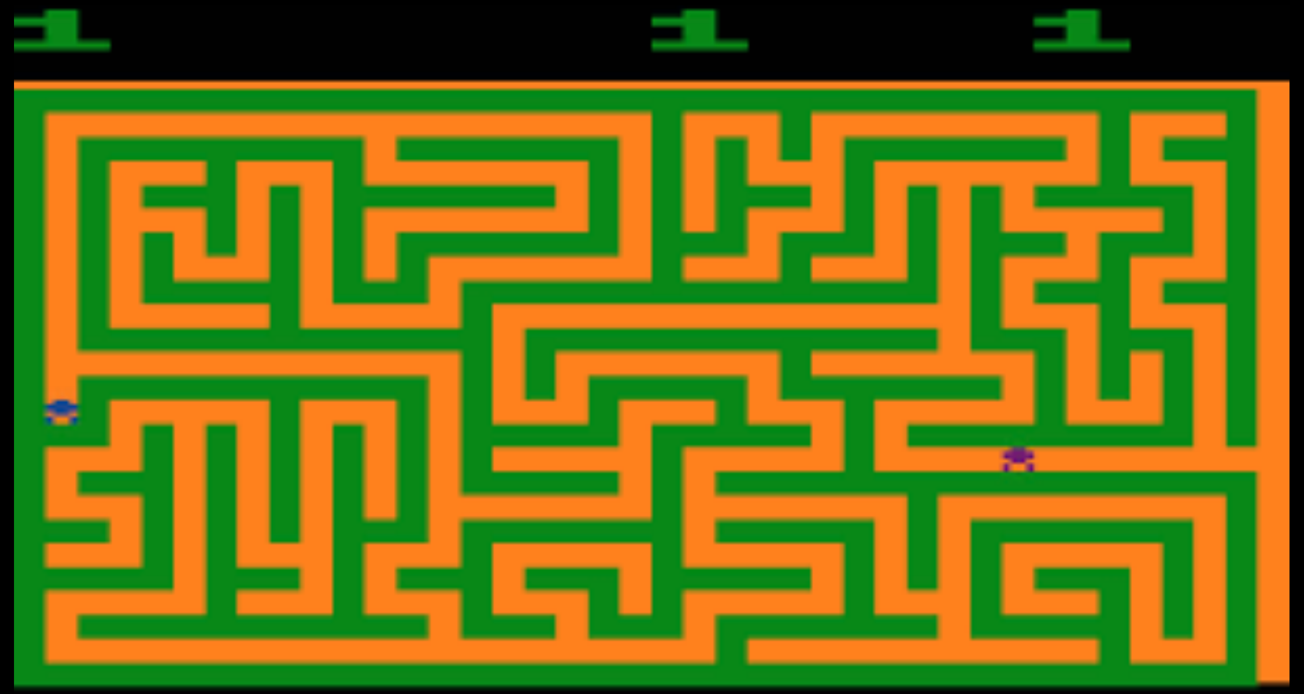
https://www.vasulka.org/archive/Artists2/Etra,Bill/general.pdf

https://www.youtube.com/watch?v=EZQiHuTbnes&t=138s

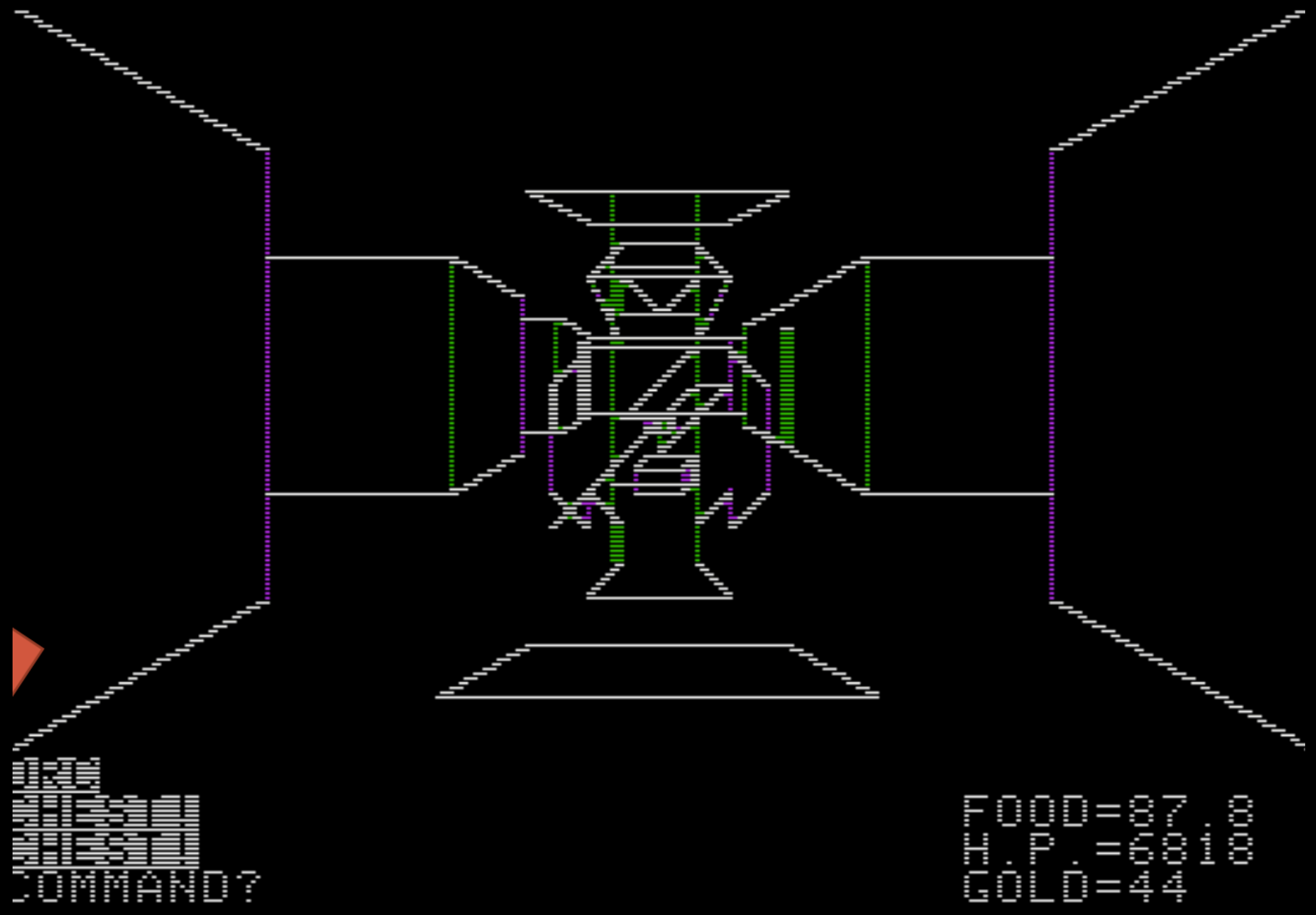


https://airtightinteractive.com/demos/js/ruttetra/

Beneath Apple Manor (1978)



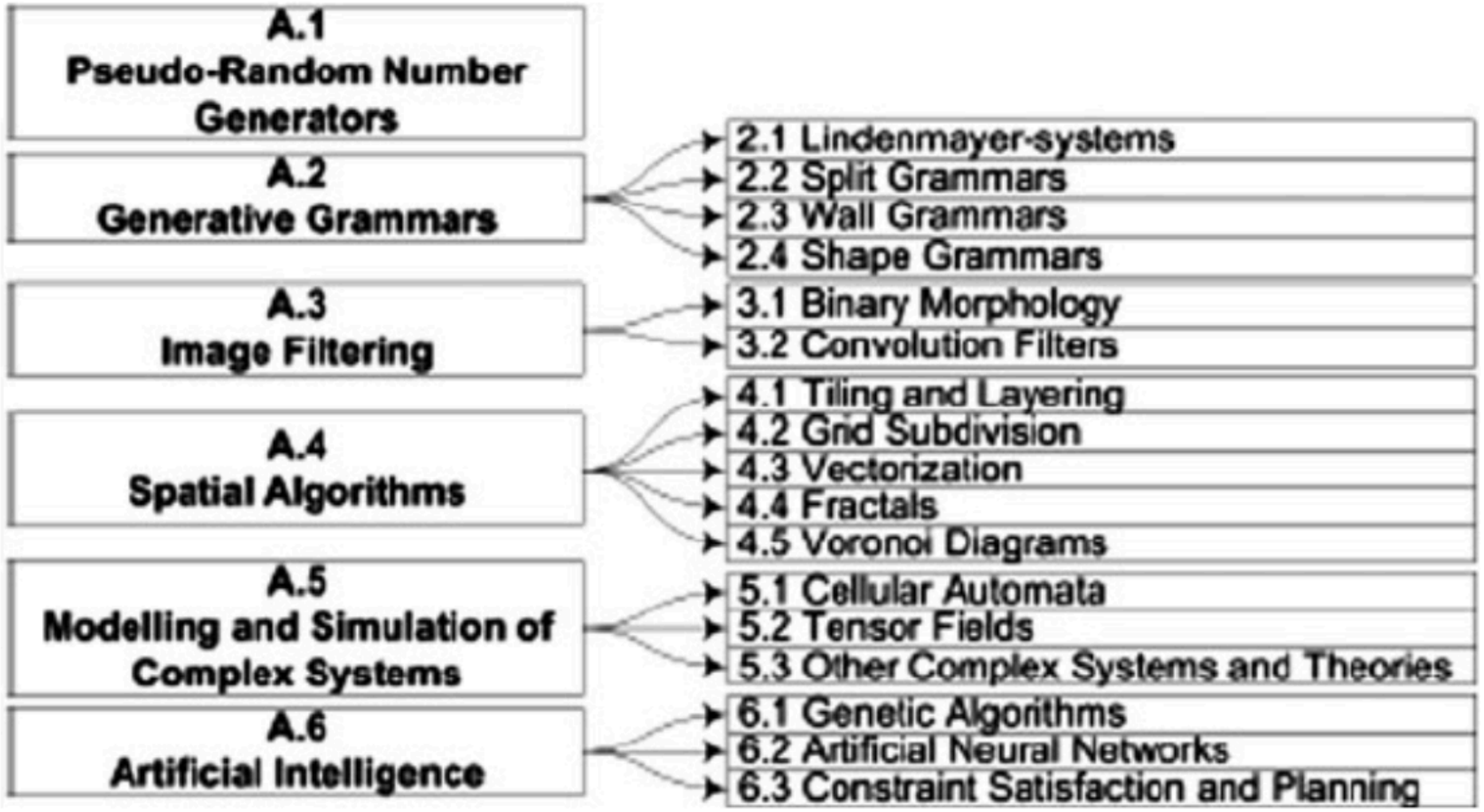
Maze Craze (1978)

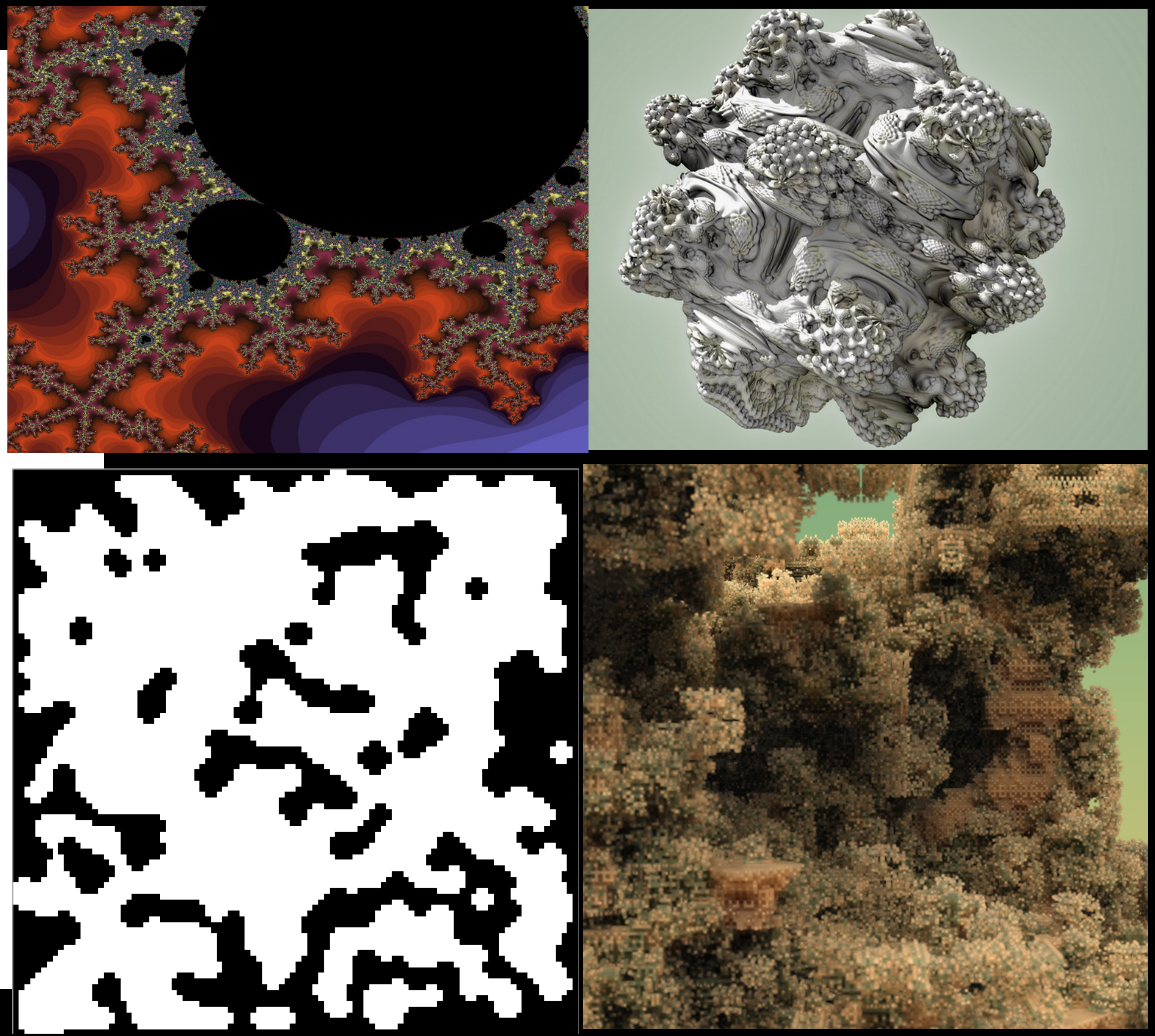


Akalabeth (1980)

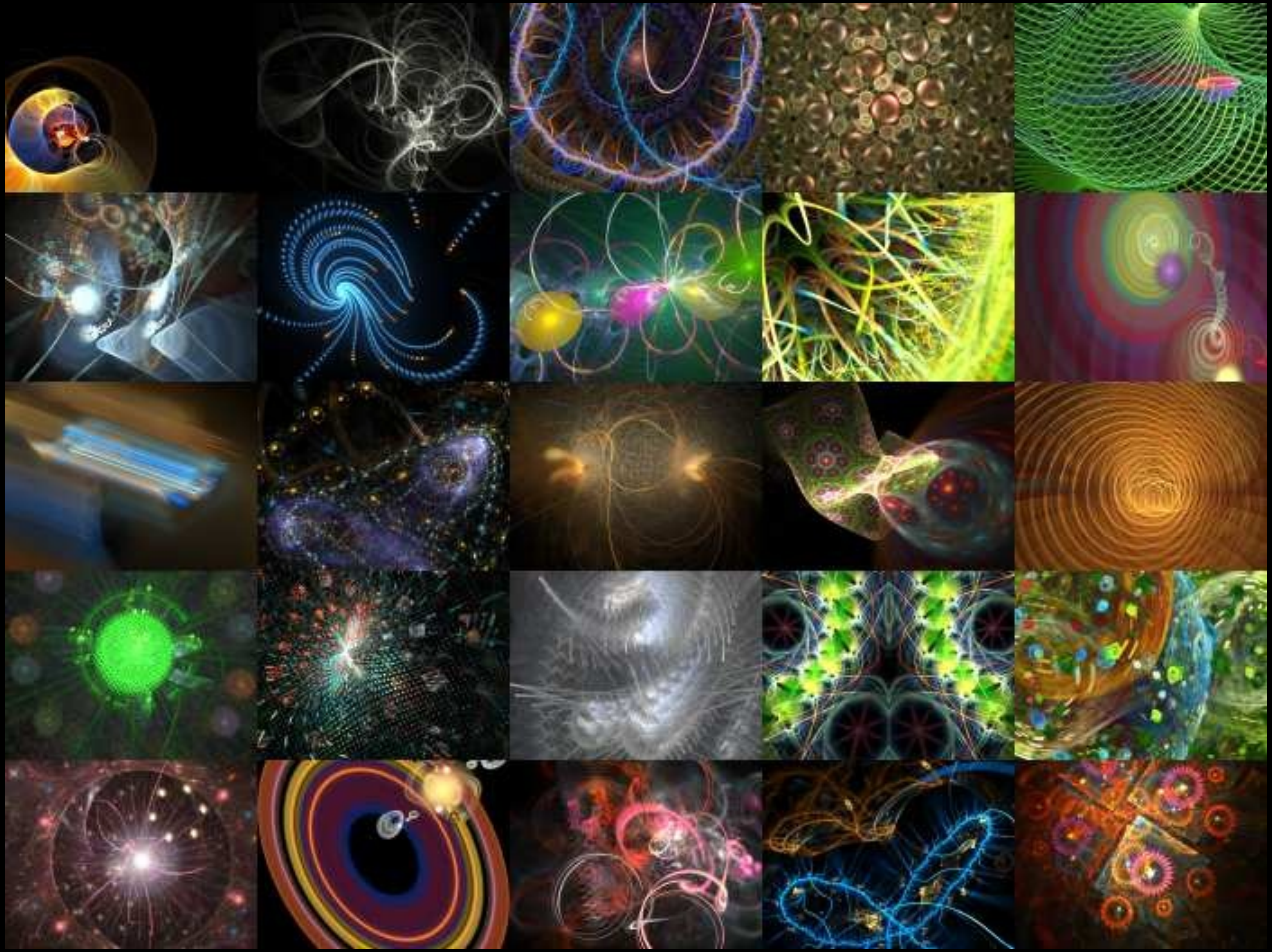
Rouge (1980)

Table 2 Categorization of technical complexity of PCG use (Hendrikx et al. 2013)





https://www.researchgate.net/publication/315863952_A_Very_Short_History_of_Dynamic_and_Procedural_Content_Generation

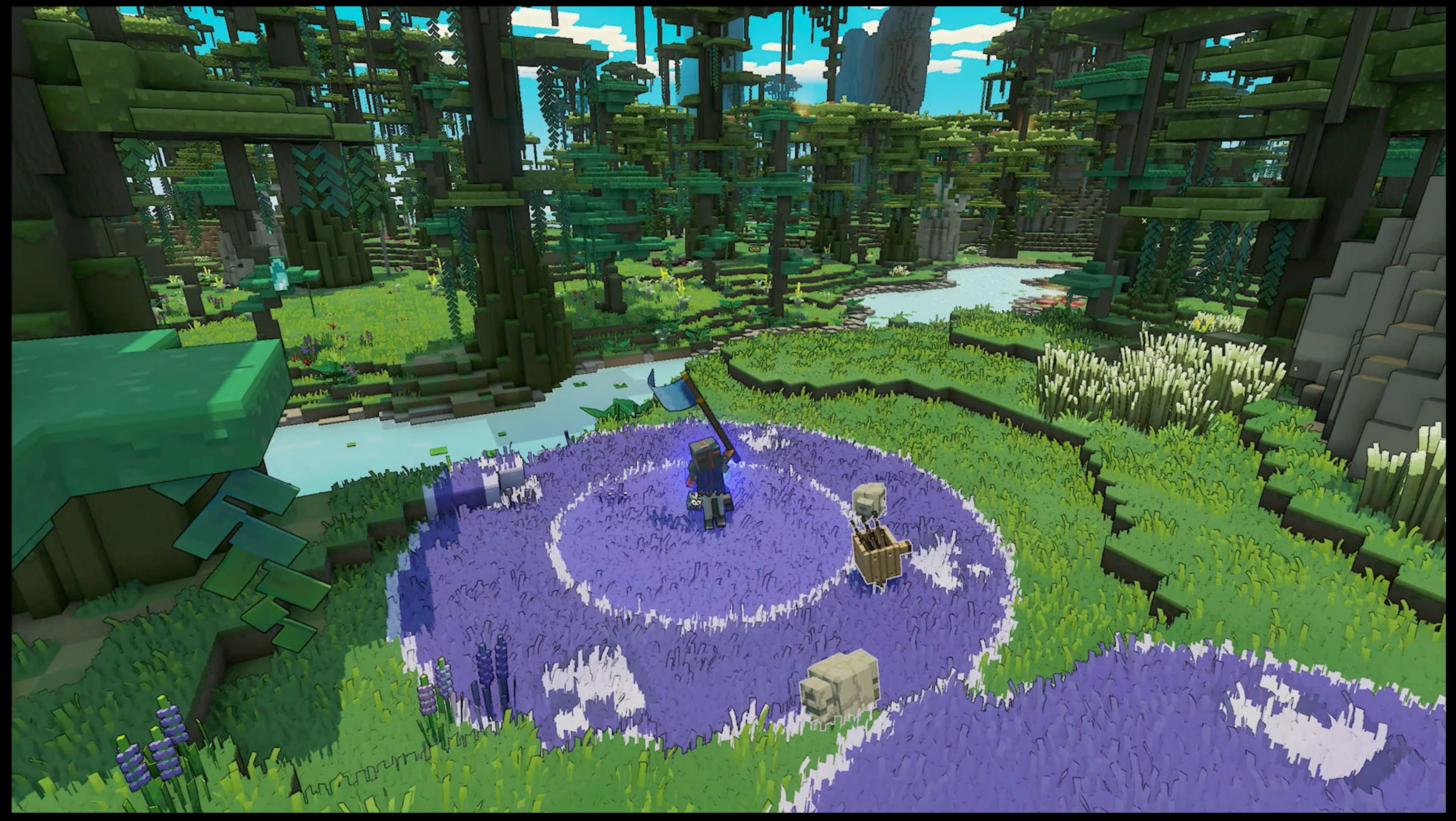


https://electricsheep.org/

Diablo (1995)

Dwarf Fortress (2006)

World of Warcraft



Minecraft

Spore (2008)

No Man's Sky (2016)

Starfield (2023)

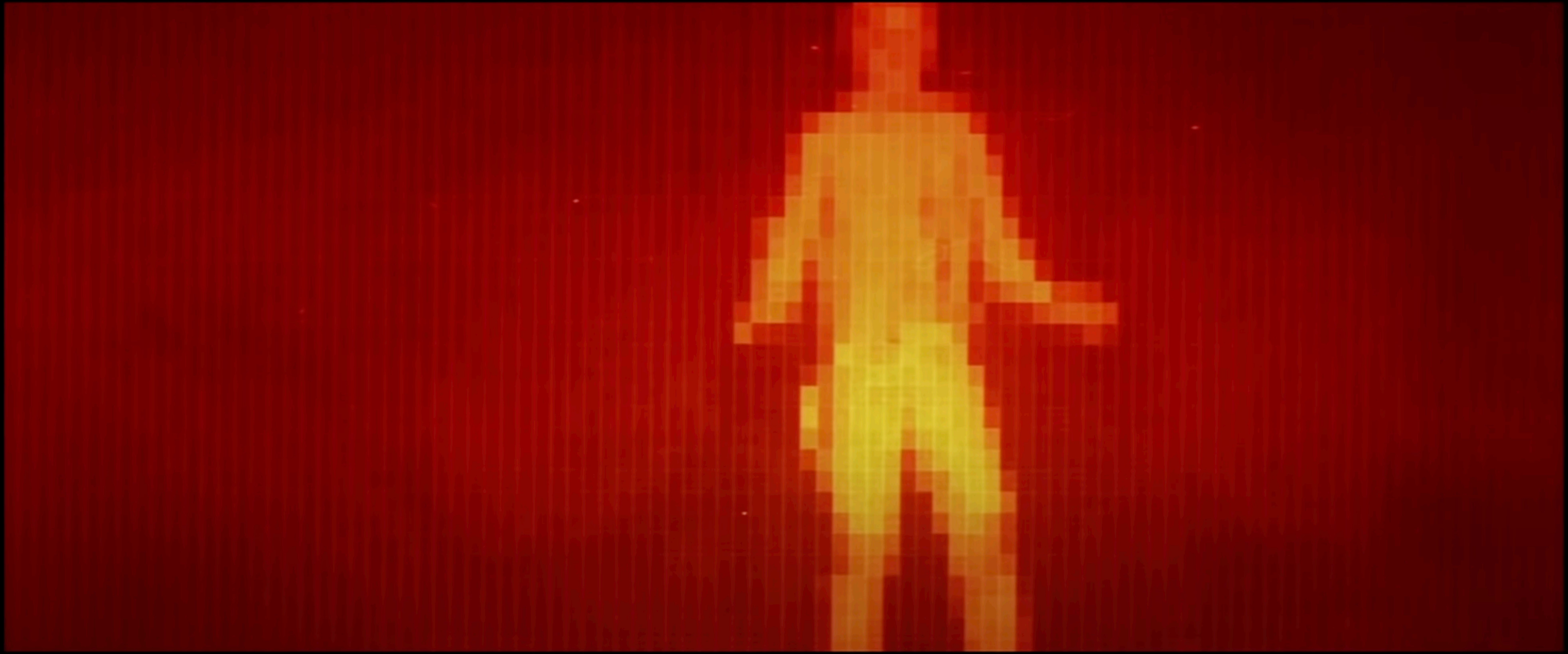
Nightingale (2023)

Shadows of Doubt (2023)

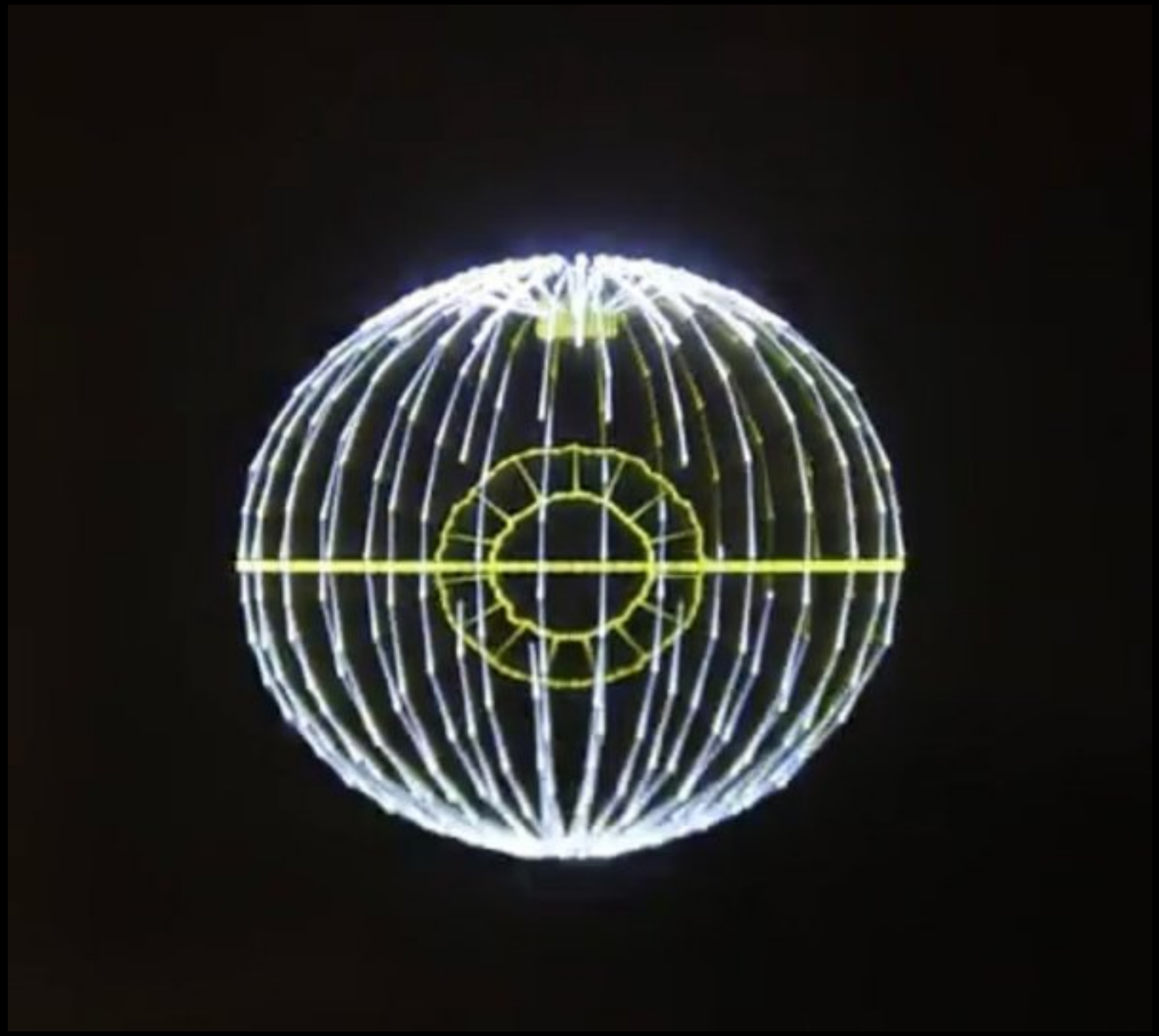
Diablo 4 (2023)

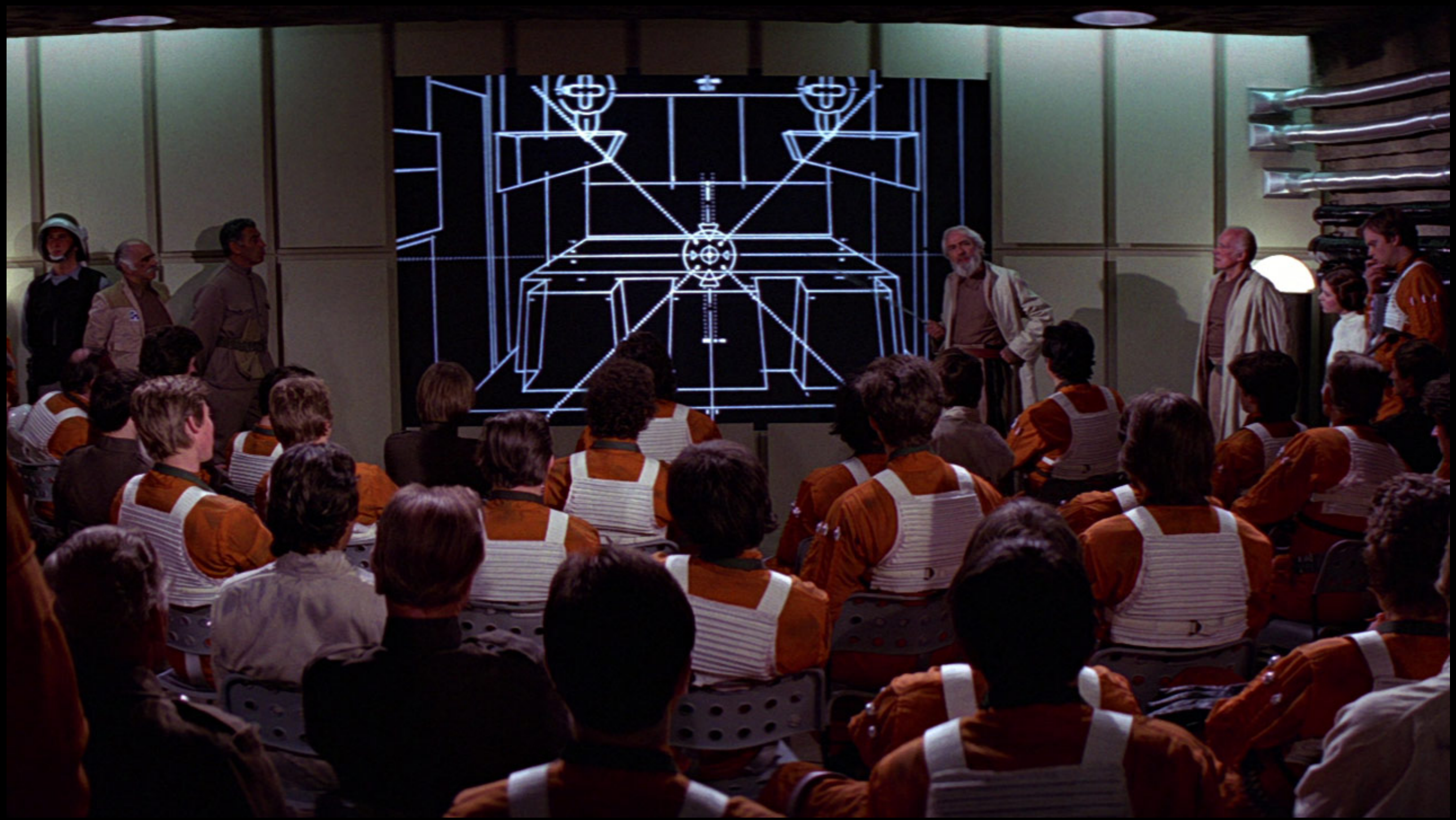
Star Wars Jedi: Survivor (2023)

EARLY 3D + GENERATIVE 3D IN FILM

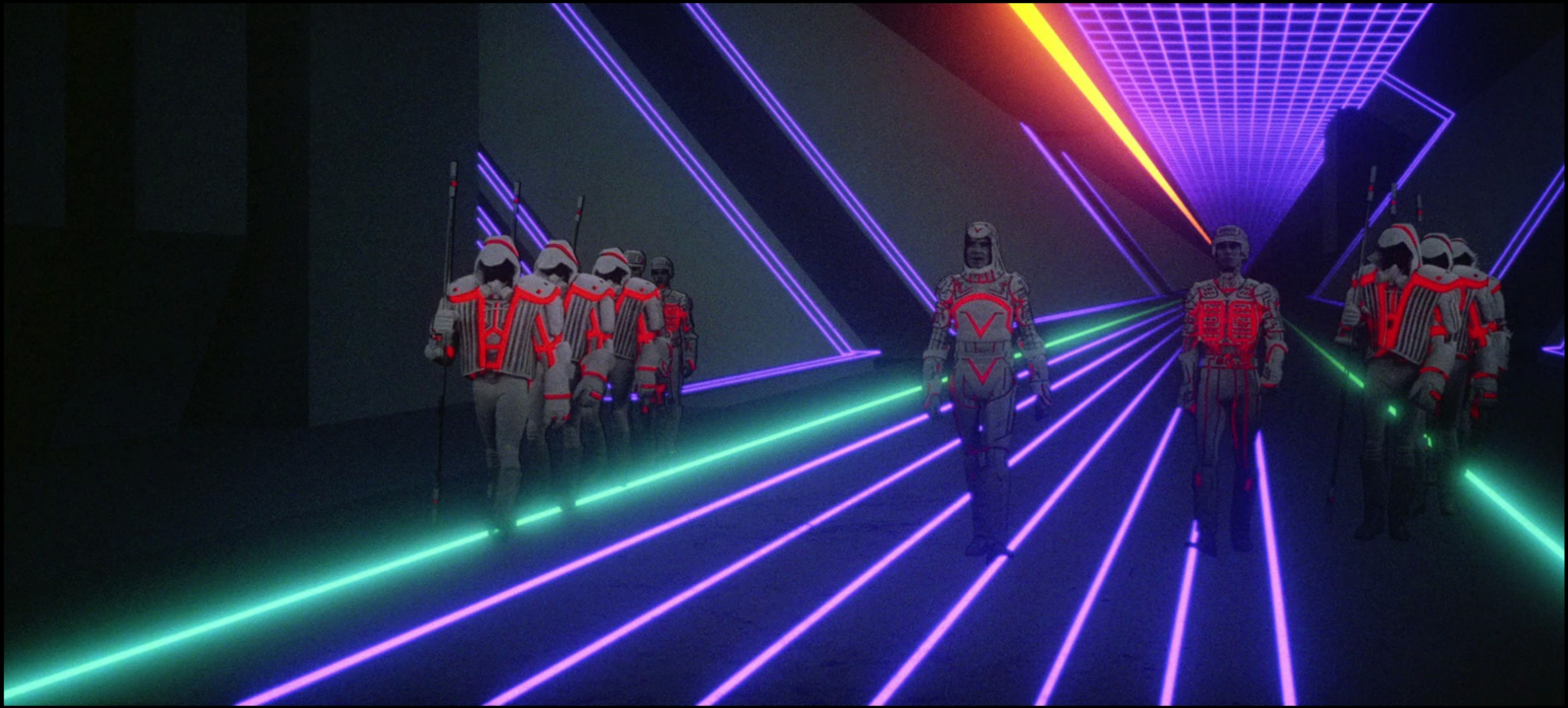


https://www.youtube.com/watch?v=nILKFlpOZi0





Star Wars (1977)

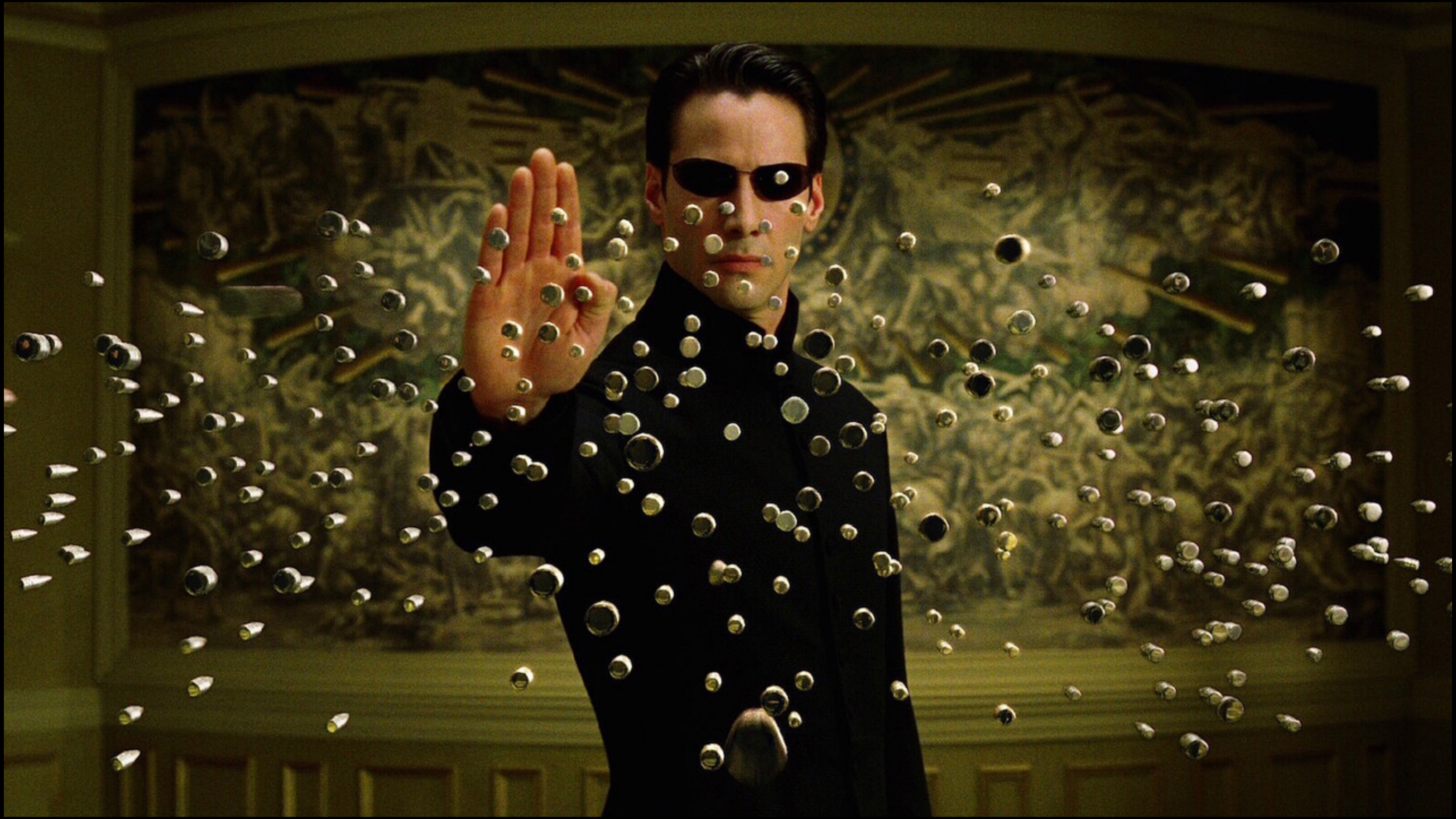


Tron (1982)

The Abyss (1989)

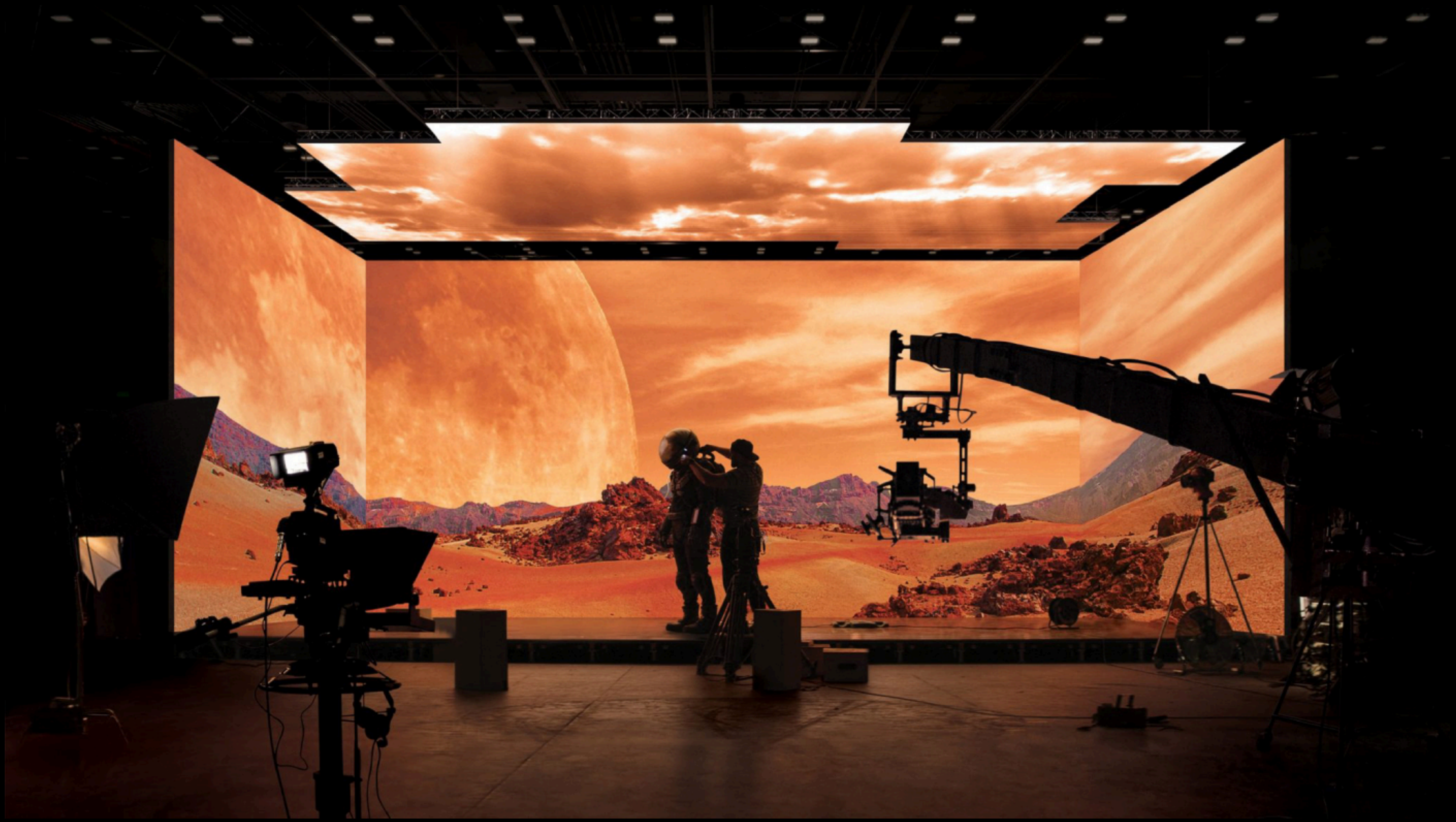
Jurassic Park (1993)

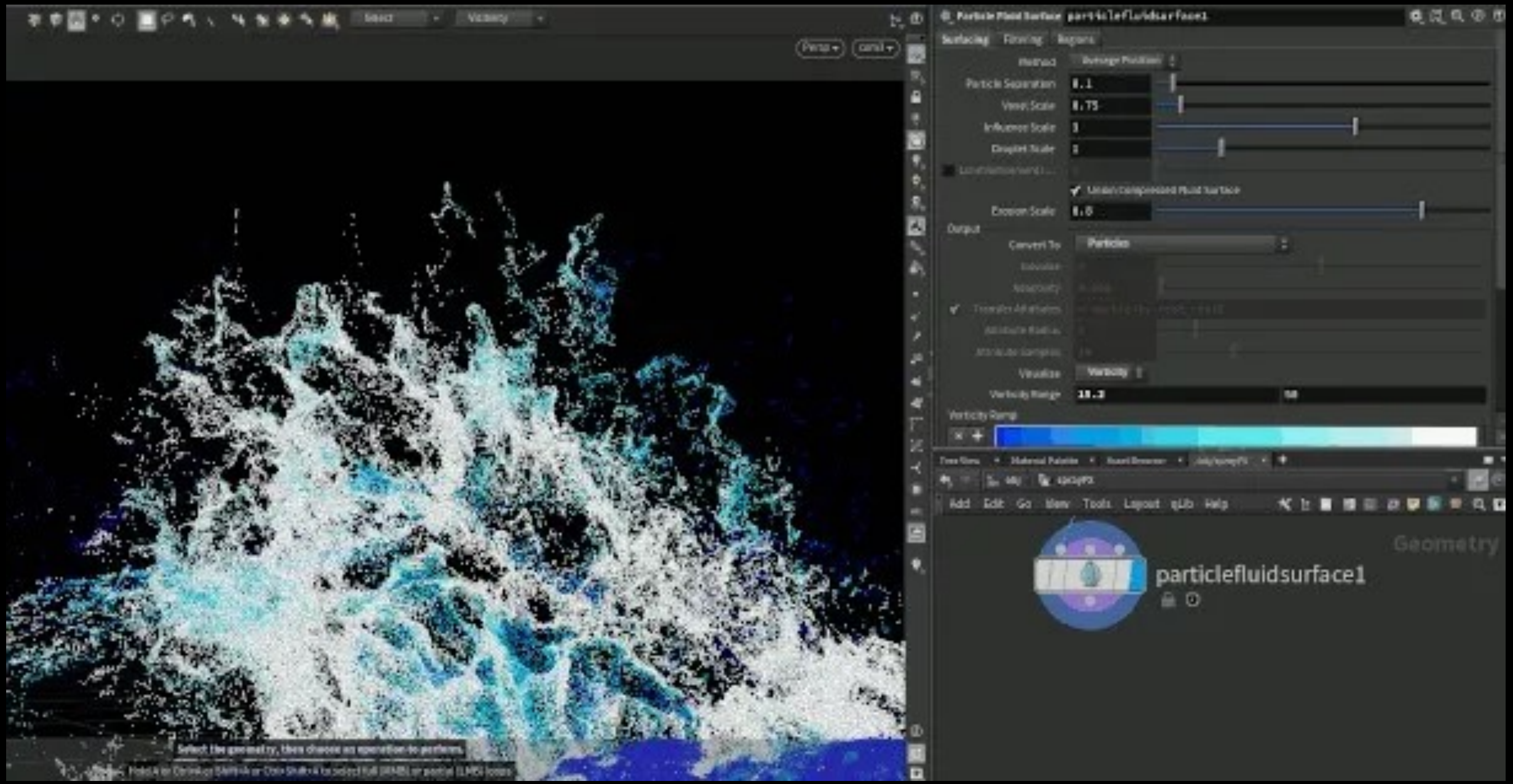
Lord of the Rings (2001)



The Matrix Reloaded (2003)

Avatar (2009)

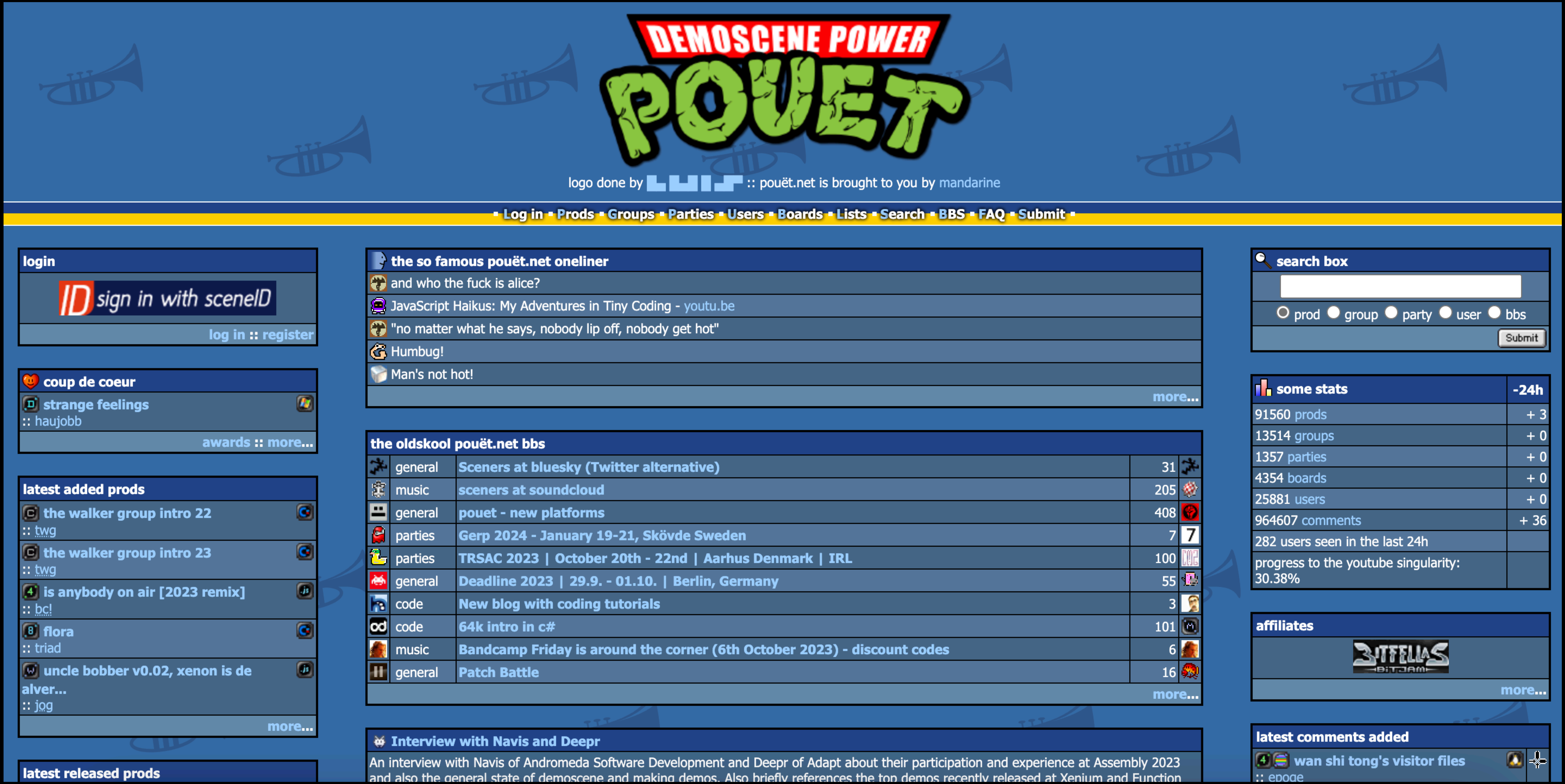



particlefluidsurface1
Geometry

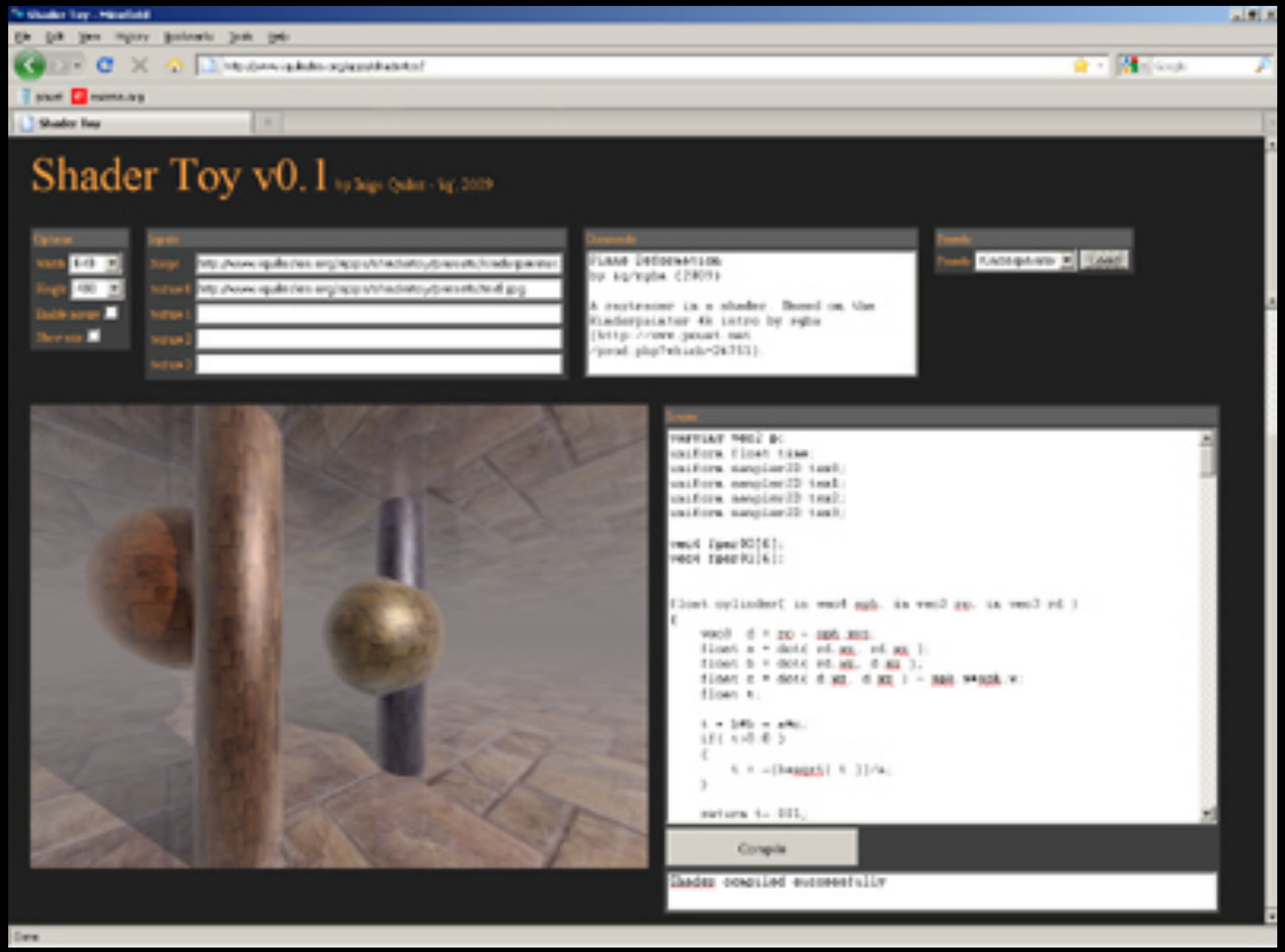

Houdini

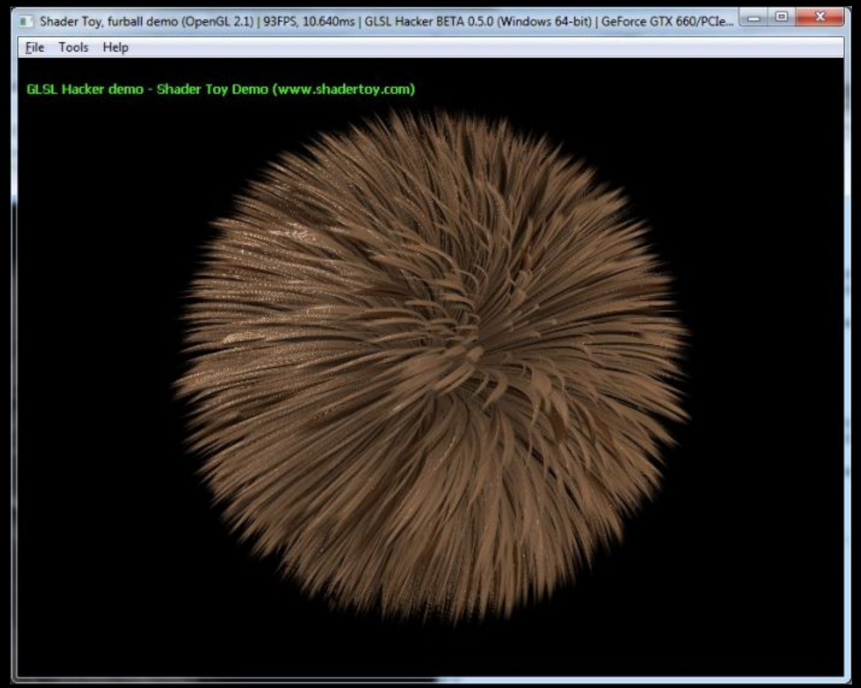

MetaHumans &
Machine Learning
GDC 2023

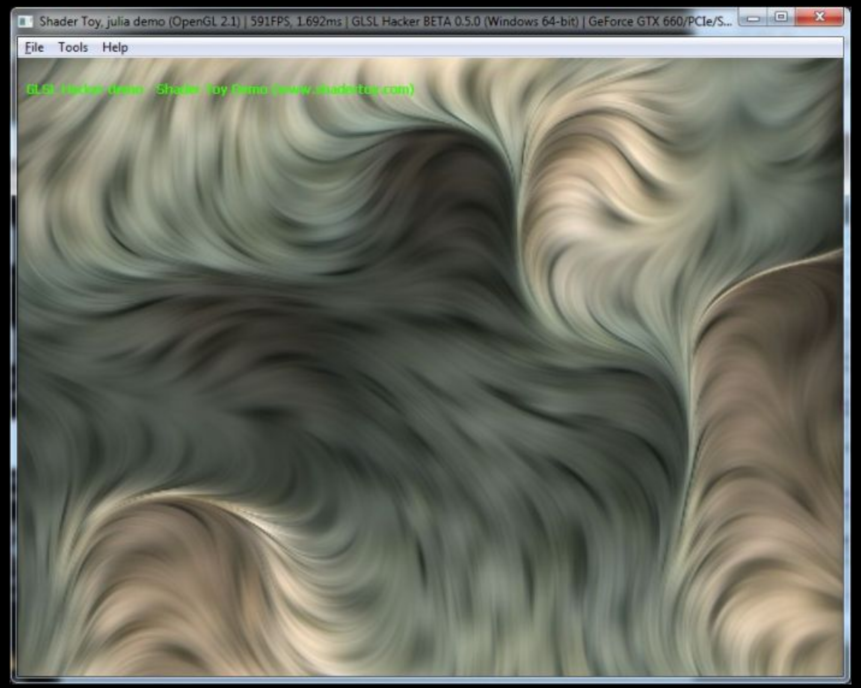
OTHER PROCEDURAL GENERATION AND GENERATIVE 3D CONTEXT

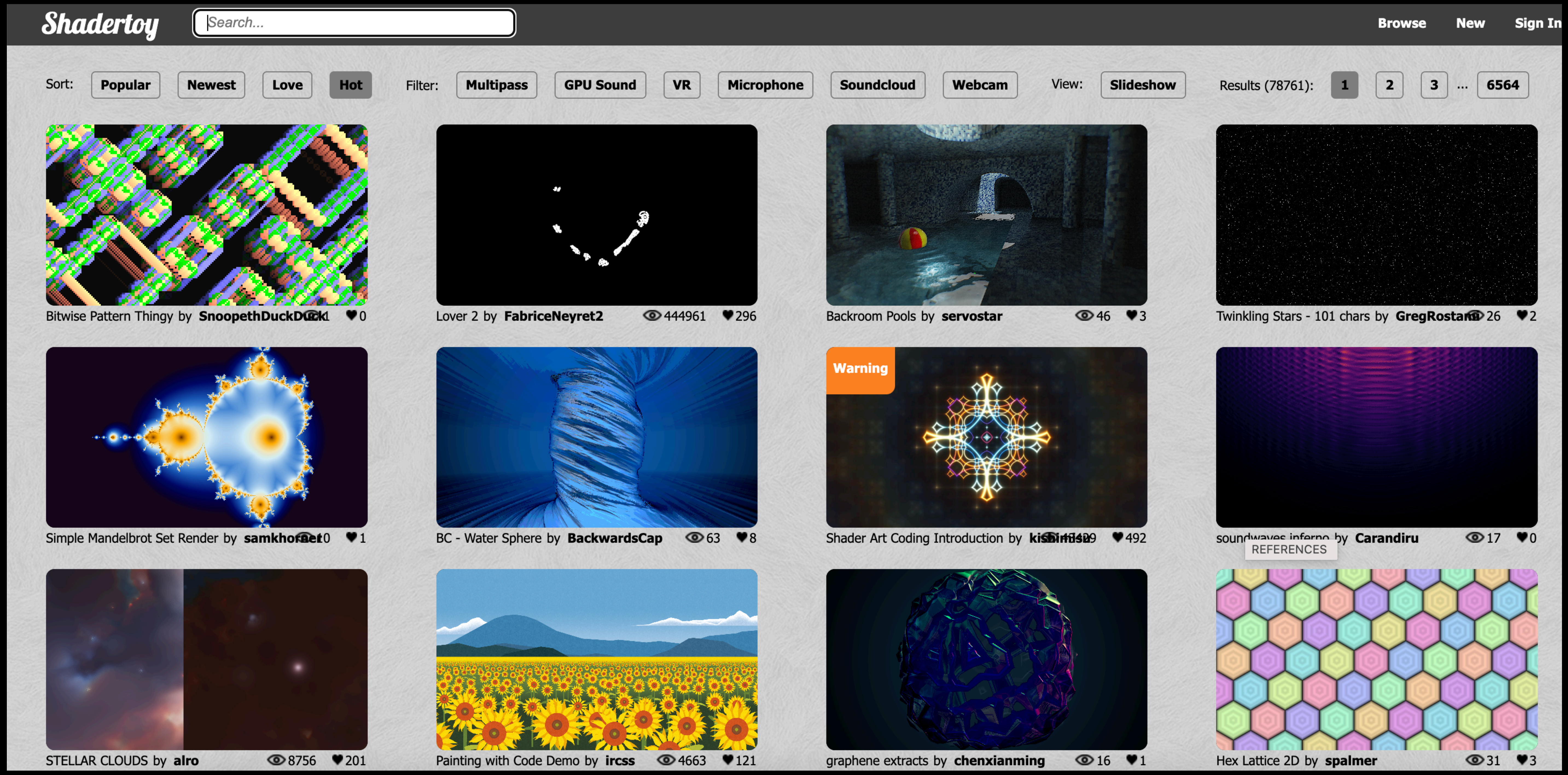


https://www.pouet.net/



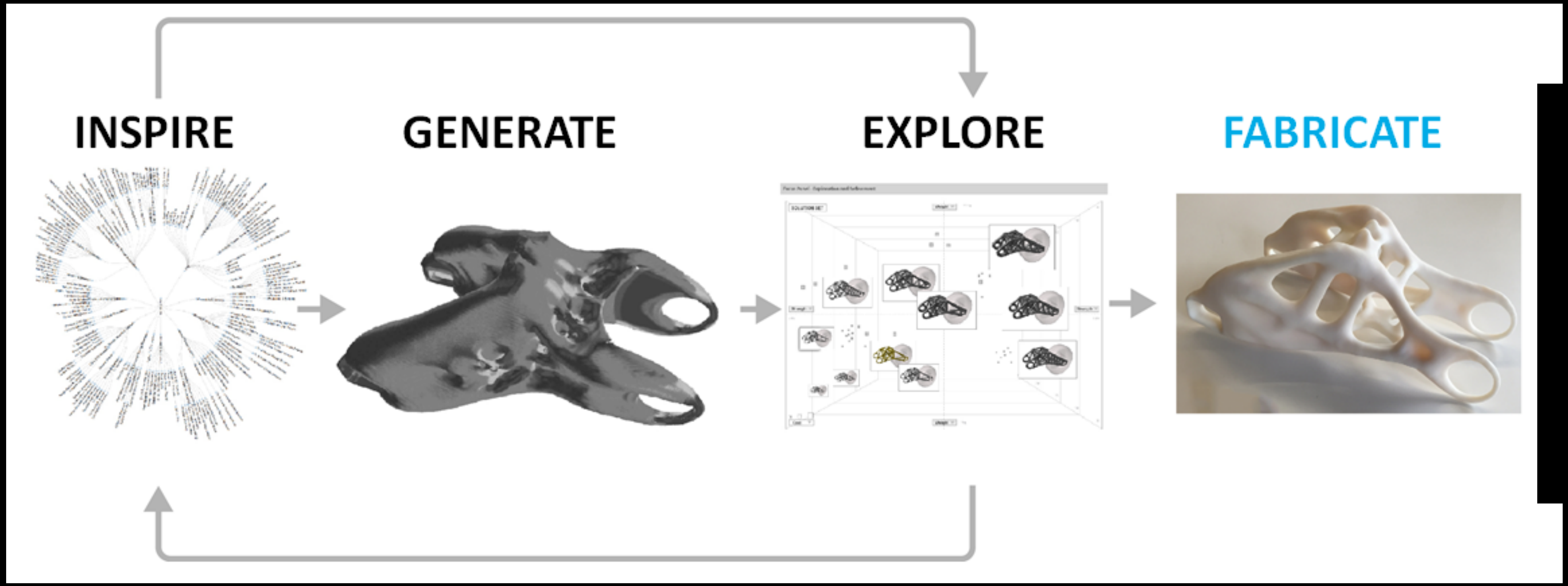


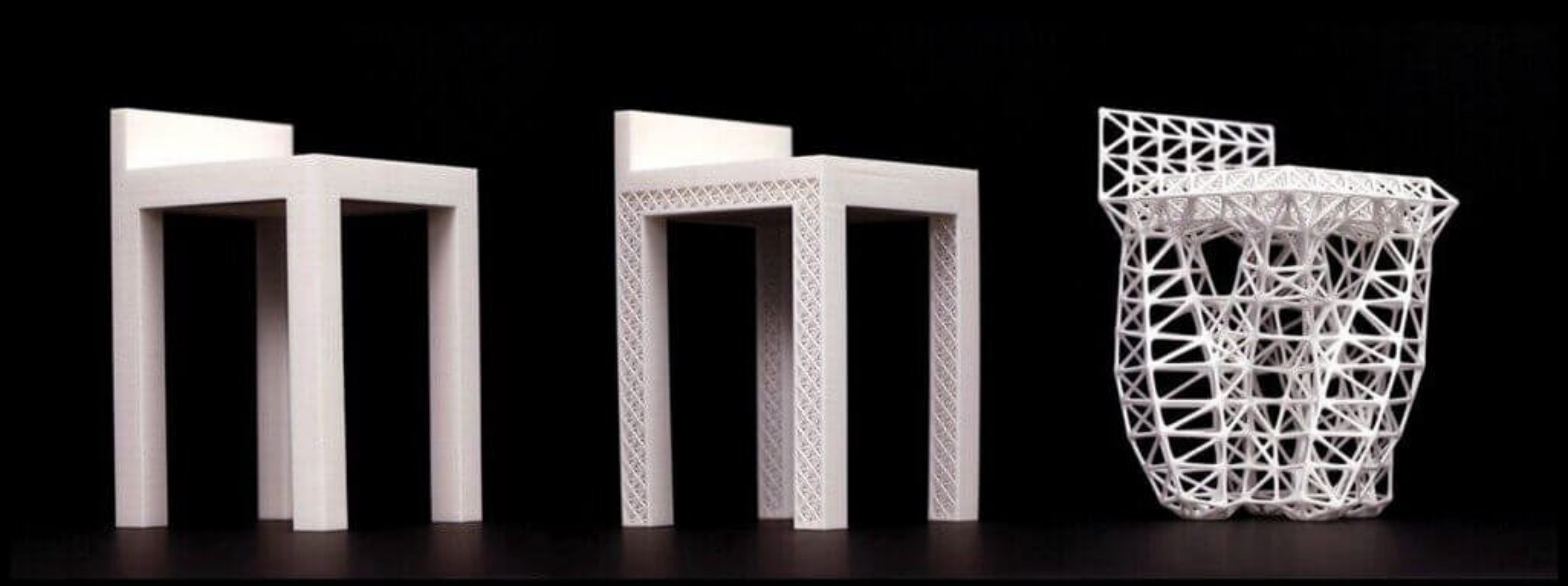


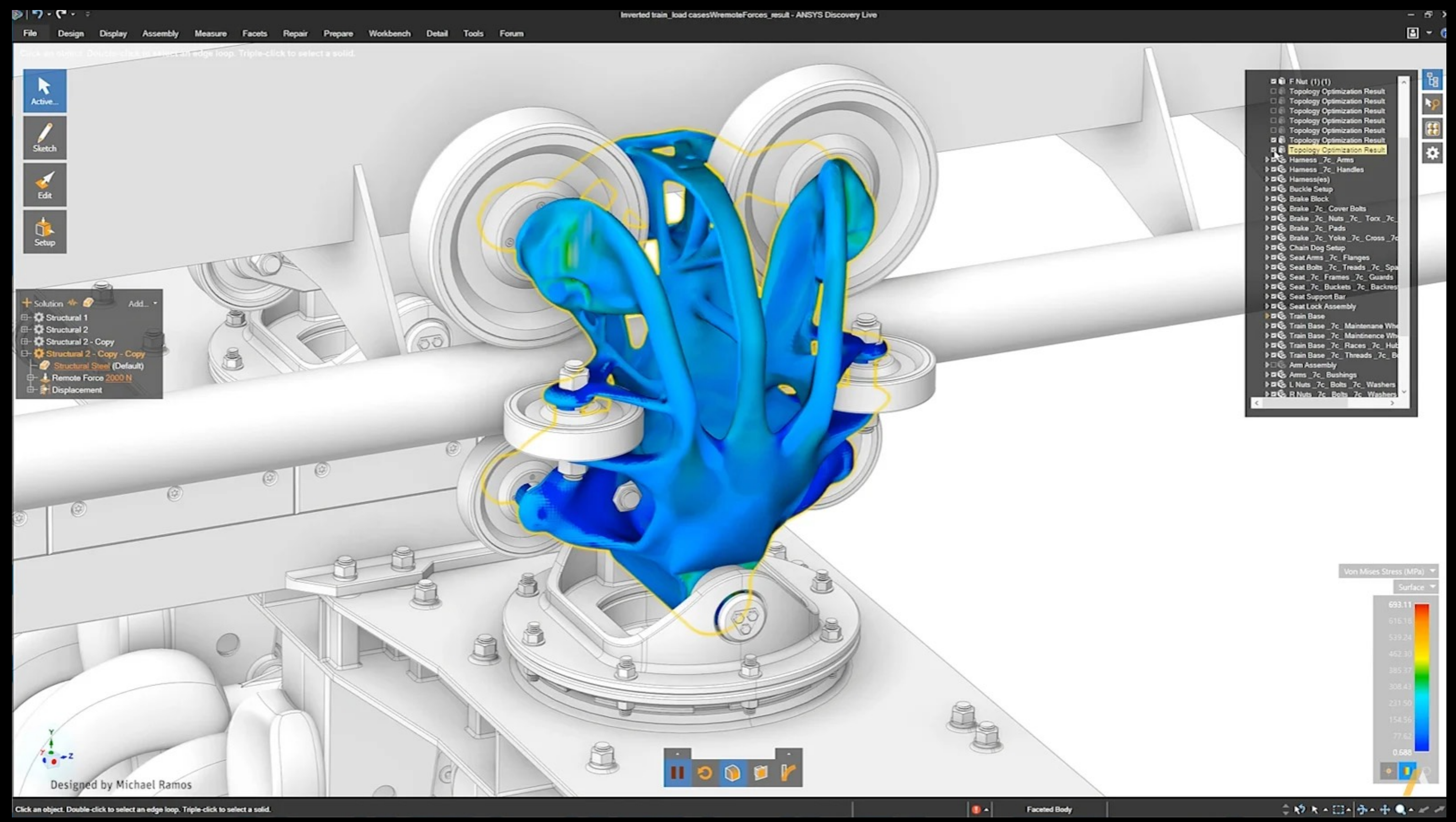


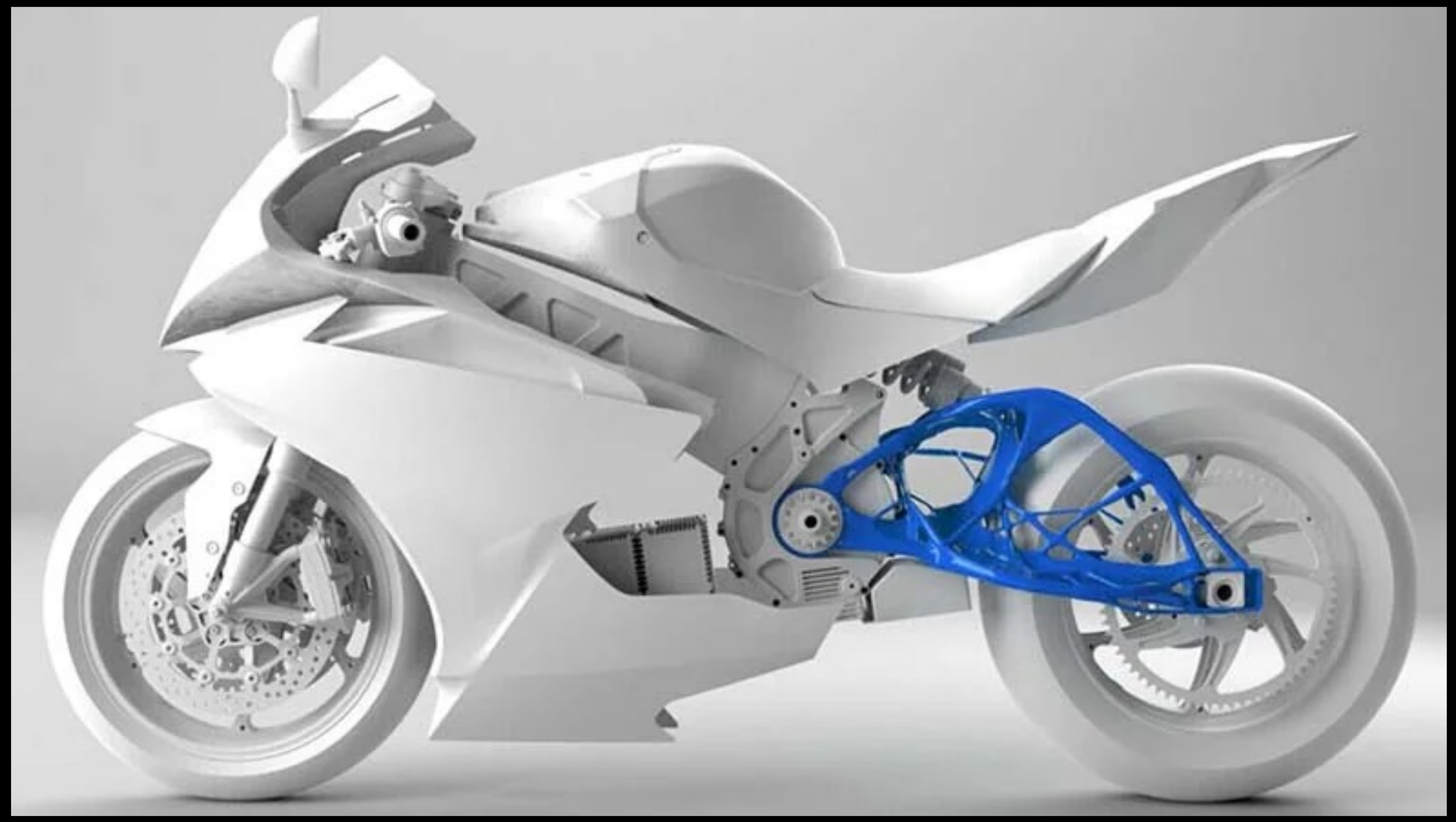
https://www.shadertoy.com/browse

https://www.geeks3d.com/20130614/shadertoy-to-glsl-hacker-demos-june-14-2013/



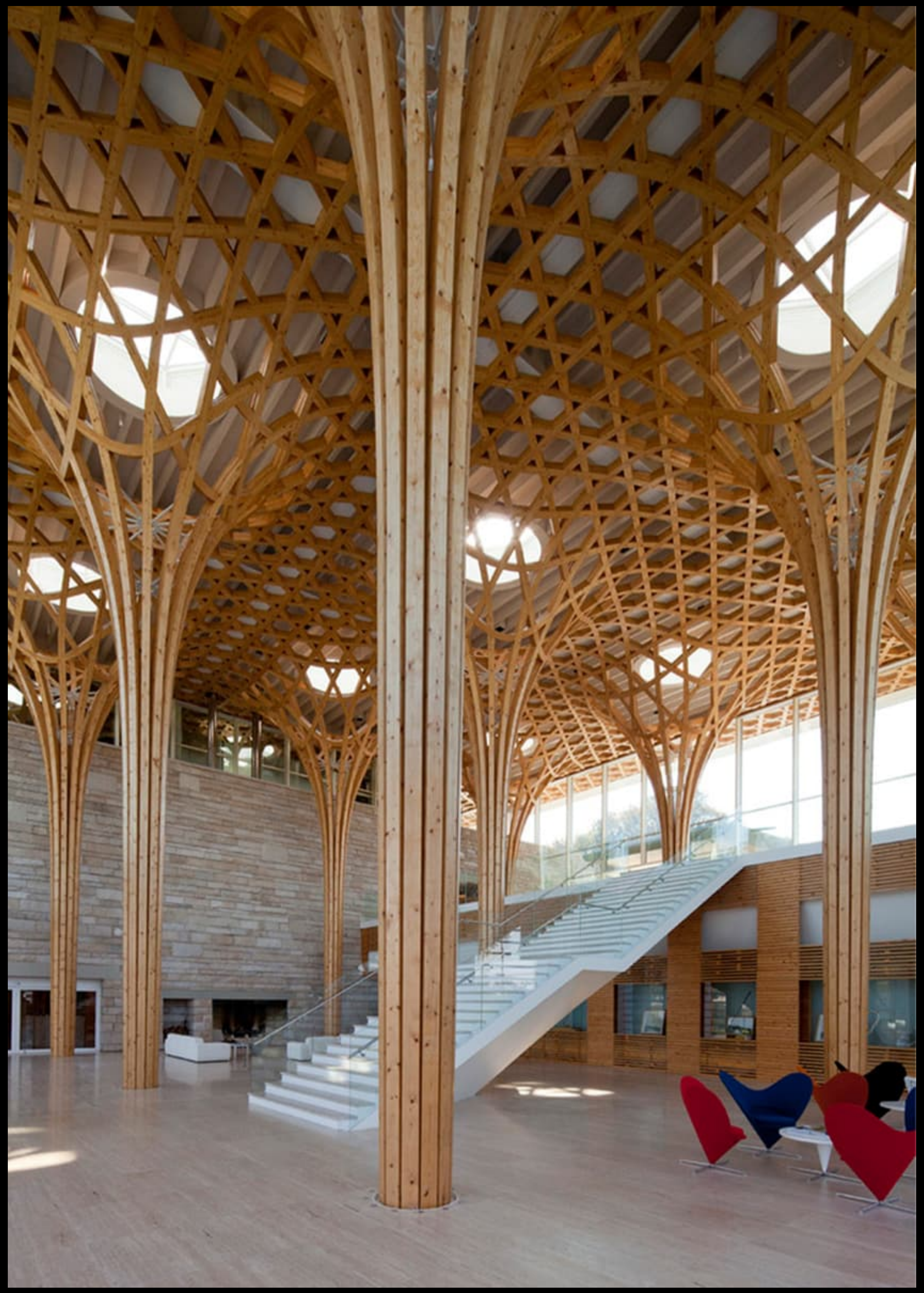




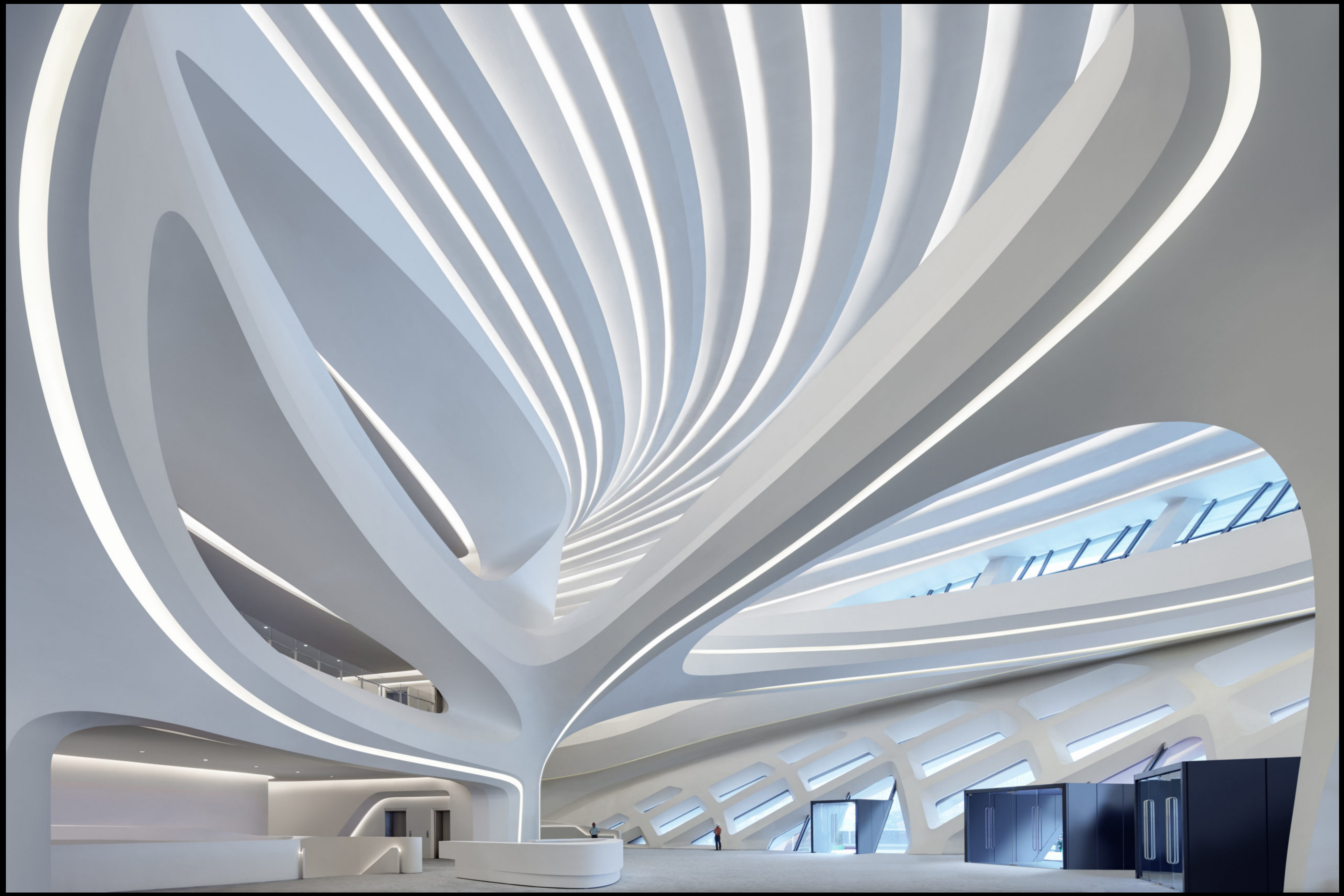


https://www.autodesk.com/solutions/generative-design

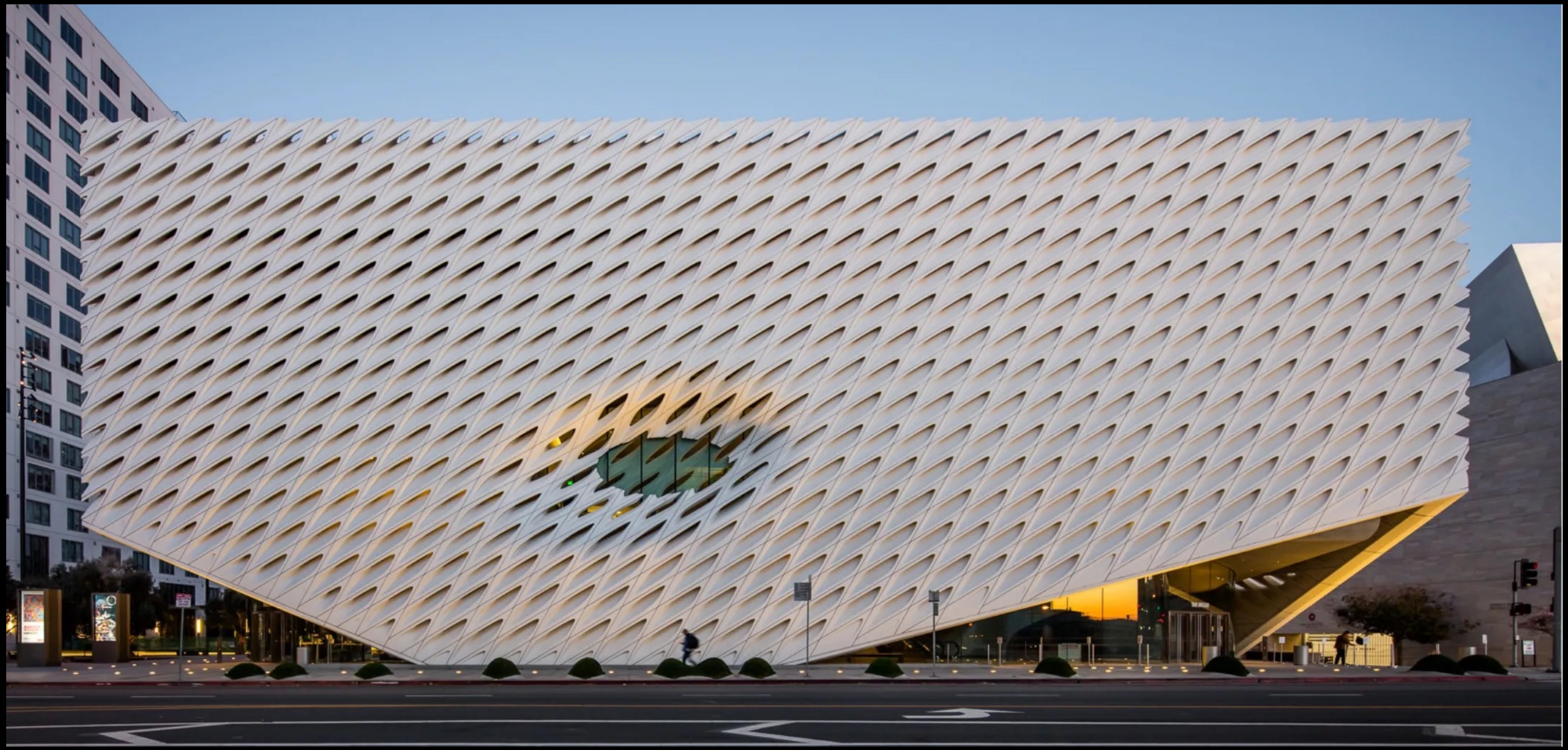
EXAMPLES OF GENERATIVE 3D IN ARCHITECTURE, DESIGN, AND INSTALLATION



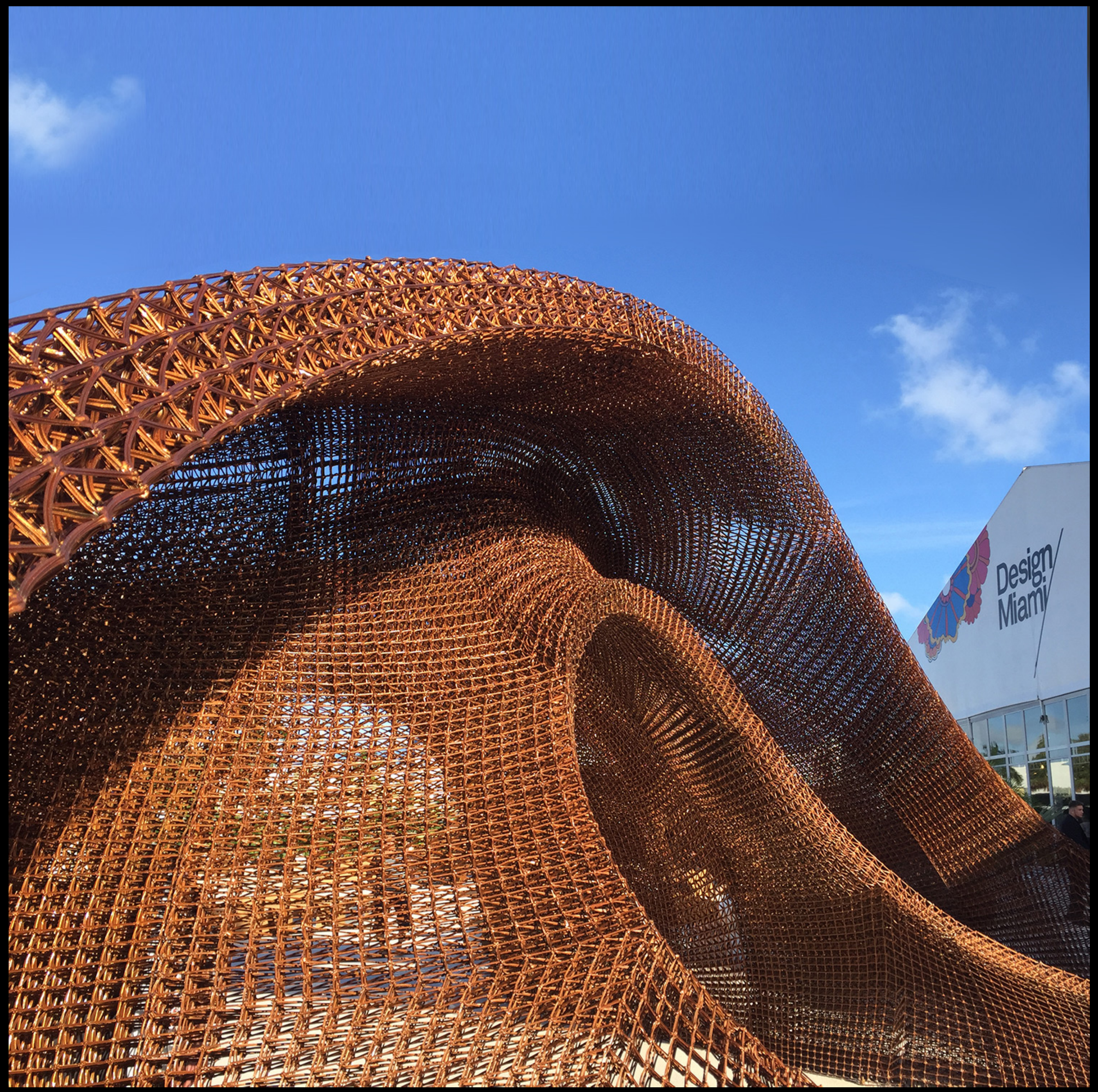
Shigeru Ban



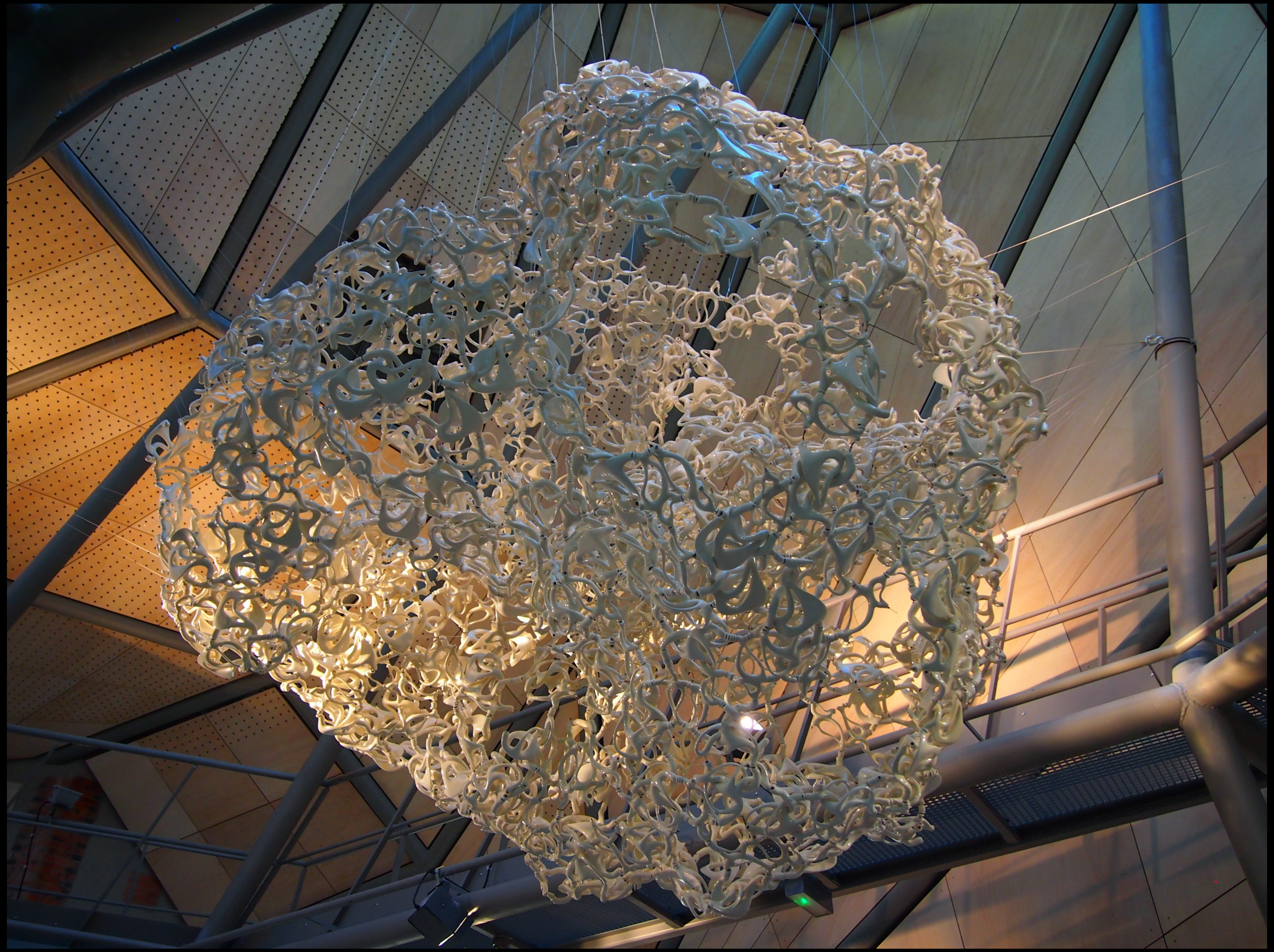
Zaha Hadid



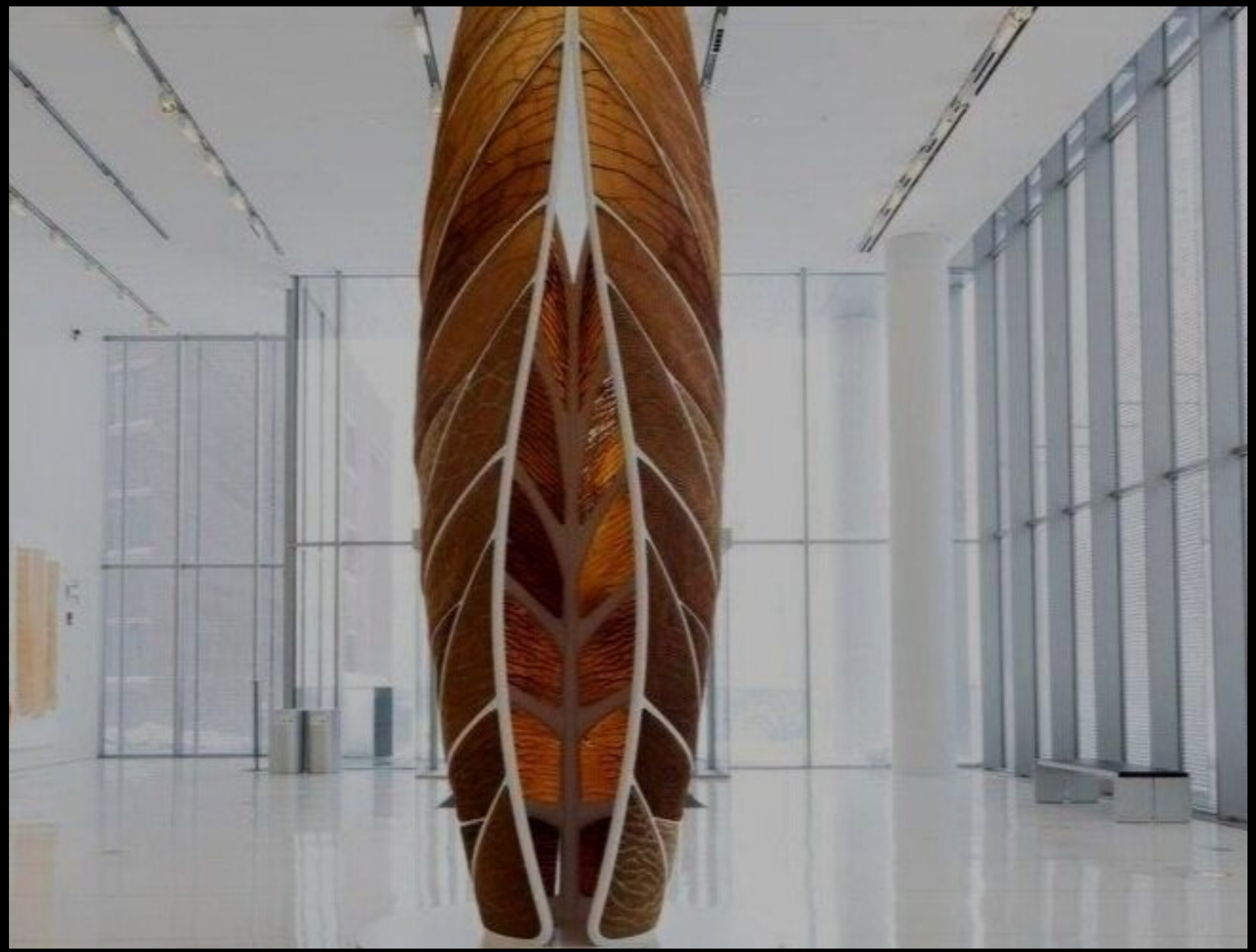
Diller Scofidio + Renfro



Branch Technology



https://www.jennysabin.com/

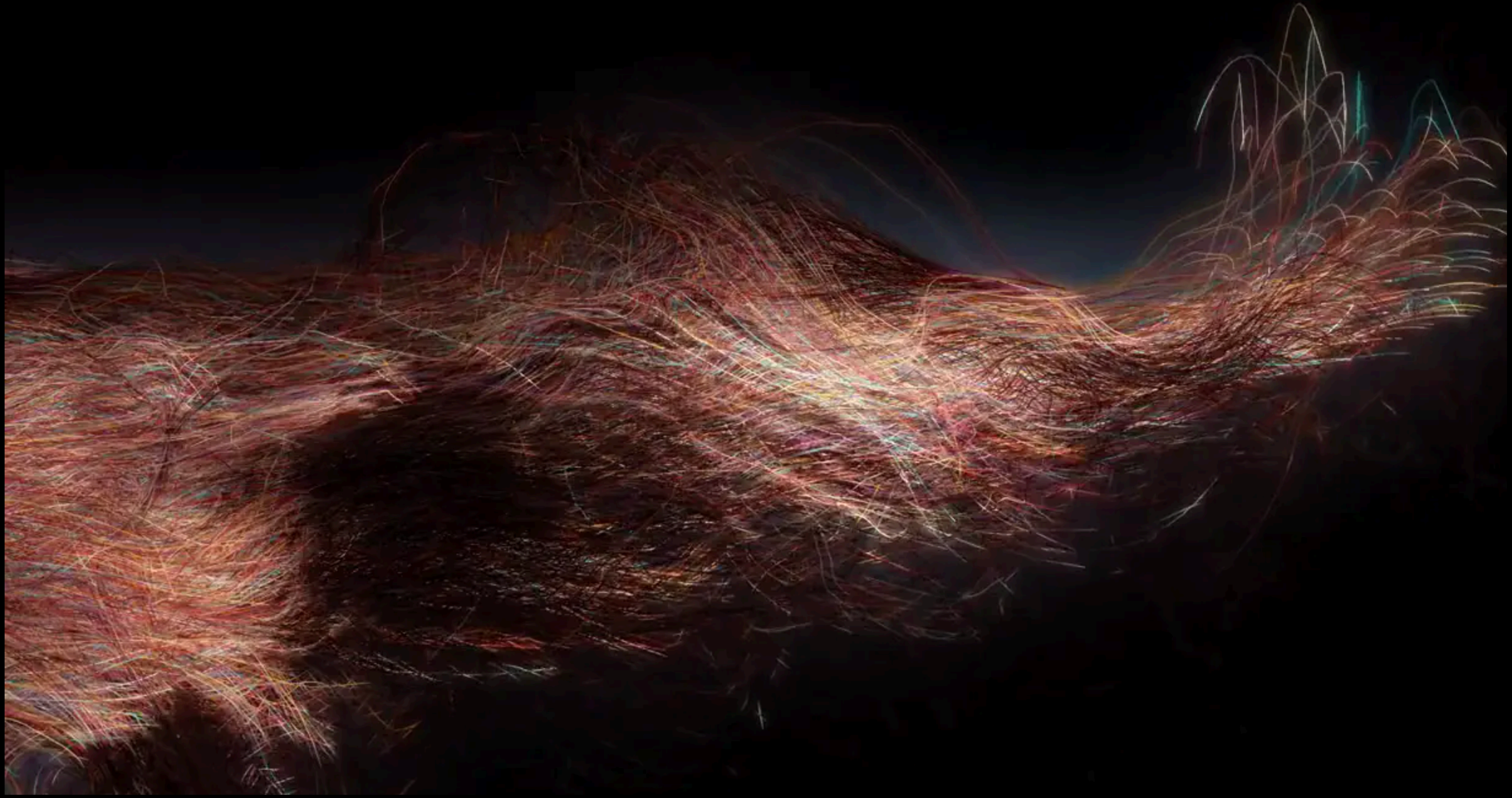


https://oxman.com/

GENERATIVE 3D IN ARTISTIC PRACTICES

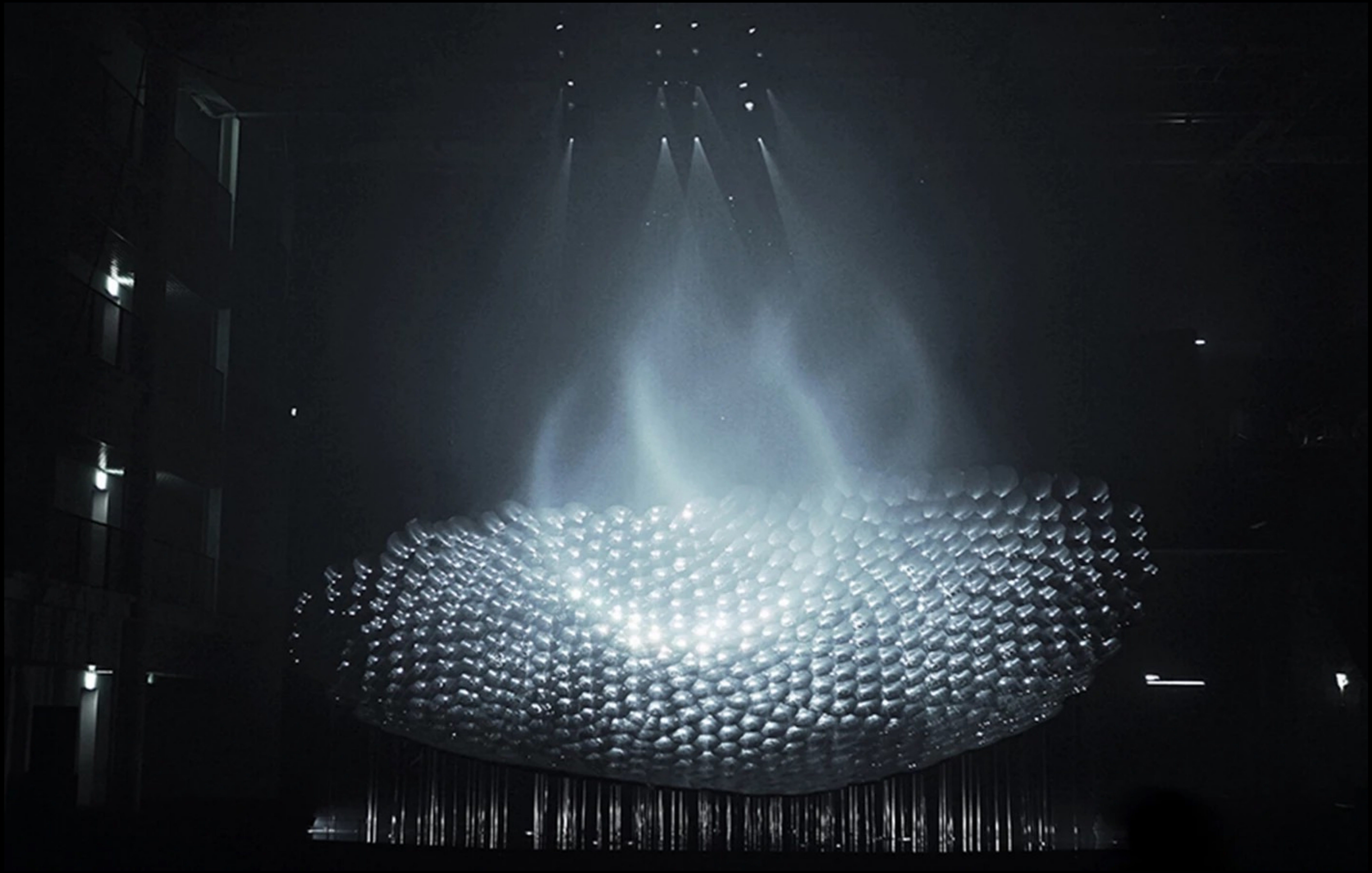
https://www.jamesgeorge.me/

https://www.memo.tv/works/sony-playstation3-video-store/



https://www.memo.tv/works/waves/

https://kylemcdonald.net/

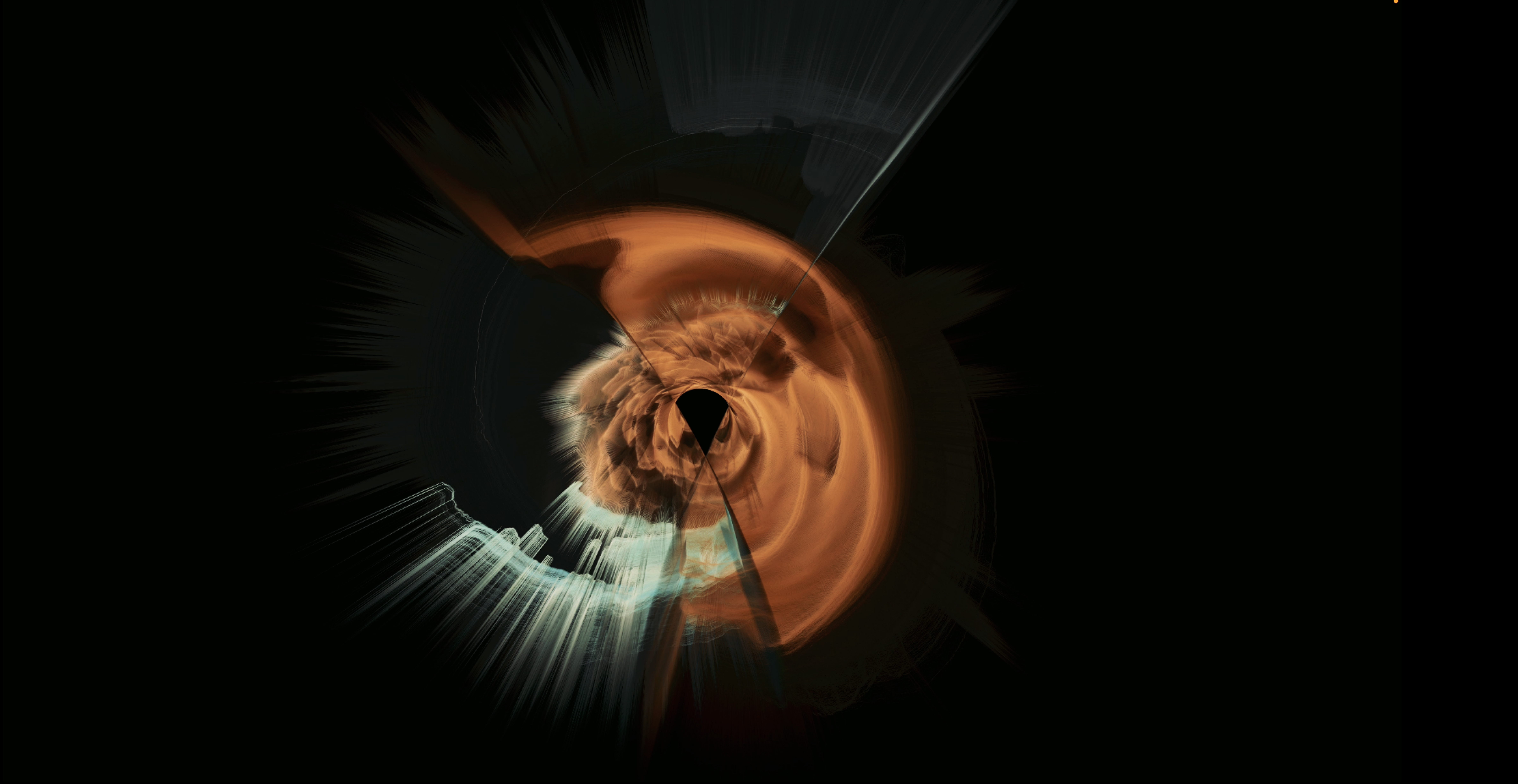


https://kimchiandchips.com/works/

https://joanielemercier.com/hambach-forest-and-the-technological-sublime/

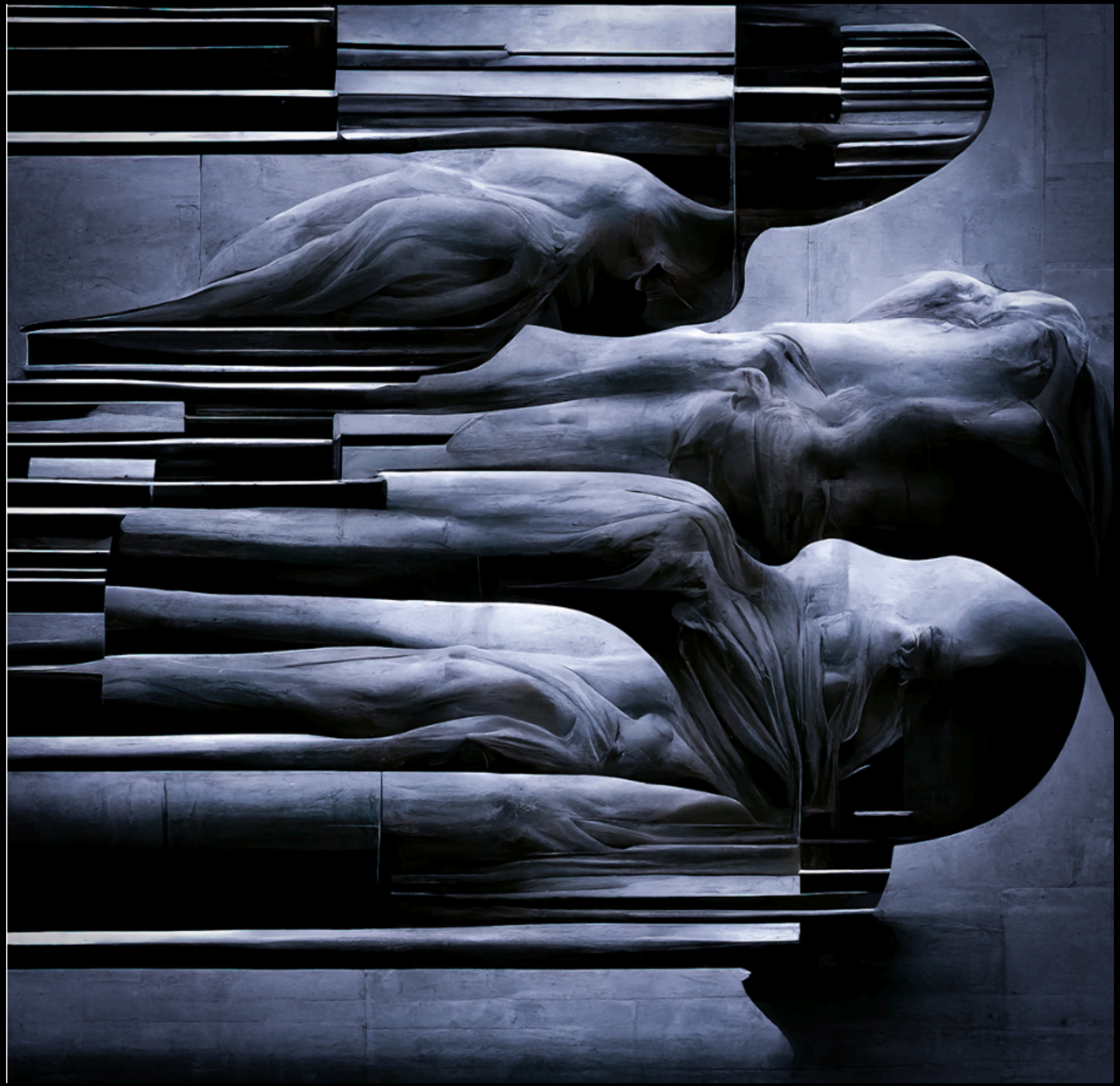
https://www.kistefosmuseum.com/sculptur/variants

https://refikanadolstudio.com/



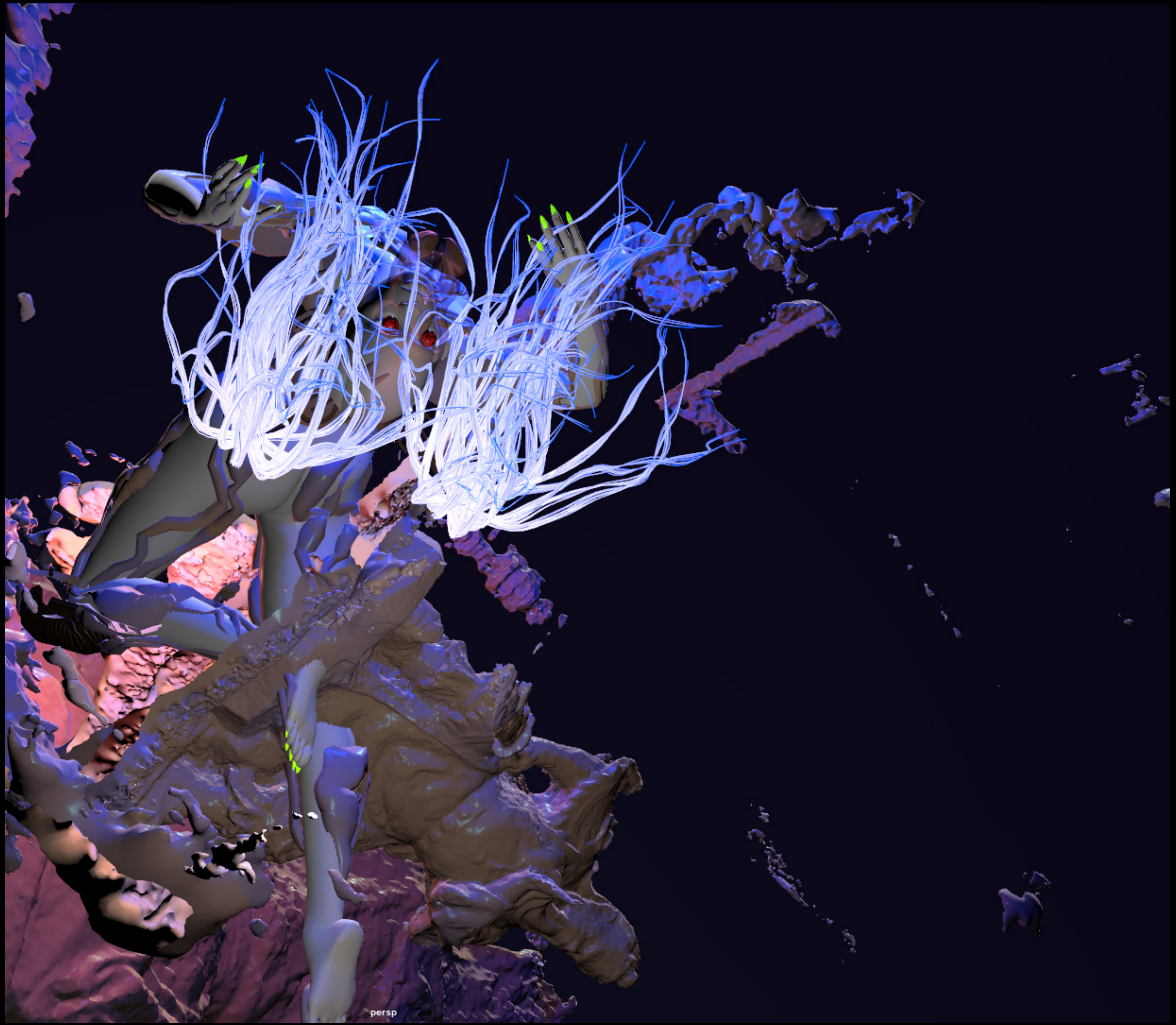
https://pkmital.com/home/works/the-surge/

https://nancybakercahill.com/



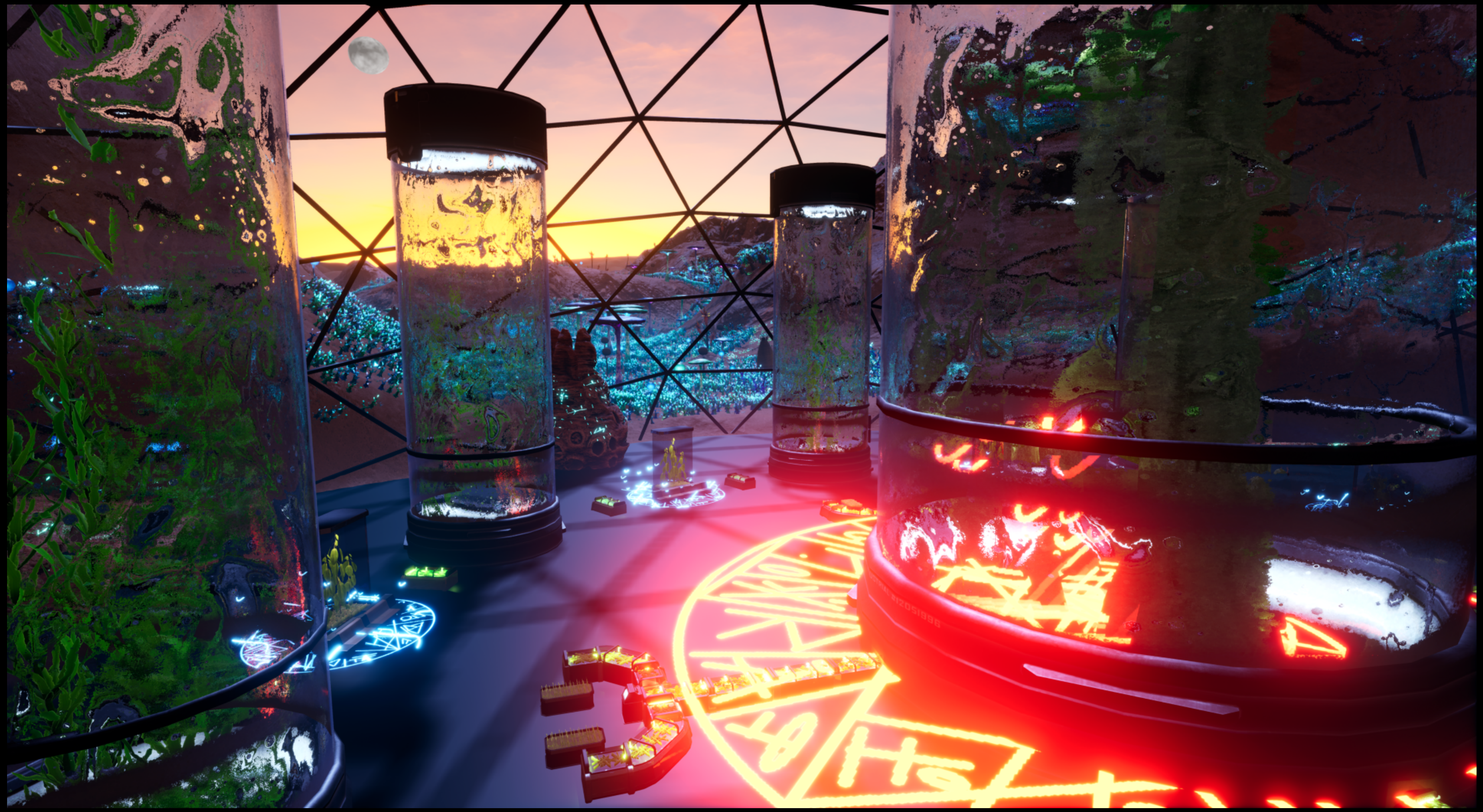
https://conniebakshi.com/

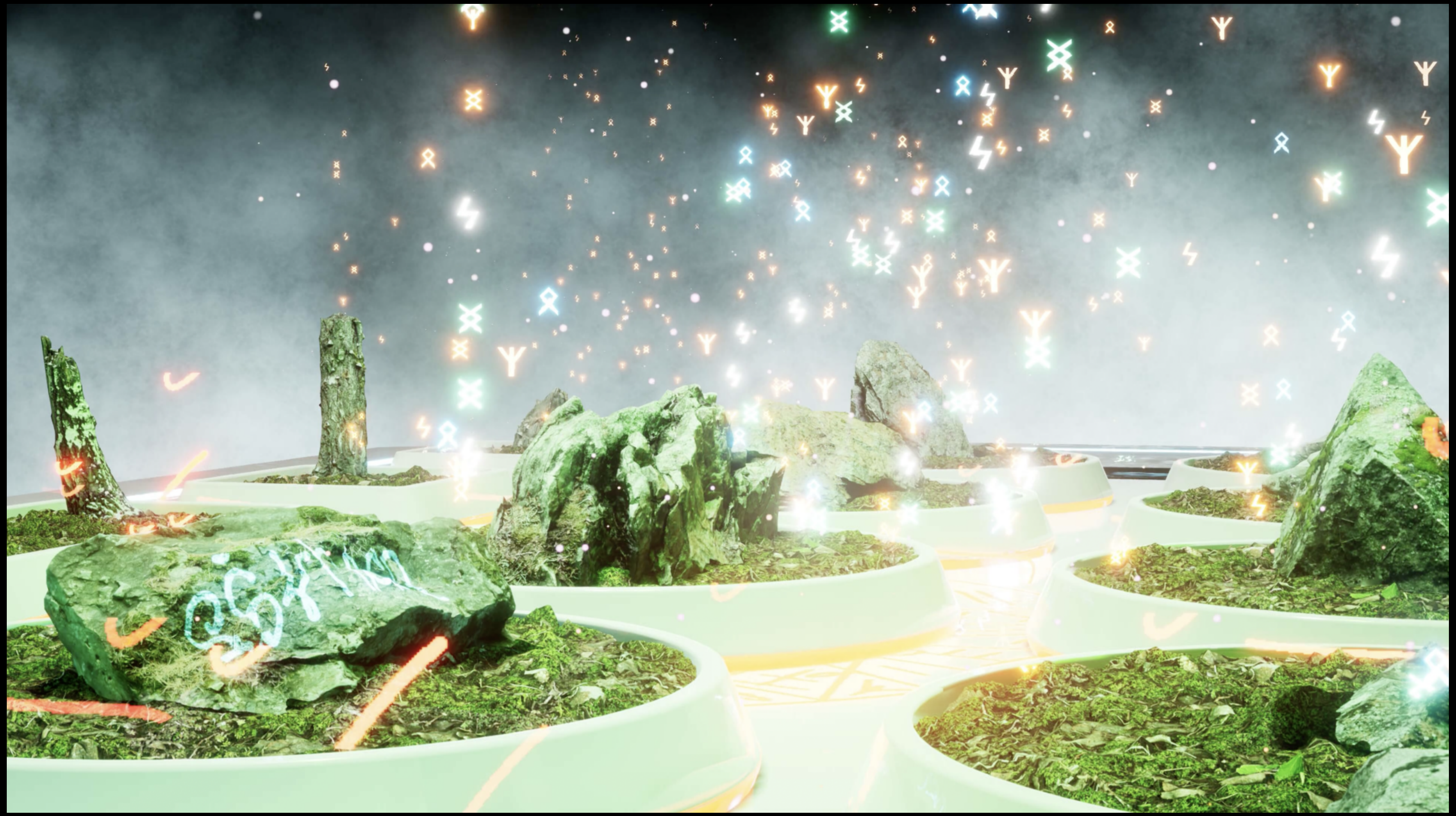
https://carriechen.works/



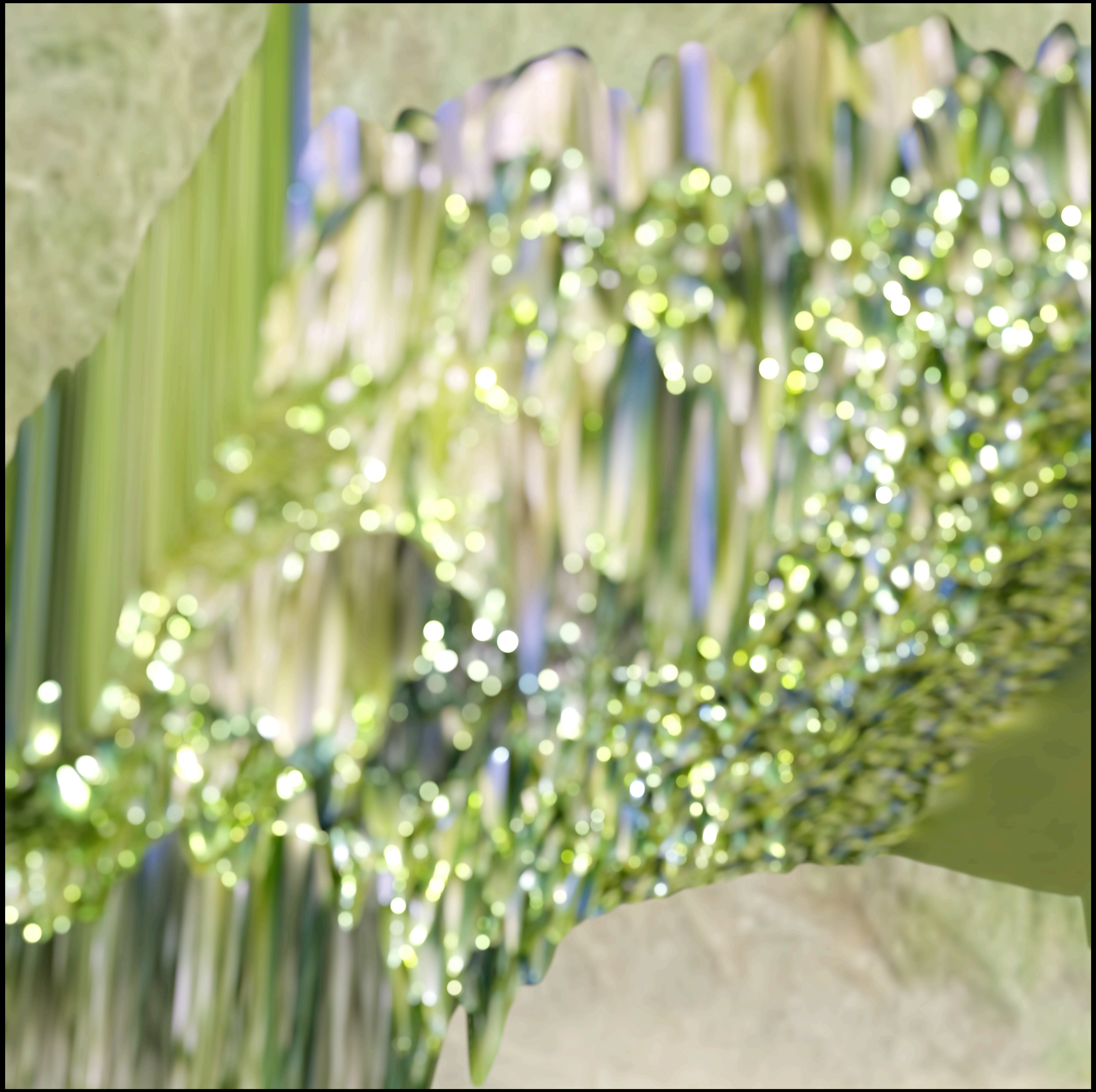
http://www.andrewthomashuang.com/index.html

https://enriqueagudo.com/projects

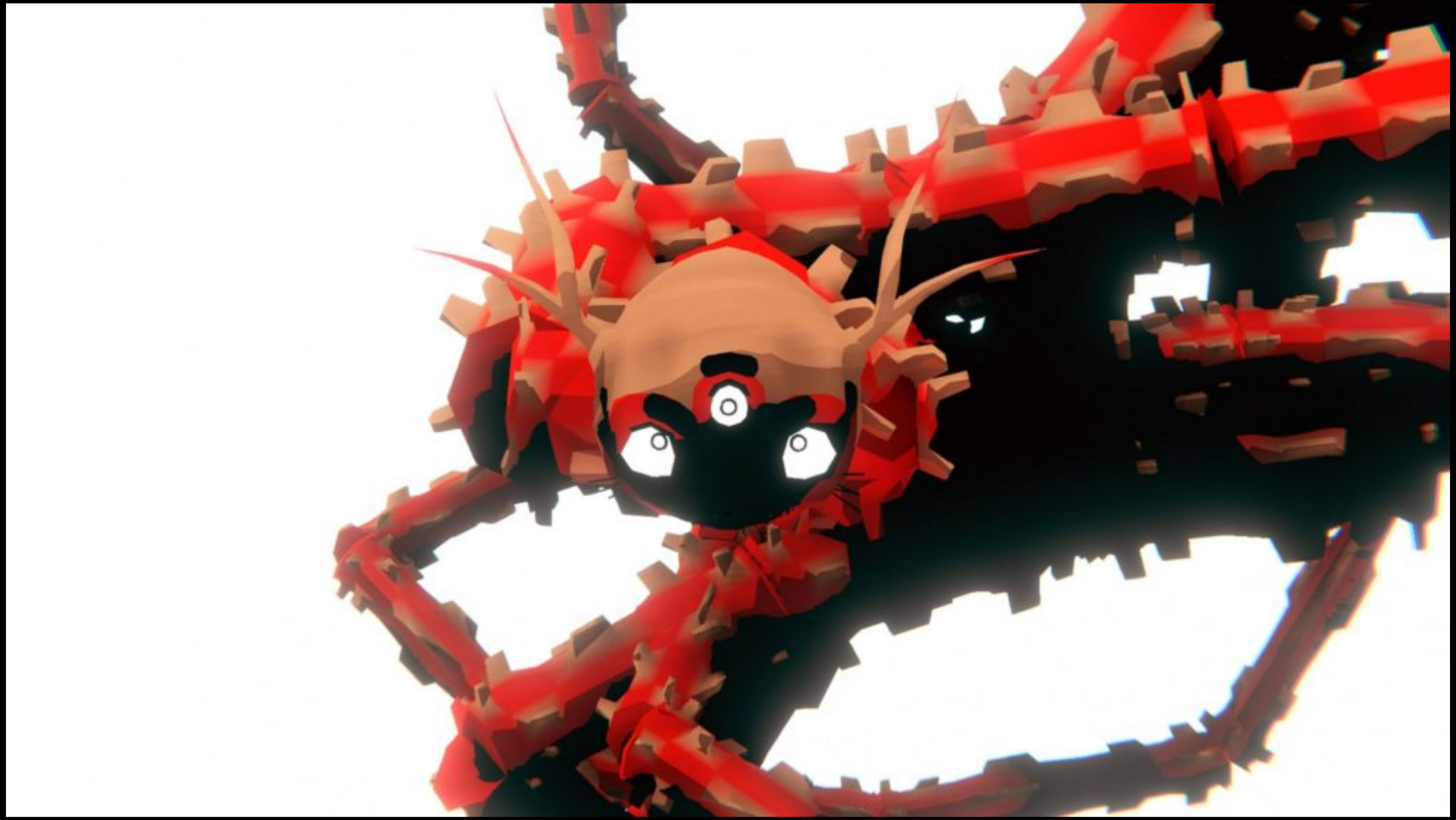




https://alicebucknell.com/



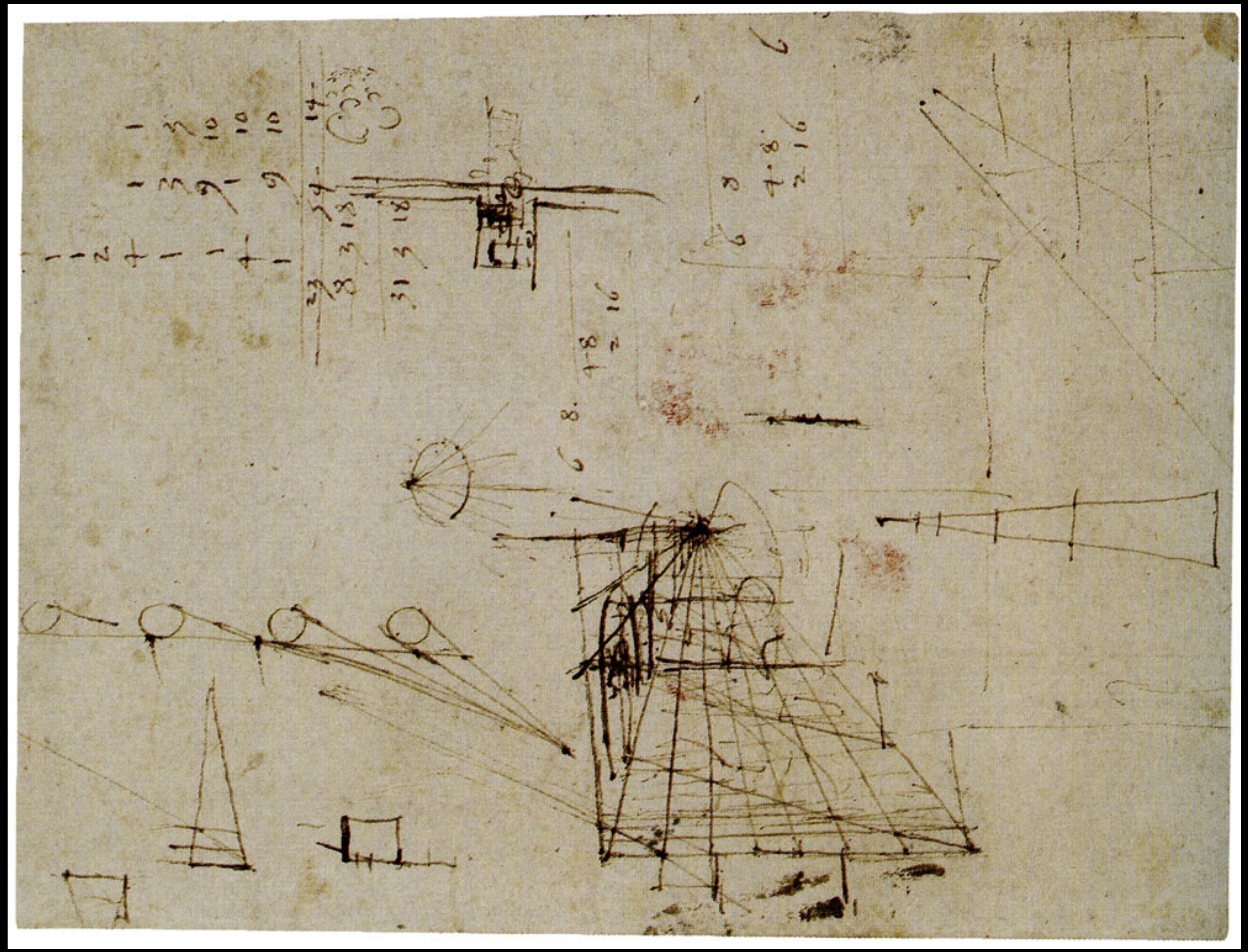
https://breannabrowning.com/

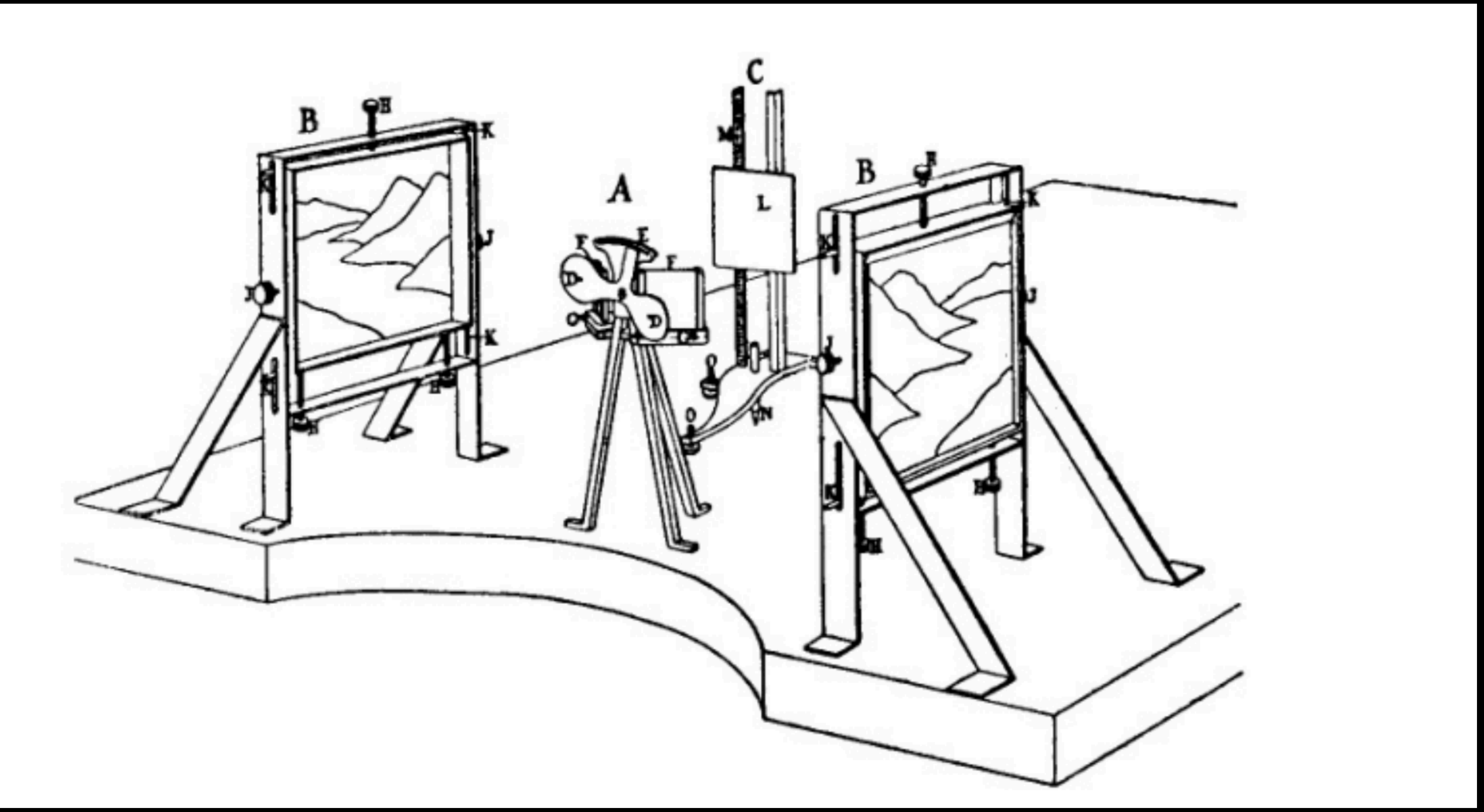


http://iancheng.com/

LAB

PHOTOGRAMMETRY + NEURAL RADIANCE FIELDS (NERFS)

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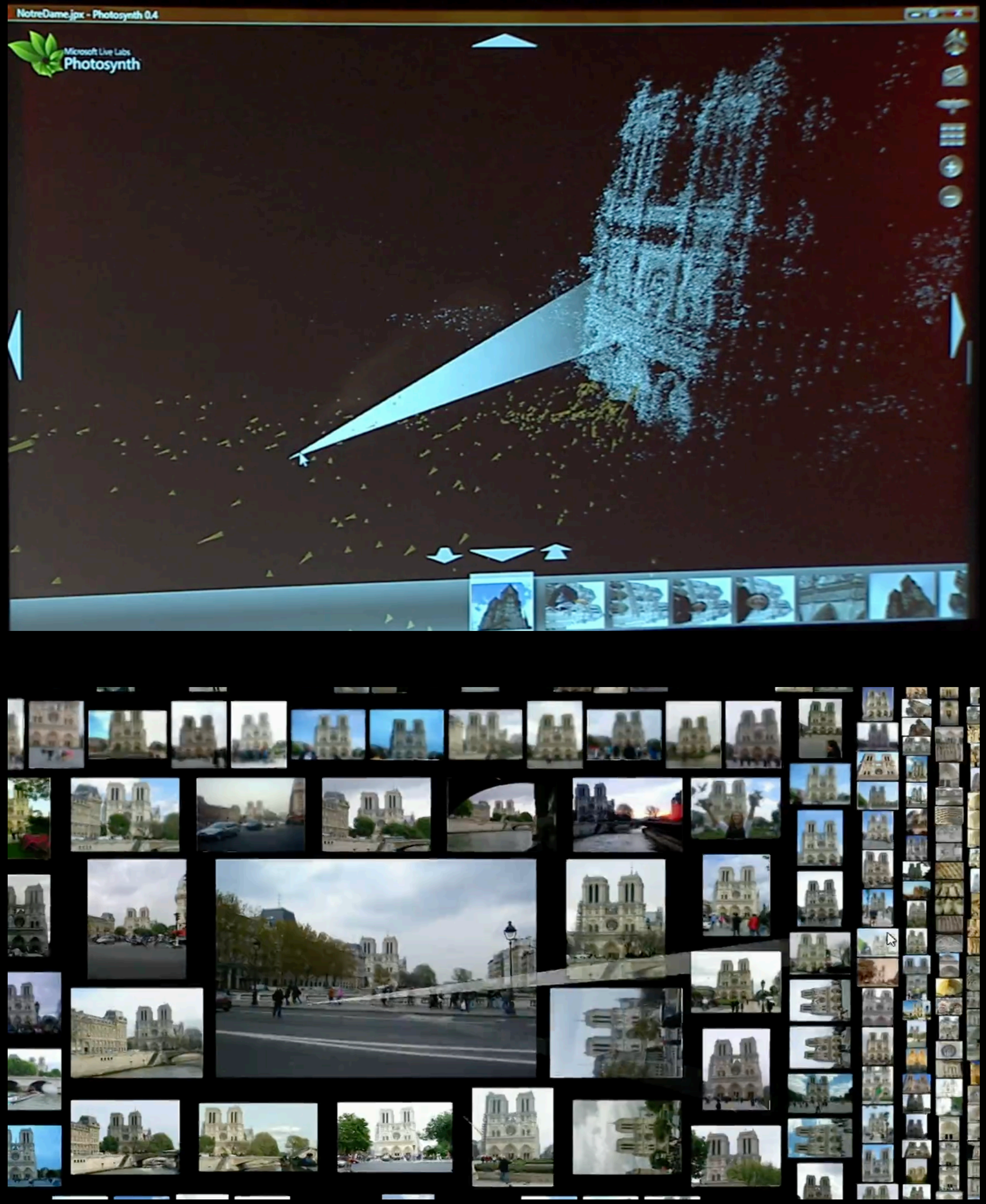
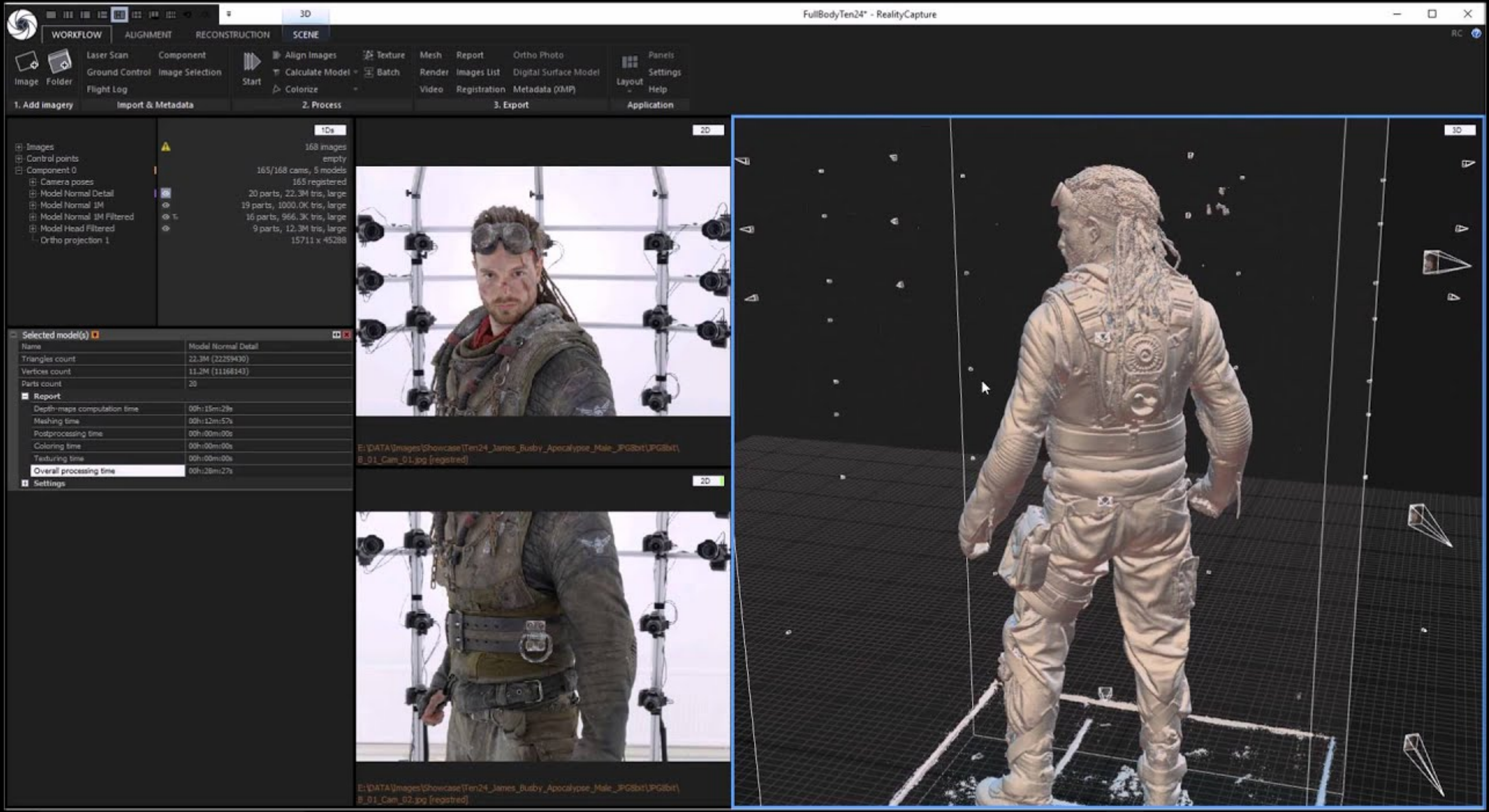


https://www.ted.com/talks/blaise_aguera_y_arcas_how_photosynth_can_connect_the_world_s_images

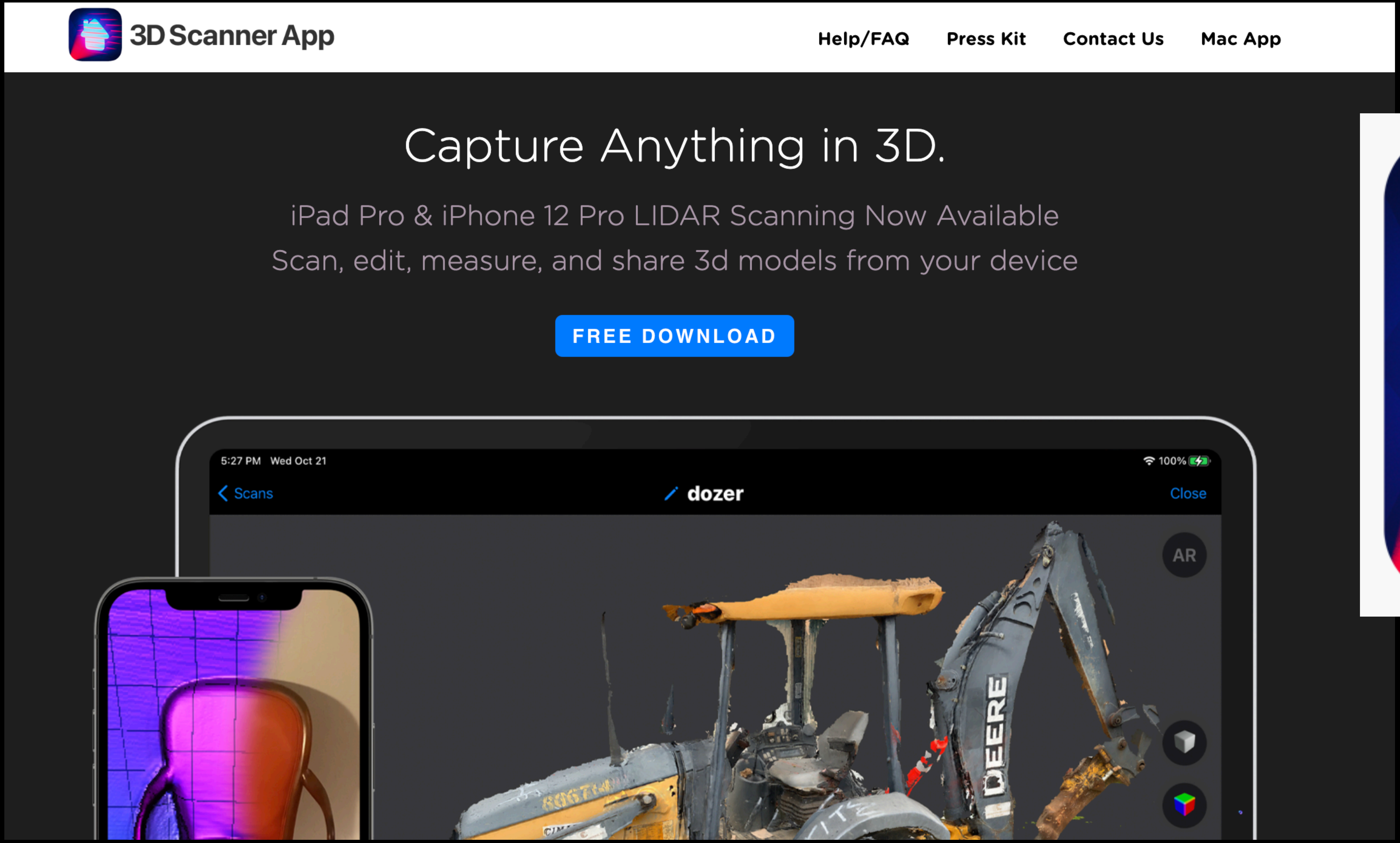
Autodesk ReCap

https://www.autodesk.com/products/recap/free-trial

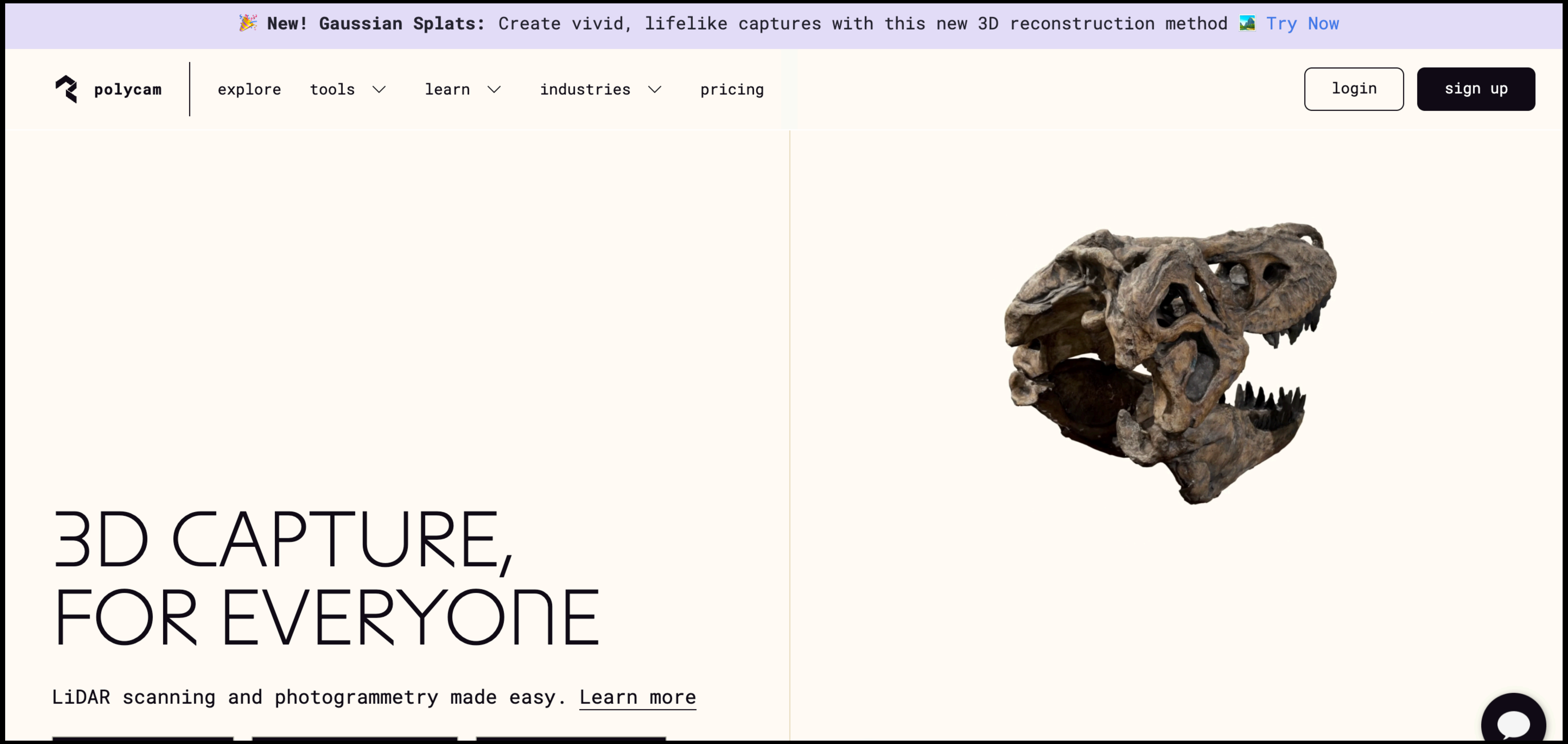
Reality Capture



https://www.capturingreality.com/



https://3dscannerapp.com/



https://poly.cam/

NVIDIA

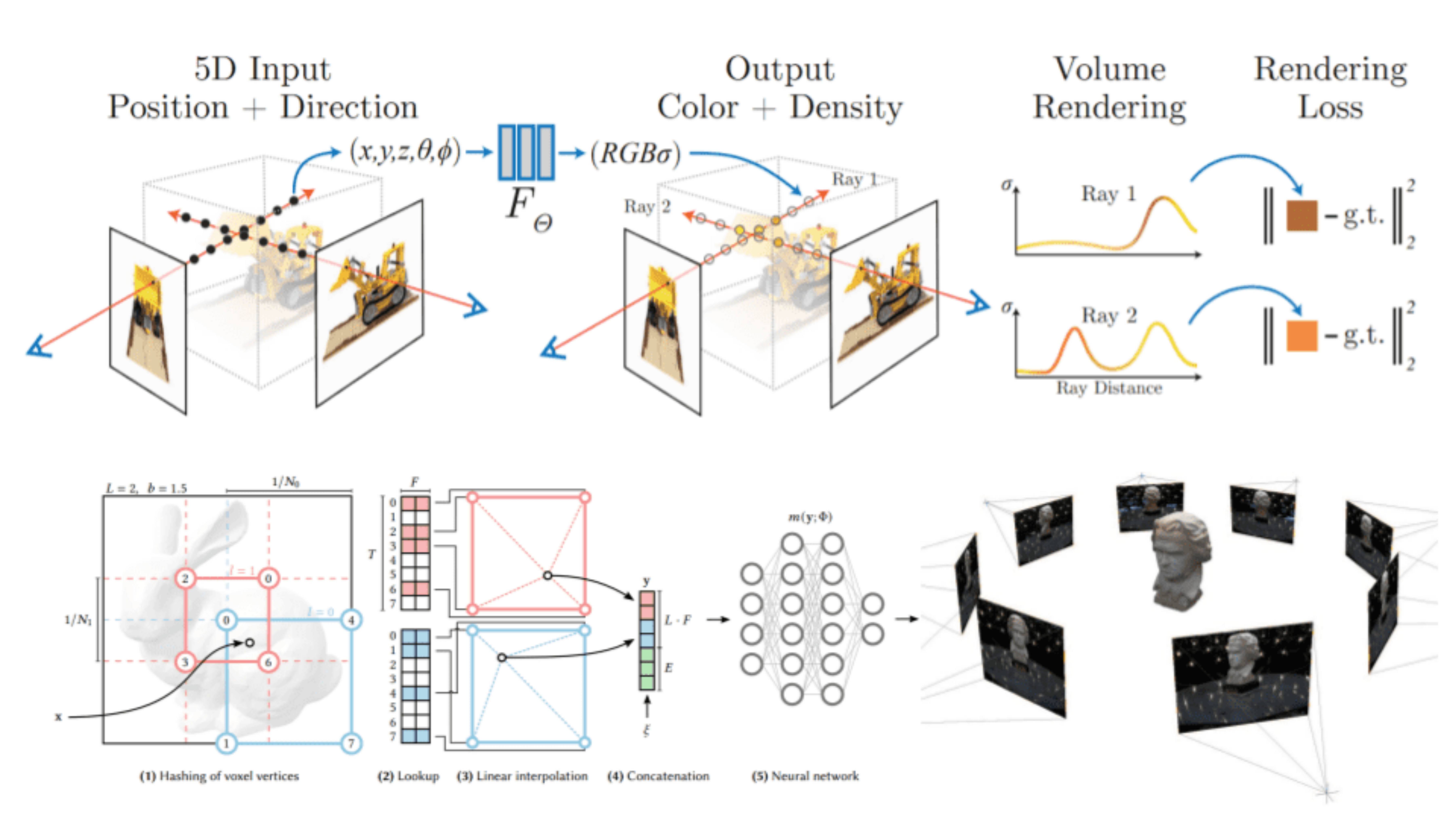
HOME | AI | DATA CENTER | DRIVING | GAMING | PRO GRAPHICS | AUTONOMOUS MACHINES | HEALTHCARE | STARTUPS | AI PODCAST

NVIDIA Research Turns 2D Photos Into 3D Scenes in the Blink of an AI

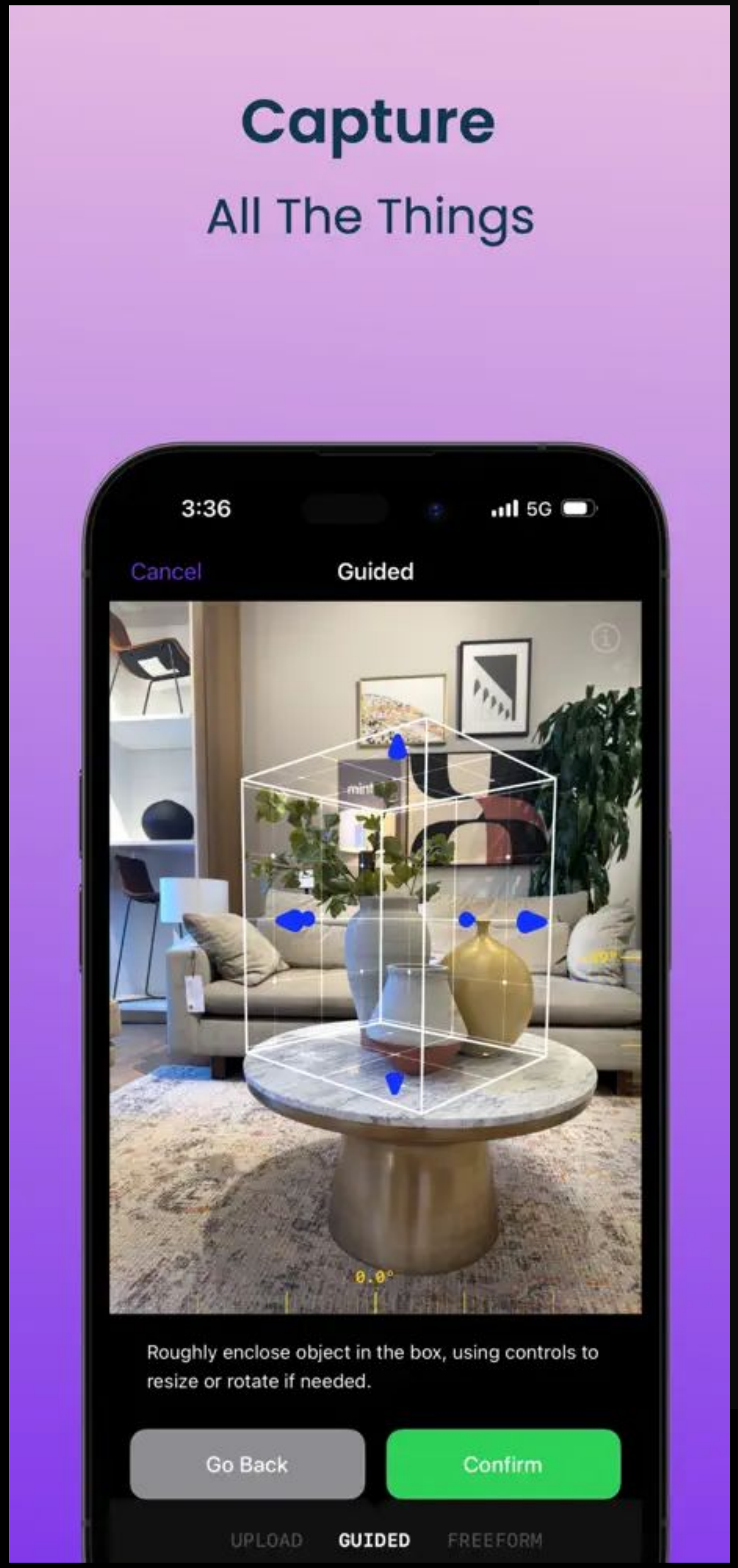
Instant NeRF is a neural rendering model that learns a high-resolution 3D scene in seconds — and can render images of that scene in a few milliseconds.

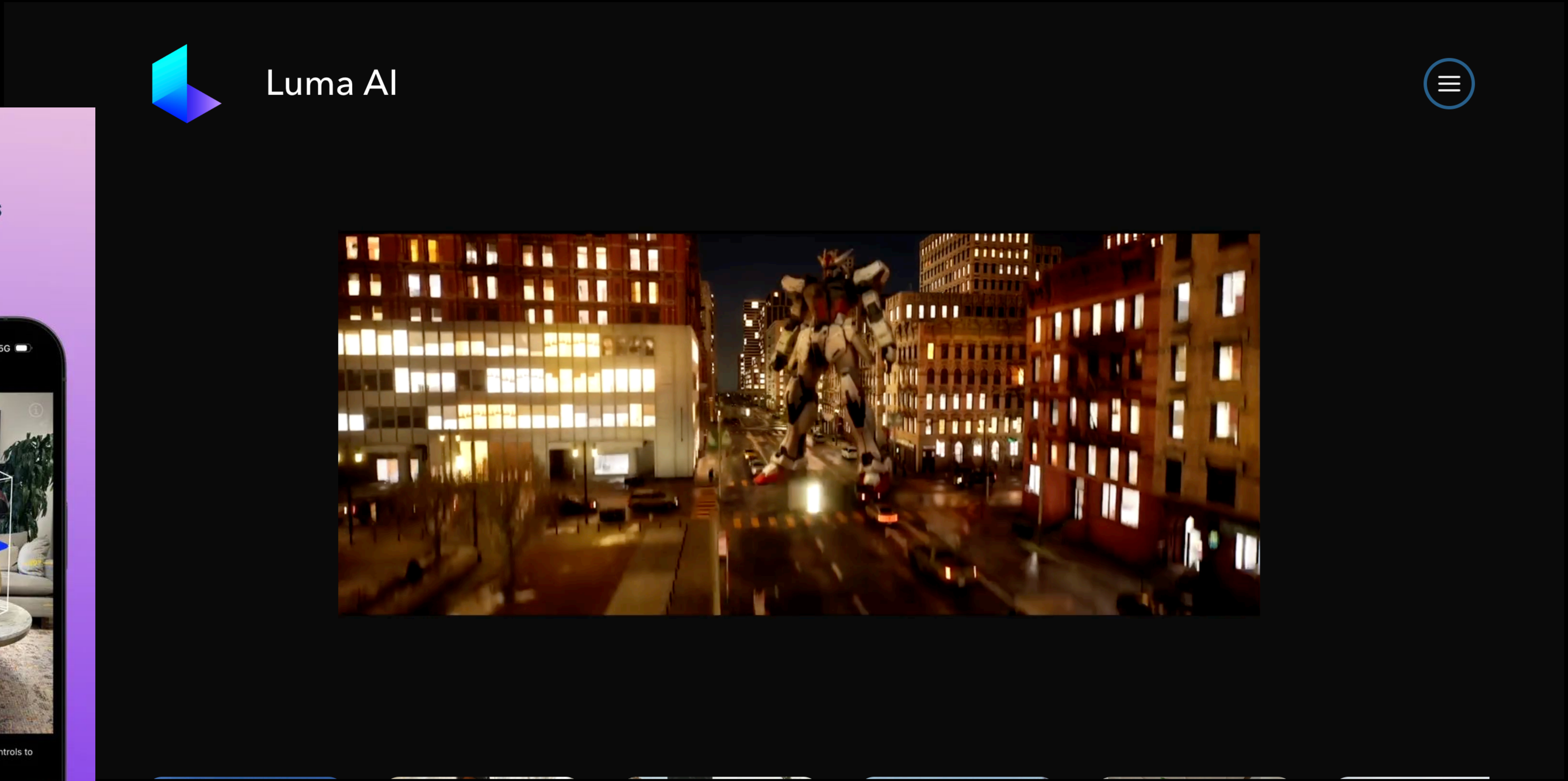
March 25, 2022 by ISHA SALIAN

https://blogs.nvidia.com/blog/2022/03/25/instant-nerf-research-3d-ai/

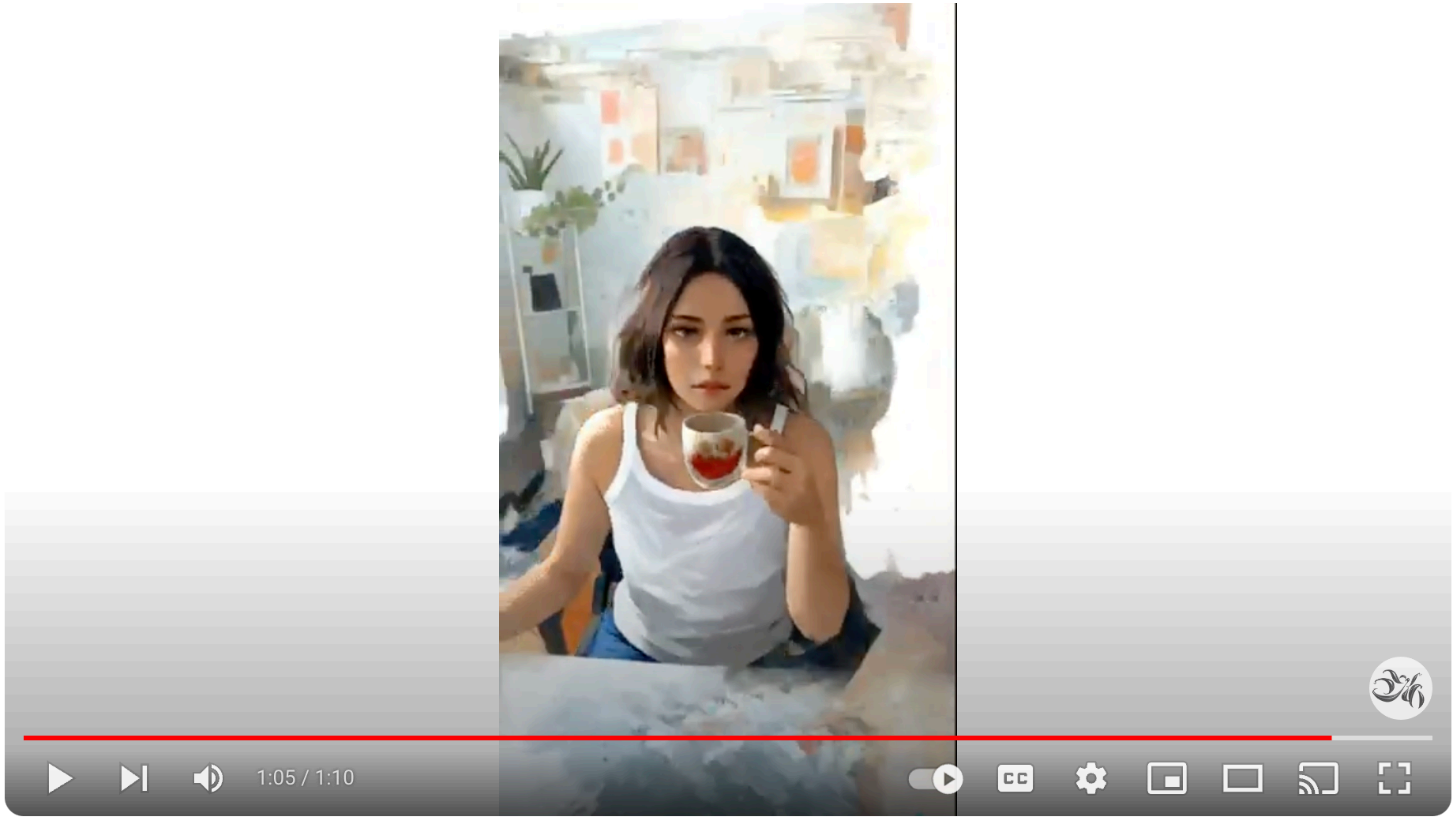


https://neuralfields.cs.brown.edu/paper_33.html





https://lumalabs.ai/



How to make a luma ai NeRF and Kaiber video #aiart #aitools #nerf

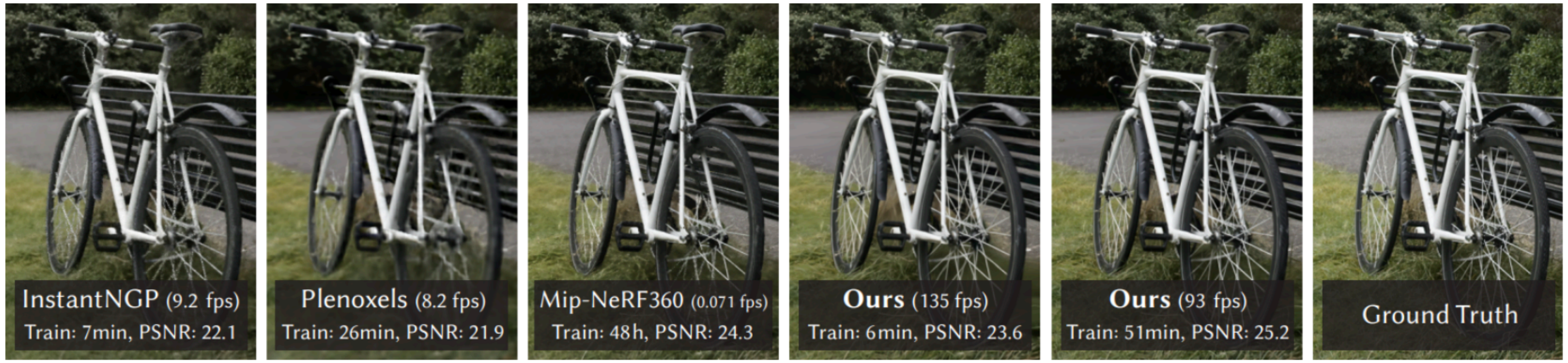
https://www.youtube.com/watch?v=A2fY3SaLTek

3D GAUSSIAN SPLATTING

README.md

3D Gaussian Splatting for Real-Time Radiance Field Rendering

Bernhard Kerbl*, Georgios Kopanas*, Thomas Leimkühler, George Drettakis (* indicates equal contribution)
| Webpage | Full Paper | Video | Other GRAPHDECO Publications | FUNGRAPH project page |
| T&T+DB COLMAP (650MB) | Pre-trained Models (14 GB) | Viewers for Windows (60MB) | Evaluation Images (7 GB) |

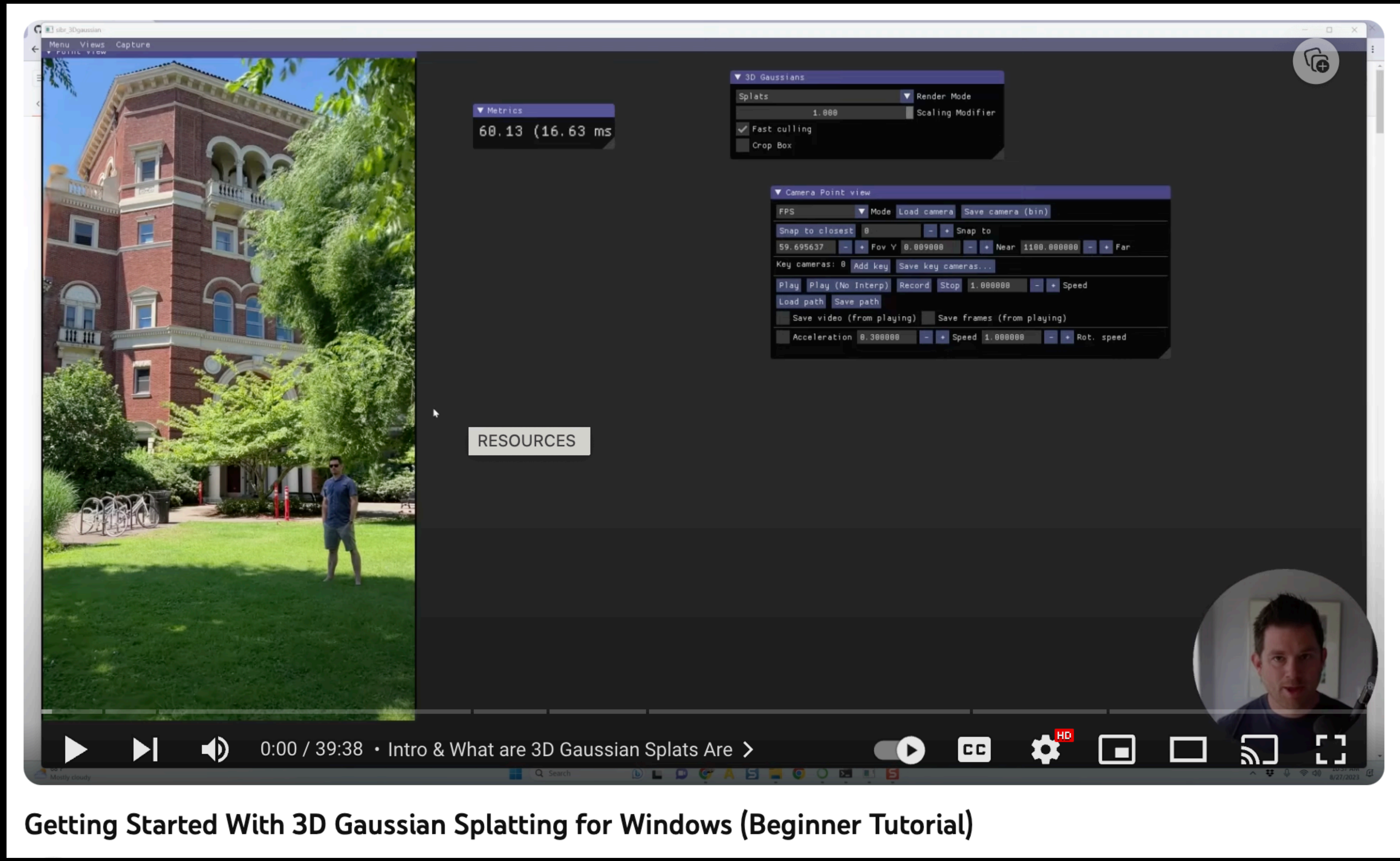


This repository contains the official authors implementation associated with the paper "3D Gaussian Splatting for Real-Time Radiance Field Rendering", which can be found here. We further provide the reference images used to create the error metrics reported in the paper, as well as recently created, pre-trained models.

https://github.com/graphdeco-inria/gaussian-splatting

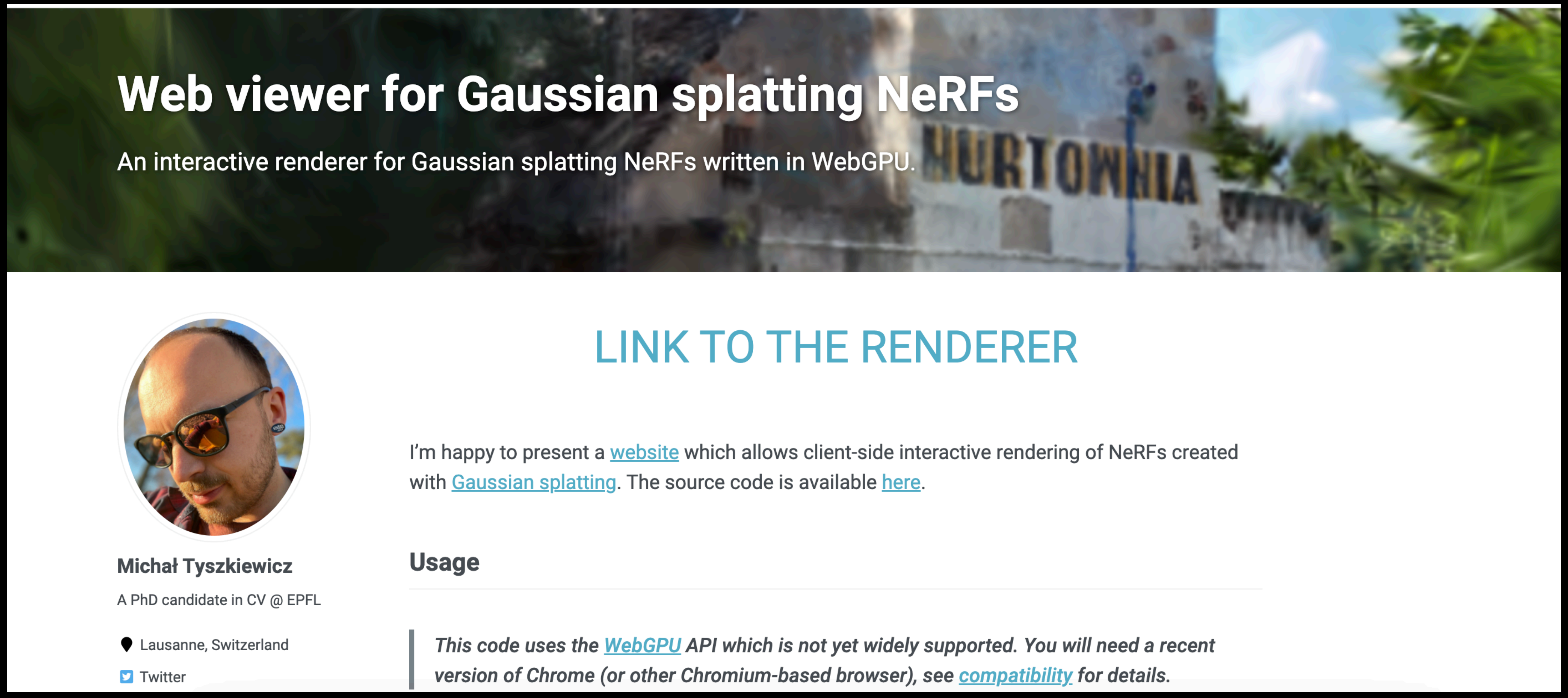
https://medium.com/axinc-ai/3d-gaussian-splatting-real-time-rendering-of-photorealistic-scenes-f7f1a47f060

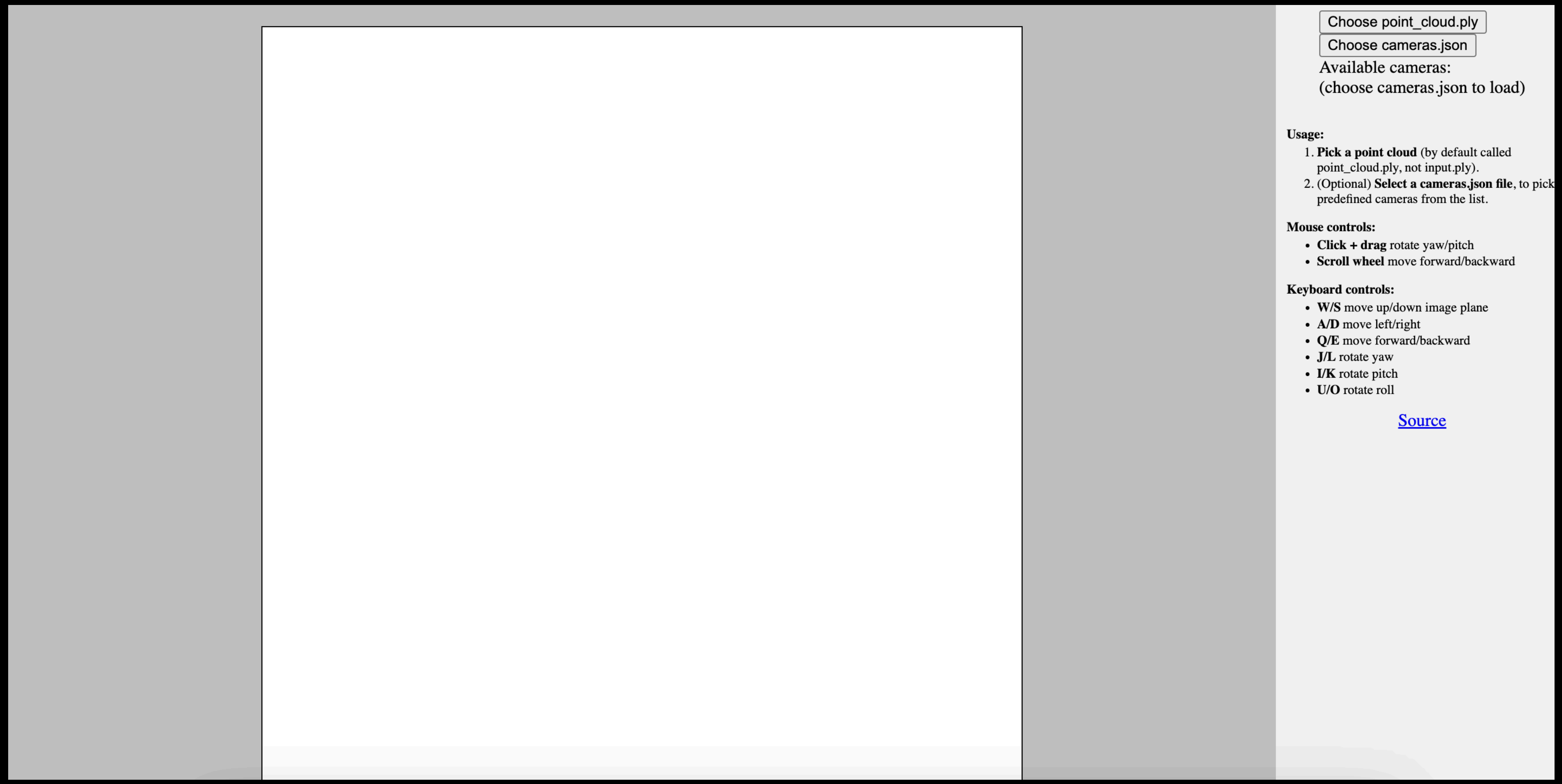
https://www.youtube.com/watch?v=Tnij_xHEnXc



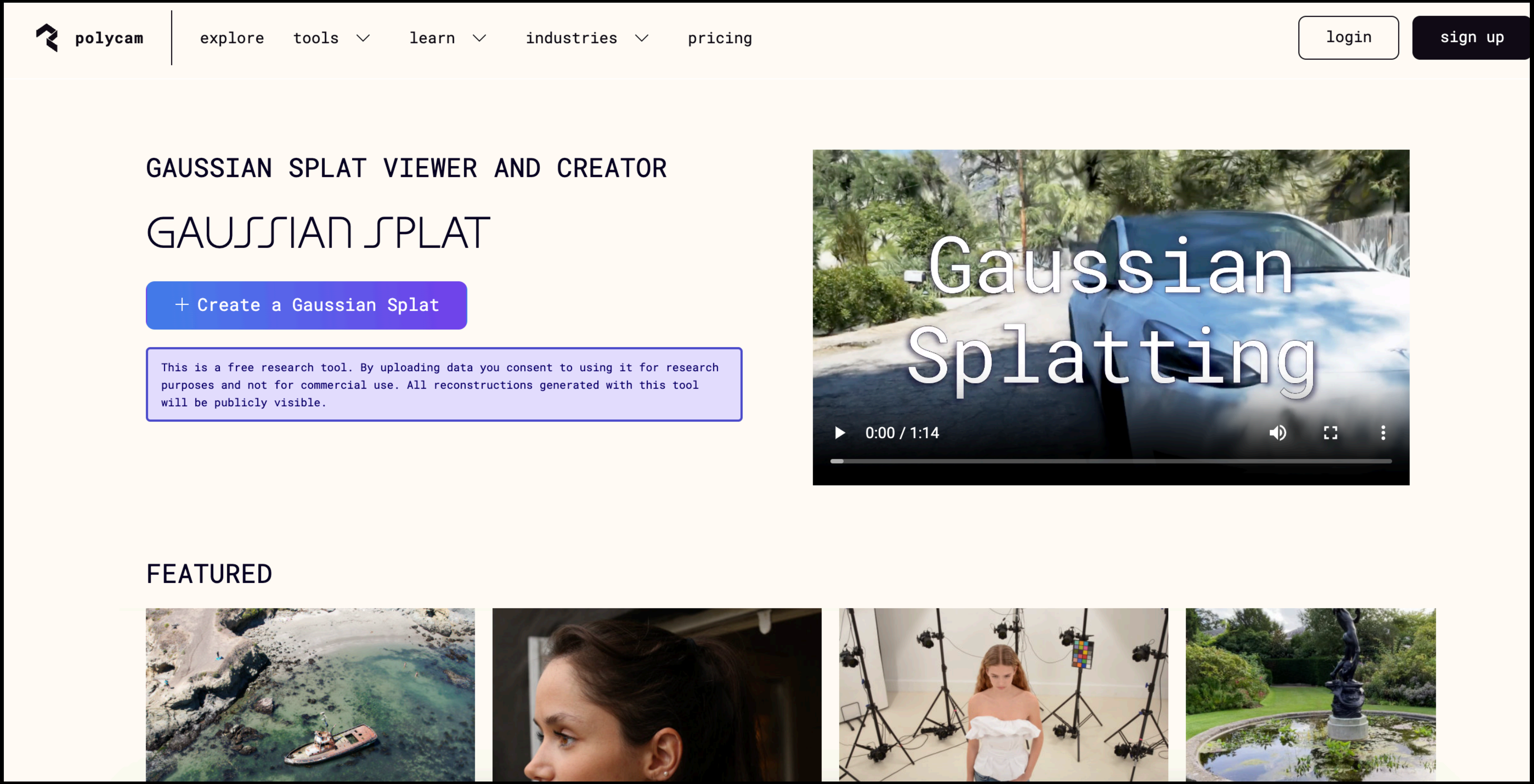
https://www.youtube.com/watch?v=UXtuigy_wYc

https://www.reshot.ai/3d-gaussian-splatting





https://jatentaki.github.io/portfolio/gaussian-splatting/



https://poly.cam/gaussian-splatting

Luma AI

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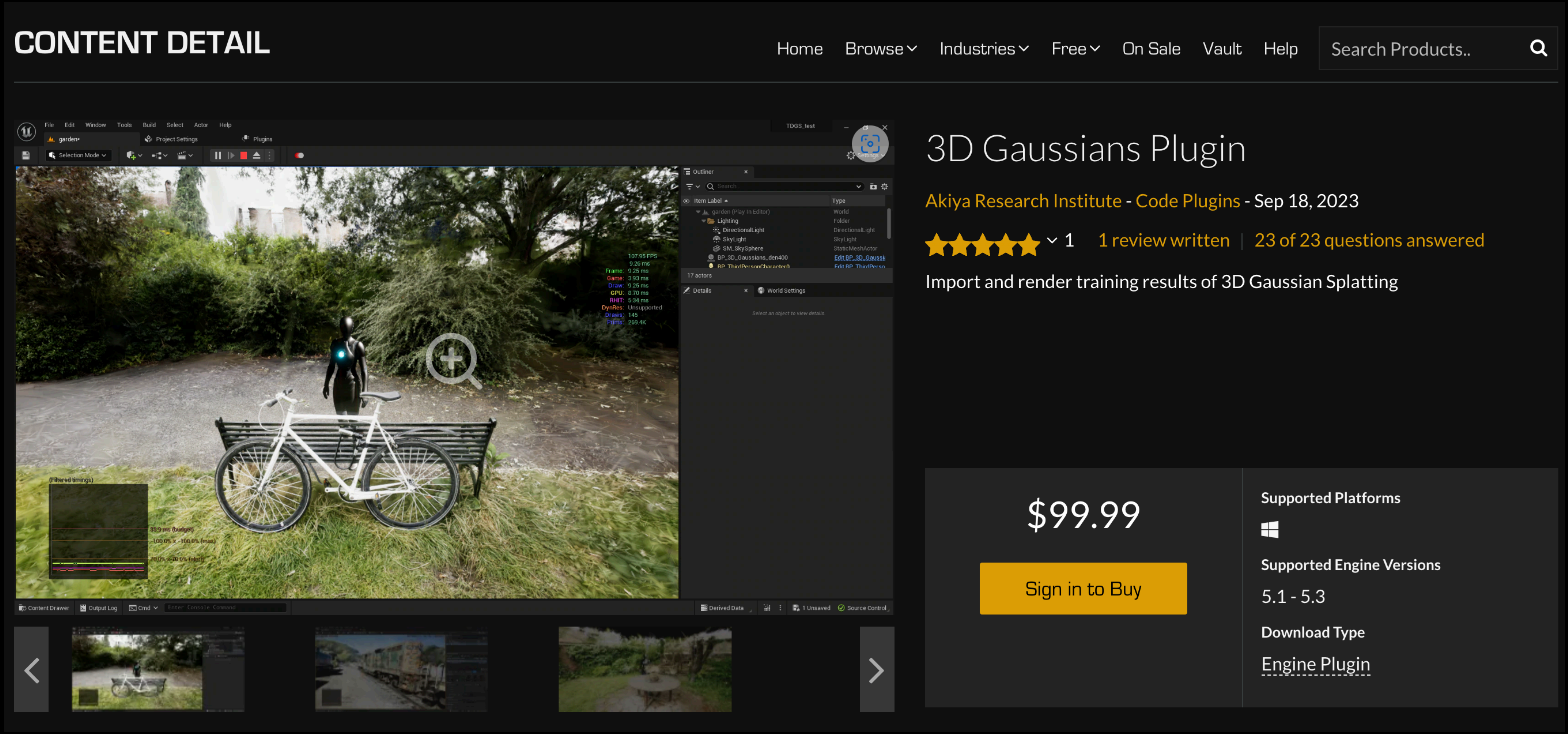
https://lumalabs.ai/interactive-scenes



https://www.unrealengine.com/marketplace/en-US/product/3d-gaussians-plugin

https://www.youtube.com/watch?v=KaAxGr_xck4&t=2s

3D Gaussians Plugin Manual

Search

What is 3D Gaussians Plugin?

3D Gaussians Plugin is a importer and a renderer of training results of 3D Gaussian Splatting for Unreal Engine.

- Just a few clicks on the UE editor to import.
- Real-time rendering at about 30-100 FPS with RTX3070 (depending on the size of the data).
- Fully implemented in Niagara and Material, without relying on Python or CUDA
- Demo project is available for free.

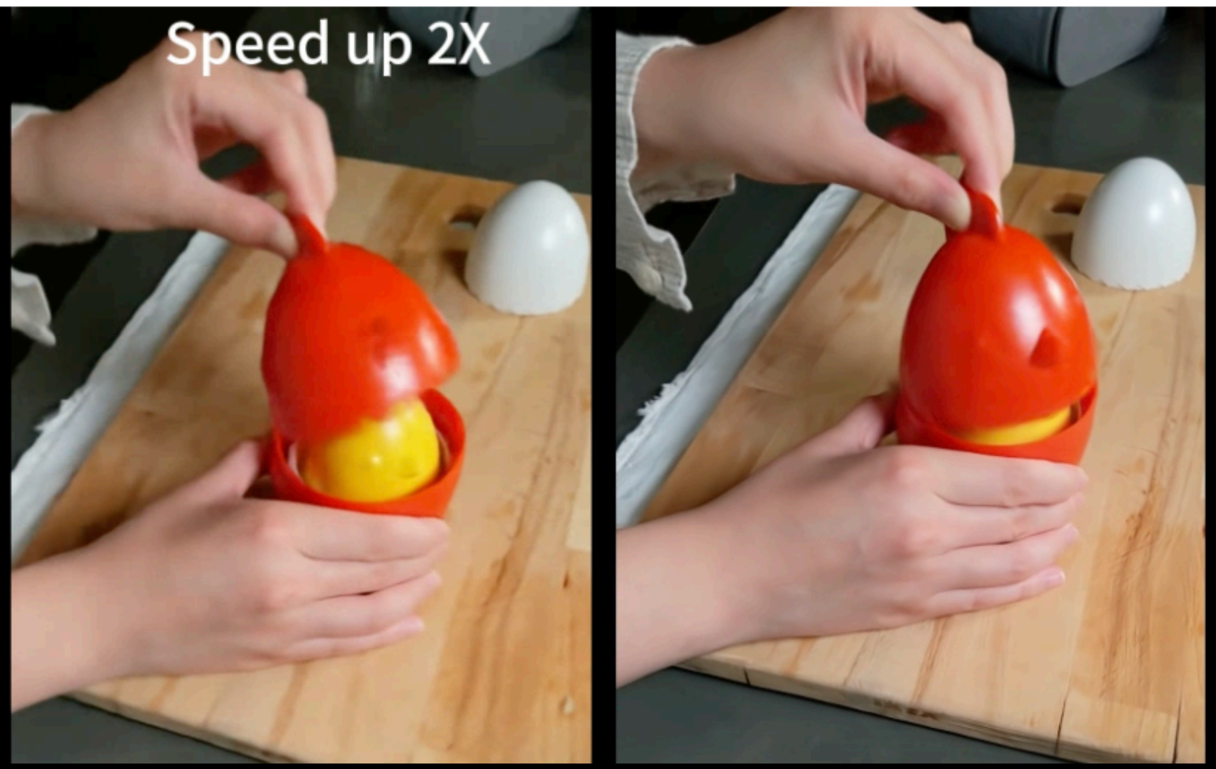
https://akiya-research-institute.github.io/3dGaussiansPlugin-Manual/en/

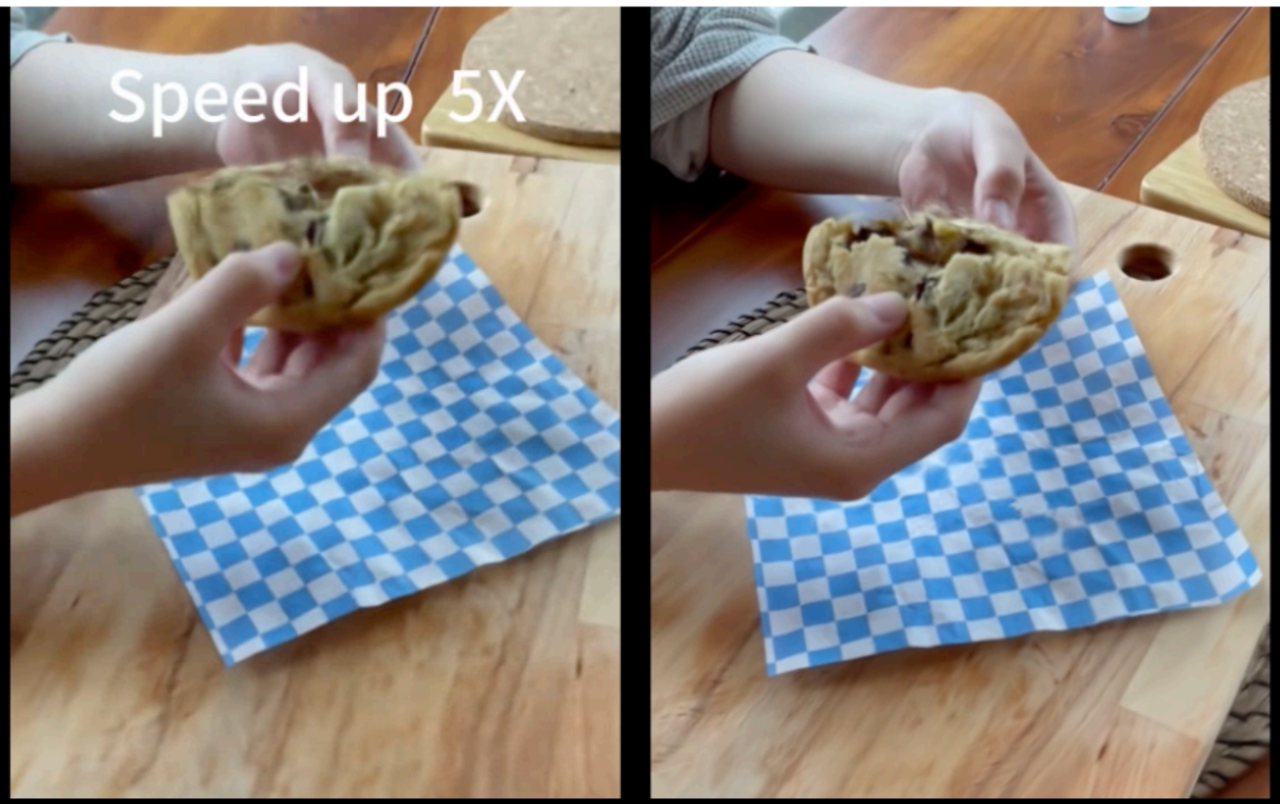
4D Gaussian Splatting for Real-Time Dynamic Scene Rendering

Guanjun Wu[1*], Taoran Yi[1*], Jiemin Fang[2], Lingxi Xie[2], Xiaopeng Zhang[2],
Wei Wei[1], Wenyu Liu[1], Tian Qi[2], Xinggang Wang[1+]
[1]Huazhong University of Science and Technology [2]Huawei Inc.
[*]Equal Contributions. [+]Corresponding Authors.

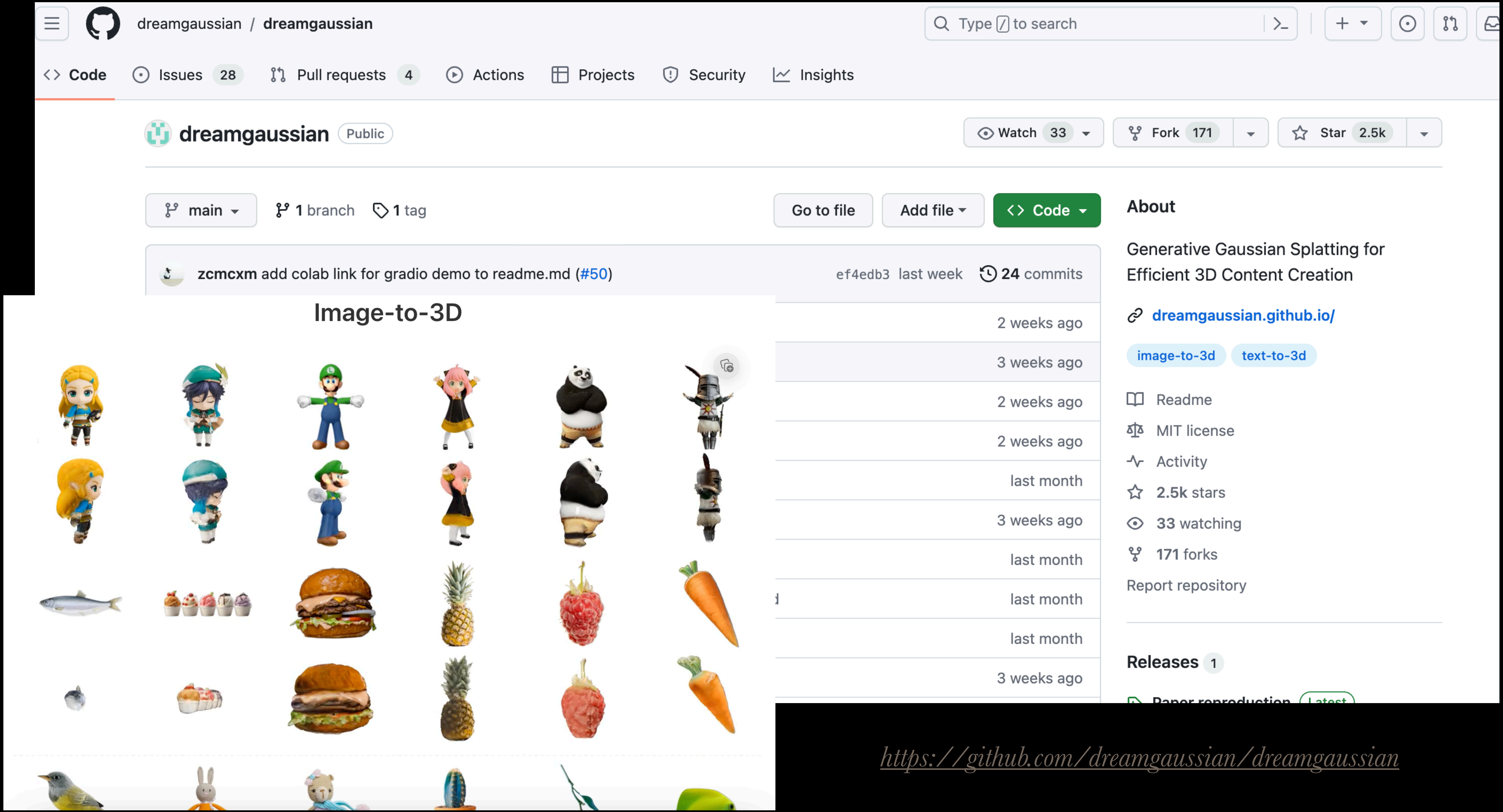
Paper | arXiv | Code

4D-GS can learn a dynamic scene within 20 minutes and reach the rendering speed over 50 fps of the view on one RTX 3080 GPU.





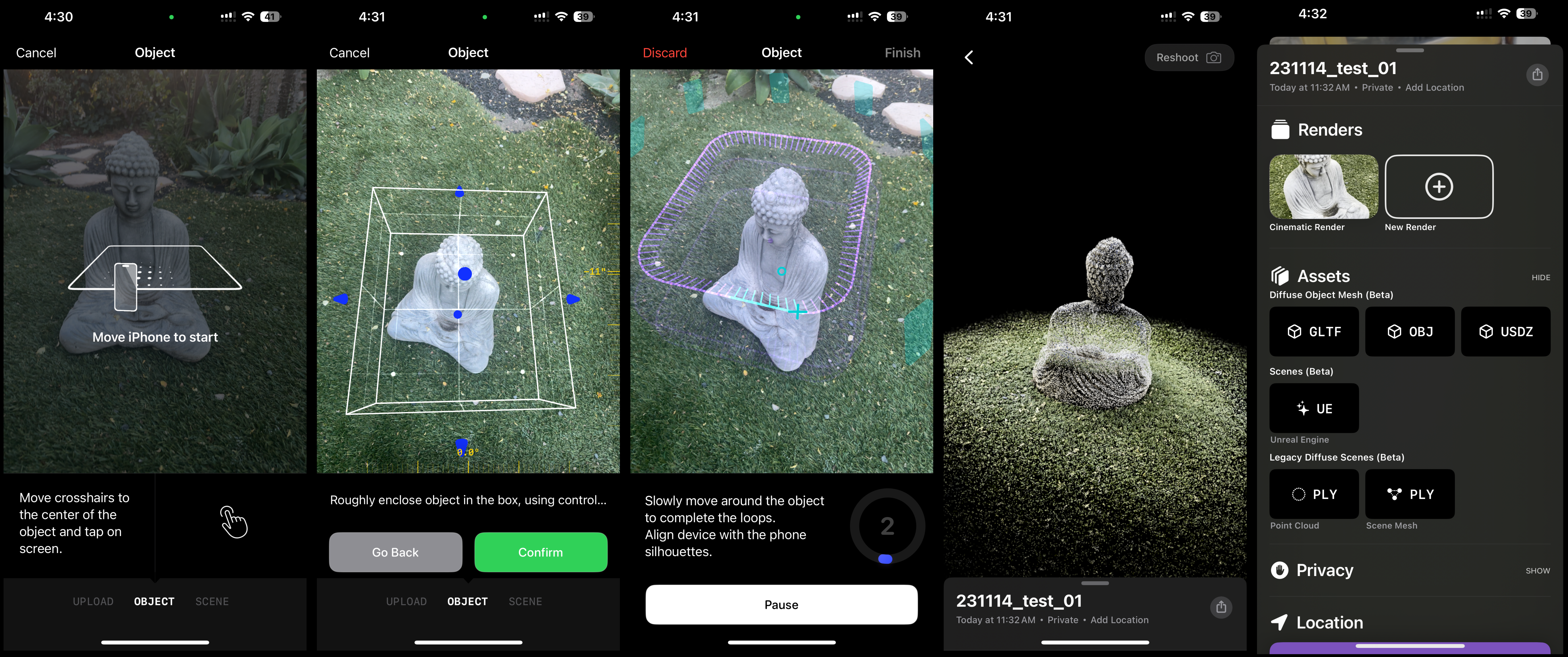
https://guanjunwu.github.io/4dgs/



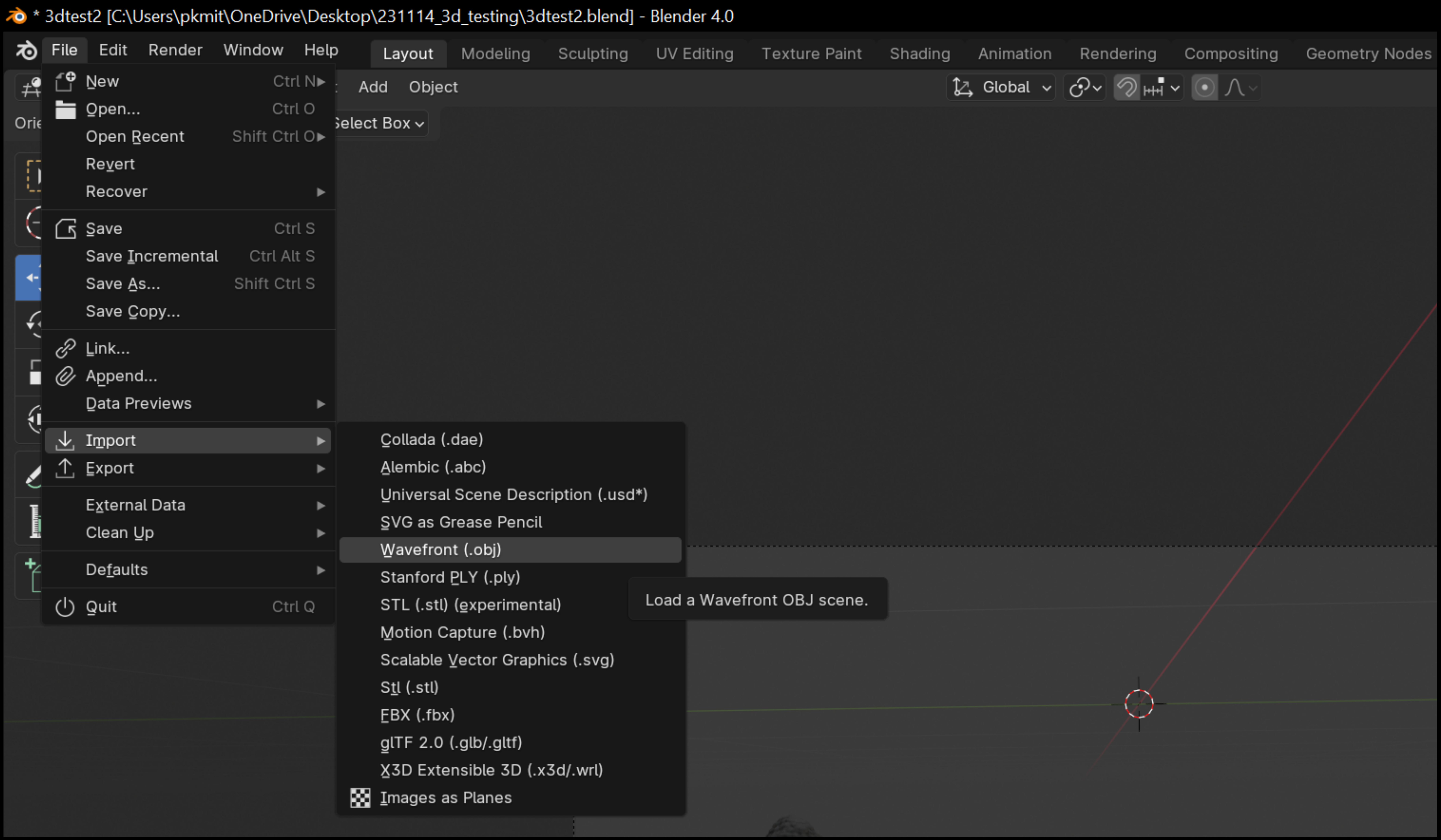
https://github.com/dreamgaussian/dreamgaussian

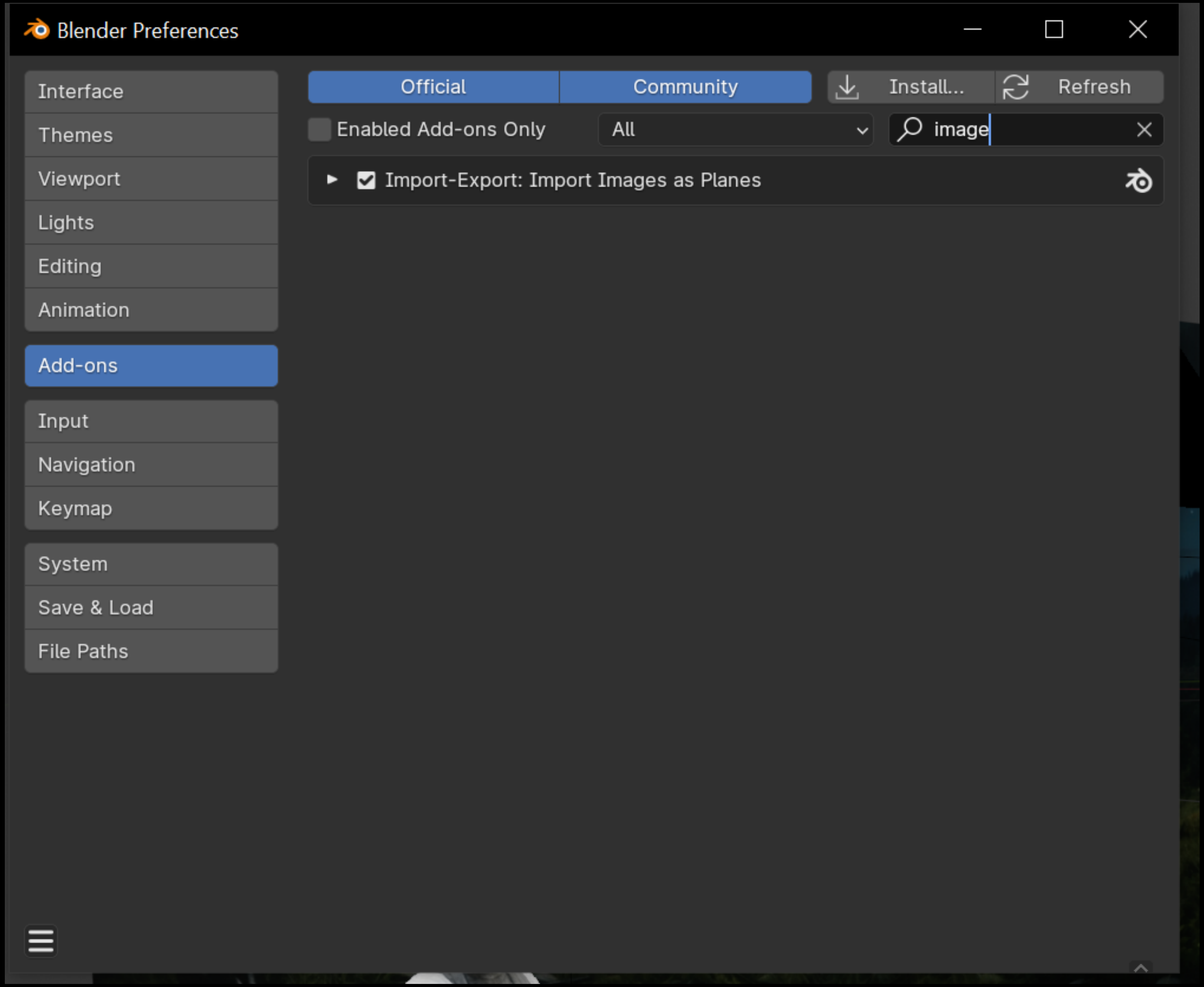
https://dreamgaussian.github.io/

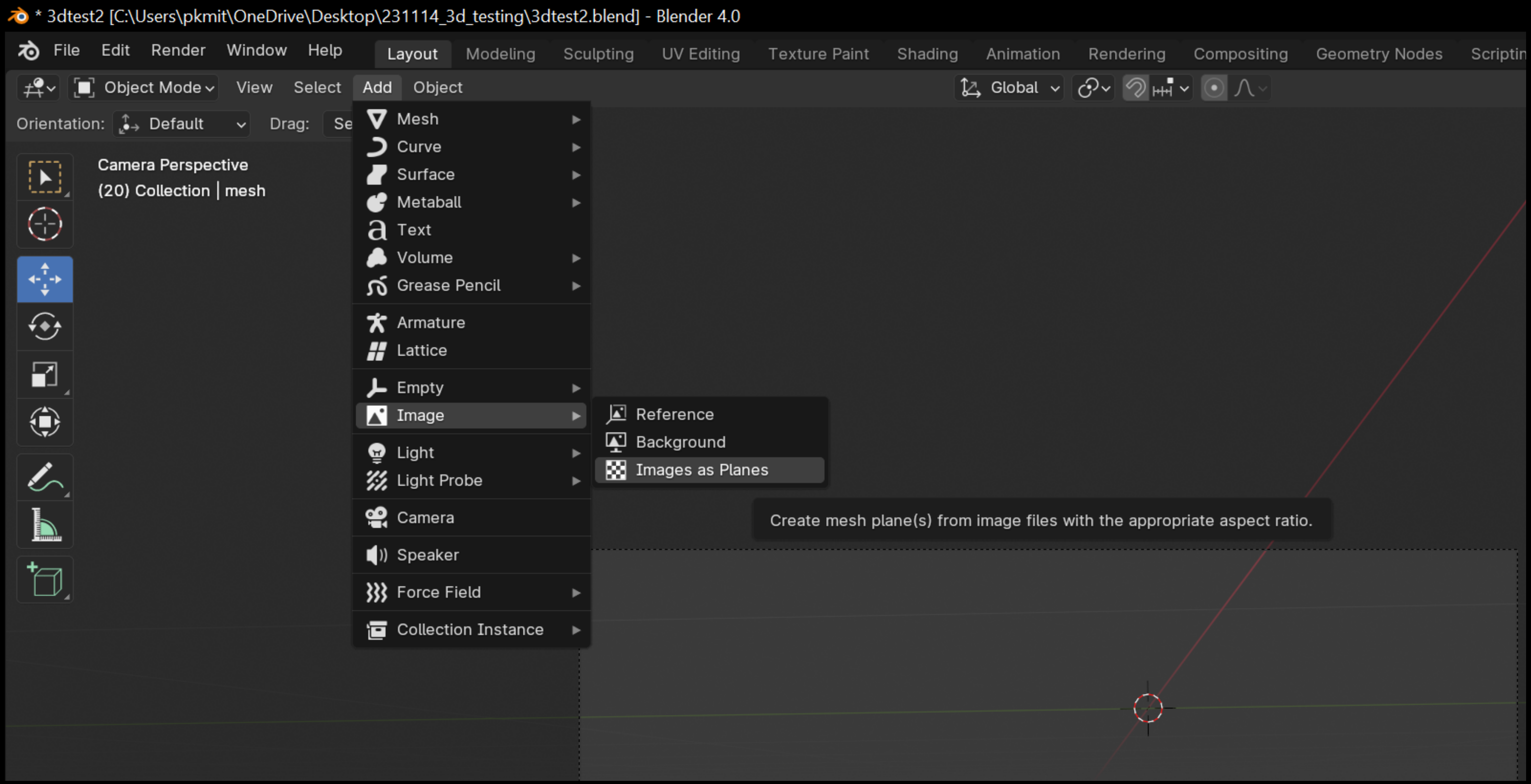
3D GAUSSIAN SPLATS + VIDEO

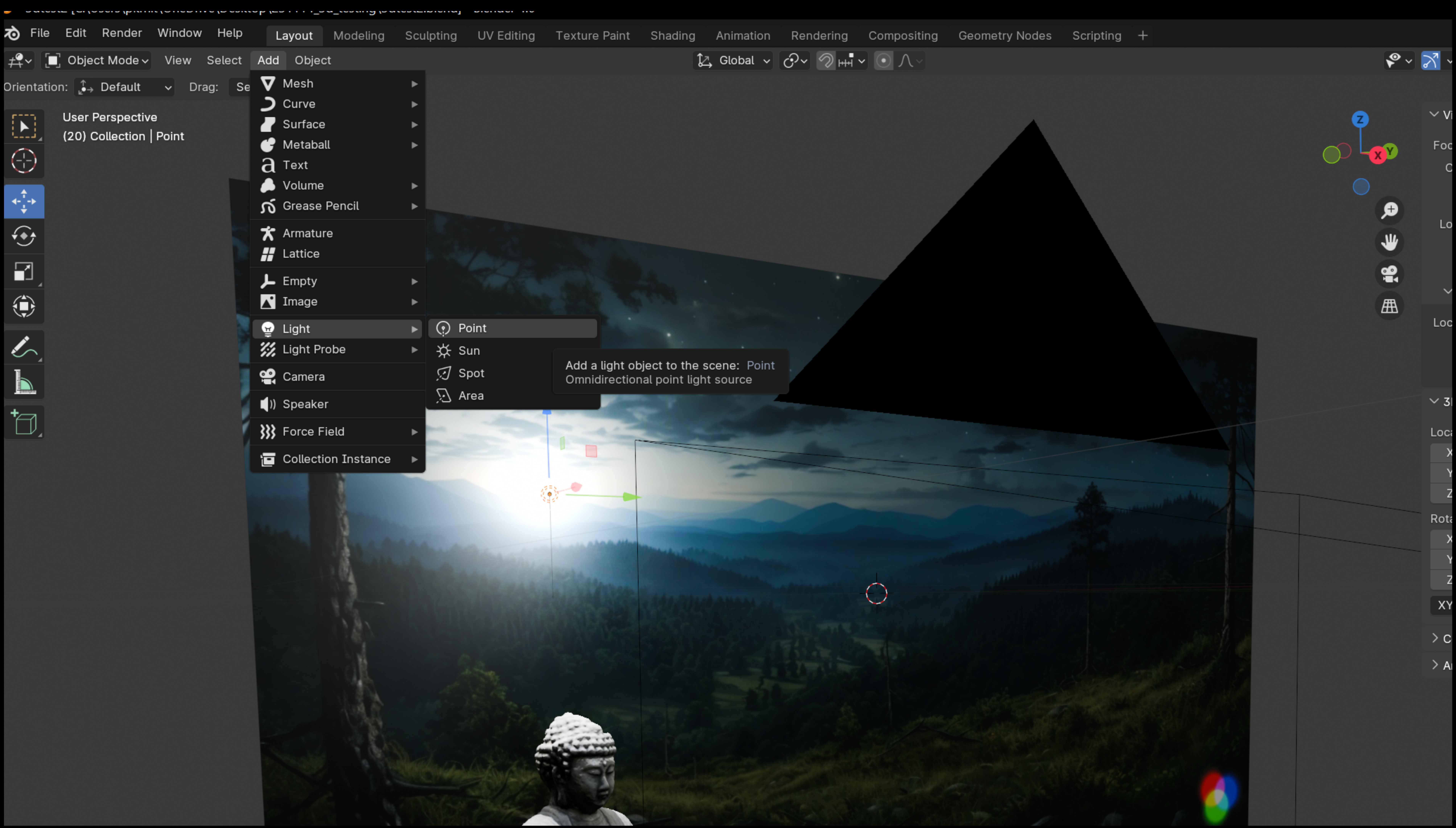


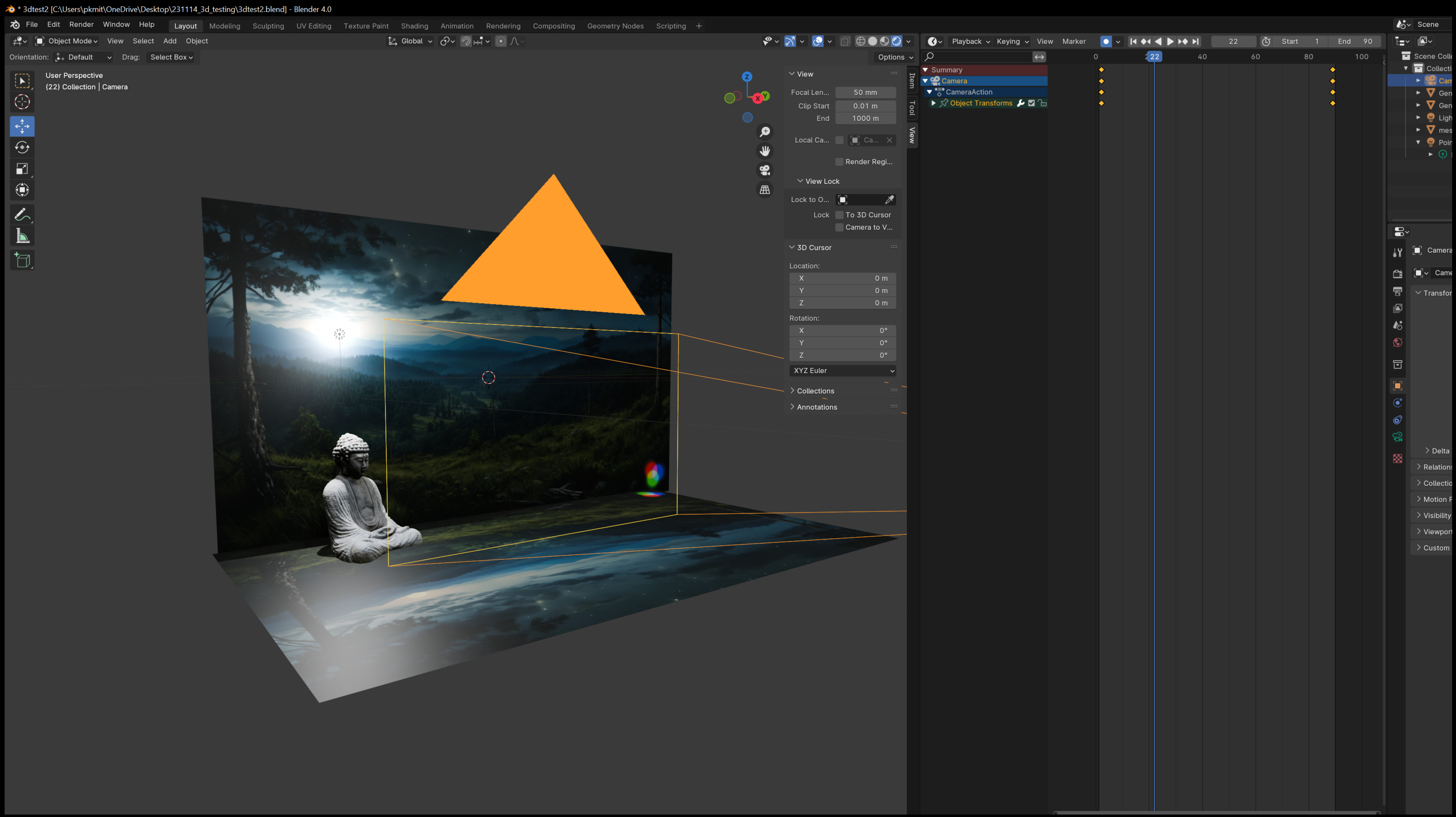
4:30
Cancel
Object
Move iPhone to start
Move crosshairs to the center of the object and tap on screen.
UPLOAD
OBJECT
SCENE
4:31
Cancel
Object
Roughly enclose object in the box, using control...
Go Back
Confirm
UPLOAD
OBJECT
SCENE
4:31
Discard
Object
Finish
Slowly move around the object to complete the loops.
Align device with the phone silhouettes.
2
Pause
4:31
Reshoot
231114_test_01
Today at 11:32 AM • Private • Add Location
4:32
231114_test_01
Today at 11:32 AM • Private • Add Location
Renders
Cinematic Render
New Render
Assets
HIDE
Diffuse Object Mesh (Beta)
GLTF
OBJ
USDZ
Scenes (Beta)
UE
Unreal Engine
Legacy Diffuse Scenes (Beta)
PLY
PLY
Point Cloud
Scene Mesh
Privacy
SHOW
Location


* 3dtest2 [C:\Users\pkmit\OneDrive\Desktop\231114_3d_testing\3dtest2.blend] - Blender 4.0
File
Edit
Render
Window
Help
Layout
Modeling
Sculpting
UV Editing
Texture Paint
Shading
Animation
Rendering
Compositing
Geometry Nodes
Add
Object
Global
Select Box
New Ctrl N
Open... Ctrl O
Open Recent Shift Ctrl O
Revert
Recover
Save Ctrl S
Save Incremental Ctrl Alt S
Save As... Shift Ctrl S
Save Copy...
Link...
Append...
Data Previews
Import
Export
External Data
Clean Up
Defaults
Quit Ctrl Q
Collada (.dae)
Alembic (.abc)
Universal Scene Description (.usd*)
SVG as Grease Pencil
Wavefront (.obj)
Stanford PLY (.ply)
STL (.stl) (experimental)
Motion Capture (.bvh)
Scalable Vector Graphics (.svg)
Stl (.stl)
FBX (.fbx)
glTF 2.0 (.glb/.gltf)
X3D Extensible 3D (.x3d/.wrl)
Images as Planes
Load a Wavefront OBJ scene.


Blender Preferences
Interface
Themes
Viewport
Lights
Editing
Animation
Add-ons
Input
Navigation
Keymap
System
Save & Load
File Paths
Official
Community
Install...
Refresh
Enabled Add-ons Only
All
image
Import-Export: Import Images as Planes

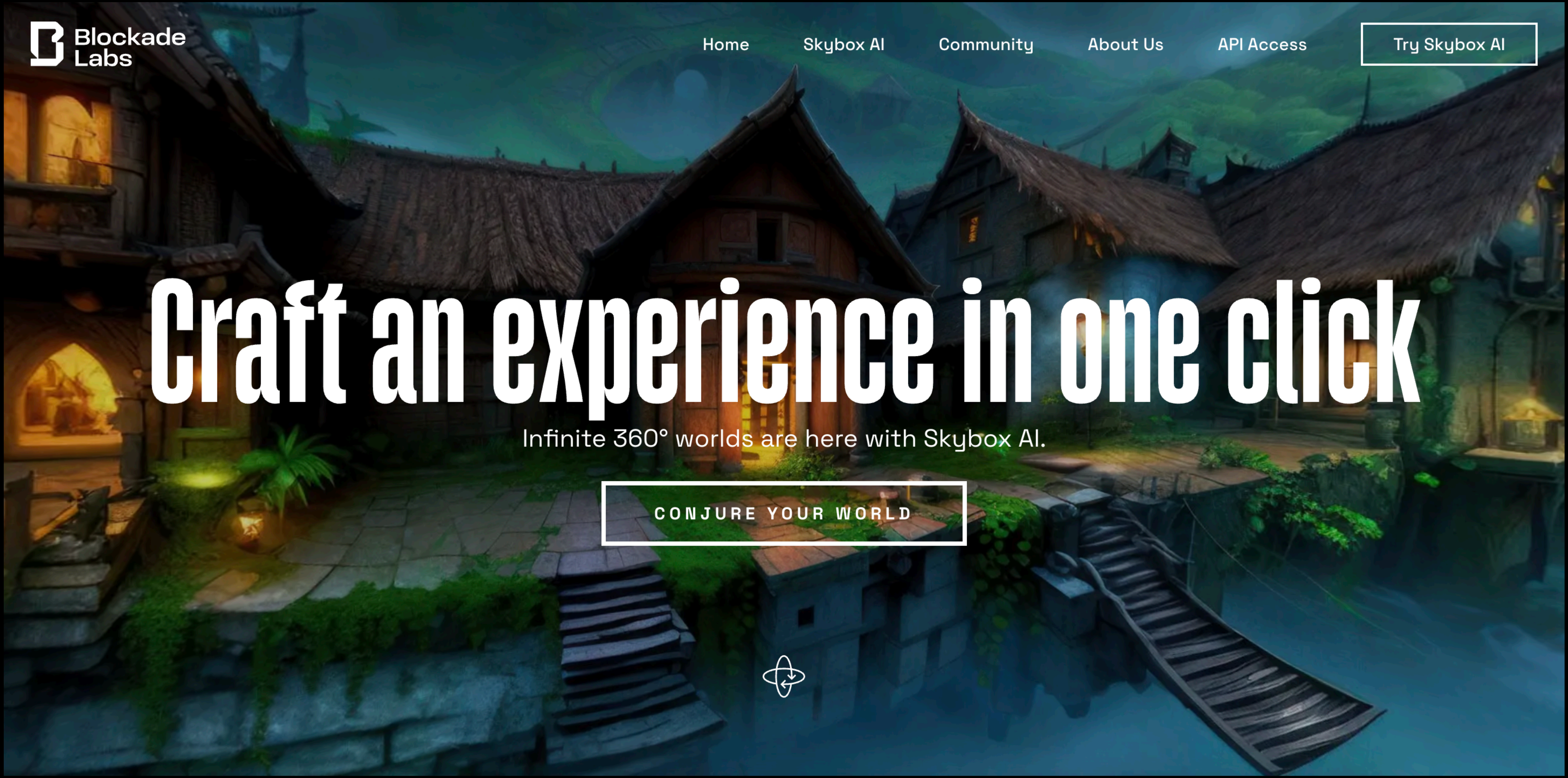

* 3dtest2 [C:\Users\pkmit\OneDrive\Desktop\231114_3d_testing\3dtest2.blend] - Blender 4.0
File Edit Render Window Help
Layout Modeling Sculpting UV Editing Texture Paint Shading Animation Rendering Compositing Geometry Nodes Scriptin
Object Mode View Select Add Object
Global
Orientation: Default Drag: Se
Camera Perspective
(20) Collection | mesh
Mesh
Curve
Surface
Metaball
Text
Volume
Grease Pencil
Armature
Lattice
Empty
Image
Light
Light Probe
Camera
Speaker
Force Field
Collection Instance
Reference
Background
Images as Planes
Create mesh plane(s) from image files with the appropriate aspect ratio.


File
Edit
Render
Window
Help
Layout
Modeling
Sculpting
UV Editing
Texture Paint
Shading
Animation
Rendering
Compositing
Geometry Nodes
Scripting
Object Mode
View
Select
Add
Object
Global
Orientation:
Default
Drag:
User Perspective
(20) Collection | Point
Mesh
Curve
Surface
Metaball
Text
Volume
Grease Pencil
Armature
Lattice
Empty
Image
Light
Light Probe
Camera
Speaker
Force Field
Collection Instance
Point
Sun
Spot
Area
Add a light object to the scene: Point
Omnidirectional point light source


3dtest2 [C:\Users\pkmit\OneDrive\Desktop\231114_3d_testing\3dtest2.blend] - Blender 4.0
File Edit Render Window Help
Layout Modeling Sculpting UV Editing Texture Paint Shading Animation Rendering Compositing Geometry Nodes Scripting
Object Mode View Select Add Object
Global
Orientation: Default Drag: Select Box
Options
User Perspective
(22) Collection | Camera
View
Focal Len... 50 mm
Clip Start 0.01 m
End 1000 m
Local Ca...
Render Regi...
View Lock
Lock to O...
Lock To 3D Cursor
Camera to V...
3D Cursor
Location:
X 0 m
Y 0 m
Z 0 m
Rotation:
X 0°
Y 0°
Z 0°
XYZ Euler
Collections
Annotations
Playback Keying View Marker
22 Start 1 End 90
Summary
Camera
CameraAction
Object Transforms
Scene


Blender Render
View
View
Image
Render Result
Slot 1
ViewLayer

OTHER TOOLS + RESOURCES



https://www.blockadelabs.com/

GSGEN: Text-to-3D using Gaussian Splatting

This repository contains the official implementation of GSGEN: Text-to-3D using Gaussian Splattng.

Open in Colab

Paper | Project Page

Video results

A_DSLR_photo_of_Car_made_out_of_sushi.mp4

https://github.com/gsgen3d/gsgen

ProlificDreamer: High-Fidelity and Diverse Text-to-3D Generation with Variational Score Distillation

Zhengyi Wang[*1,3], Cheng Lu[*1], Yikai Wang[1], Fan Bao[1,3], Chongxuan Li[2], Hang Su[1], Jun Zhu[1,3]

[*]Equal contribution.

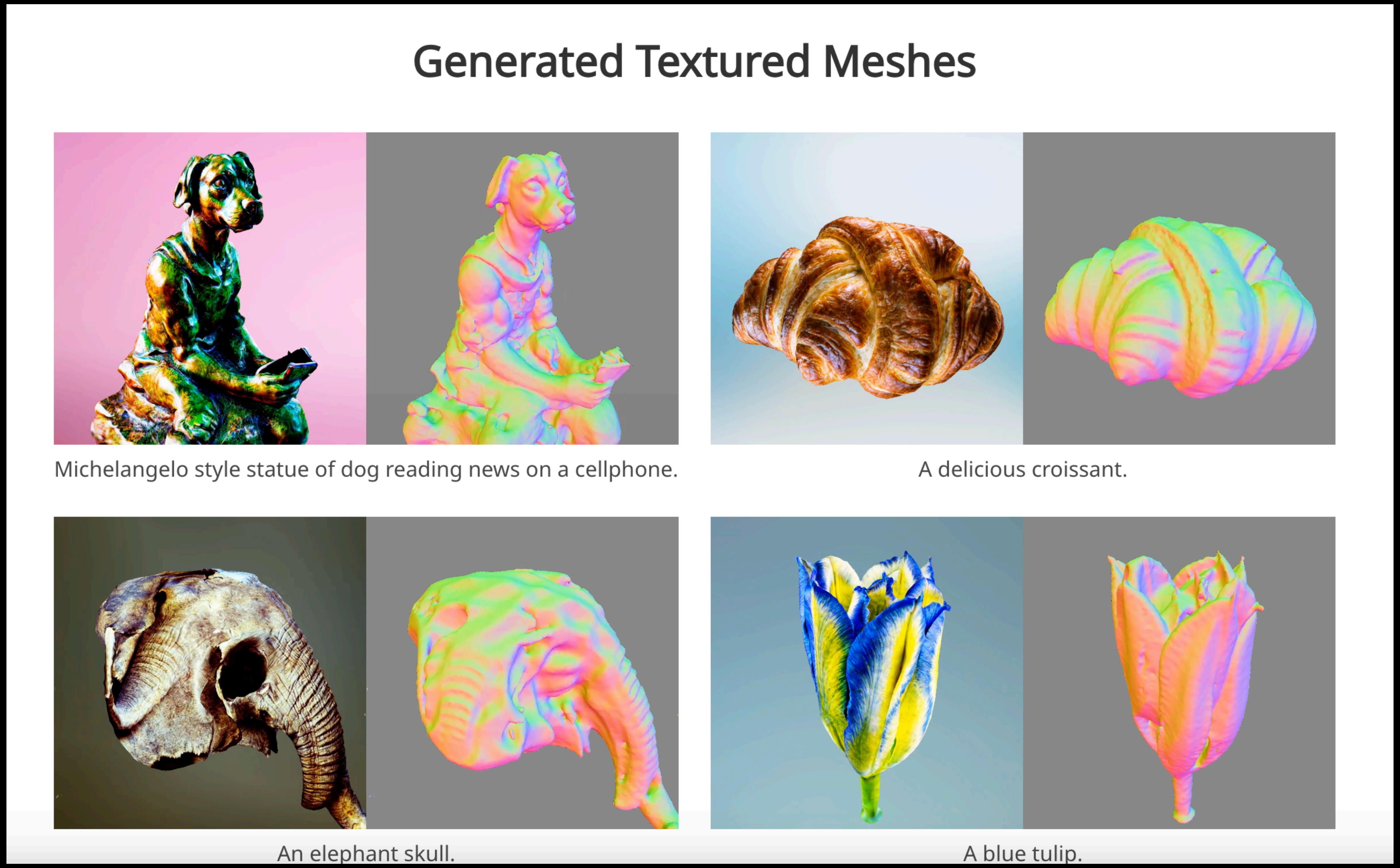
[1]Tsinghua University, [2]Renmin University of China, [3]ShengShu

NeurIPS 2023 (Spotlight)

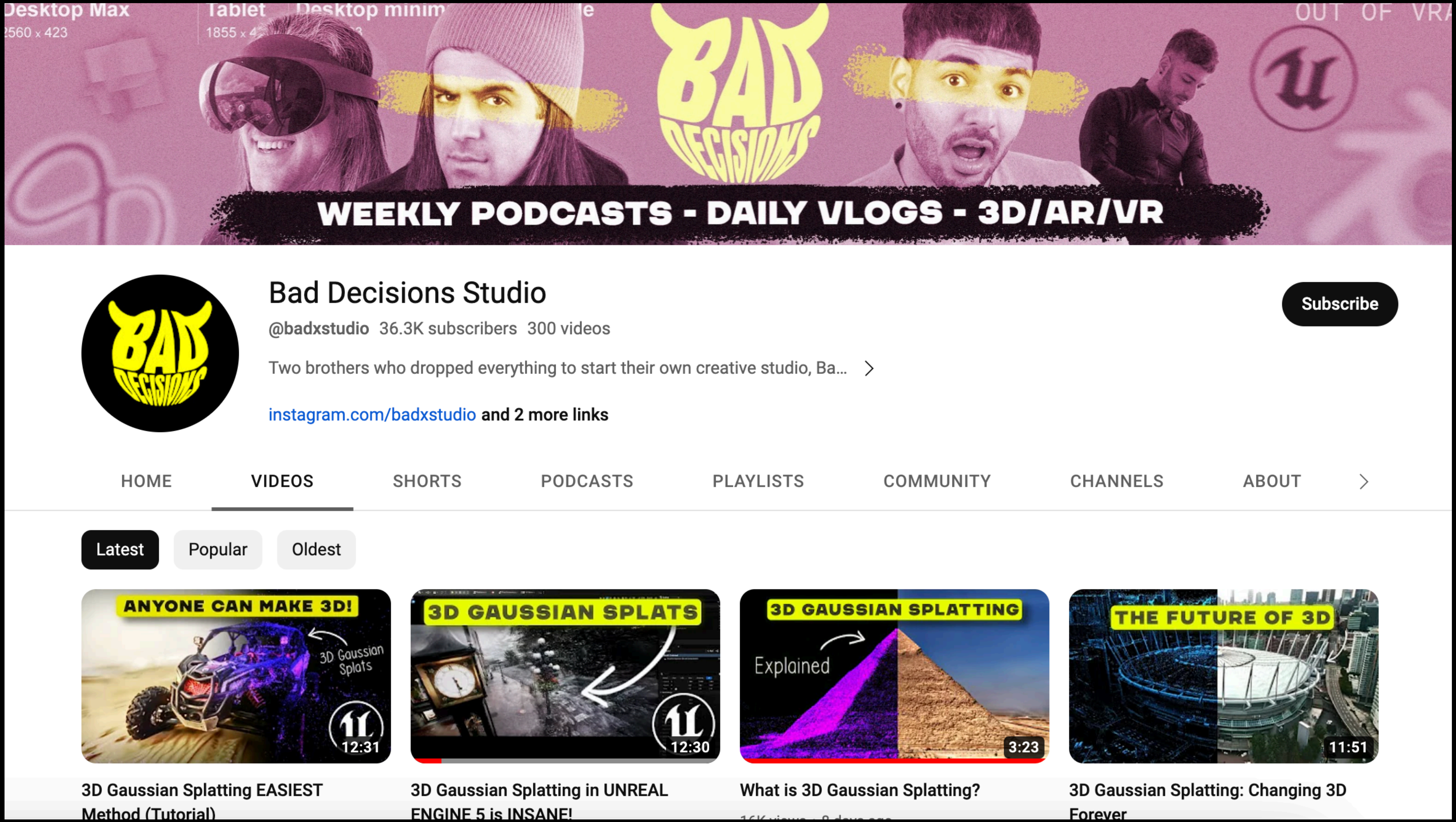
Paper arXiv Slides Code (Coming Soon)

Abstract

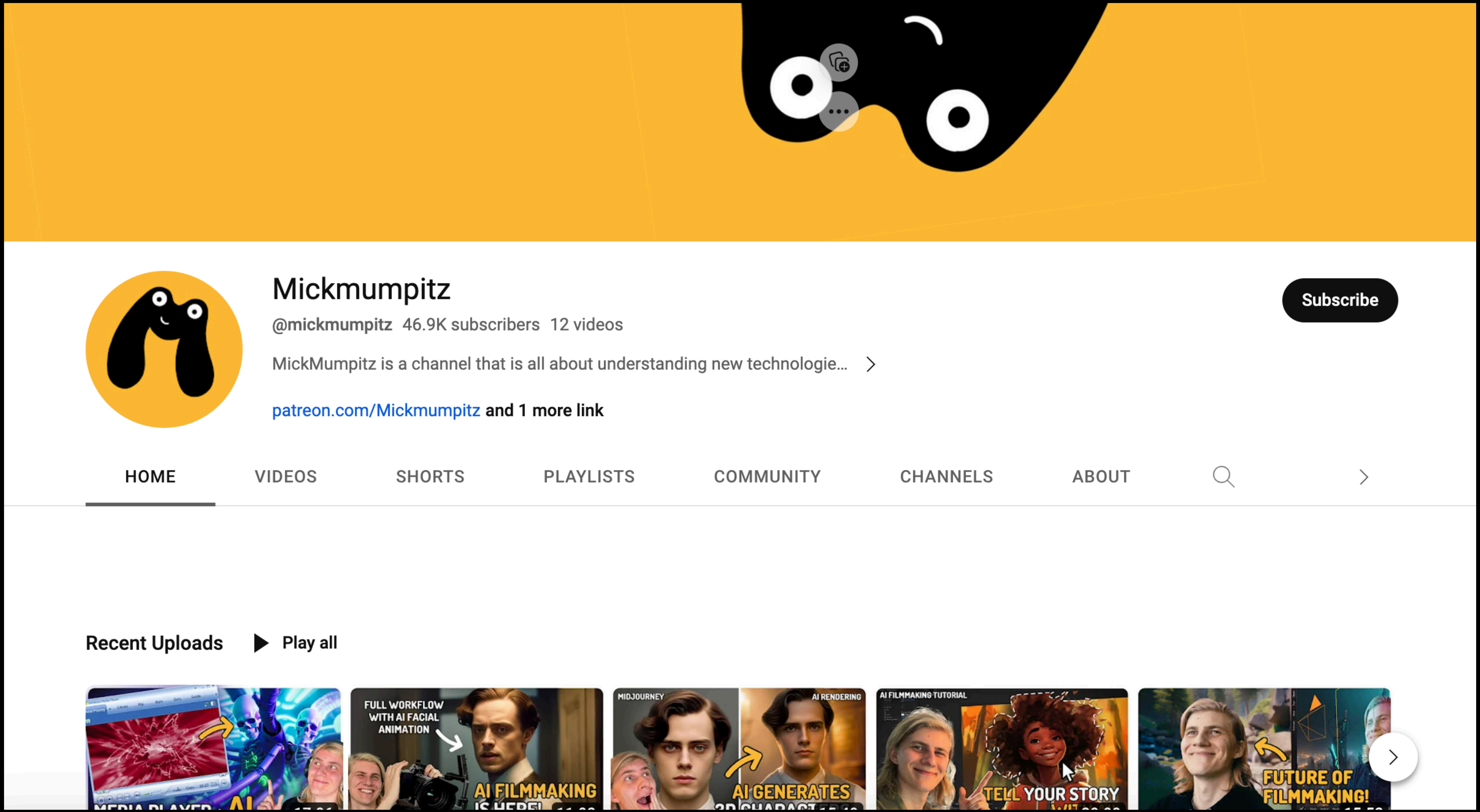
Score distillation sampling (SDS) has shown great promise in text-to-3D generation by distilling pretrained large-scale text-to-image diffusion models, but suffers from over-saturation, over-smoothing, and low-diversity problems. In this work, we propose to model the 3D parameter as a



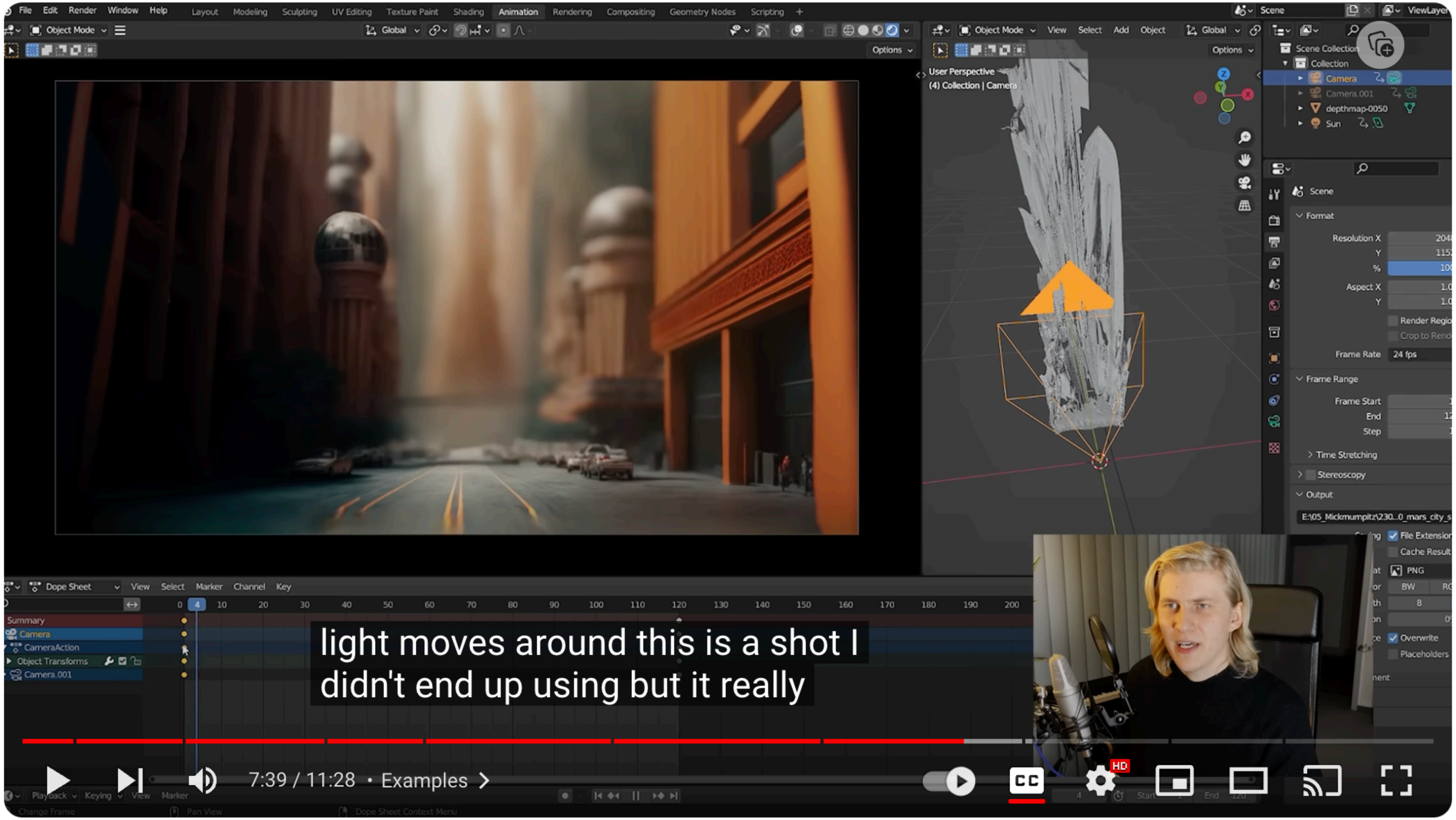
https://ml.cs.tsinghua.edu.cn/prolificdreamer/



https://www.youtube.com/@badxstudio/videos

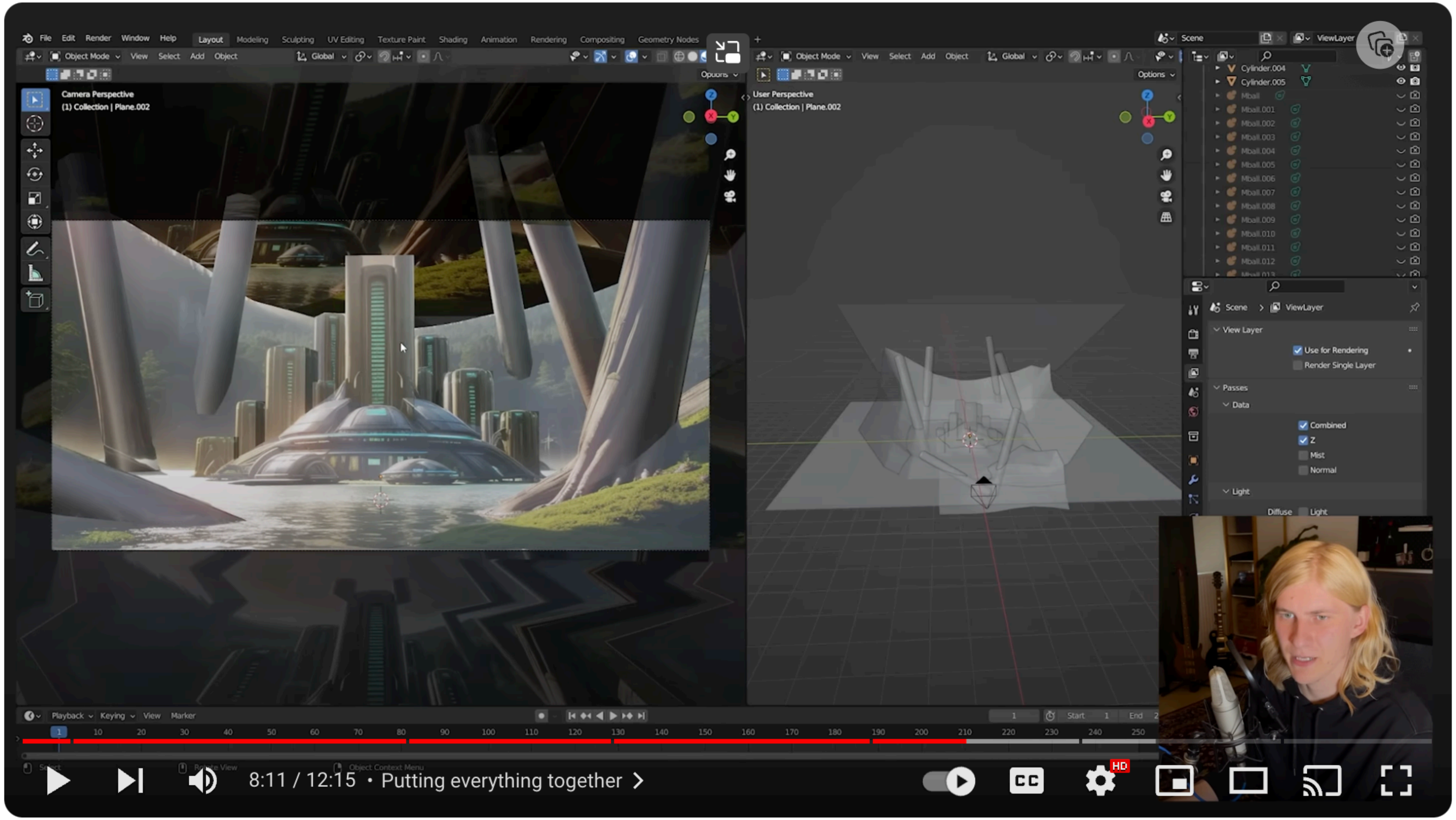


https://www.youtube.com/@badxstudio/videos



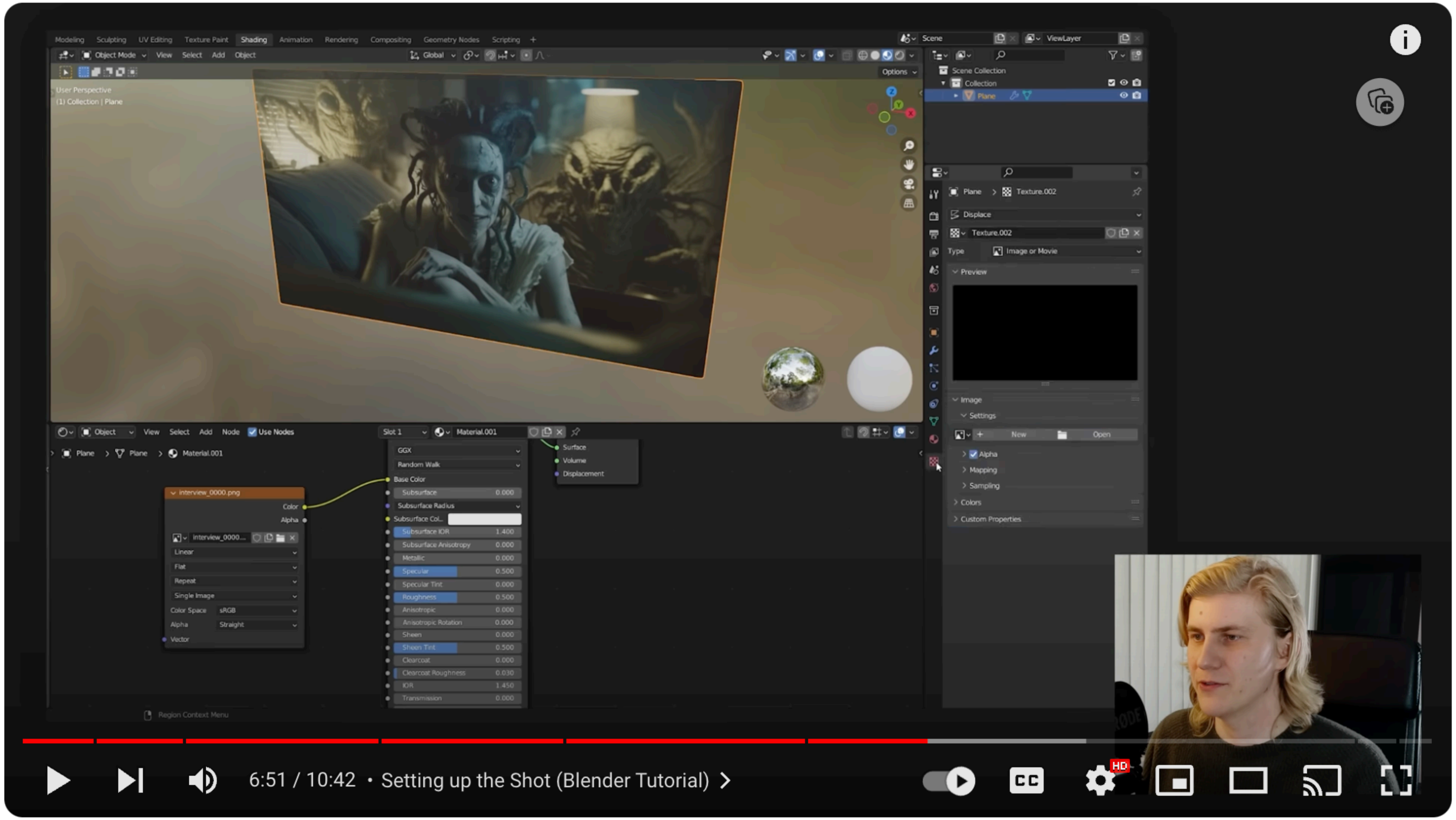
Generate 3D SHORT FILMS from 2D AI images!

https://www.youtube.com/watch?v=PFybvdKH8hc&t=613s



Use AI to create amazing 3D Animations!

https://www.youtube.com/watch?v=YW3FzfVxAEs



Create 3D animations of your AI-generated characters

https://www.youtube.com/watch?v=0tFe9dashgI

HOMEWORK

Homework

- In groups of 2, explore the use of 3+ of the 3d generation tools presented in class
- Create models, environments, game levels, objects etc.. related to your interests / topic for the course
- This work should be able to be presented as a standalone project, but should ideally contribute towards the development of your final project
- Presentation format is open to student preference, but should be limited to 3-5 minutes