Simulating materials with unusual microstructures

DI (FH) Thomas Radeke


THE MEDIUM
1 PLAYER
2 PLAYER
360
XBOX 360
XBOX
XBOX

Thomas Radeke

Born 1982 in Berlin
Studied Information Design

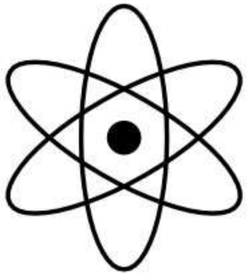
Teaching 3D Graphics & Animation at
University of Applied Sciences JOANNEUM
Graz, Austria

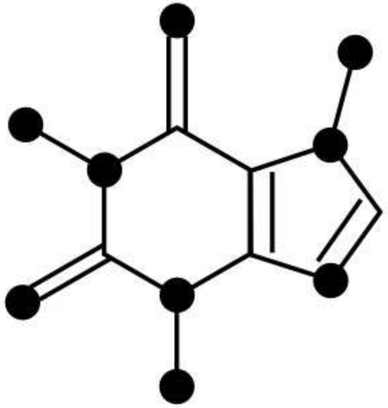
FH | JOANNEUM
University of Applied Sciences

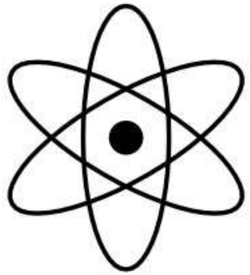
Loves 2D/3D graphics, programming, (retro) videogames, photography, technology in general

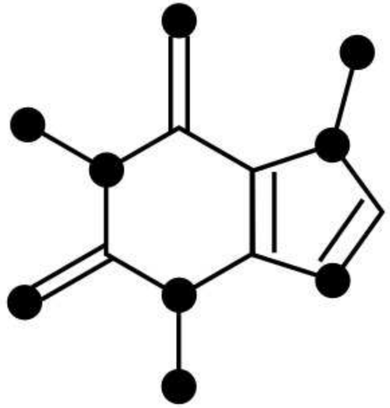
Website
rahdick.at

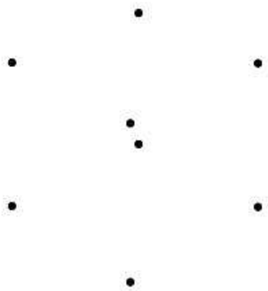
Talk info & Downloads
http://goo.gl/K3F3EU

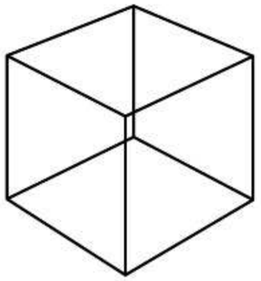













SUPER NINTENDO
ENTERTAINMENT SYSTEM
SELECT
START
X
Y
A
B

File Render Window Help Compositing Scene Cycles Render v2.76 | Verts:384 | Faces:386 | Tris:764 | Objects:1/2 | Lamps:0/1 | Mem:158.80M | Cube

View Search All Scenes

Scene
RenderLayers
World
Cube
Sun

Scene

▼ Render

Render Animation Audio

Display: Image Editor
Feature Set: Supported
Device: GPU Compute

▼ Dimensions

Render Presets

Resolution:
X: 1920 px
Y: 1080 px
50%

Frame Range:
Start Frame: 1
End Frame: 250
Frame Step: 1

Aspect Ratio:
X: 1.000
Y: 1.000

Frame Rate:
24 fps

Time Remapping:
Old: 100 New: 100

Border Crop

▶ Metadata

▼ Output

/tmp/

Overwrite File Extensions
Placeholders Cache Result

PNG BW RGB RGBA

Color Depth: 8 16

Compression: 15%

▶ Freestyle
▶ Sampling
▶ Volume Sampling
▶ Light Paths
▶ Motion Blur

▼ Film

Exposure: 1.00
Transparent

Gaussian
Width: 1.50

▶ Performance
▶ Post Processing
▶ Bake

Wand

View Select Add Node Wand F Use Nodes

Lock to Cursor
Lock Camera to View

Clip:
Start: 0.100
End: 500.000

Local Camera:

Render Border

▼ 3D Cursor

Location:
X: 0.00000
Y: 0.00000
Z: 0.00000

▼ Item

Cube

▼ Display

Only Render
World Background
Outline Selected
All Object Origins
Relationship Lines
Grid Floor X Y Z

View Image IMG_20150321_1656... F View

View Select Add Object Object Mode Global

0 50 100 150 200 250

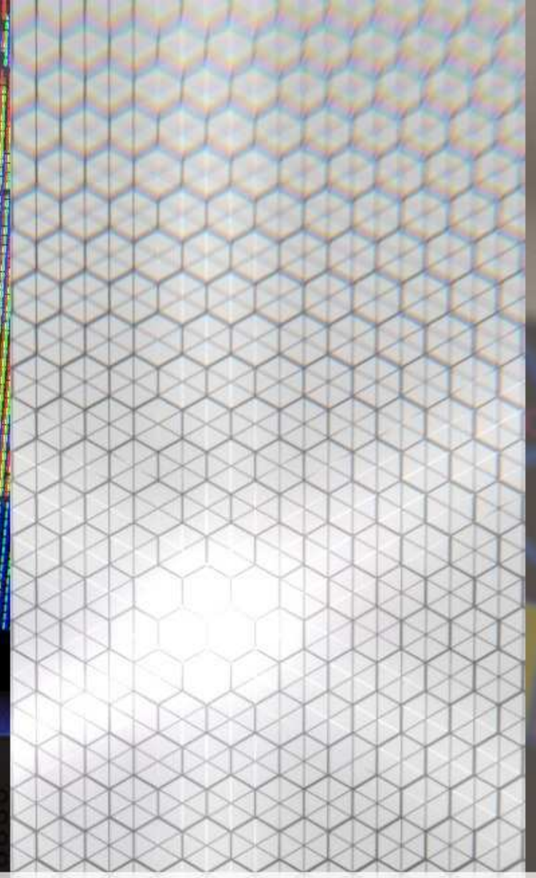
Start: 1 End: 250


SCHNITTIG!
EINBAHN
Ausgenommen Radfahrer


20
EURO
CENT


EURO
CENT

CRTs and other subpixel displays

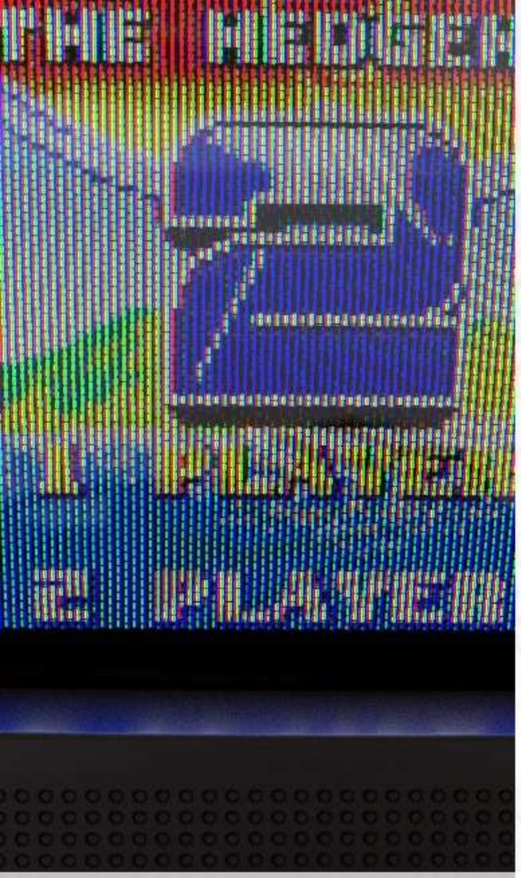


Retroreflective surfaces

Security holograms

Wooden surfaces with reflective anomalies

Lenticular prints



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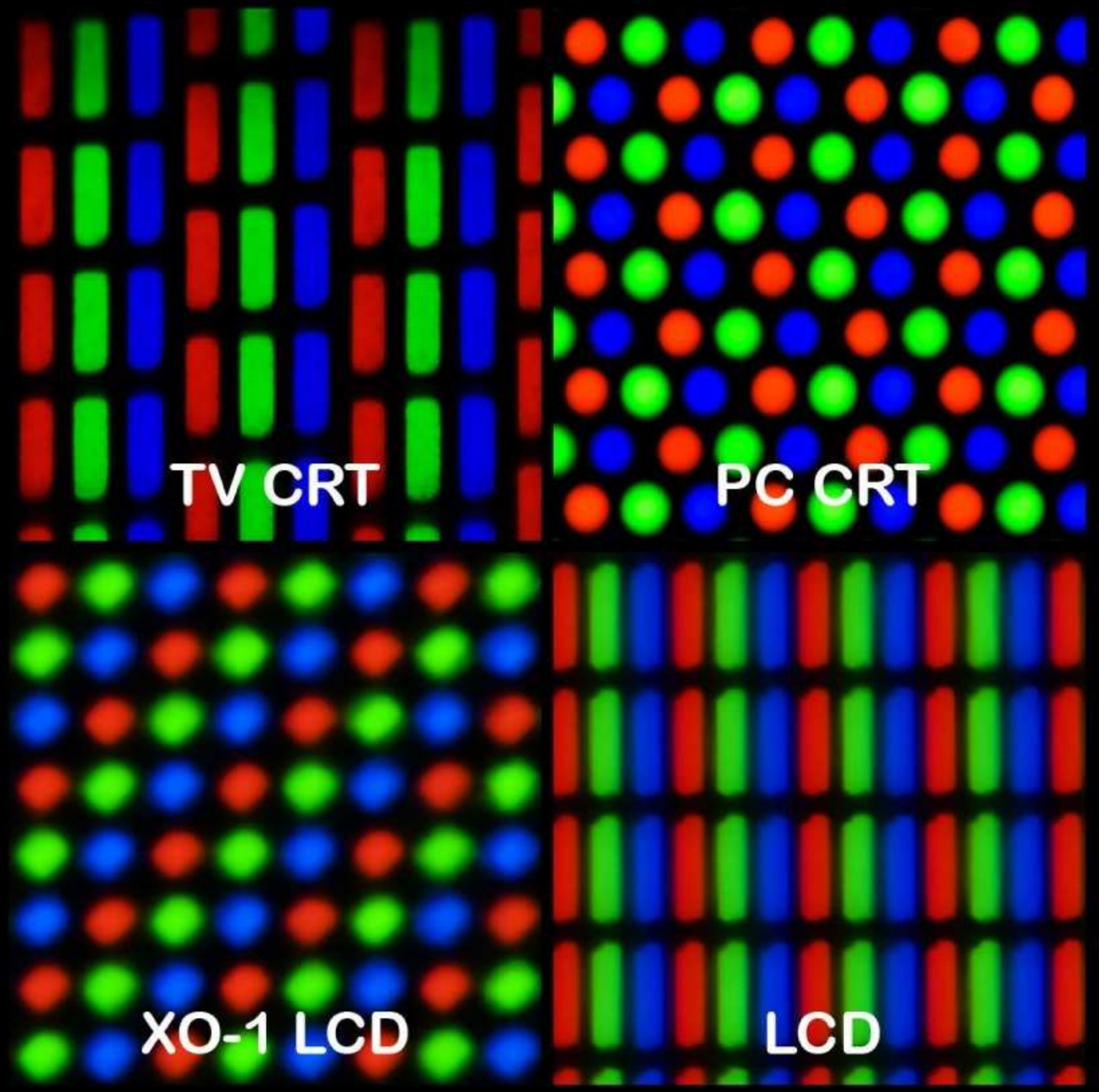
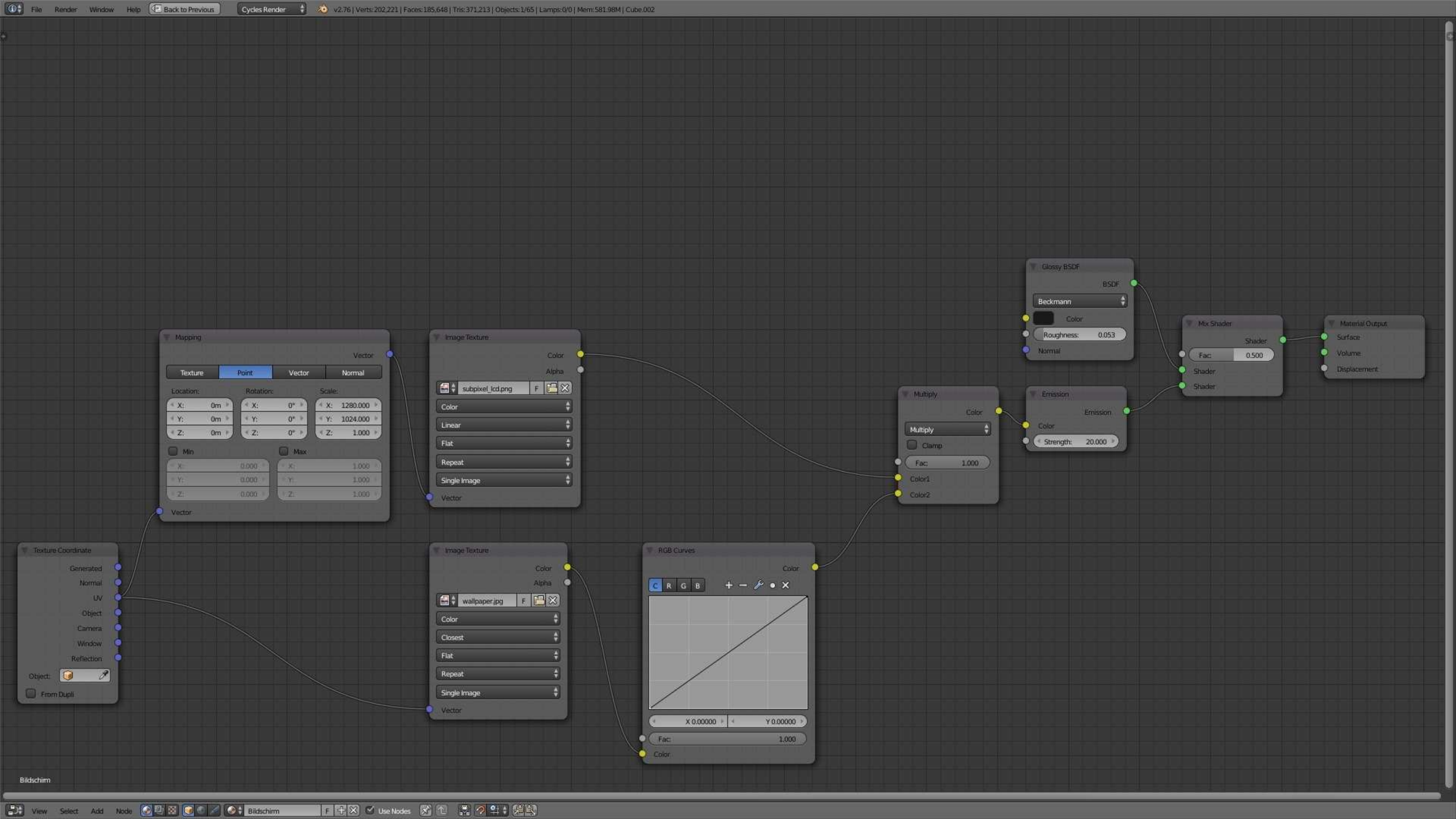
SAMSUNG



https://en.wikipedia.org/wiki/Subpixel_rendering#/media/File:Pixel_geometry_01_Pengo.jpg


File
Render
Window
Help
Back to Previous
Cycles Render
v2.76 | Verts:202,221 | Faces:185,648 | Tris:371,213 | Objects:1/65 | Lamps:0/0 | Mem:581.98M | Cube.002
Mapping
Vector
Texture
Point
Vector
Normal
Location:
Rotation:
Scale:
X: 0m
Y: 0m
Z: 0m
X: 0°
Y: 0°
Z: 0°
X: 1280.000
Y: 1024.000
Z: 1.000
Min
Max
Vector
Image Texture
Color
Alpha
subpixel_lcd.png
Color
Linear
Flat
Repeat
Single Image
Vector
Glossy BSDF
BSDF
Beckmann
Color
Roughness: 0.053
Normal
Mix Shader
Shader
Fac: 0.500
Shader
Shader
Material Output
Surface
Volume
Displacement
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Color
Multiply
Clamp
Fac: 1.000
Color1
Color2
Emission
Emission
Color
Strength: 20.000
Texture Coordinate
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Image Texture
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wallpaper.jpg
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Closest
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Single Image
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RGB Curves
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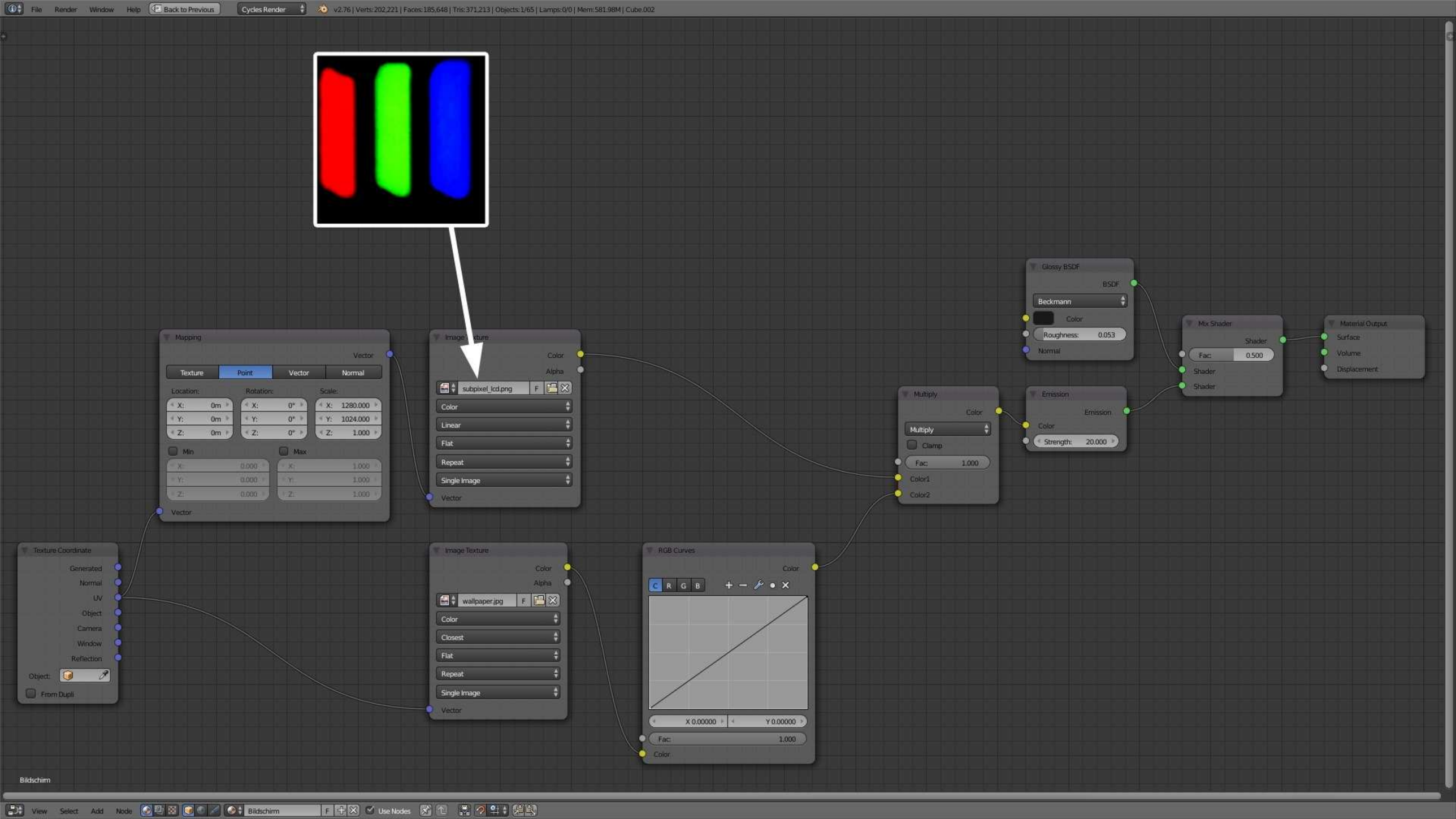
Fac: 1.000
Color
Bildschirm
View
Select
Add
Node
Bildschirm
Use Nodes


File
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Back to Previous
Cycles Render
v2.76 | Verts:202,221 | Faces:185,648 | Tris:371,213 | Objects:1/65 | Lamps:0/0 | Mem:581.98M | Cube.002
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Y: 1024.000
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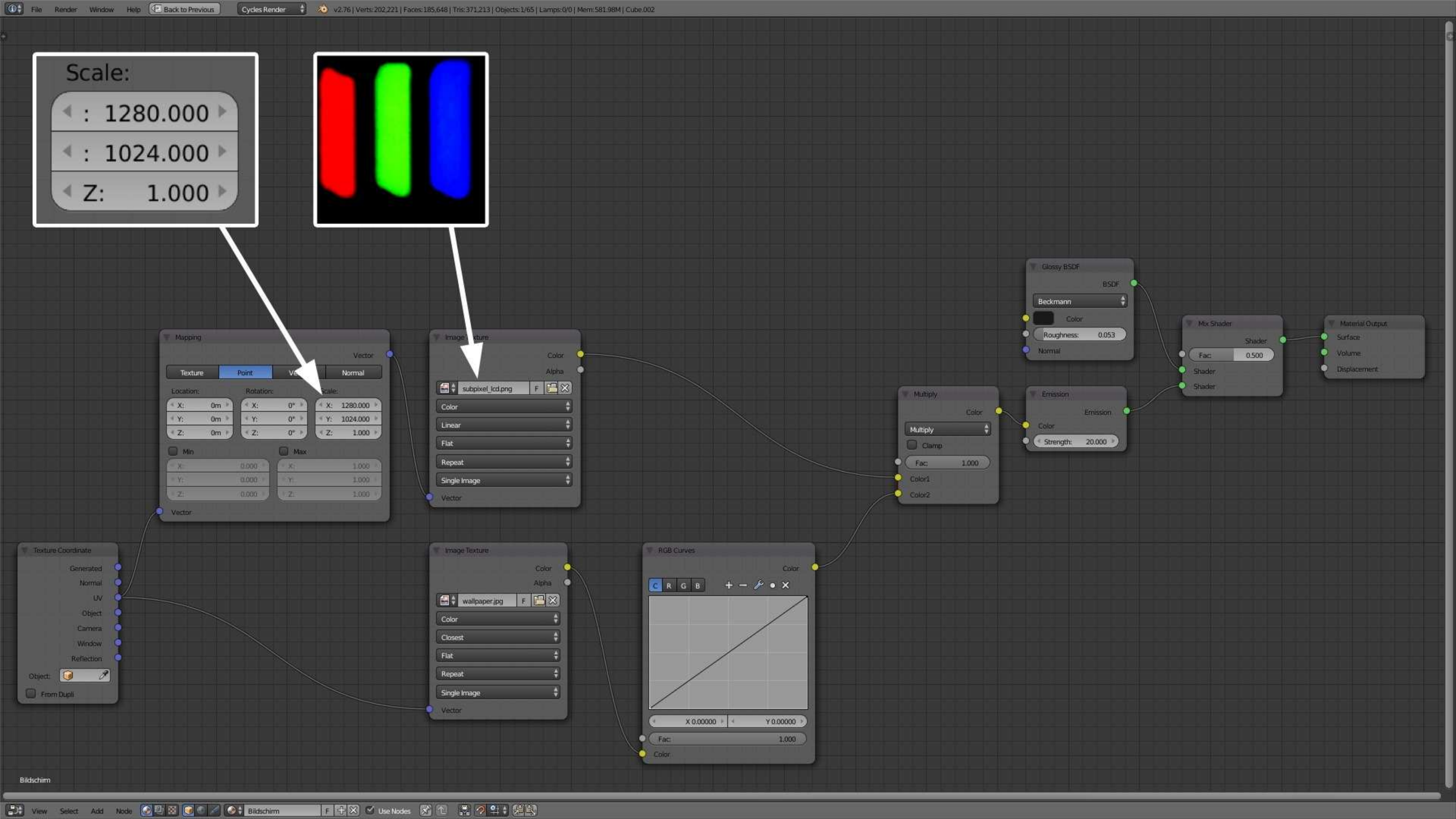
Bildschirm
Use Nodes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Back to Previous
Cycles Render
v2.76 | Verts:202,221 | Faces:185,648 | Tris:371,213 | Objects:1/65 | Lamps:0/0 | Mem:581.98M | Cube.002
Scale:
: 1280.000
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Z: 1.000
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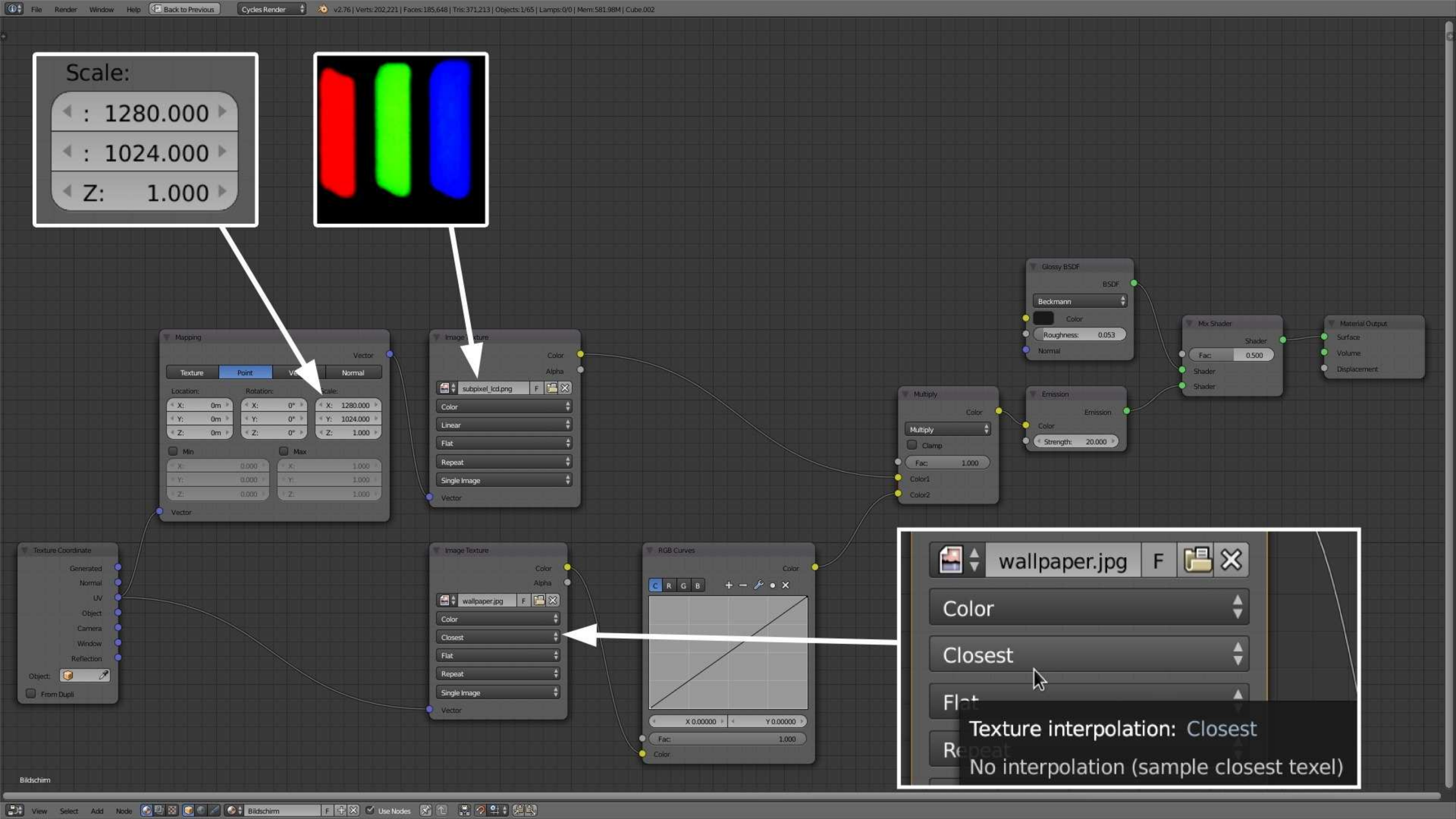
Bildschirm
Use Nodes


File Render Window Help Back to Previous Cycles Render
v2.76 | Verts:202,221 | Faces:185,648 | Tris:371,213 | Objects:1/65 | Lamps:0/0 | Mem:581.98M | Cube.002
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: 1024.000
Z: 1.000
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Location: Rotation: Scale:
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Y: 0m Y: 0° Y: 1024.000
Z: 0m Z: 0° Z: 1.000
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Fac: 1.000
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wallpaper.jpg F
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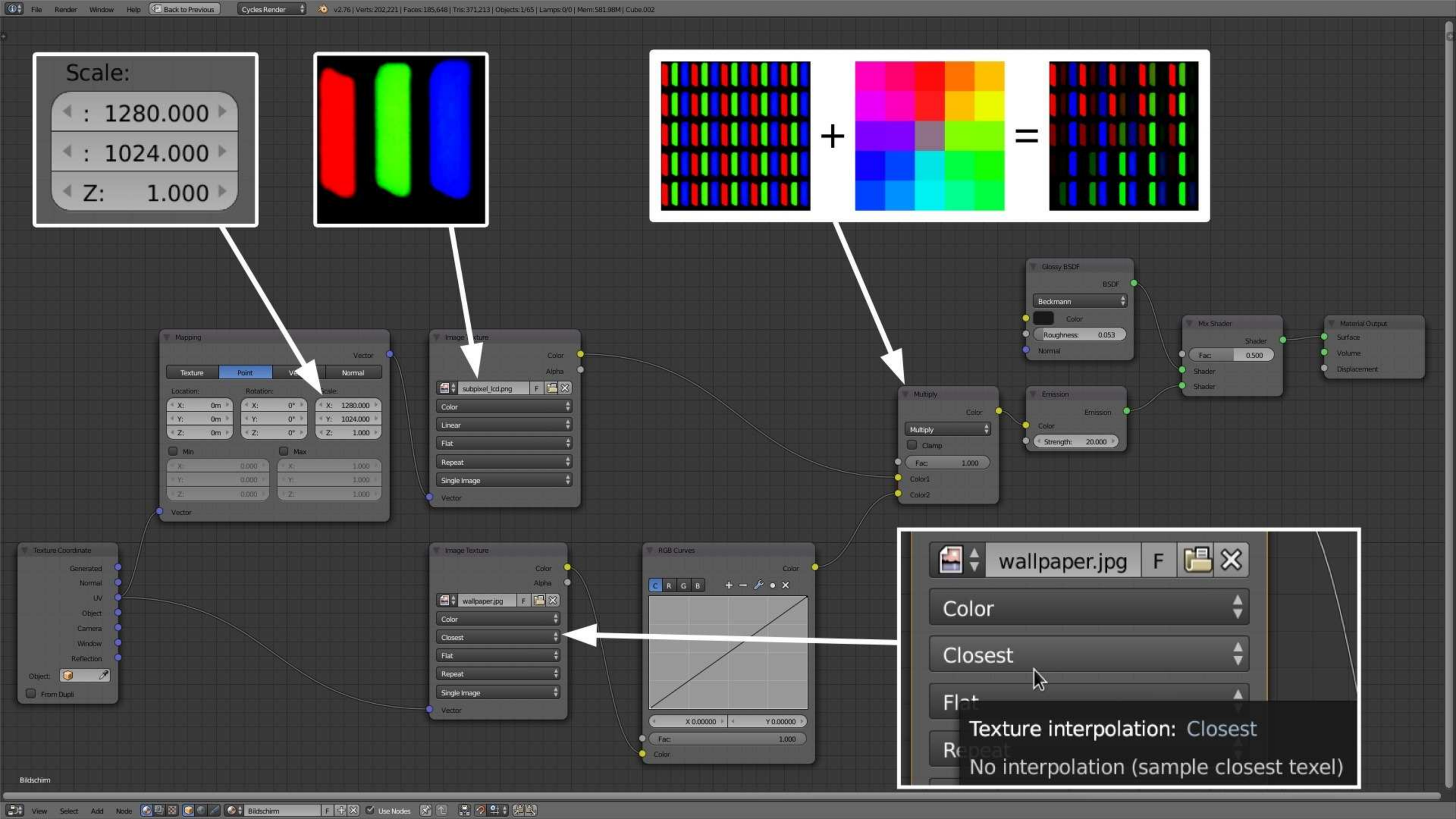
Closest
Flat
Repeat
Texture interpolation: Closest
No interpolation (sample closest texel)
Bildschirm
View Select Add Node Bildschirm F Use Nodes


File Render Window Help Back to Previous Cycles Render
v2.76 | Verts:202,221 | Faces:185,648 | Tris:371,213 | Objects:1/65 | Lamps:0/0 | Mem:581.98M | Cube.002
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Texture Point Normal
Location: Rotation: Scale:
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Y: 0m Y: 0° Y: 1024.000
Z: 0m Z: 0° Z: 1.000
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Vector
Image Texture
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Alpha
subpixel_lcd.png F
Color
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Flat
Repeat
Single Image
Vector
Glossy BSDF
BSDF
Beckmann
Color
Roughness: 0.053
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Mix Shader
Shader
Fac: 0.500
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Material Output
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Volume
Displacement
Multiply
Color
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Clamp
Fac: 1.000
Color1
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Emission
Emission
Color
Strength: 20.000
Texture Coordinate
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Color
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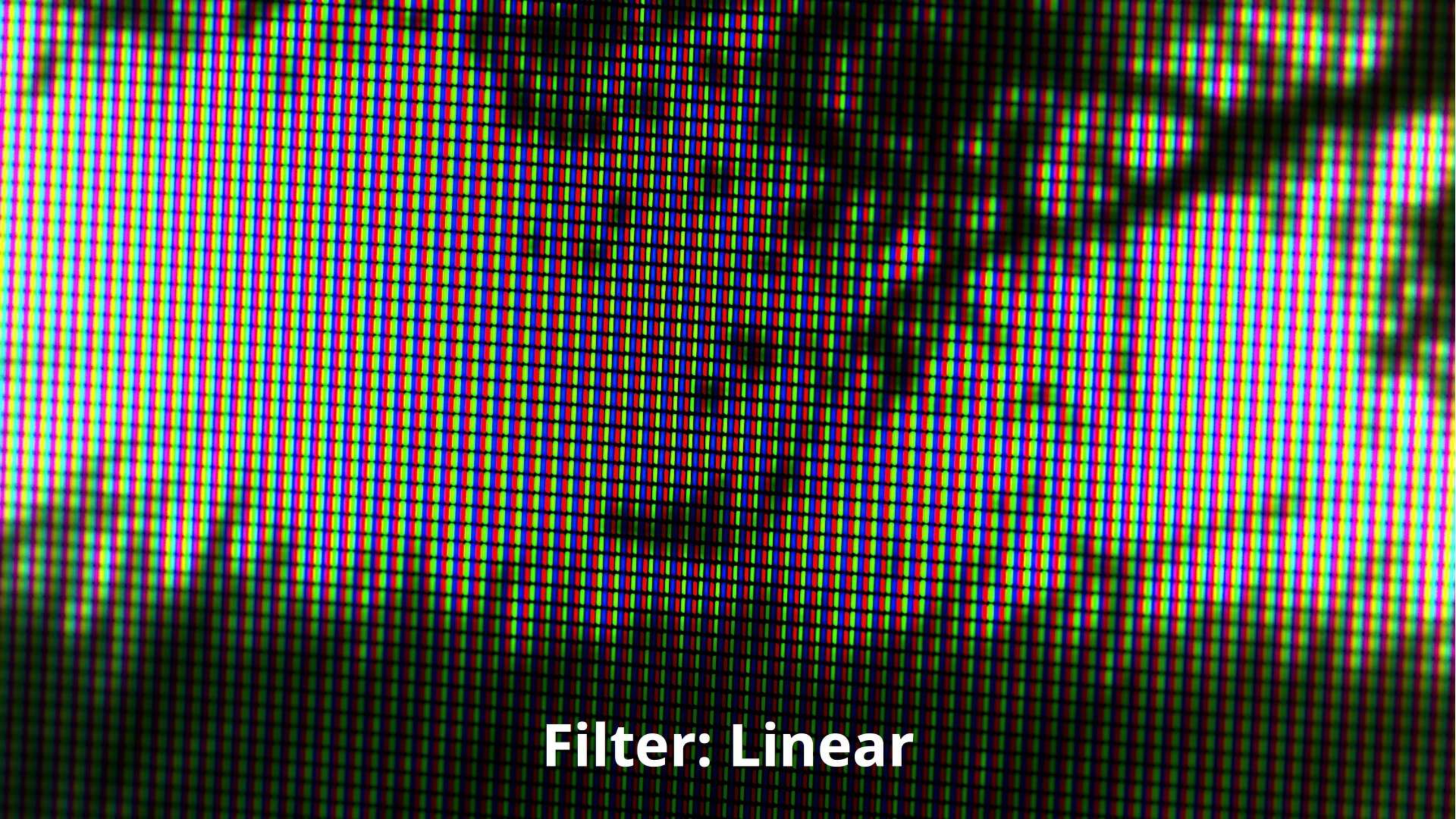
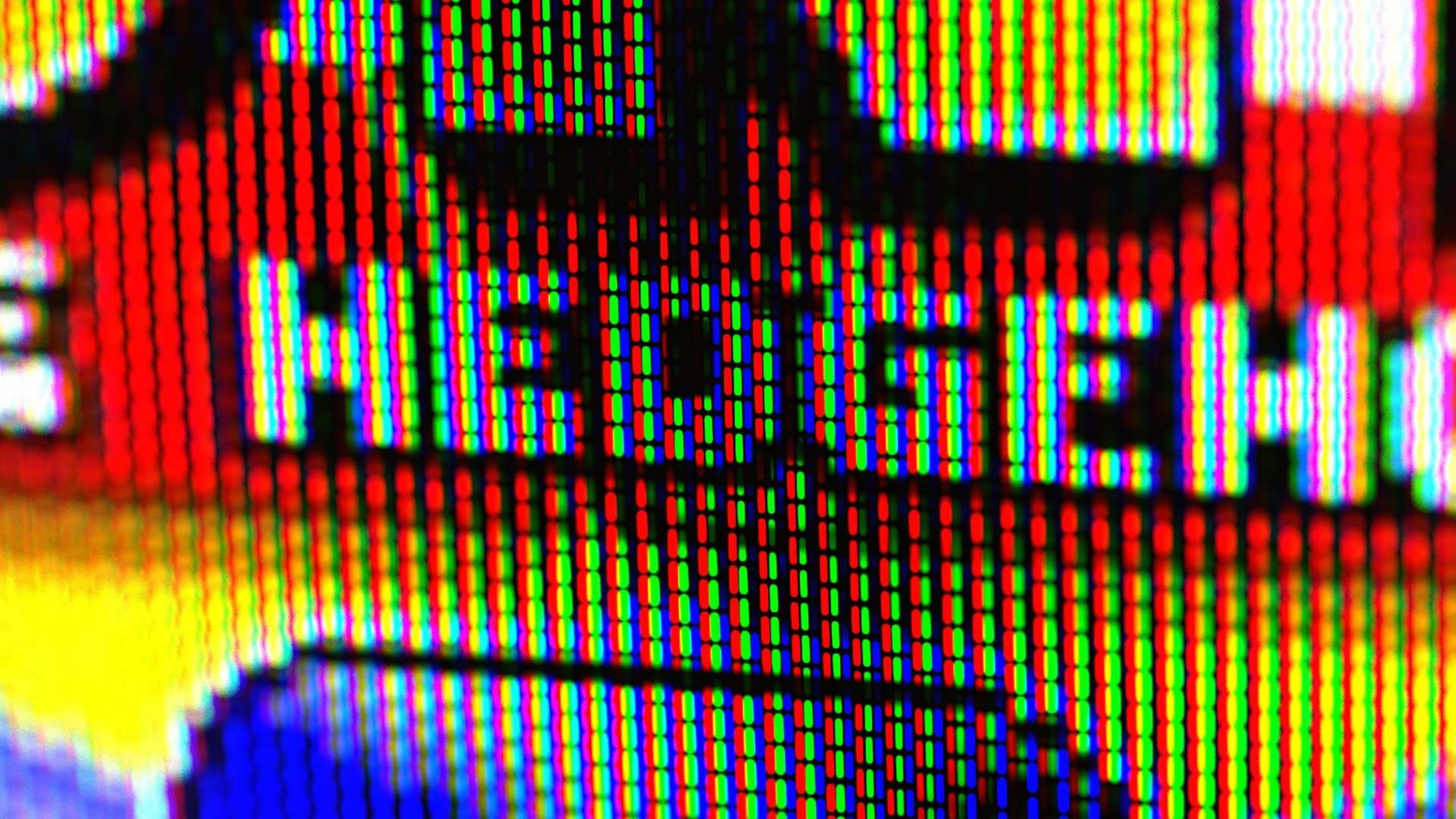
wallpaper.jpg F
Color
Closest
Flat
Repeat
Single Image
Vector
RGB Curves
Color
C R G B
X 0.00000 Y 0.00000
Fac: 1.000
Color
wallpaper.jpg F
Color
Closest
Flat
Repeat
Texture interpolation: Closest
No interpolation (sample closest texel)
Bildschirm
View Select Add Node Bildschirm F Use Nodes


ViewSonic
SAMSUNG
SONIC
THE HEDGEHOG
2
TM
2 PLAYER VS © 1992 SEGA
SABA

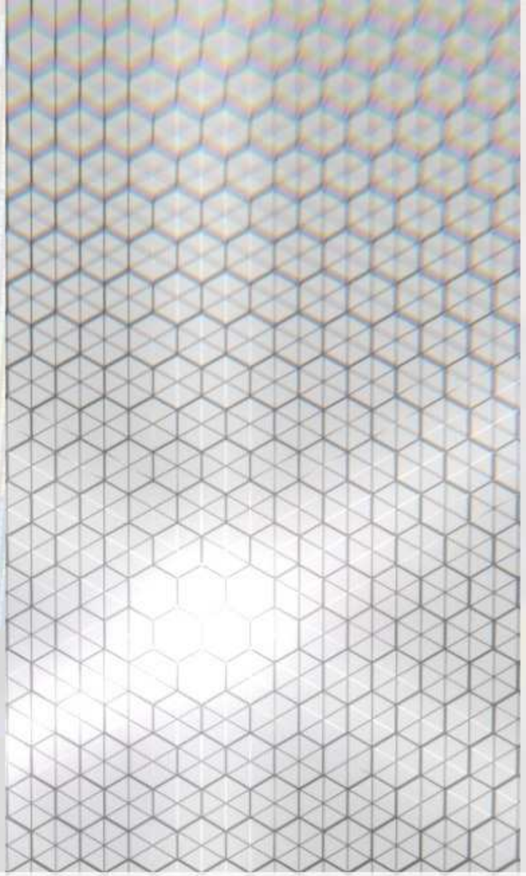

SAMSUNG
SONIC
THE HEDGEHOG
2
1 PLAYER
2 PLAYER VS
© 1992 SEGA
SABA


Filter: Linear


Filter: Closest



CRTs and other subpixel displays



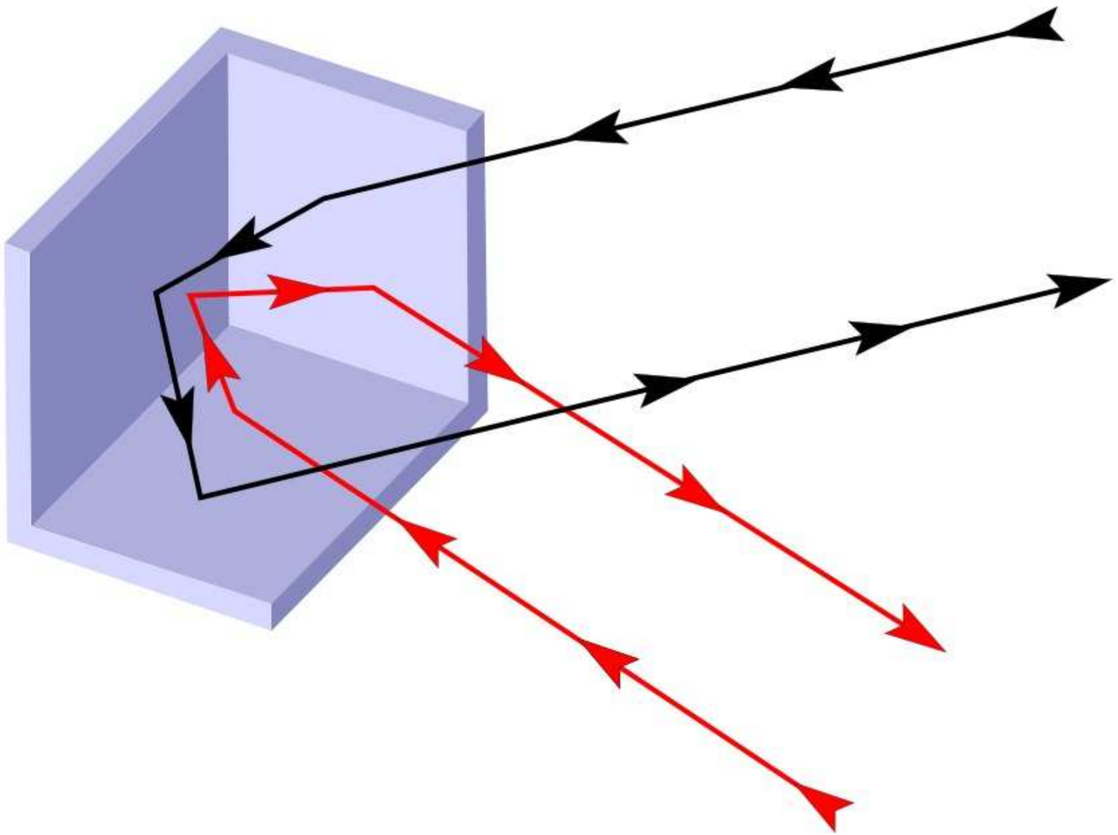
Retroreflective surfaces

Security holograms

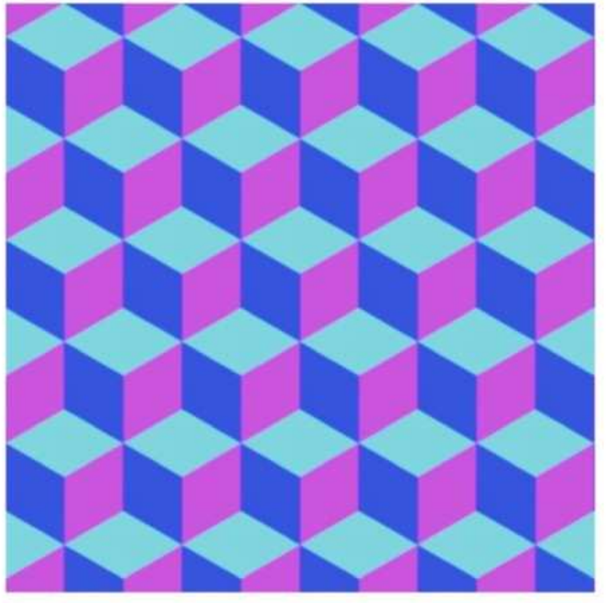
Wooden surfaces with reflective anomalies

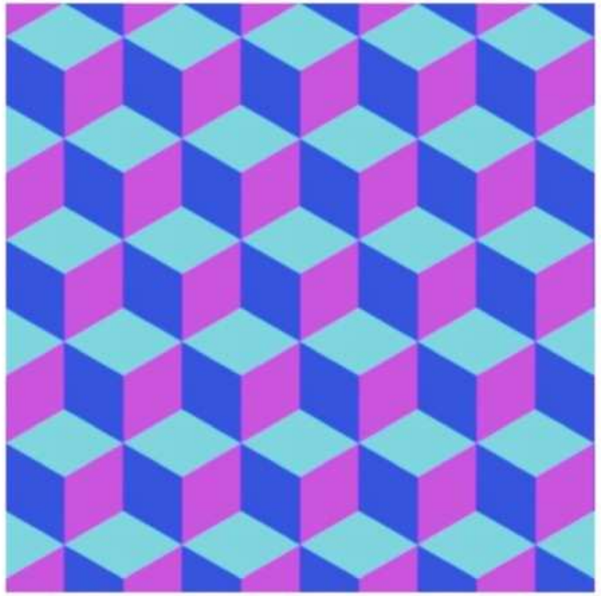
Lenticular prints

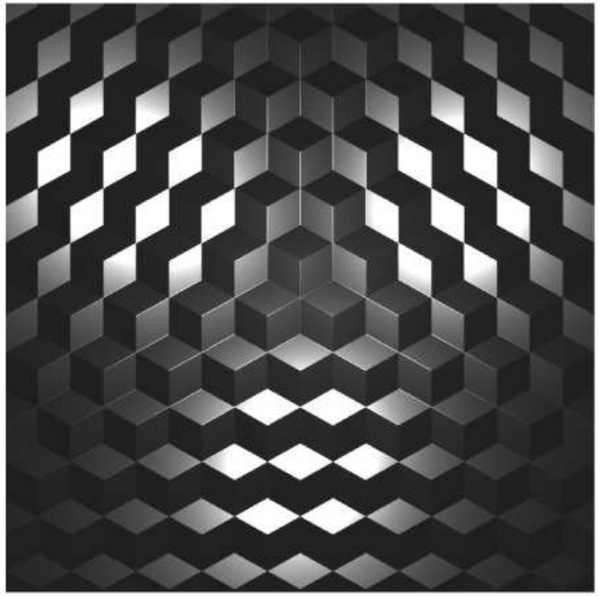
https://en.wikipedia.org/wiki/Retroreflector
#/media/File:BicycleRetroreflectors.JPG

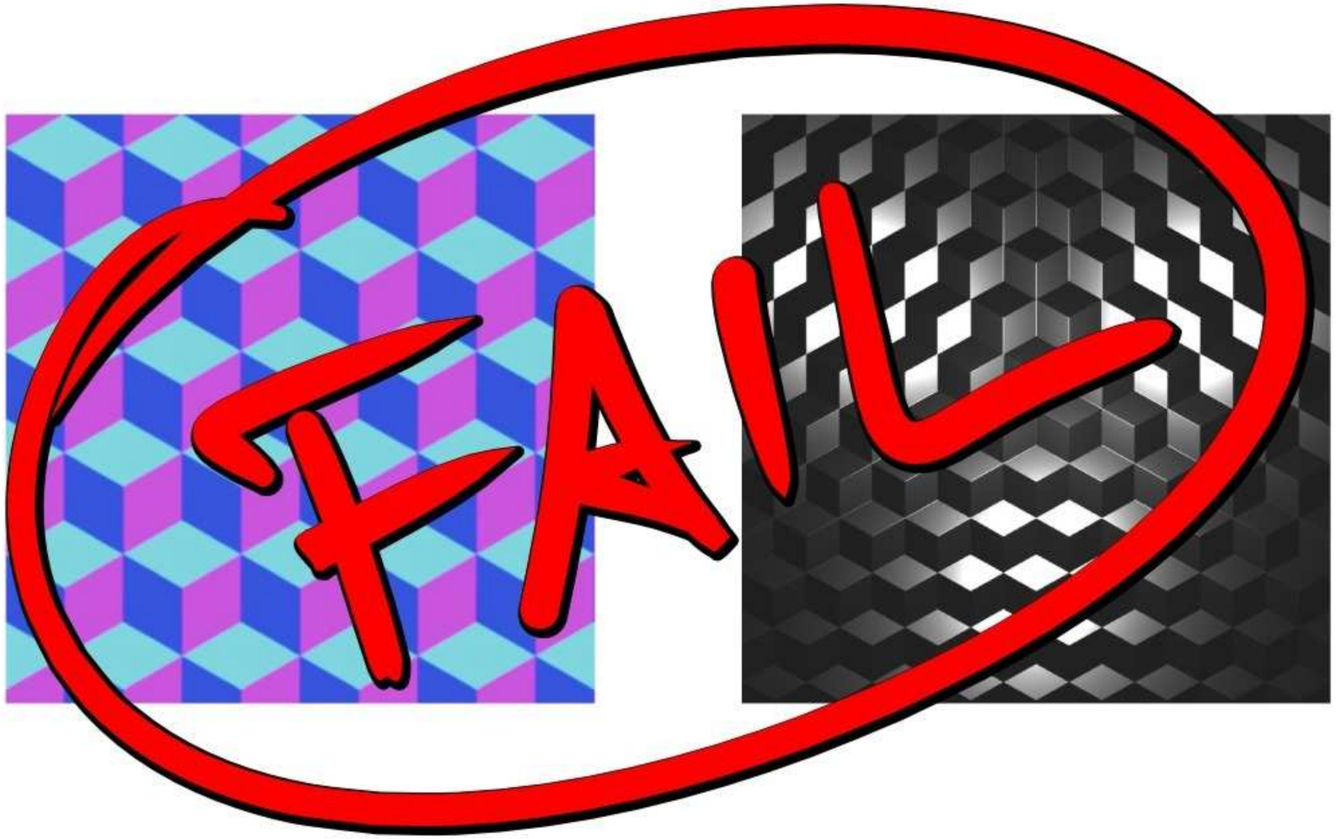


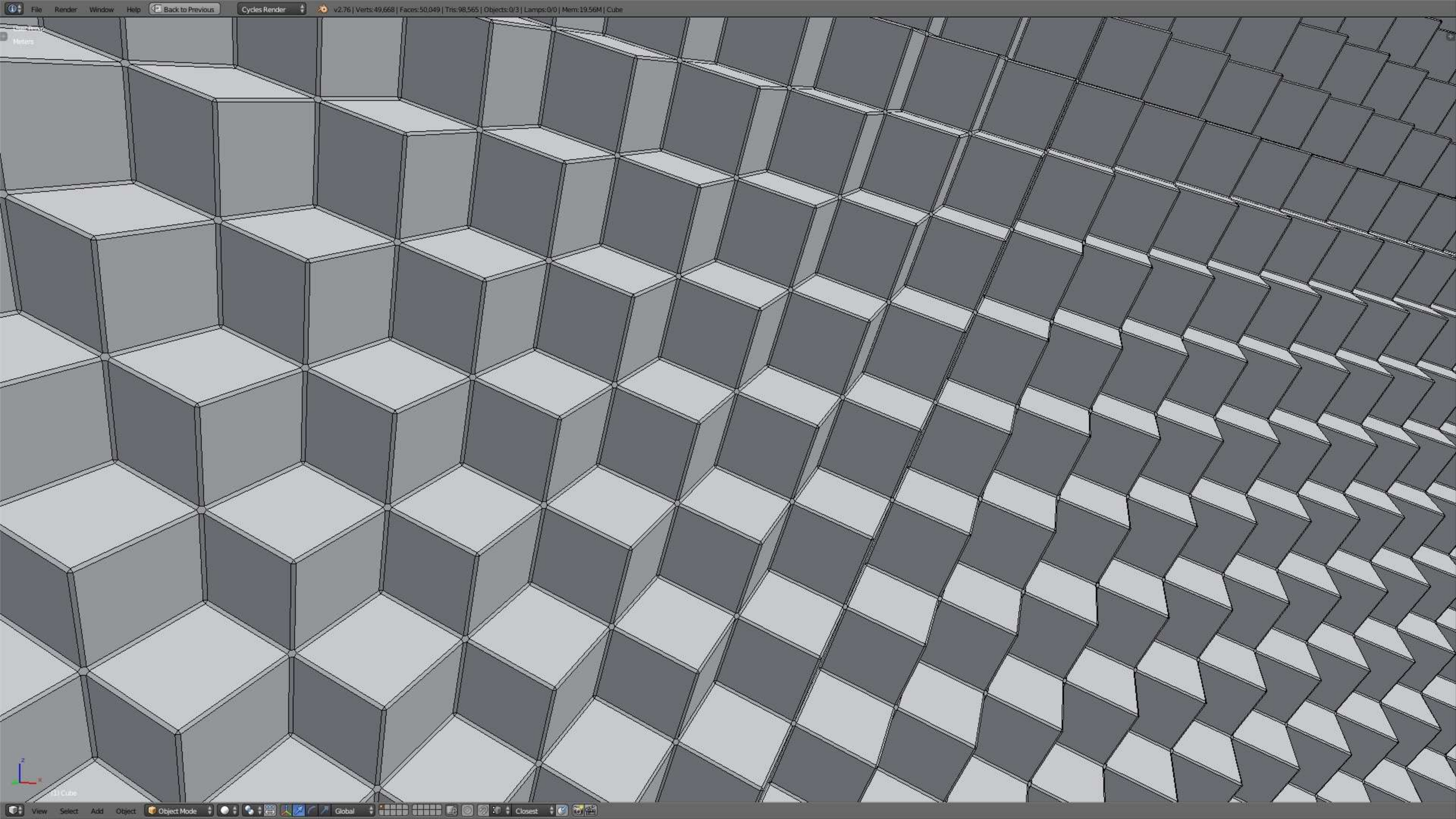
https://en.wikipedia.org/wiki/File:Corner_reflector.svg

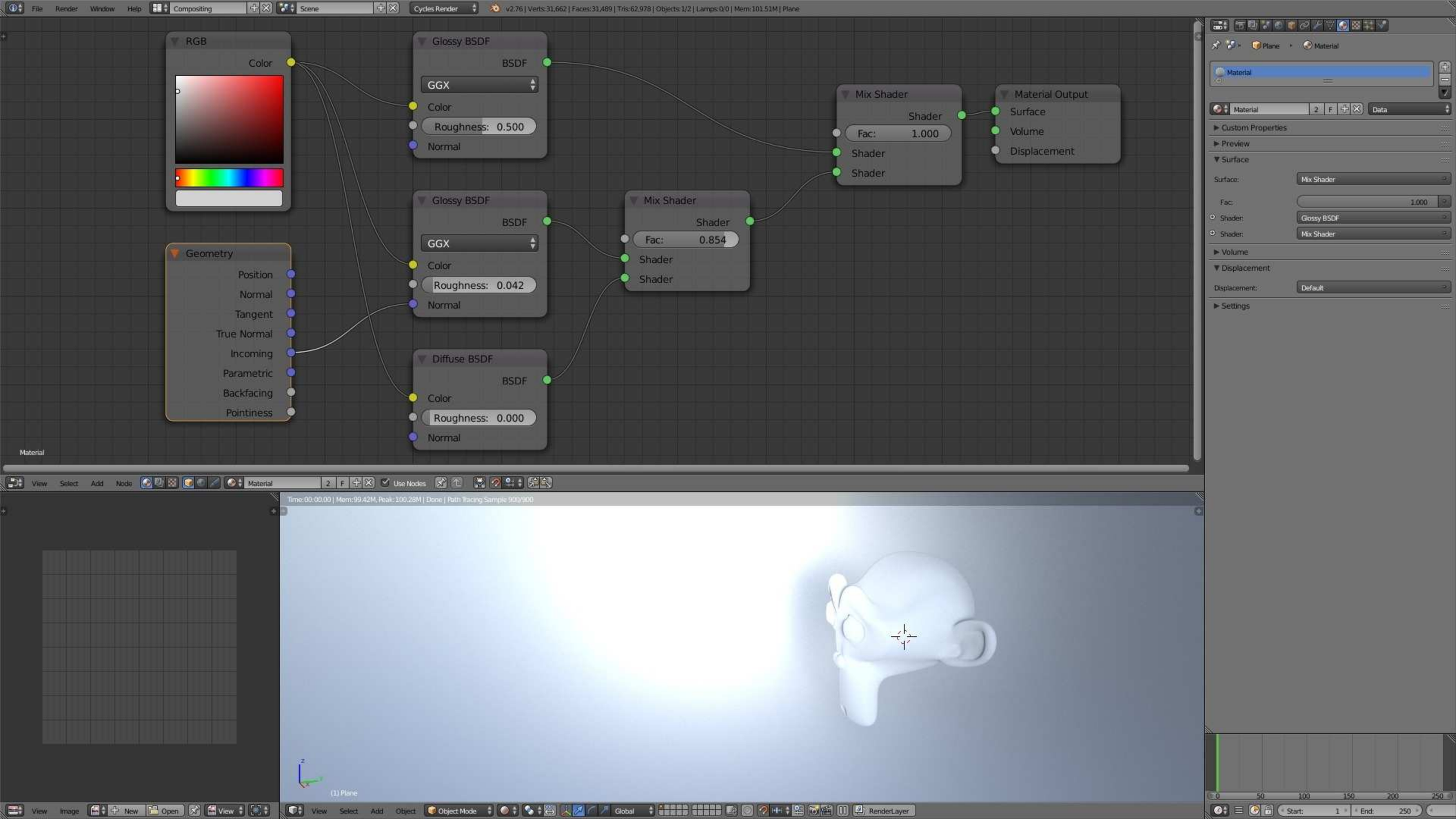






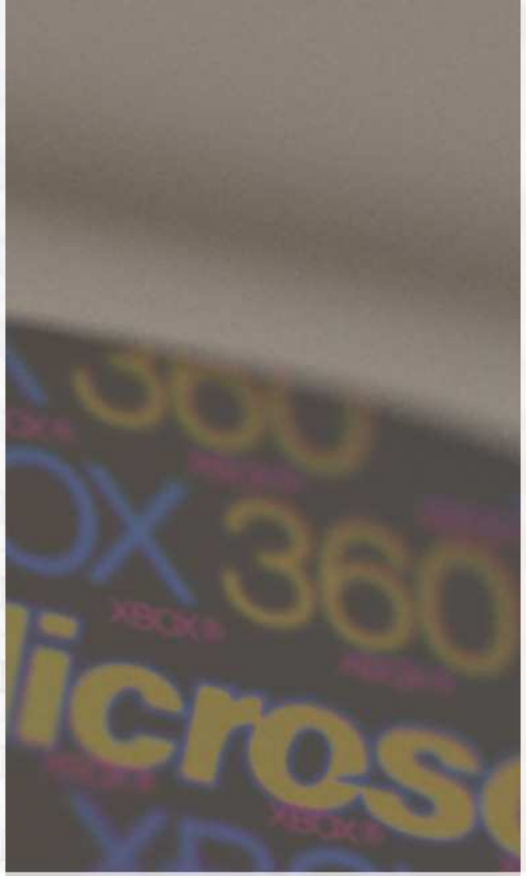

FAIL


File
Render
Window
Help
Back to Previous
Cycles Render
v2.76 | Verts:49,668 | Faces:50,049 | Tris:98,565 | Objects:0/3 | Lamps:0/0 | Mem:19.56M | Cube
View
Select
Add
Object
Object Mode
Global
Closest


File Render Window Help
Compositing
Scene
Cycles Render
v2.76 | Verts:31,662 | Faces:31,489 | Tris:62,978 | Objects:1/2 | Lamps:0/0 | Mem:101.51M | Plane
RGB
Color
Glossy BSDF
BSDF
GGX
Color
Roughness: 0.500
Normal
Mix Shader
Shader
Fac: 1.000
Shader
Shader
Material Output
Surface
Volume
Displacement
Glossy BSDF
BSDF
GGX
Color
Roughness: 0.042
Normal
Mix Shader
Shader
Fac: 0.854
Shader
Shader
Geometry
Position
Normal
Tangent
True Normal
Incoming
Parametric
Backfacing
Pointiness
Diffuse BSDF
BSDF
Color
Roughness: 0.000
Normal
Material
View Select Add Node
Material
Use Nodes
Time:00:00.00 | Mem:99.42M, Peak:100.28M | Done | Path Tracing Sample 900/900
(1) Plane
View Image New Open View
View Select Add Object
Object Mode
Global
RenderLayer
Plane
Material
Material
Material
Data
Custom Properties
Preview
Surface
Surface:
Mix Shader
Fac:
1.000
Shader:
Glossy BSDF
Shader:
Mix Shader
Volume
Displacement
Displacement:
Default
Settings
Start: 1
End: 250

CRTs and other subpixel displays

Retroreflective surfaces



Security holograms

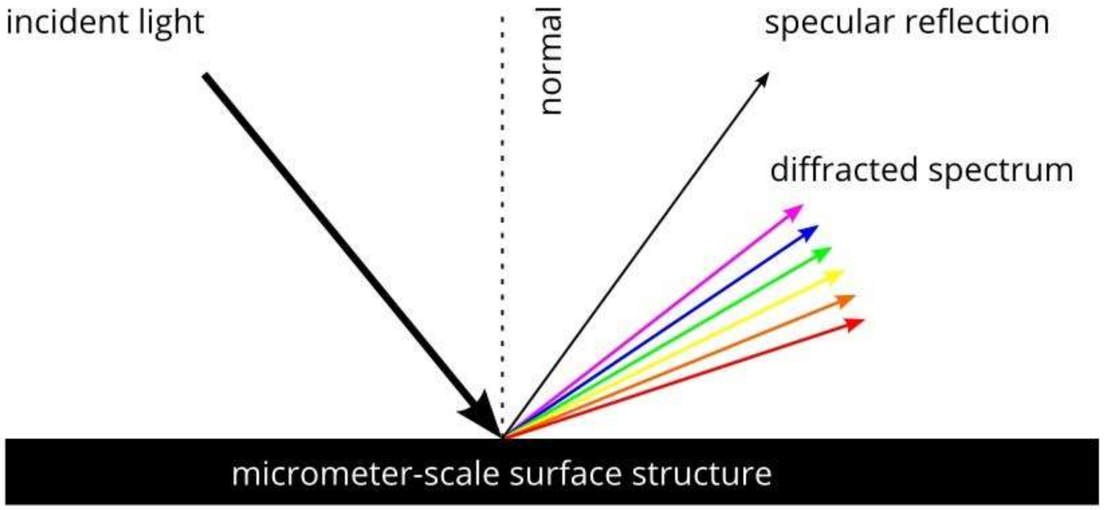
Wooden surfaces with reflective anomalies

Lenticular prints

https://en.wikipedia.org/wiki/Security_hologram#/media/File:Nokia_Battery_Hologram.jpg

http://www.holoteam.com/picture/en/product/hologram_security_stickers_05-1.jpg

Search keywords: iridescence, thin-film interference, structurual coloration, diffraction

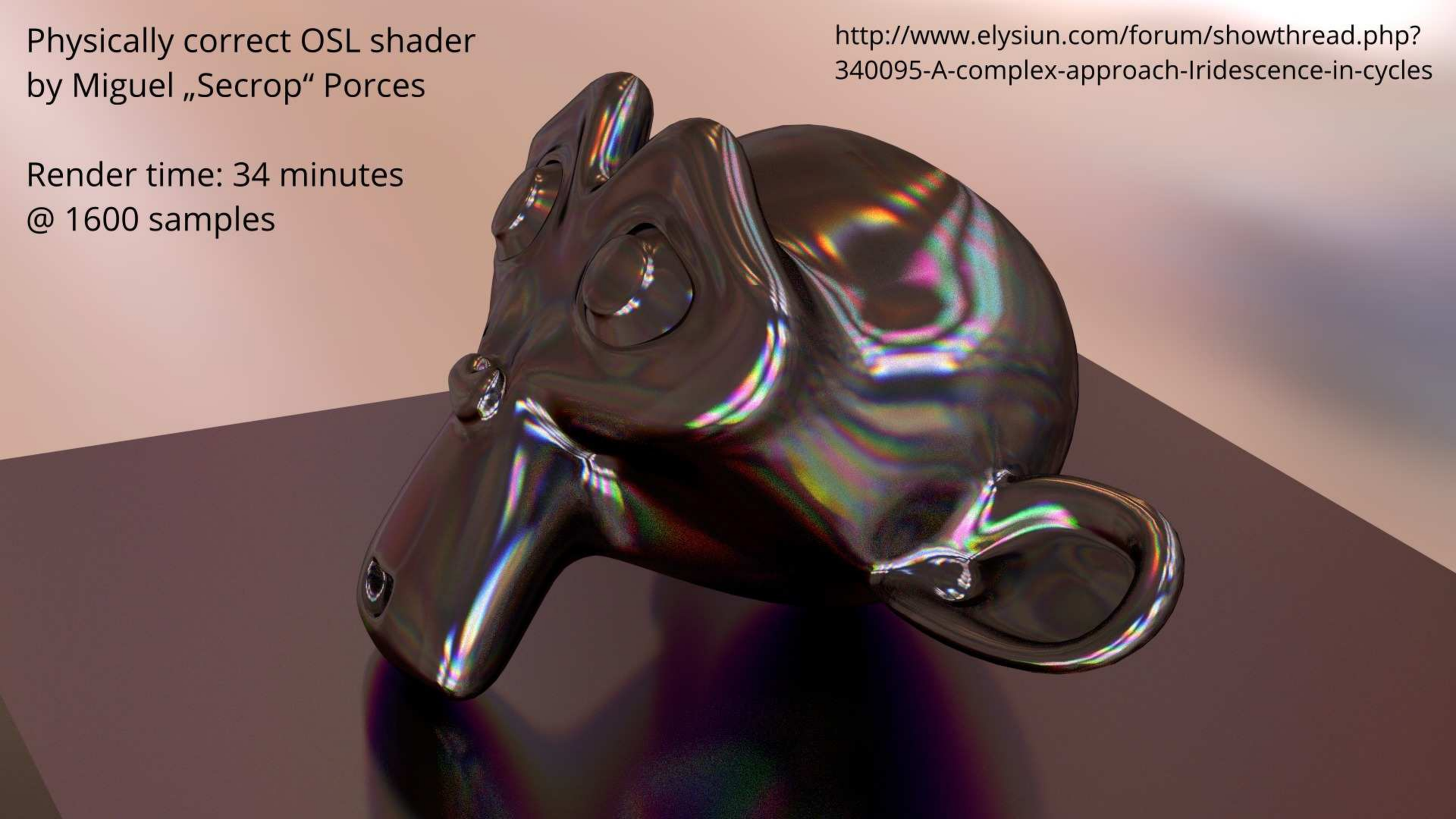


http://www.colours.phy.cam.ac.uk/iridescent-tulips/

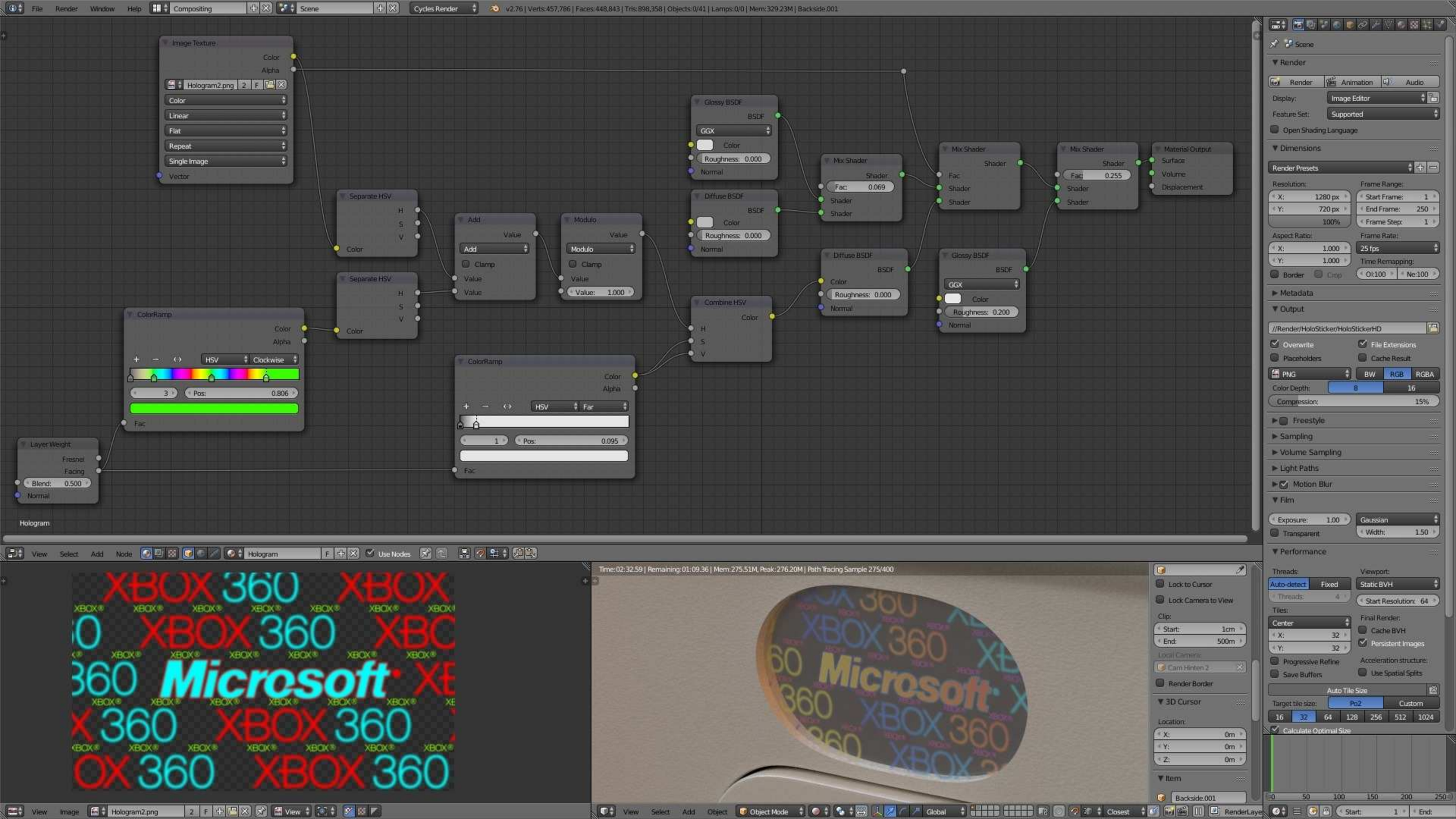
Physically correct OSL shader
by Miguel „Secrop“ Porces

Render time: 34 minutes
@ 1600 samples

http://www.elysiun.com/forum/showthread.php?
340095-A-complex-approach-Iridescence-in-cycles




LT
Microsoft


File Render Window Help
Compositing
Scene
Cycles Render
v2.76 | Verts:457,786 | Faces:448,843 | Tris:898,358 | Objects:0/41 | Lamps:0/0 | Mem:329.23M | Backside.001
Image Texture
Color
Alpha
Hologram2.png
Color
Linear
Flat
Repeat
Single Image
Vector
Separate HSV
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S
V
Color
Add
Value
Clamp
Modulo
Value: 1.000
ColorRamp
HSV
Clockwise
Pos: 0.806
Fac
Layer Weight
Fresnel
Facing
Blend: 0.500
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Glossy BSDF
BSDF
GGX
Roughness: 0.000
Diffuse BSDF
Combine HSV
Mix Shader
Fac: 0.069
Fac: 0.255
Shader
Material Output
Surface
Volume
Displacement
Roughness: 0.200
Far
Pos: 0.095
Hologram
View Select Add Node
Use Nodes
Time:02:32.59 | Remaining:01:09.36 | Mem:275.51M, Peak:276.20M | Path Tracing Sample 275/400
Microsoft
XBOX 360
View Image
Hologram2.png
View Select Add Object
Object Mode
Global
Closest
RenderLayer
Lock to Cursor
Lock Camera to View
Clip:
Start: 1cm
End: 500m
Local Camera:
Cam Hinten 2
Render Border
3D Cursor
Location:
X: 0m
Y: 0m
Z: 0m
Item
Backside.001
Scene
Render
Render Animation Audio
Display: Image Editor
Feature Set: Supported
Open Shading Language
Dimensions
Render Presets
Resolution:
X: 1280 px
Y: 720 px
100%
Frame Range:
Start Frame: 1
End Frame: 250
Frame Step: 1
Aspect Ratio:
X: 1.000
Y: 1.000
Frame Rate:
25 fps
Time Remapping:
Ol:100
Ne:100
Border Crop
Metadata
Output
//Render/HoloSticker/HoloStickerHD
Overwrite
File Extensions
Placeholders
Cache Result
PNG
BW RGB RGBA
Color Depth: 8 16
Compression: 15%
Freestyle
Sampling
Volume Sampling
Light Paths
Motion Blur
Film
Exposure: 1.00
Gaussian
Transparent
Width: 1.50
Performance
Threads:
Auto-detect Fixed
Threads: 4
Viewport:
Static BVH
Start Resolution: 64
Tiles:
Center
X: 32
Y: 32
Final Render:
Cache BVH
Persistent Images
Progressive Refine
Save Buffers
Acceleration structure:
Use Spatial Splits
Auto Tile Size
Target tile size:
Po2 Custom
16 32 64 128 256 512 1024
Calculate Optimal Size
0 50 100 150 200 250
Start: 1
End:


Microsoft
BACK
START
LT
RT
LB
RB
Microsoft
XBOX 360

CRTs and other subpixel displays

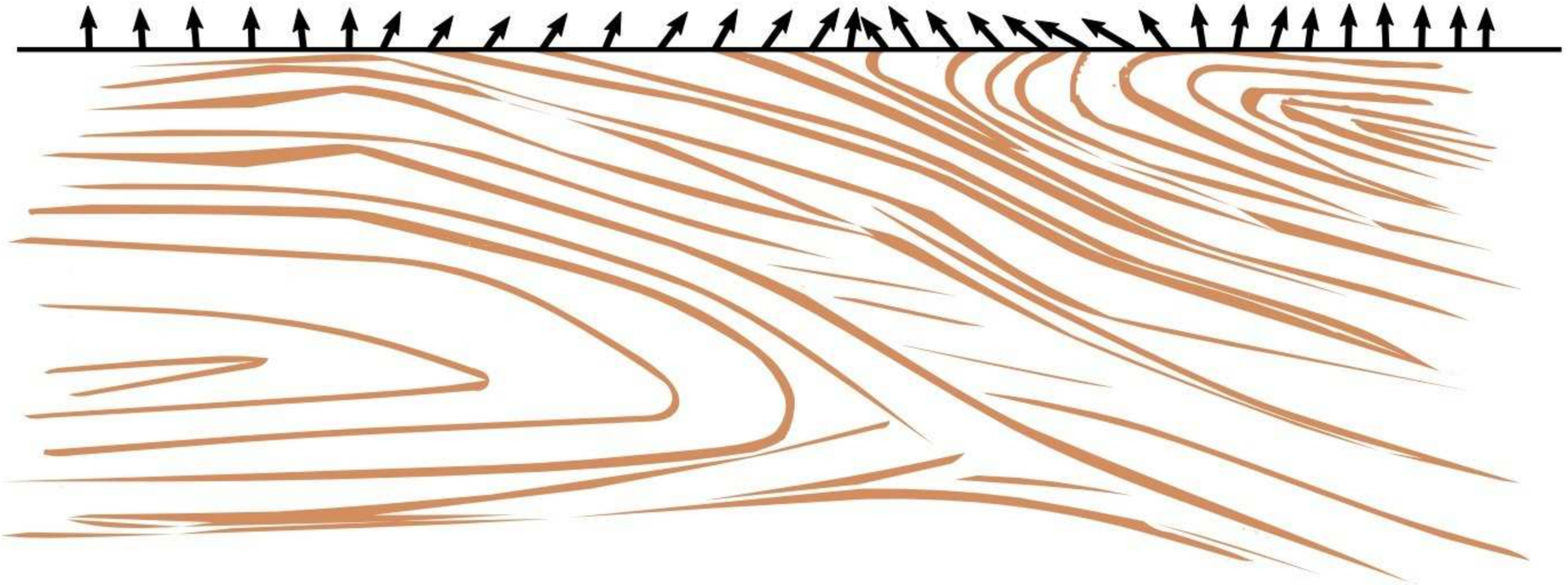
Retroreflective surfaces

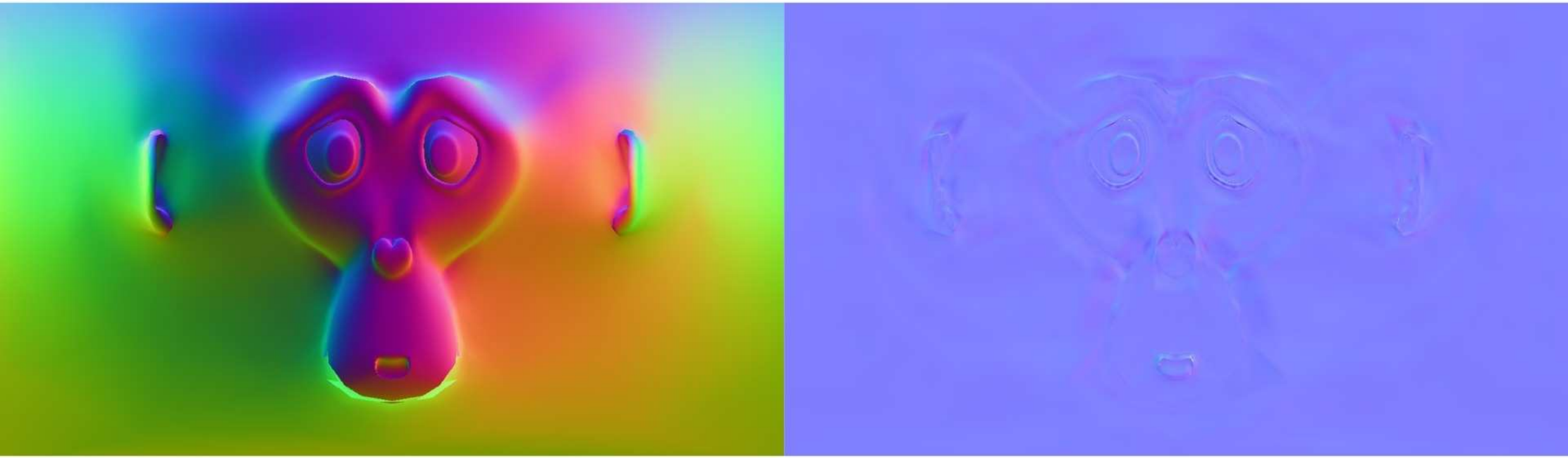
Security holograms

Wooden surfaces with reflective anomalies

Lenticular prints

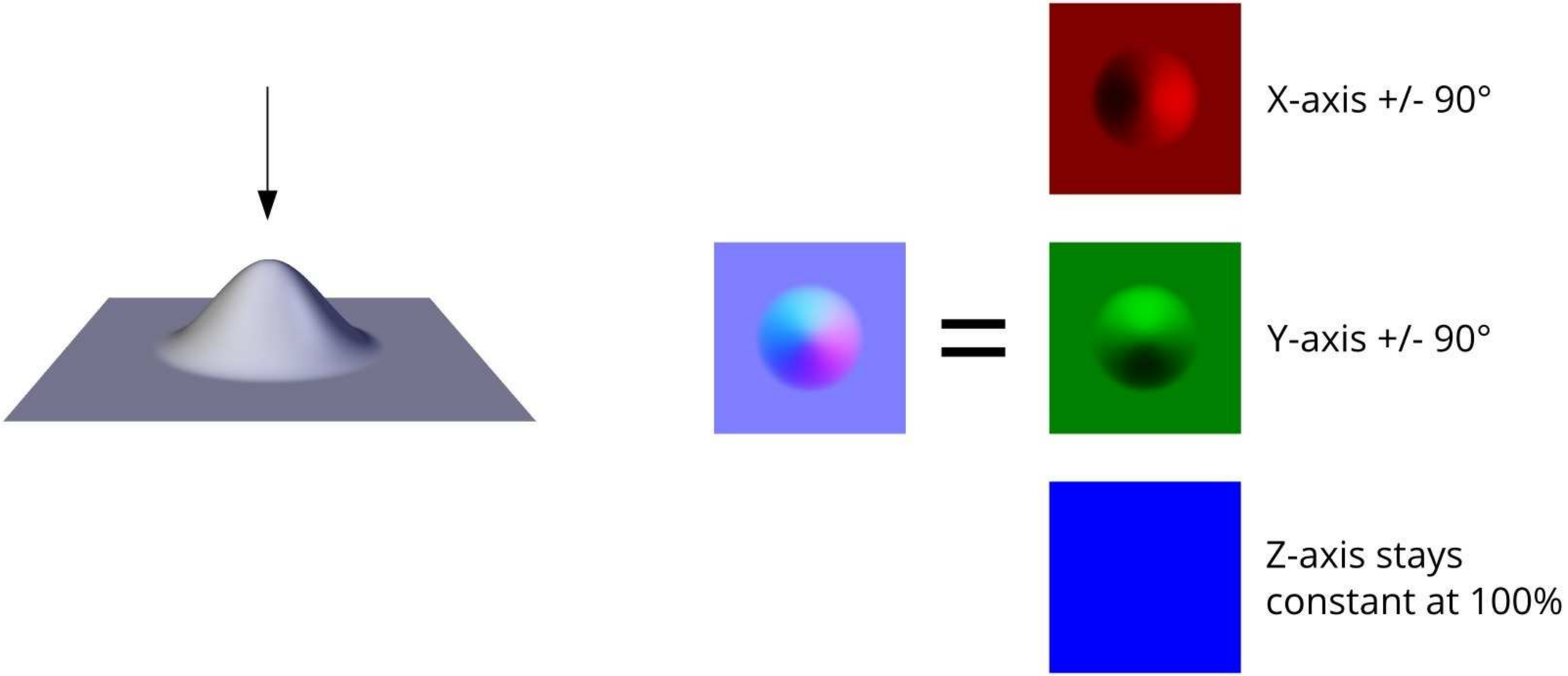
IKEA BJÖRKUDDEN kitchen table
http://www.ikea.com/au/en/catalog/products/20161756/

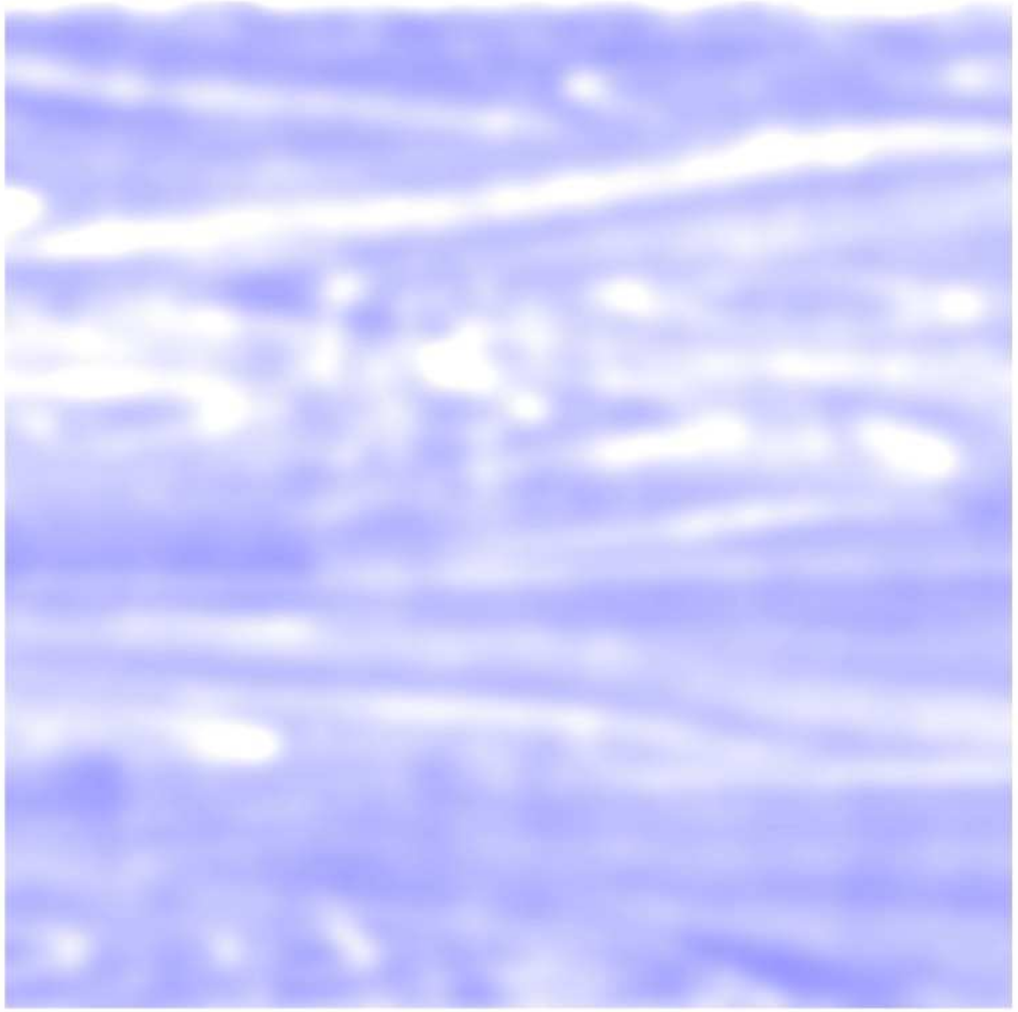




object-space

tangent-space


X-axis +/- 90°
Y-axis +/- 90°
Z-axis stays
constant at 100%



CRTs and other subpixel displays

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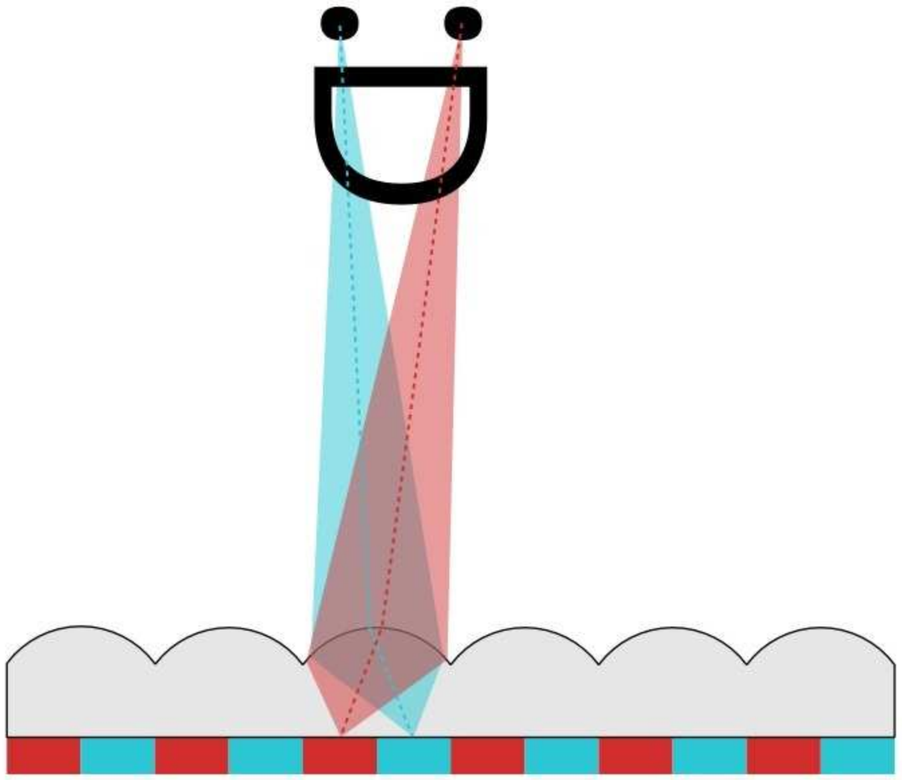
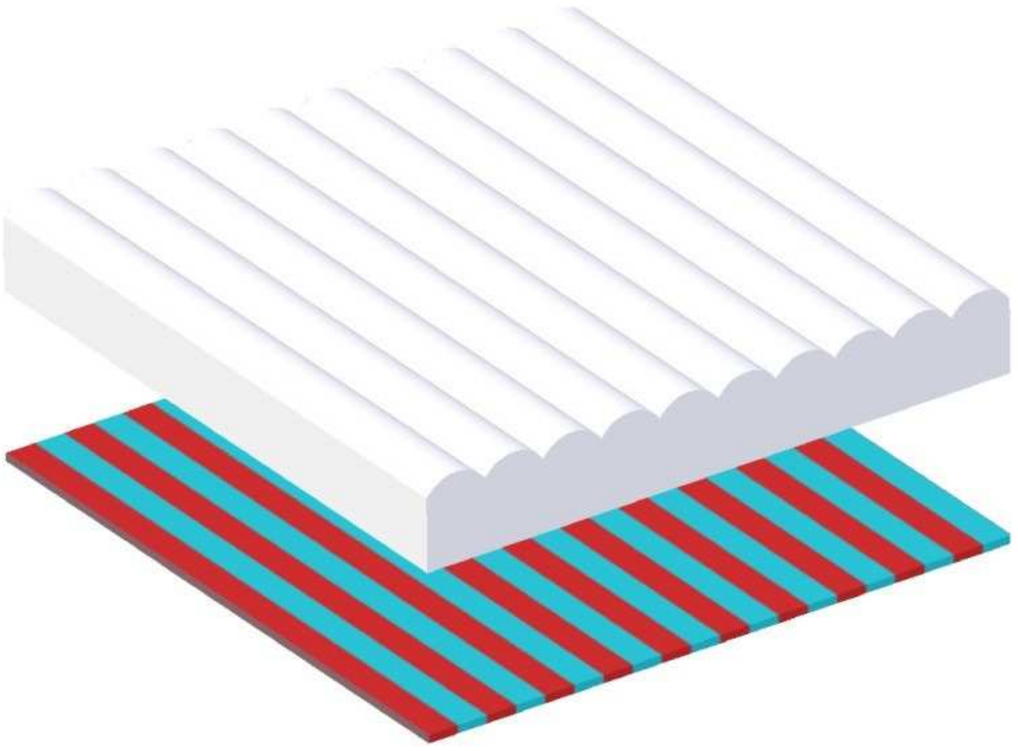
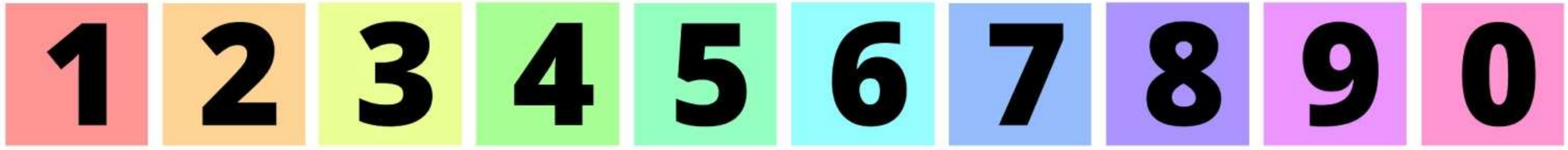
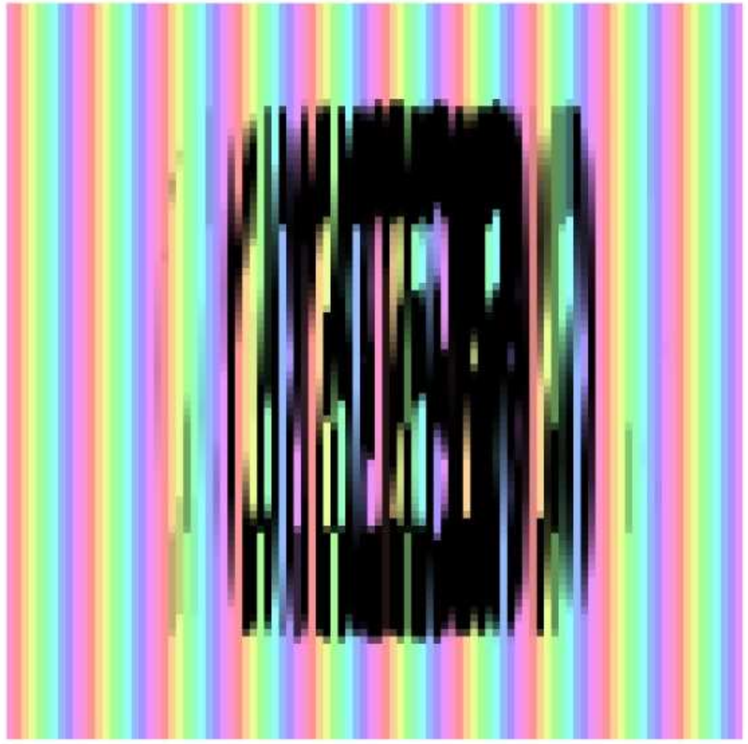
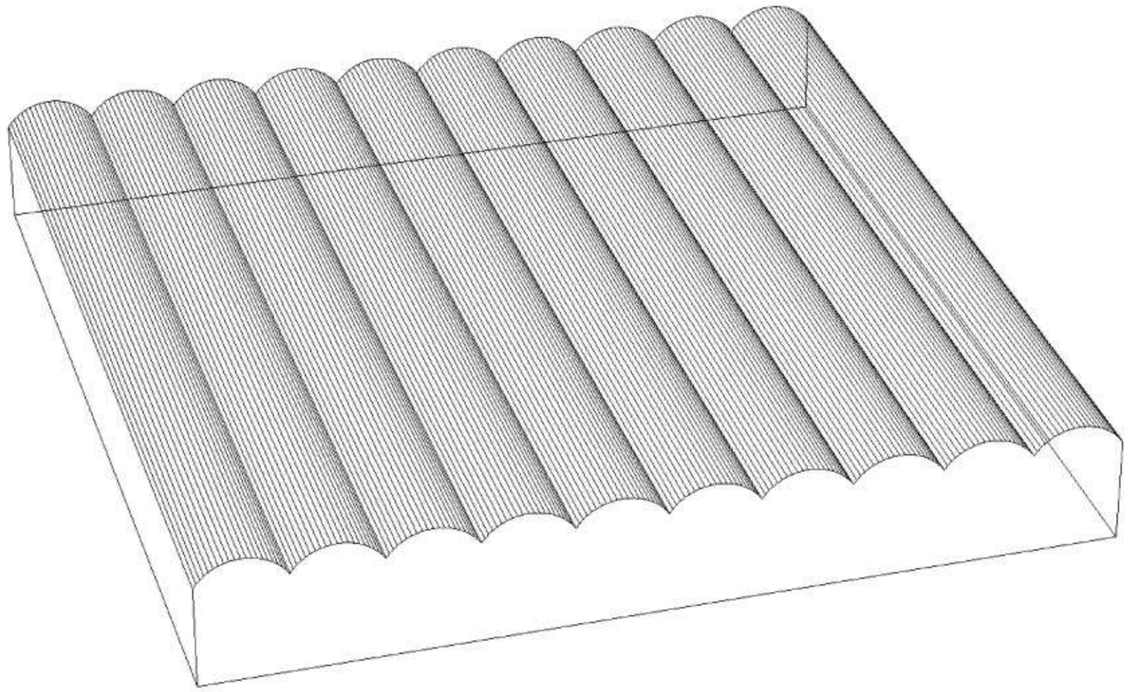




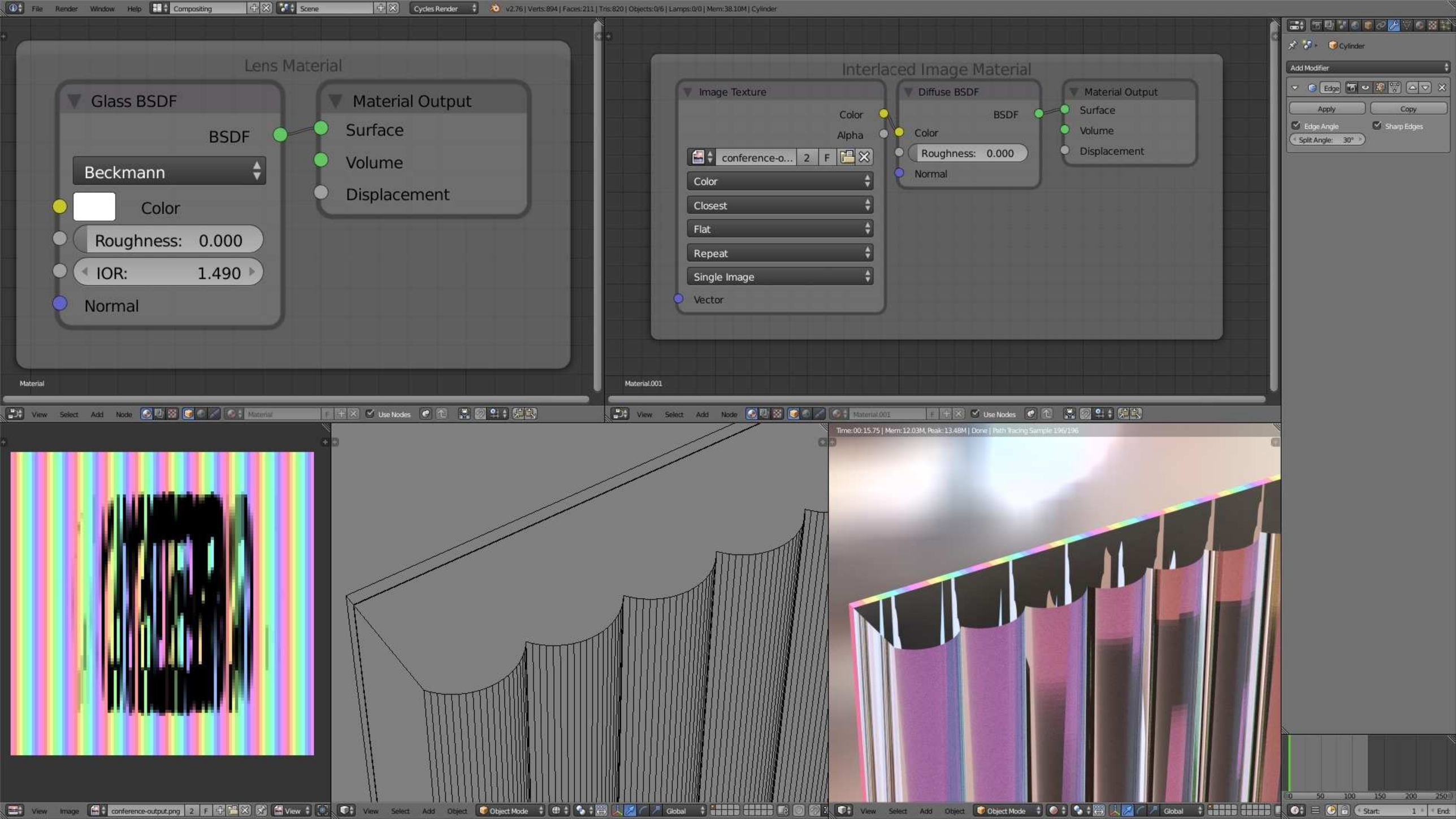


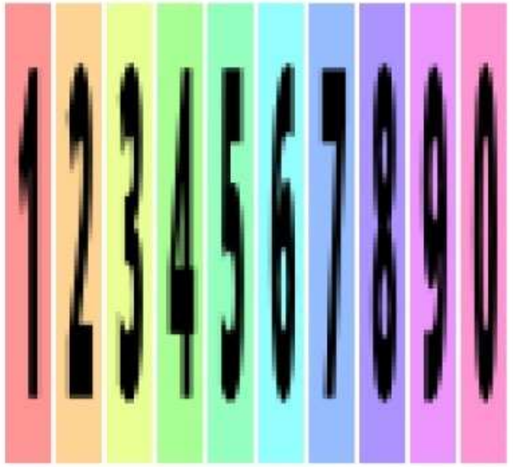
Resized (squashed) to 10x100 individually, interlaced to make 100x100 image

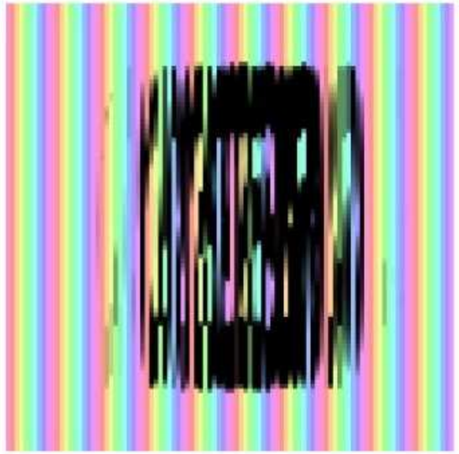




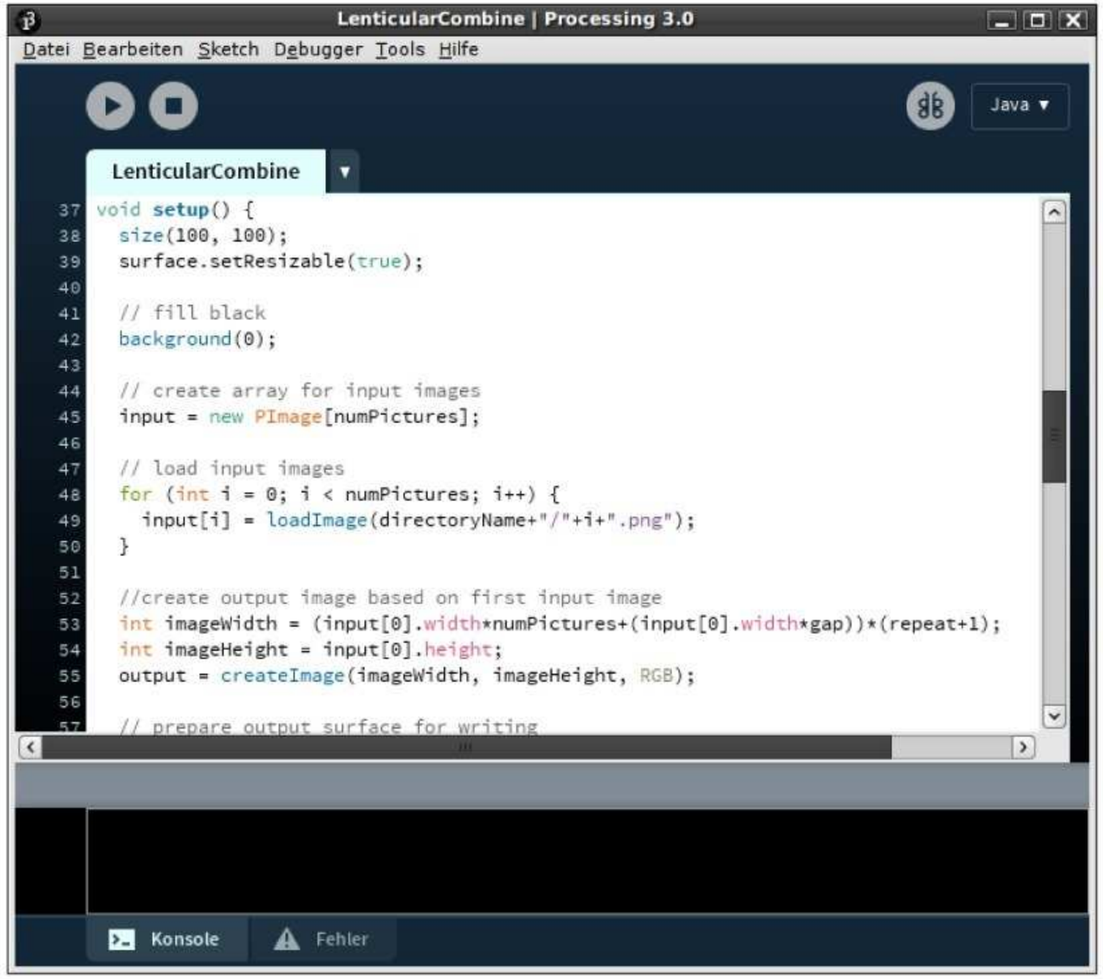
100x100 image, 10 lenses x 10 pixels per lens


File Render Window Help
Compositing
Scene
Cycles Render
v2.76 | Verts:894 | Faces:211 | Tris:820 | Objects:0/6 | Lamps:0/0 | Mem:38.10M | Cylinder
Lens Material
Glass BSDF
BSDF
Beckmann
Color
Roughness: 0.000
IOR: 1.490
Normal
Material Output
Surface
Volume
Displacement
Material
Interlaced Image Material
Image Texture
Color
Alpha
conference-o...
2
F
Color
Closest
Flat
Repeat
Single Image
Vector
Diffuse BSDF
BSDF
Color
Roughness: 0.000
Normal
Material Output
Surface
Volume
Displacement
Material.001
View Select Add Node
Use Nodes
Cylinder
Add Modifier
Edge
Apply
Copy
Edge Angle
Sharp Edges
Split Angle: 30°
Time:00:15.75 | Mem:12.03M, Peak:13.48M | Done | Path Tracing Sample 196/196
View Image
conference-output.png
View Select Add Object
Object Mode
Global
View Select Add Object
Object Mode
Global
0 50 100 150 200 250
Start: 1
End:

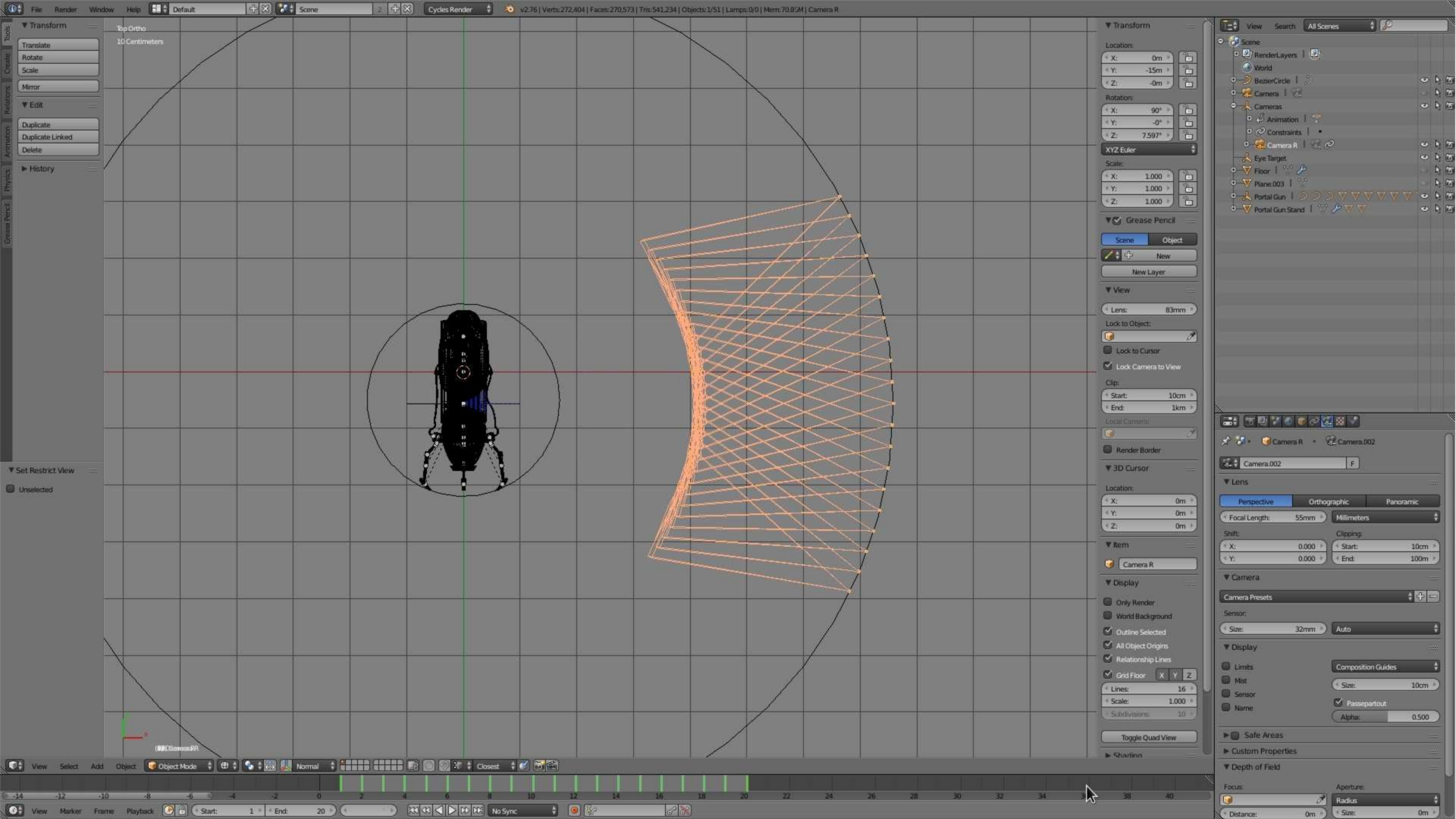


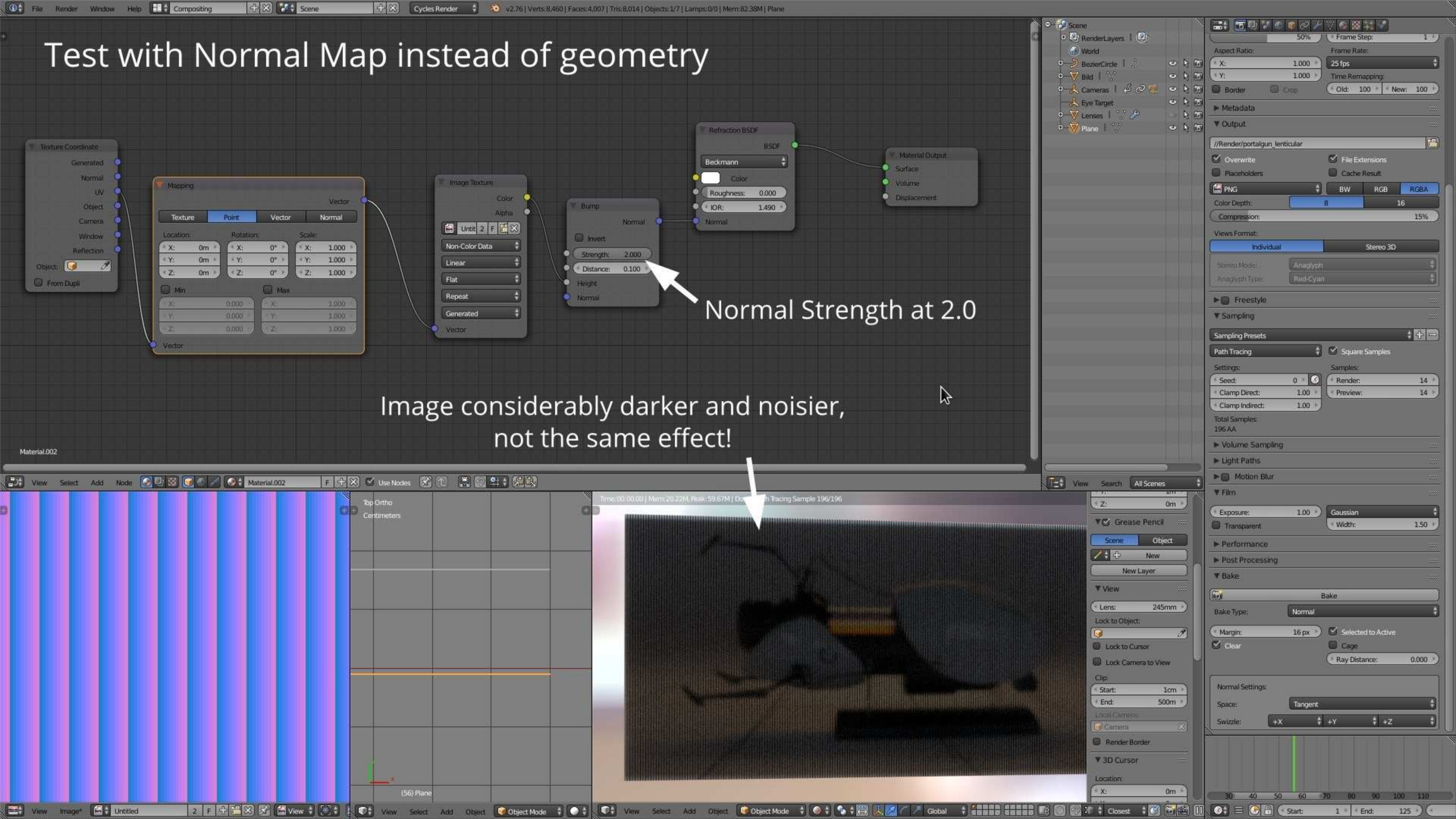


http://processing.org



Script download
http://rahdick.at/en/02_projects/
2015-09-01_blender_conference_unusual_materials


File Render Window Help
Default
Scene
Cycles Render
v2.76 | Verts:272,404 | Faces:270,573 | Tris:541,234 | Objects:1/51 | Lamps:0/0 | Mem: 70.85M | Camera R
Transform
Translate
Rotate
Scale
Mirror
Edit
Duplicate
Duplicate Linked
Delete
History
Set Restrict View
Unselected
Top Ortho
10 Centimeters
Camera R
View Select Add Object
Object Mode
Normal
Closest
View Marker Frame Playback
Start: 1
End: 20
No Sync
Transform
Location:
X: 0m
Y: -15m
Z: -0m
Rotation:
X: 90°
Y: -0°
Z: 7.597°
XYZ Euler
Scale:
X: 1.000
Y: 1.000
Z: 1.000
Grease Pencil
Scene
Object
New
New Layer
View
Lens: 83mm
Lock to Object:
Lock to Cursor
Lock Camera to View
Clip:
Start: 10cm
End: 1km
Local Camera:
Render Border
3D Cursor
Location:
X: 0m
Y: 0m
Z: 0m
Item
Camera R
Display
Only Render
World Background
Outline Selected
All Object Origins
Relationship Lines
Grid Floor
X Y Z
Lines: 16
Scale: 1.000
Subdivisions: 10
Toggle Quad View
View Search All Scenes
Scene
RenderLayers
World
BezierCircle
Camera
Cameras
Animation
Constraints
Camera R
Eye Target
Floor
Plane.003
Portal Gun
Portal Gun Stand
Camera R
Camera.002
Camera.002
Lens
Perspective
Orthographic
Panoramic
Focal Length: 55mm
Millimeters
Shift:
X: 0.000
Y: 0.000
Clipping:
Start: 10cm
End: 100m
Camera
Camera Presets
Sensor:
Size: 32mm
Auto
Display
Limits
Mist
Sensor
Name
Composition Guides
Size: 10cm
Passepartout
Alpha: 0.500
Safe Areas
Custom Properties
Depth of Field
Focus:
Aperture:
Radius
Distance: 0m
Size: 0m


Test with Normal Map instead of geometry
Texture Coordinate
Mapping
Image Texture
Bump
Refraction BSDF
Material Output
Normal Strength at 2.0
Image considerably darker and noisier,
not the same effect!

Conclusion

Subpixel displays

Shader only ★★★★½

Problems with shifted pixel arrangements

Retroreflectors

Geometry ★★★★☆

Doesn't scale well

Shader only ★★★★★

Fine for almost all purposes

Security Holograms

Colorful Fake ★★★☆☆

Not accurate but looks ok

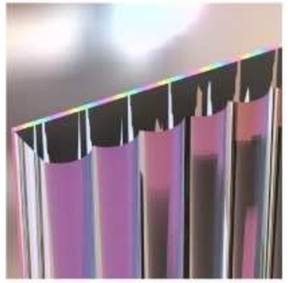
Secrop's OSL Shader ★★★☆☆

Accurate but slow

Wood Glossiness

Shader only ★★★★☆

Needs measured normals for 100% accuracy



Lenticular Prints

Geometry ★★★★★

Fast & accurate.

Normal Map ★★☆☆☆

Slow, noisy & inaccurate

Thank you!

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