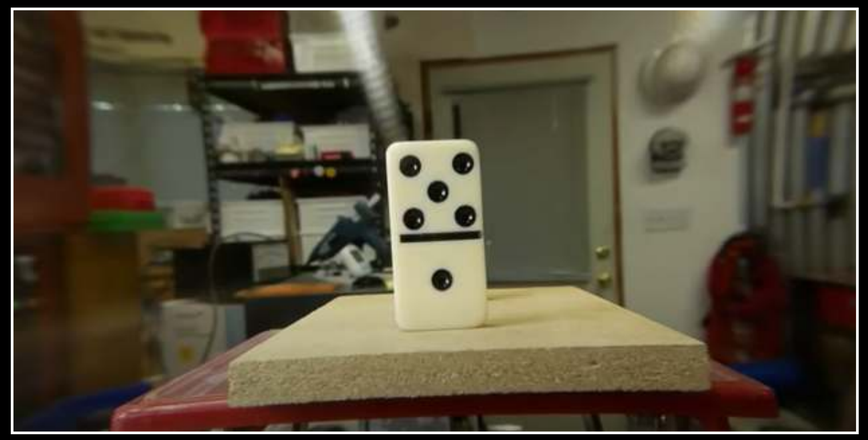
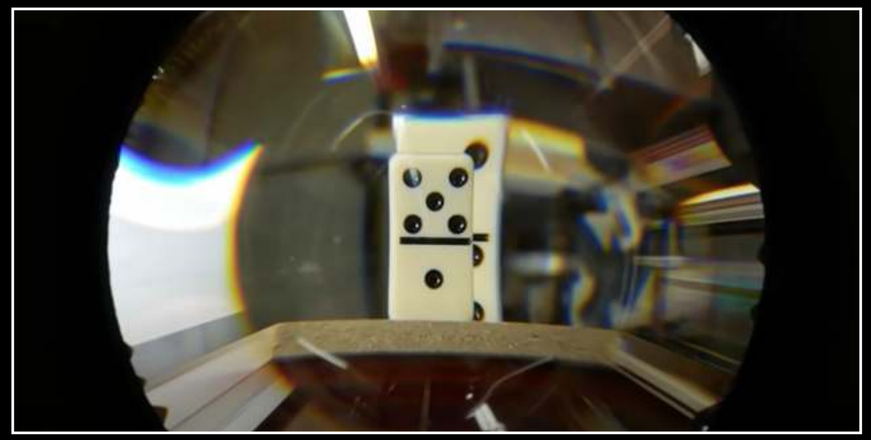
Reverse Perspective

Presented by Paul Bourke, 8 July 2020
http://paulbourke.net/revpersp/

Motivation 1

- “Hypercentric optics: A camera lens that can see behind objects” Ben Krasnow
- https://www.youtube.com/watch?v=iJ4yL6kaV1A&feature=youtu.be





Another example

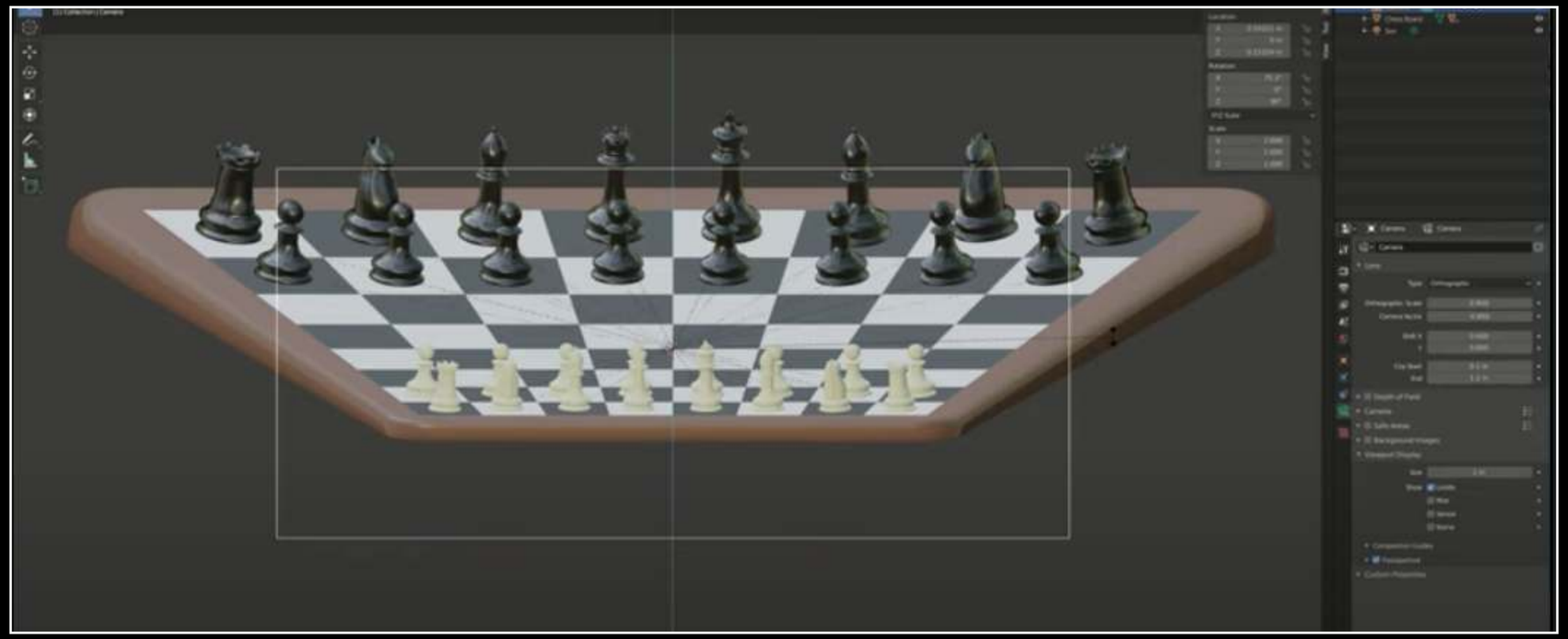
https://www.youtube.com/watch?v=bba4rD00S-M

Motivation 2

- Idea that it was used by various painters.
- Most notably Byzantine and other Russian Orthodox iconography.
- While these are often quoted as examples, there is much debate as to whether the artists thought in terms of reverse perspective.

Motivation 3

- Didn’t find any references to implementations online.
- But in the last week Николай has developed a Blender version, for the Eevee rendering engine.



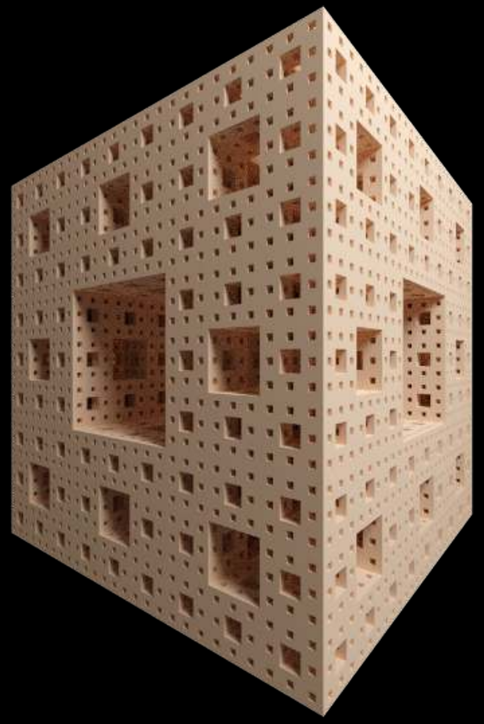
Perspective, way of thinking #1

- In the computer graphics and photography community we are used to thinking about a lenses field of view and camera position.

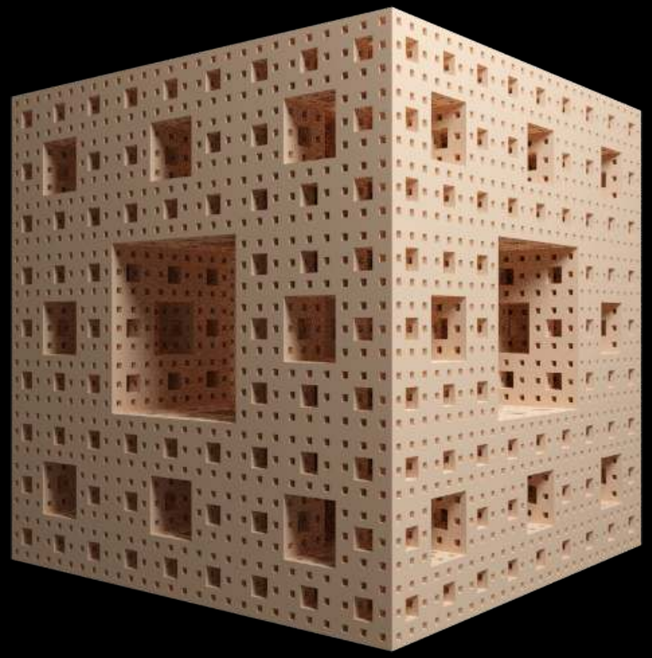
- In order to keep an object framed, as we move the camera closer we need a wider field of view. As we move the camera away we need a narrower FOV.

- The degree to which distant objects appear smaller than foreground depends on the camera position.

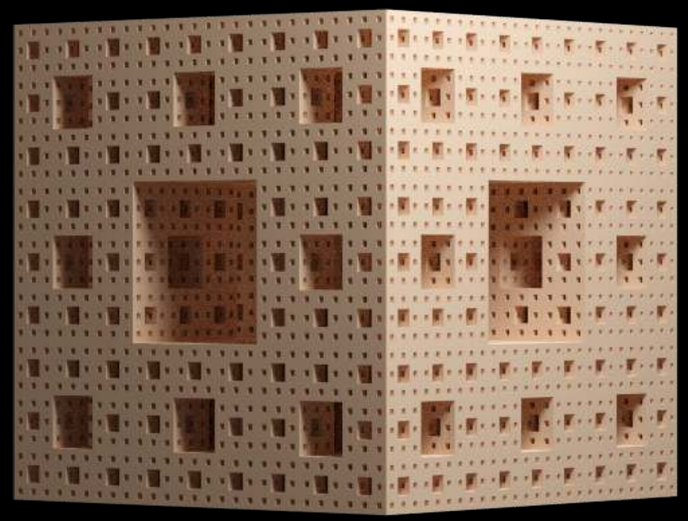
- In the limit (camera infinitely far away) we have an orthographic projection, objects appear without any distance related scaling.



Close camera
Wide FOV



Midrange camera
Narrower FOV



Distant camera
Narrow FOV
(Orthographic)

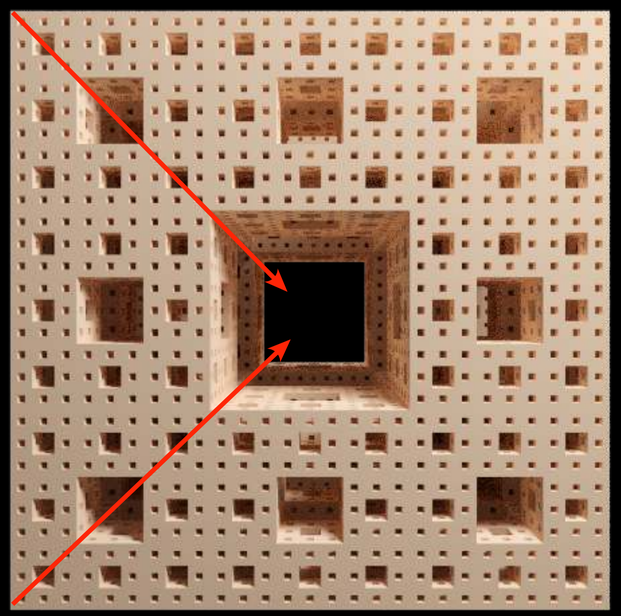
Can we keep moving to the right on this continuum?

Instead of distant objects appearing smaller, they will appear larger .

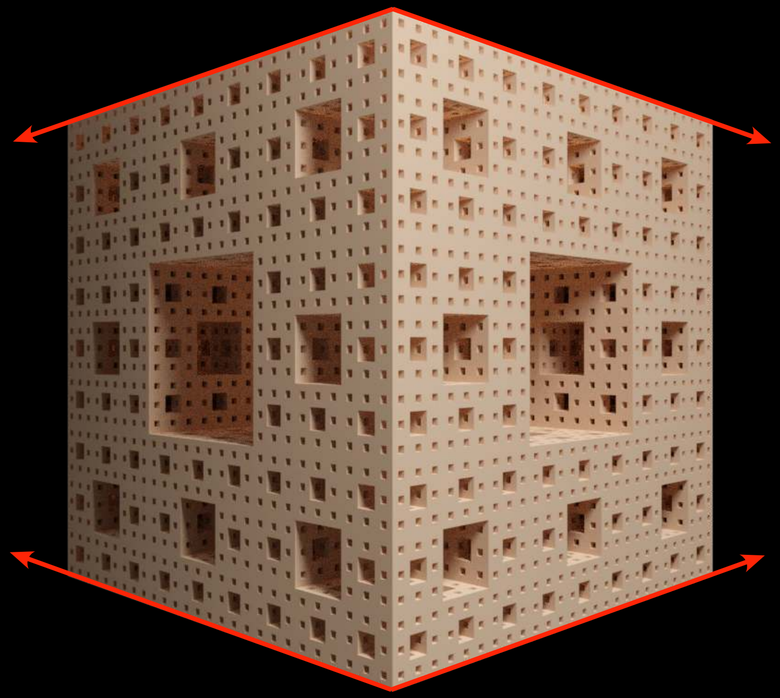
Perspective, way of thinking #2

- Traditional perspective drawing and drafting is taught in terms of vanishing points.

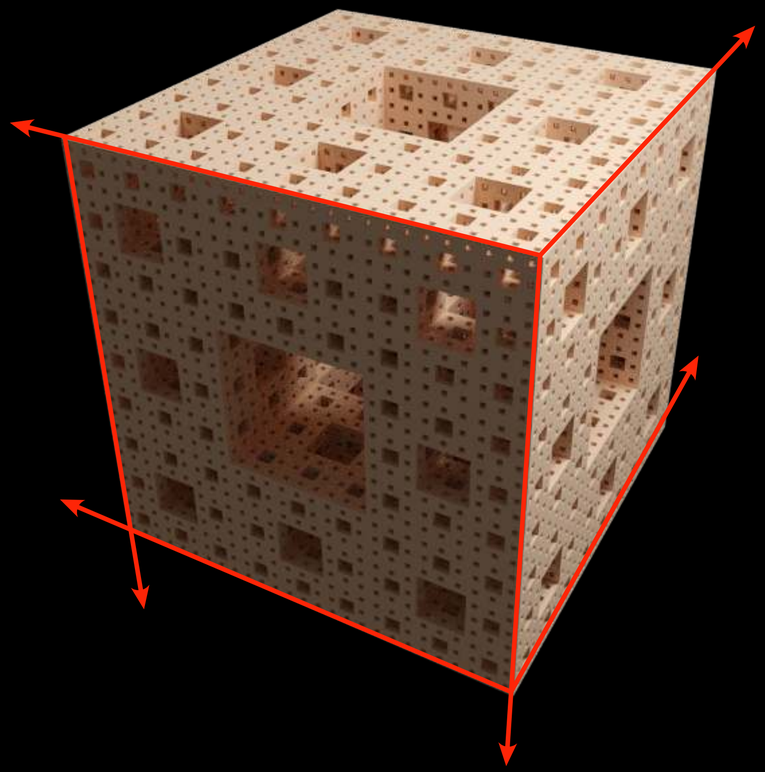
- One considers where lines along parallel features meet, and how many there are.



One point



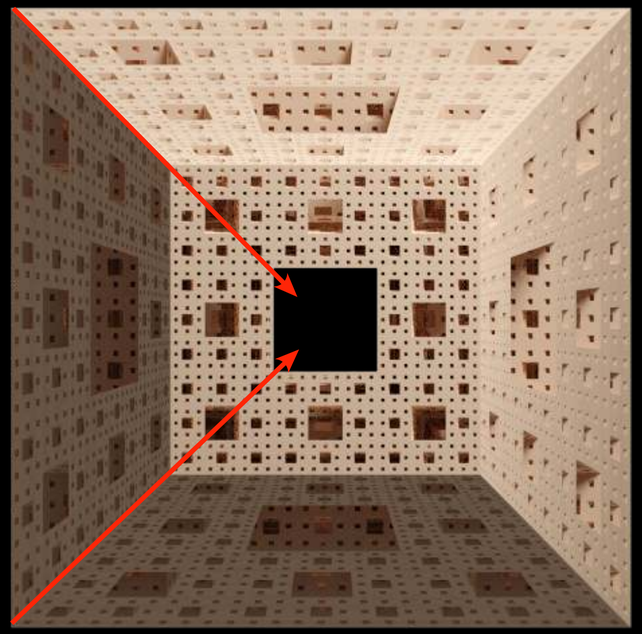
Two point

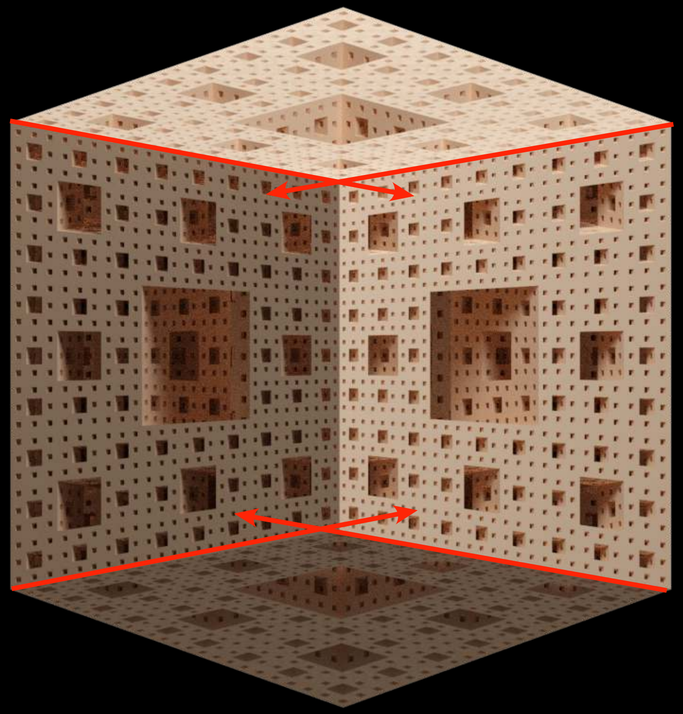


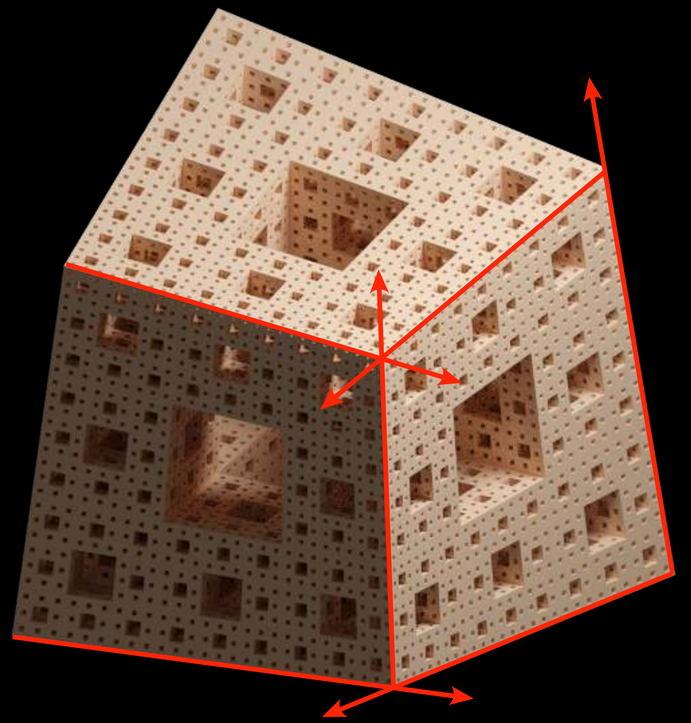
Three point

The vanishing points are all on the other side of the object with respect to the viewer.

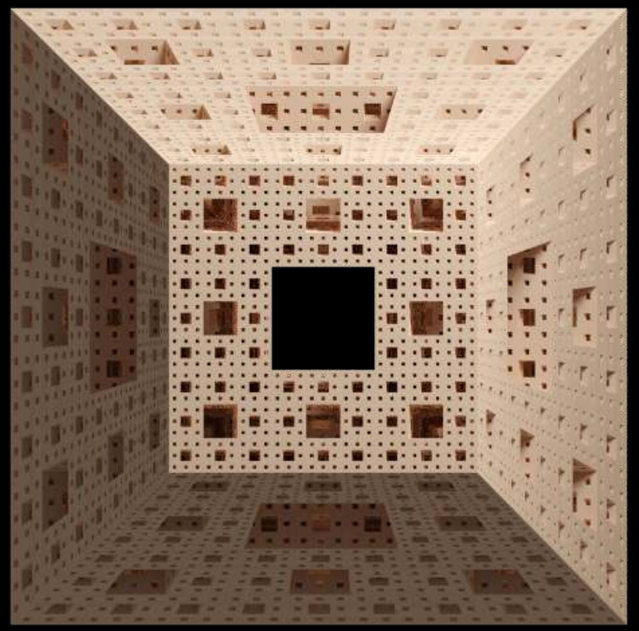
Now the concept of negative perspective is more obvious.

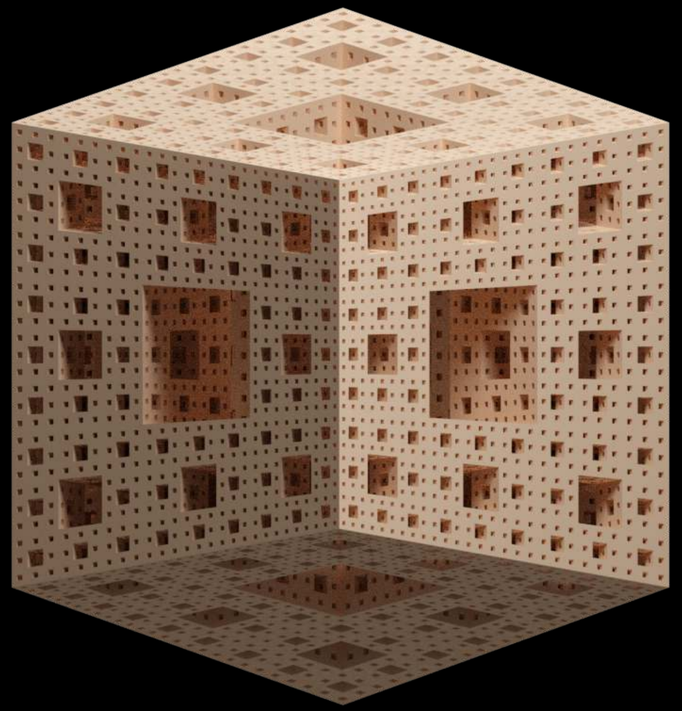


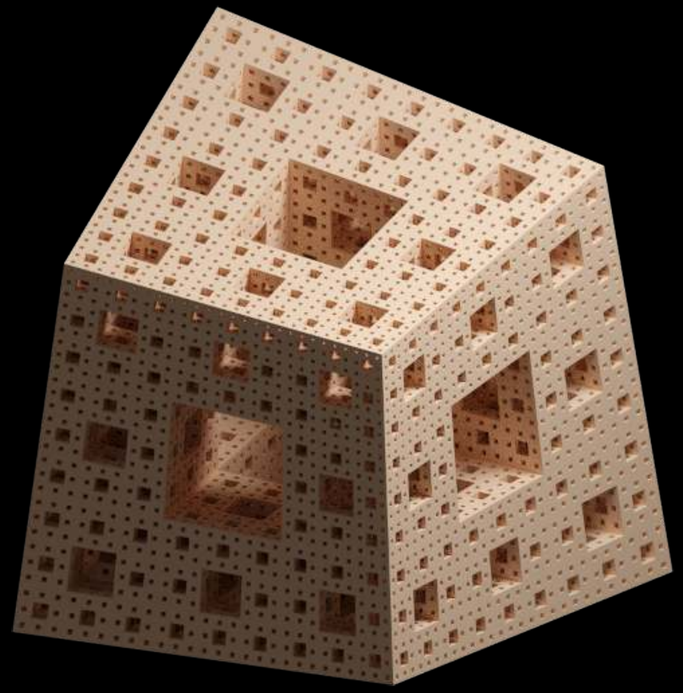




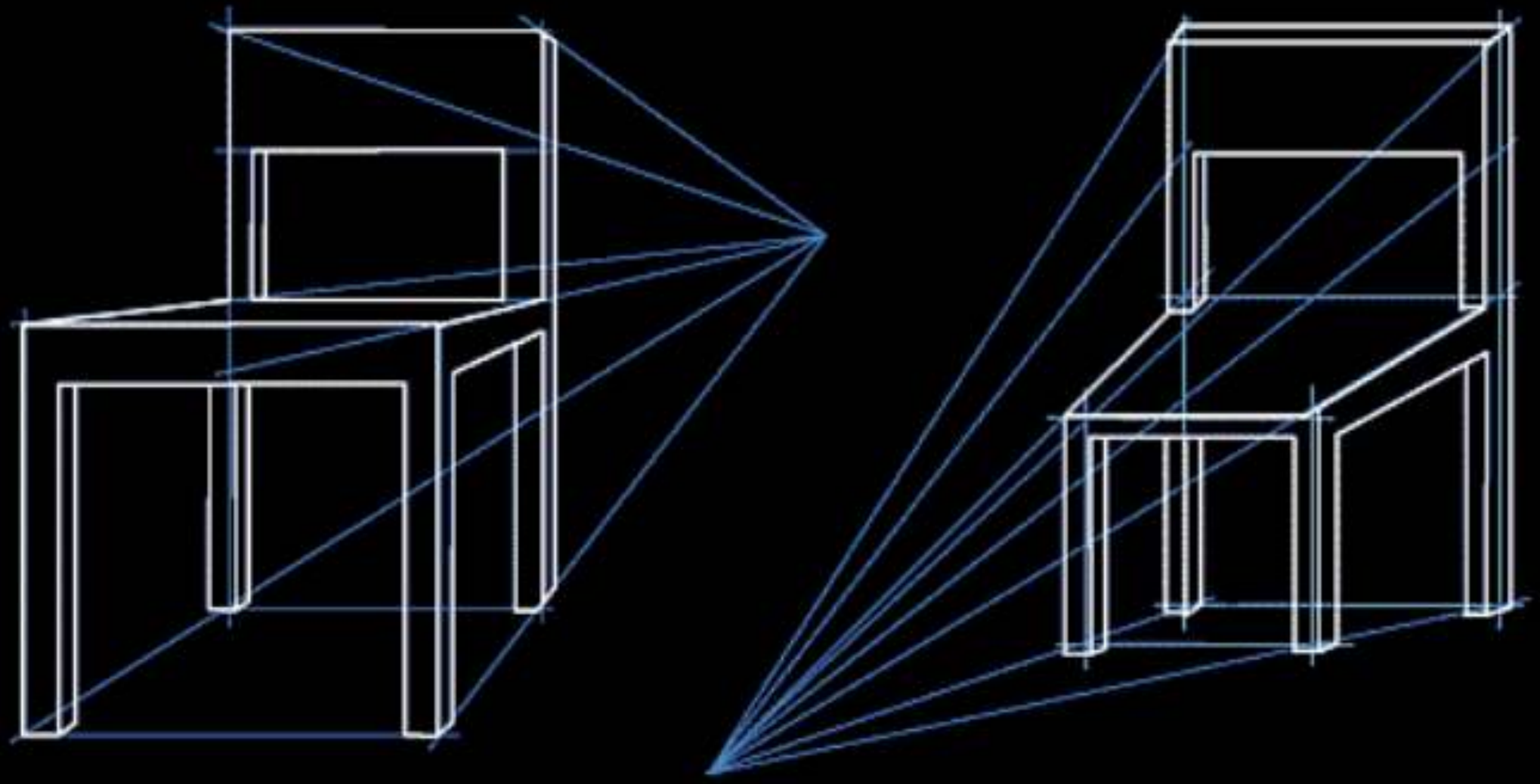
Move the vanishing points to being on the viewer side of the projection plane.







It’s a bit like looking at the model from the vanishing points.



Perspective

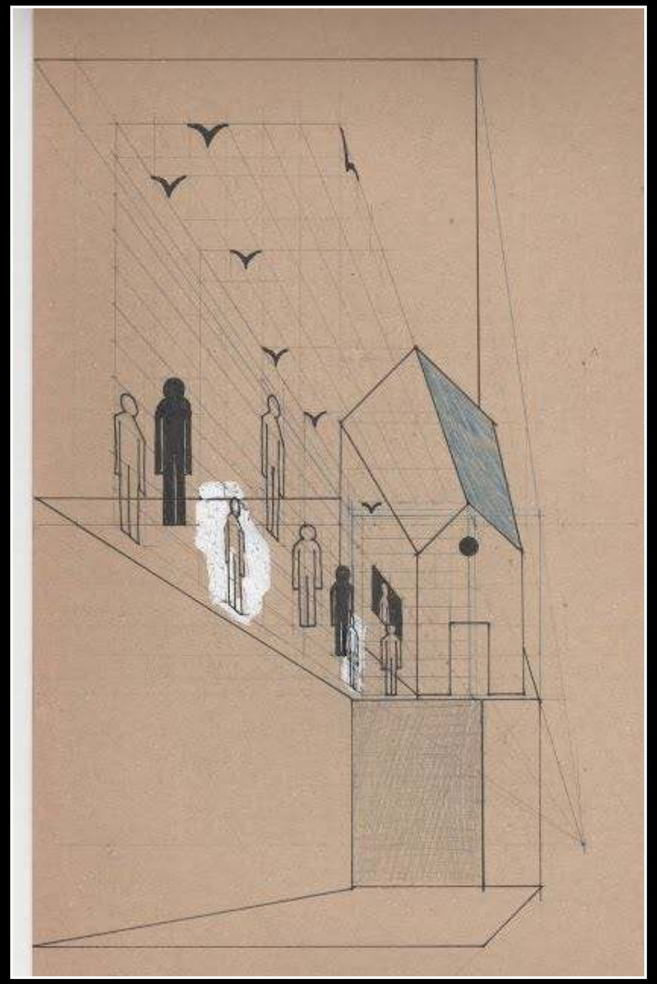
Reverse perspective

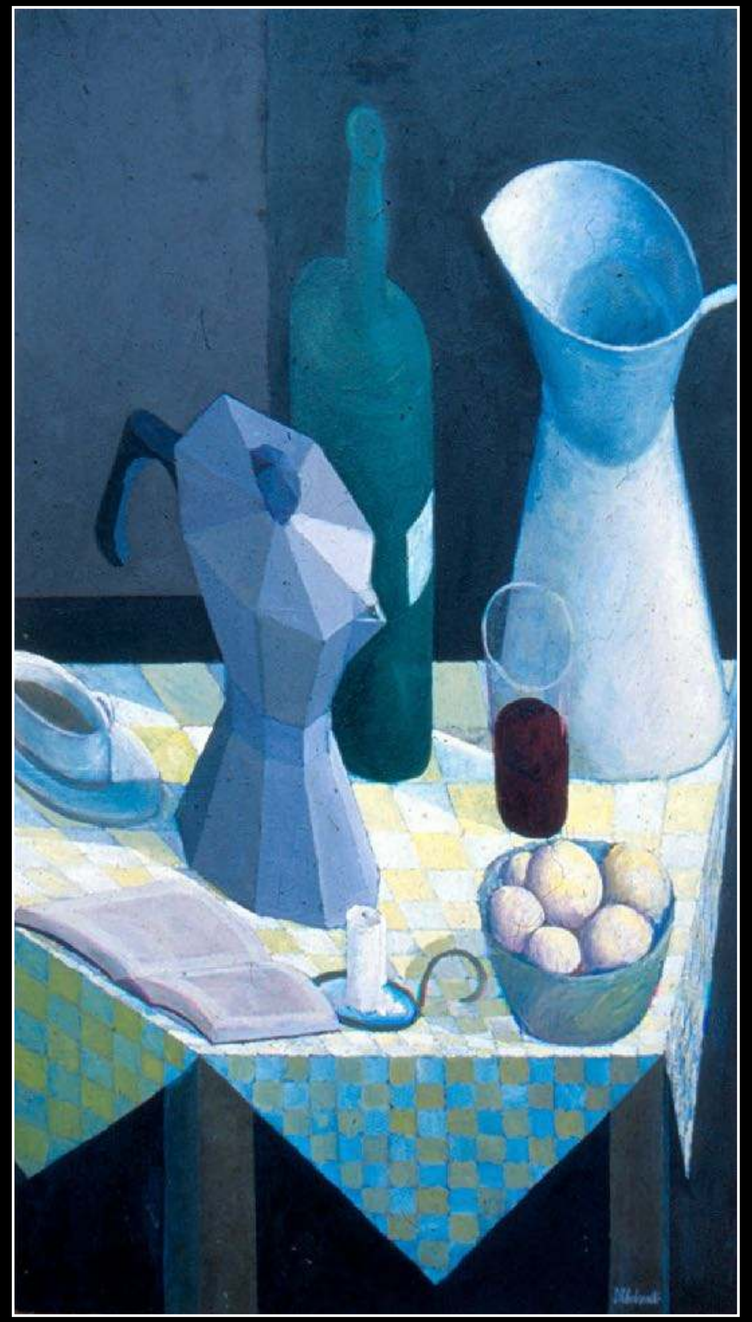
"Old Testament Trinity", Andrei Rublov

“Annunciation”, Andrei Rublev

More modern examples

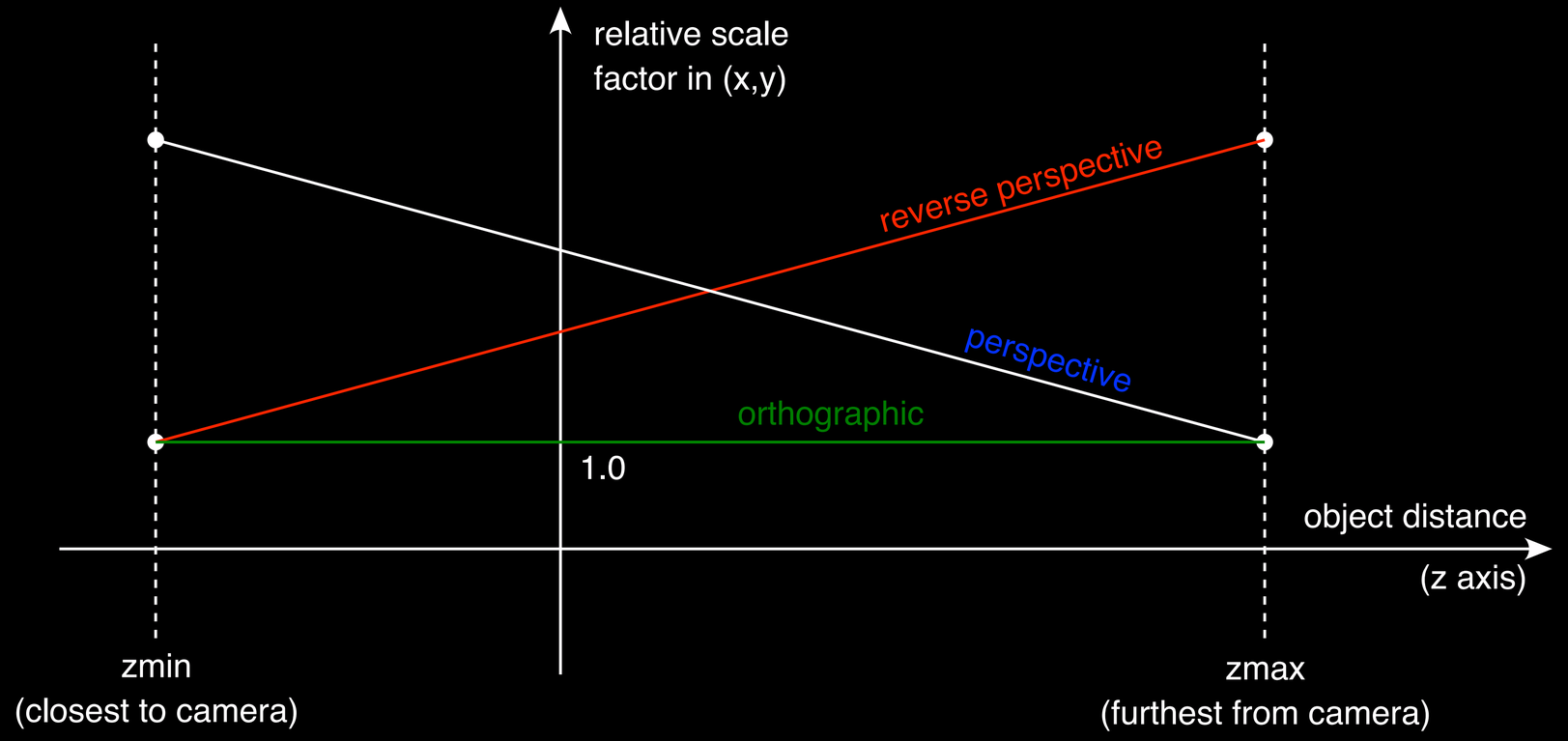
David R. Belmonte



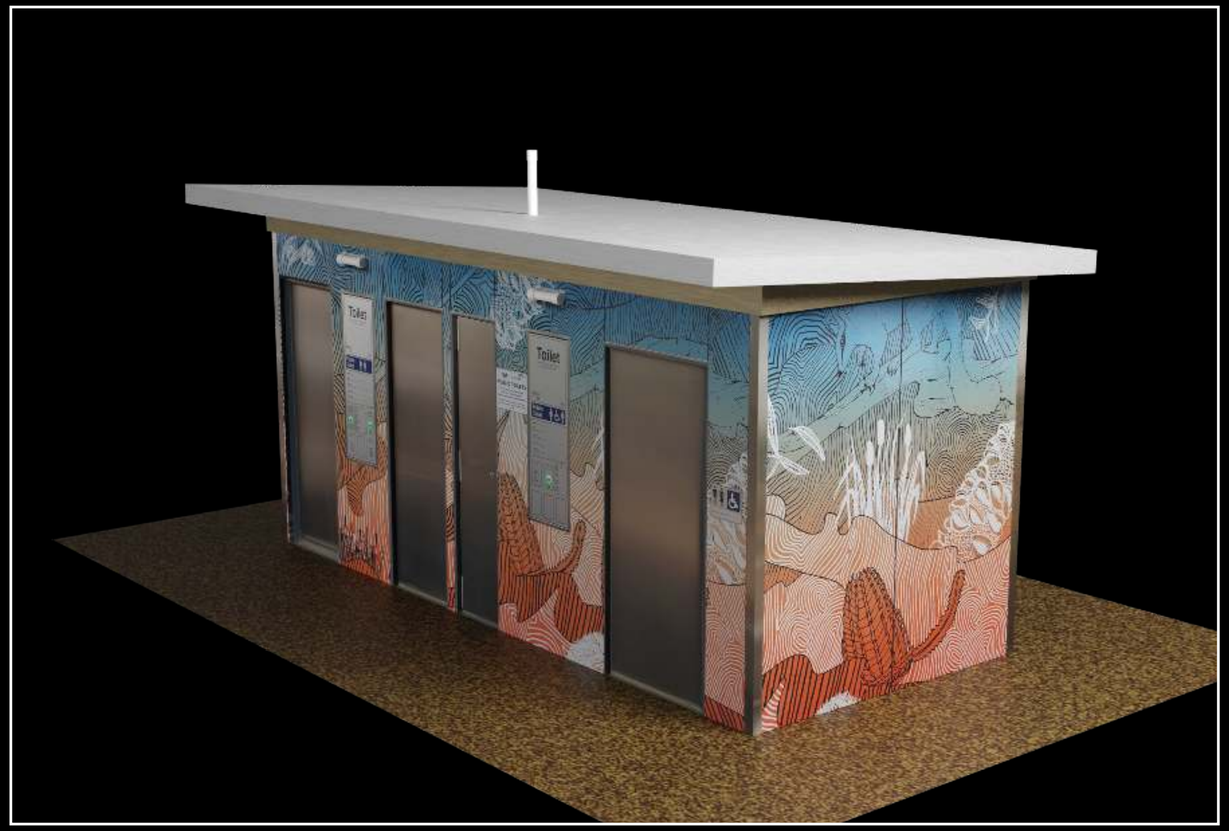


Implementation

- Vertex shader for Blenders Cycles renderer (Ray Tracer style).
- This works because the relationship between depth and scale is linear. So no need to tessellate the geometry.



Example



Perspective

Reverse perspective

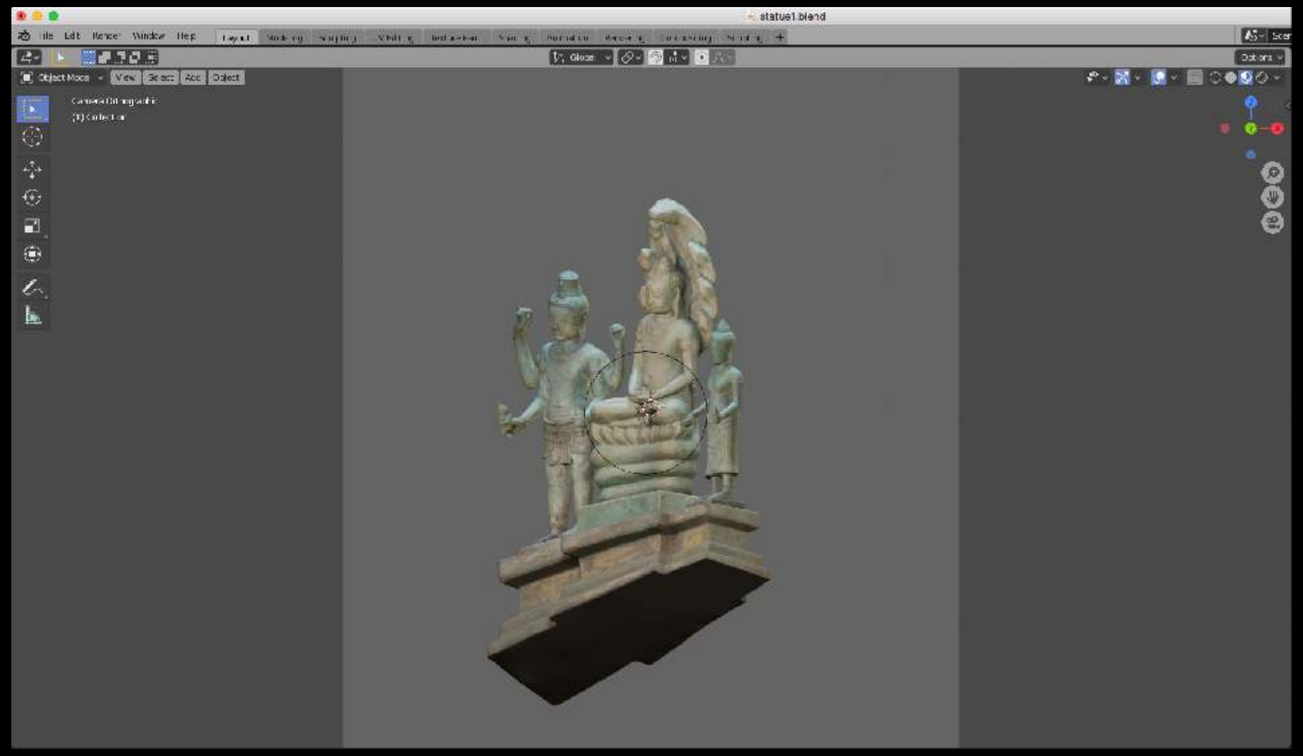
Example

Perspective

Orthographic

Reverse perspective

Side view of vertex shader result



Correct reverse perspective view

Orthographic

Modest reverse perspective

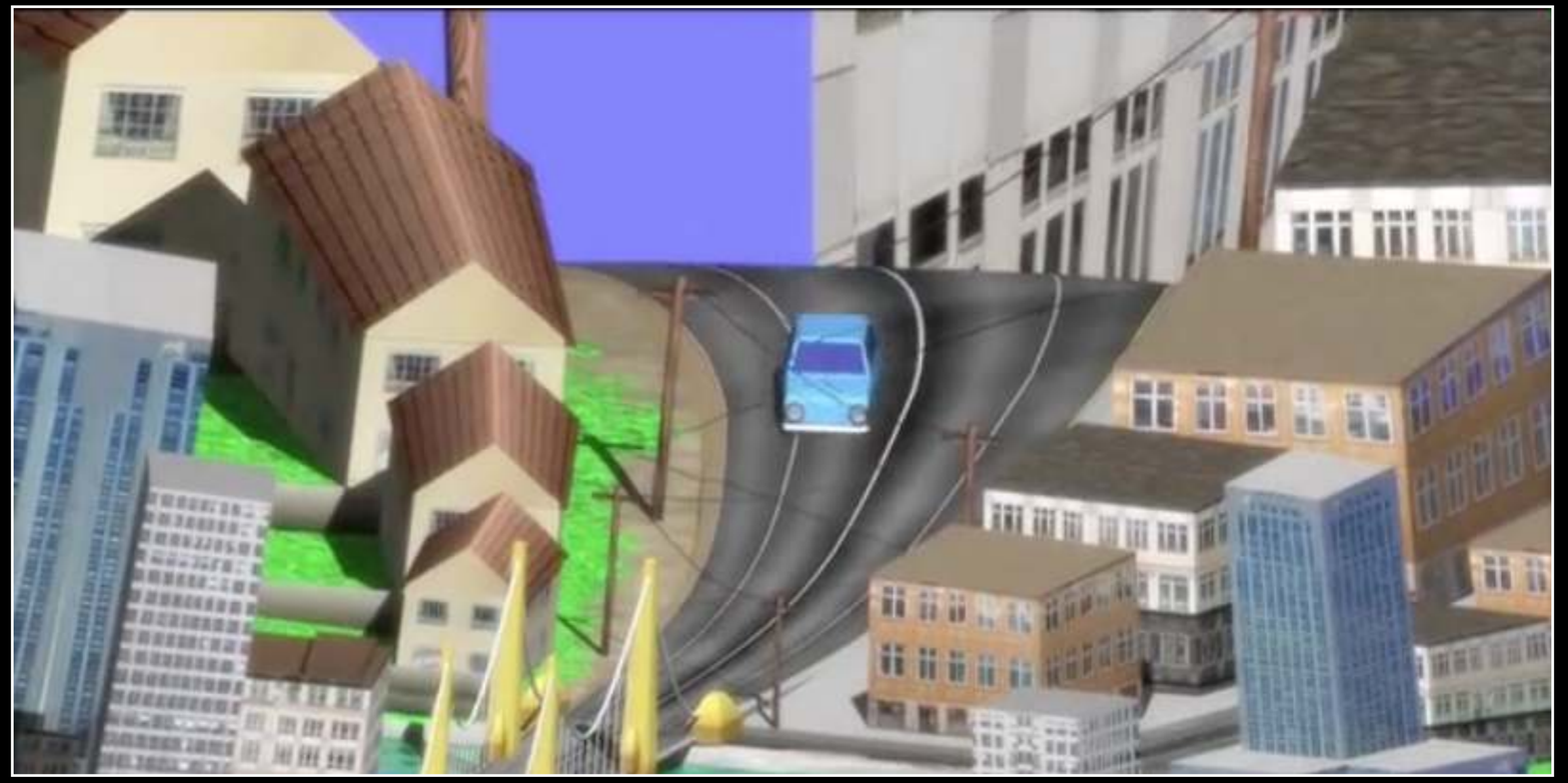
Increased reverse perspective

Other historical digital works

Tamas Waliczky, 1994

https://www.youtube.com/watch?v=HLhkg_WIqg0

Other historical digital works



“JMS”, 2009

https://vimeo.com/jms77

Actual lenses

Future work

- Create a release version plugin for Blender.
- Extend to panoramas.
- Have vague ideas around applications for 6dof viewing.
- … but mostly just having fun.

Questions?