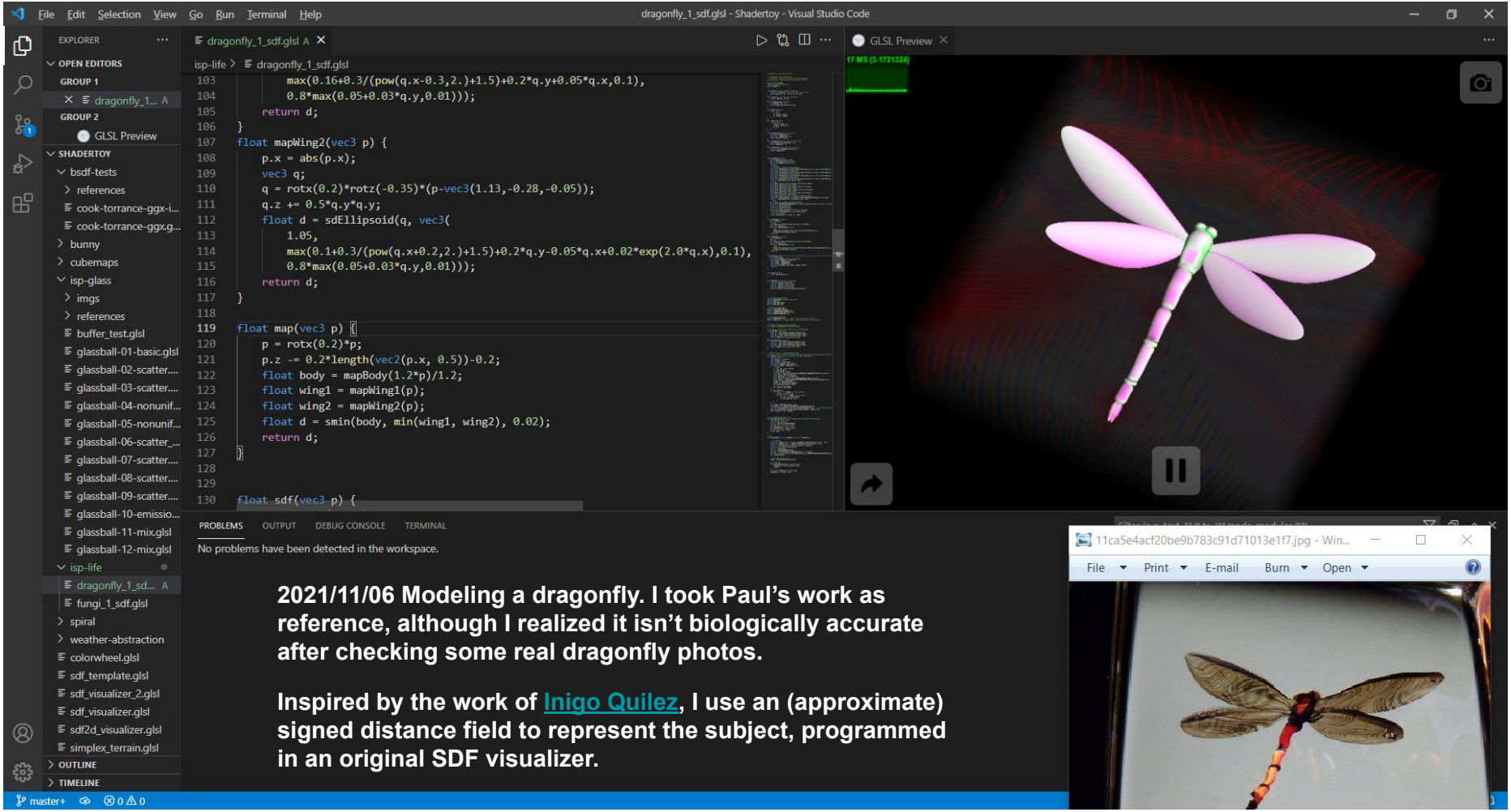
ISP Step 2

Mentor Artist Study

Characteristics I observed from photographs of Paul J. Stankard's work:

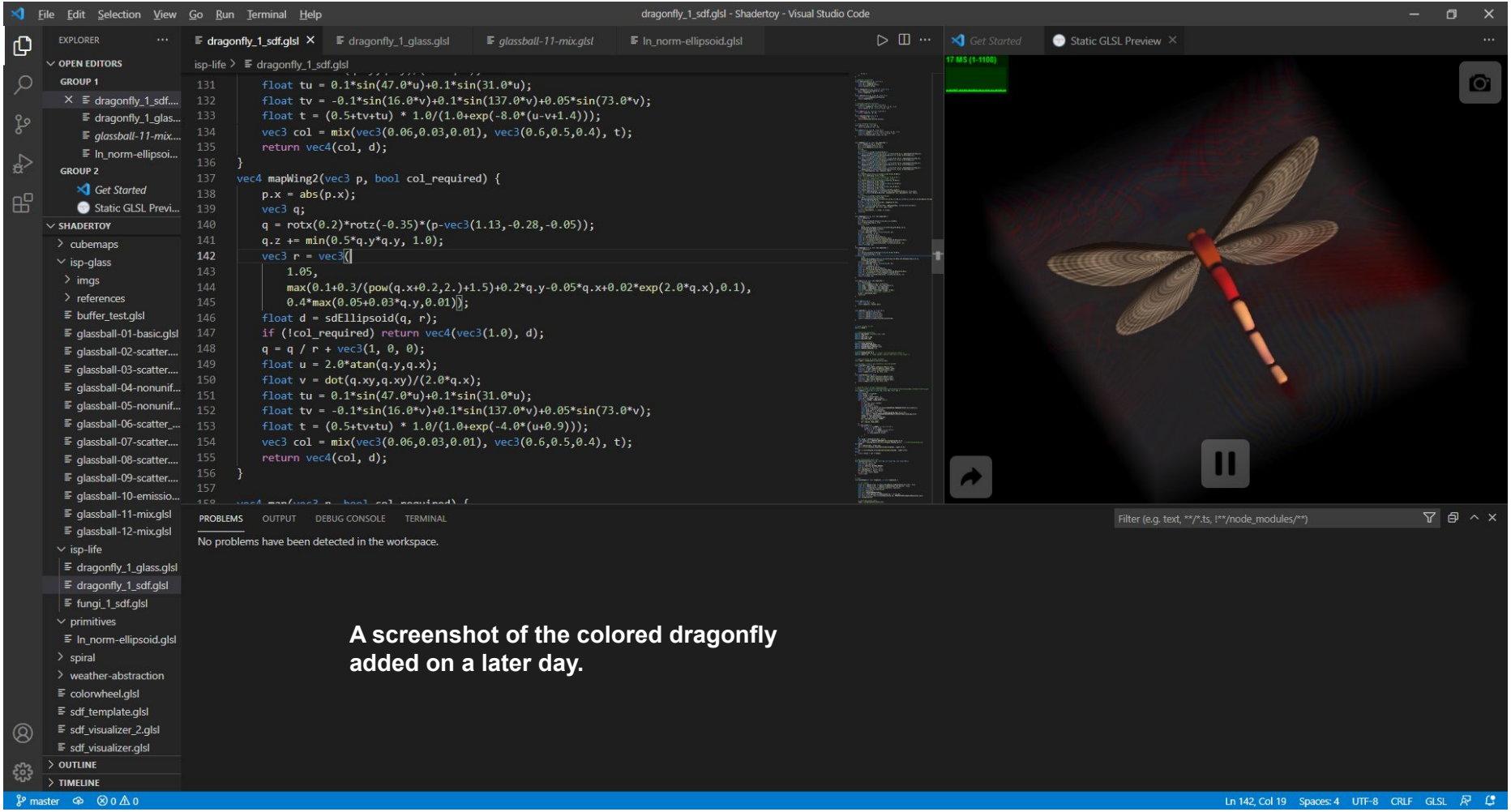
- Realism, nearly biologically accurate with simplification
- Combination of different plants, insects, and objects
- A variety of forms and colors
- Contents at the center of the glass with major and minor islands
- Unity and harmony: no strong focus, each part works together
- Shape of glass is either a sphere or a cuboid with rounded edges and curved faces
- Photographed on dark glossy surface with blurred environmental lighting

Image sources:
https://www.thisiscolossal.com/2014/06/artistic-glass-paperweights-paul-stankard/
https://www.google.com/search?q=Paul+J.+Stankard&tbm=isch

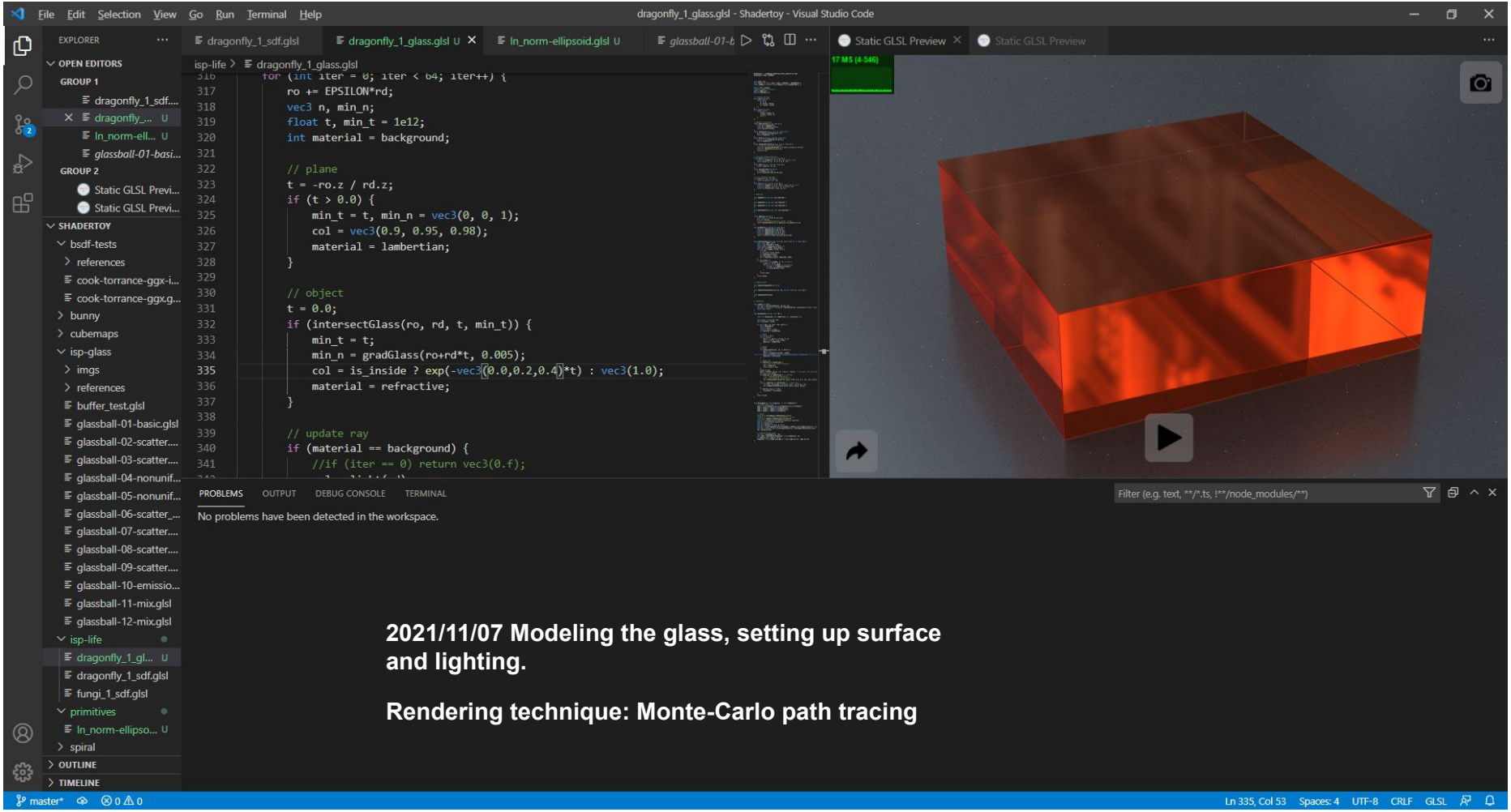


2021/11/06 Modeling a dragonfly. I took Paul's work as reference, although I realized it isn't biologically accurate after checking some real dragonfly photos.

Inspired by the work of Inigo Quilez, I use an (approximate) signed distance field to represent the subject, programmed in an original SDF visualizer.

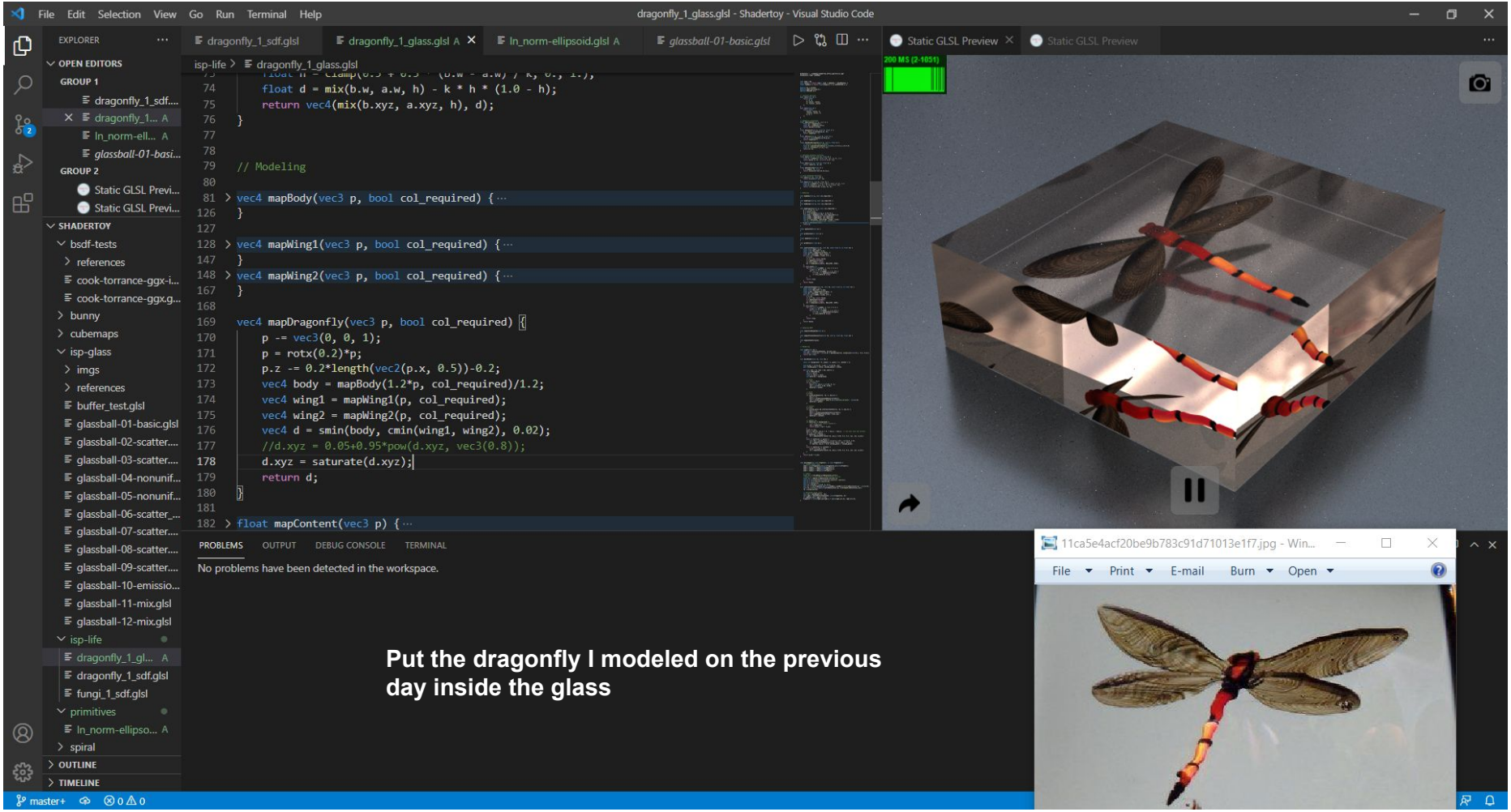


A screenshot of the colored dragonfly added on a later day.



2021/11/07 Modeling the glass, setting up surface and lighting.

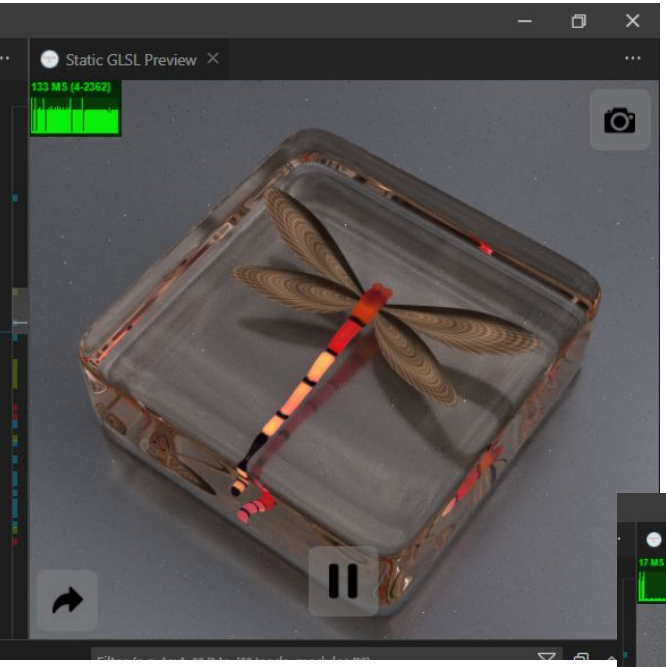
Rendering technique: Monte-Carlo path tracing

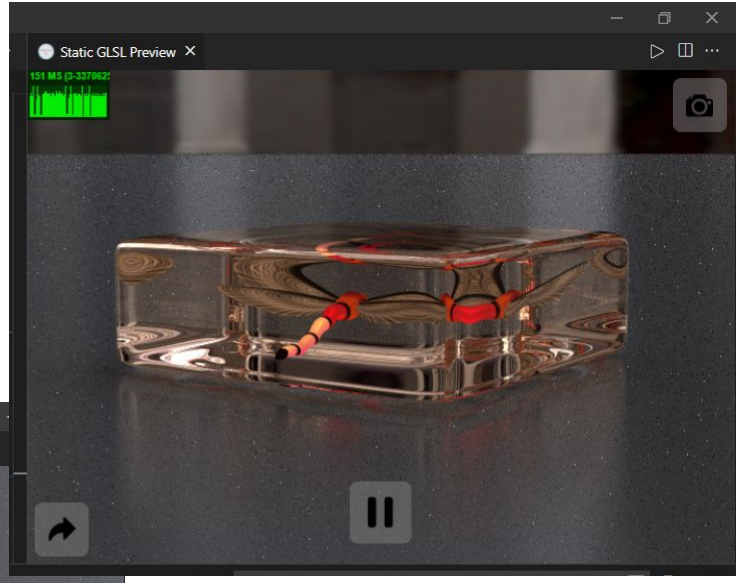


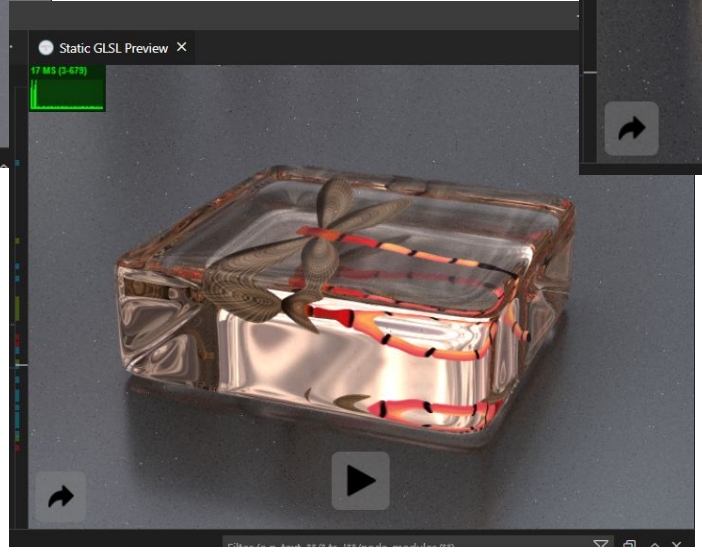
Put the dragonfly I modeled on the previous day inside the glass

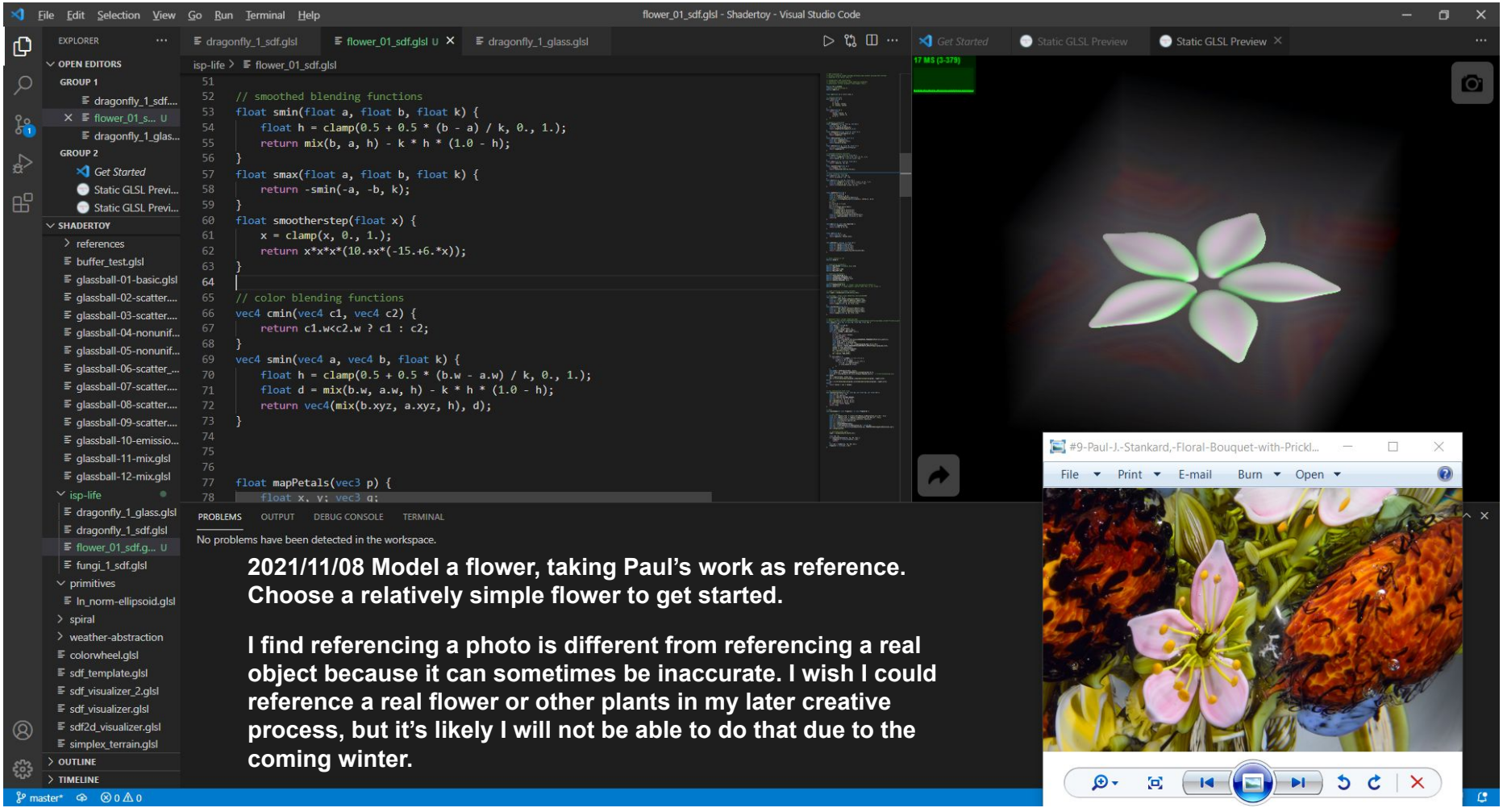
Try cuboid with rounded edges. Some screenshots from different angles.

Here the dragonfly's wing is opaque (Cook-Torrance BRDF). I tried subsurface scattering but it doesn't look that nice.



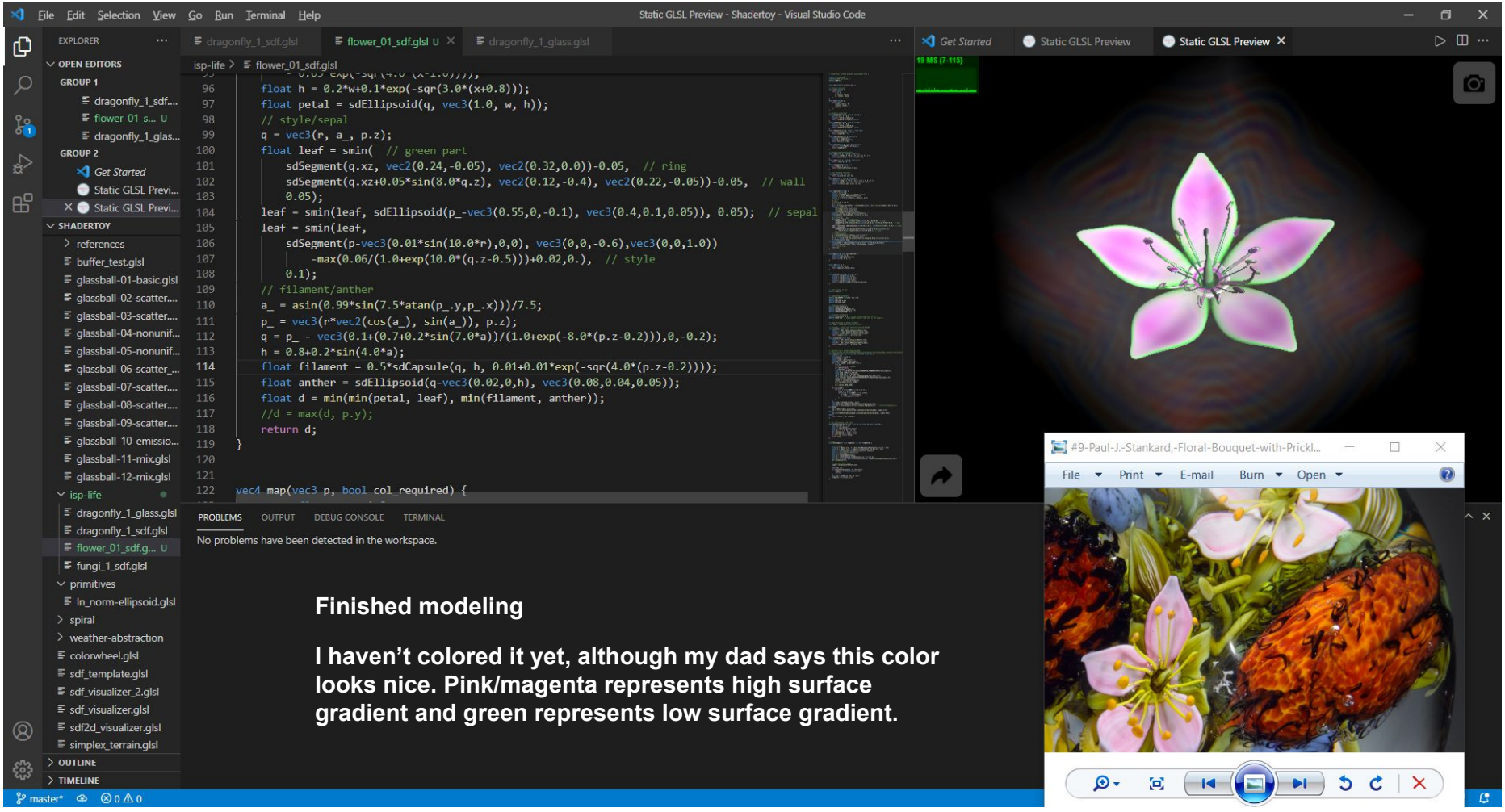






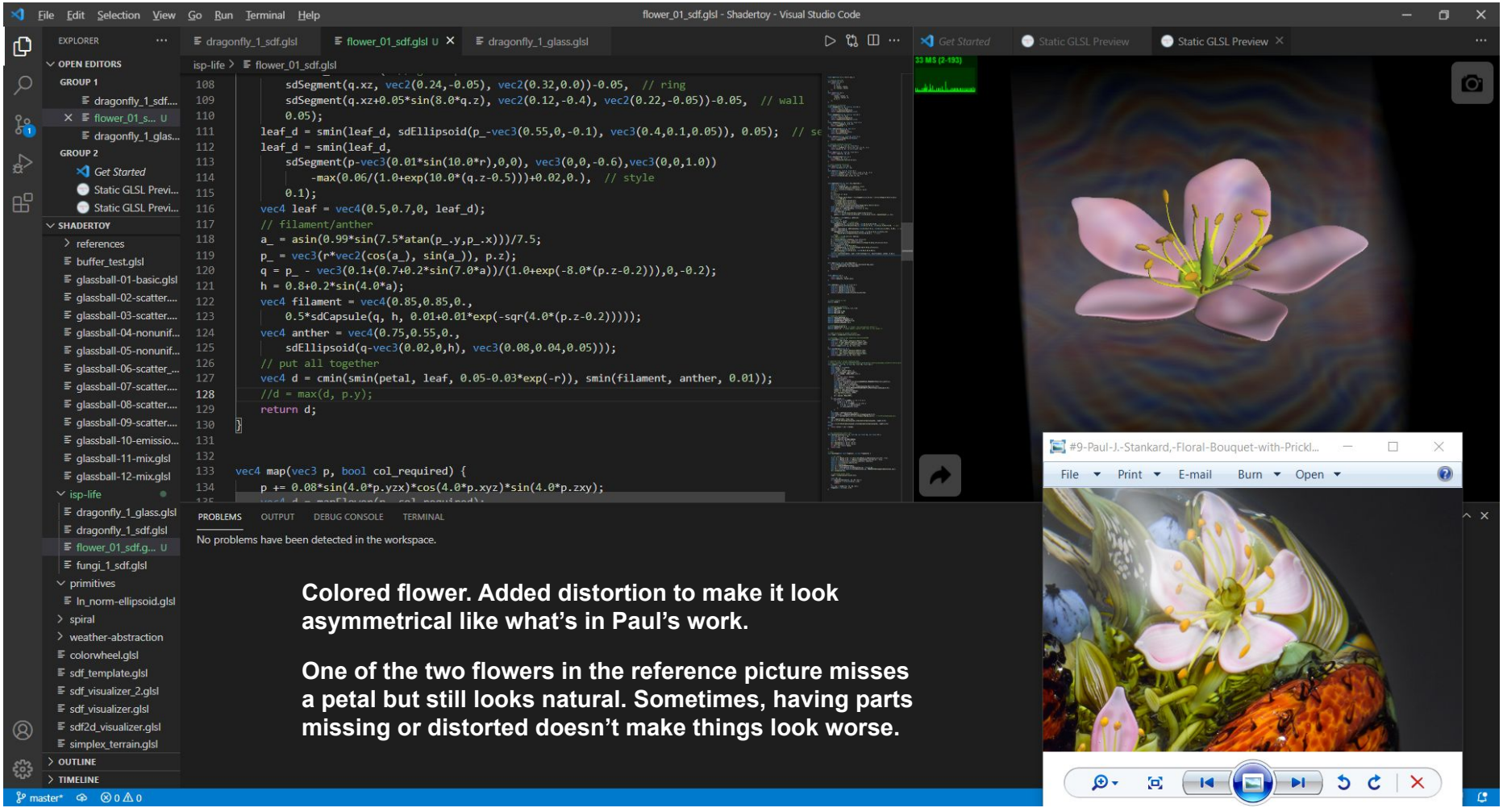
2021/11/08 Model a flower, taking Paul's work as reference. Choose a relatively simple flower to get started.

I find referencing a photo is different from referencing a real object because it can sometimes be inaccurate. I wish I could reference a real flower or other plants in my later creative process, but it's likely I will not be able to do that due to the coming winter.



Finished modeling

I haven't colored it yet, although my dad says this color looks nice. Pink/magenta represents high surface gradient and green represents low surface gradient.


flower_01_sdf.glsl - Shadertoy - Visual Studio Code
File Edit Selection View Go Run Terminal Help
EXPLORER
OPEN EDITORS
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dragonfly_1_sdf....
flower_01_s... U
dragonfly_1_glas...
GROUP 2
Get Started
Static GLSL Previ...
Static GLSL Previ...
SHADERTOY
references
buffer_test.glsl
glassball-01-basic.glsl
glassball-02-scatter....
glassball-03-scatter....
glassball-04-nonunif...
glassball-05-nonunif...
glassball-06-scatter_...
glassball-07-scatter....
glassball-08-scatter....
glassball-09-scatter....
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glassball-12-mix.glsl
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weather-abstraction
colorwheel.glsl
sdf_template.glsl
sdf_visualizer_2.glsl
sdf_visualizer.glsl
sdf2d_visualizer.glsl
simplex_terrain.glsl
OUTLINE
TIMELINE
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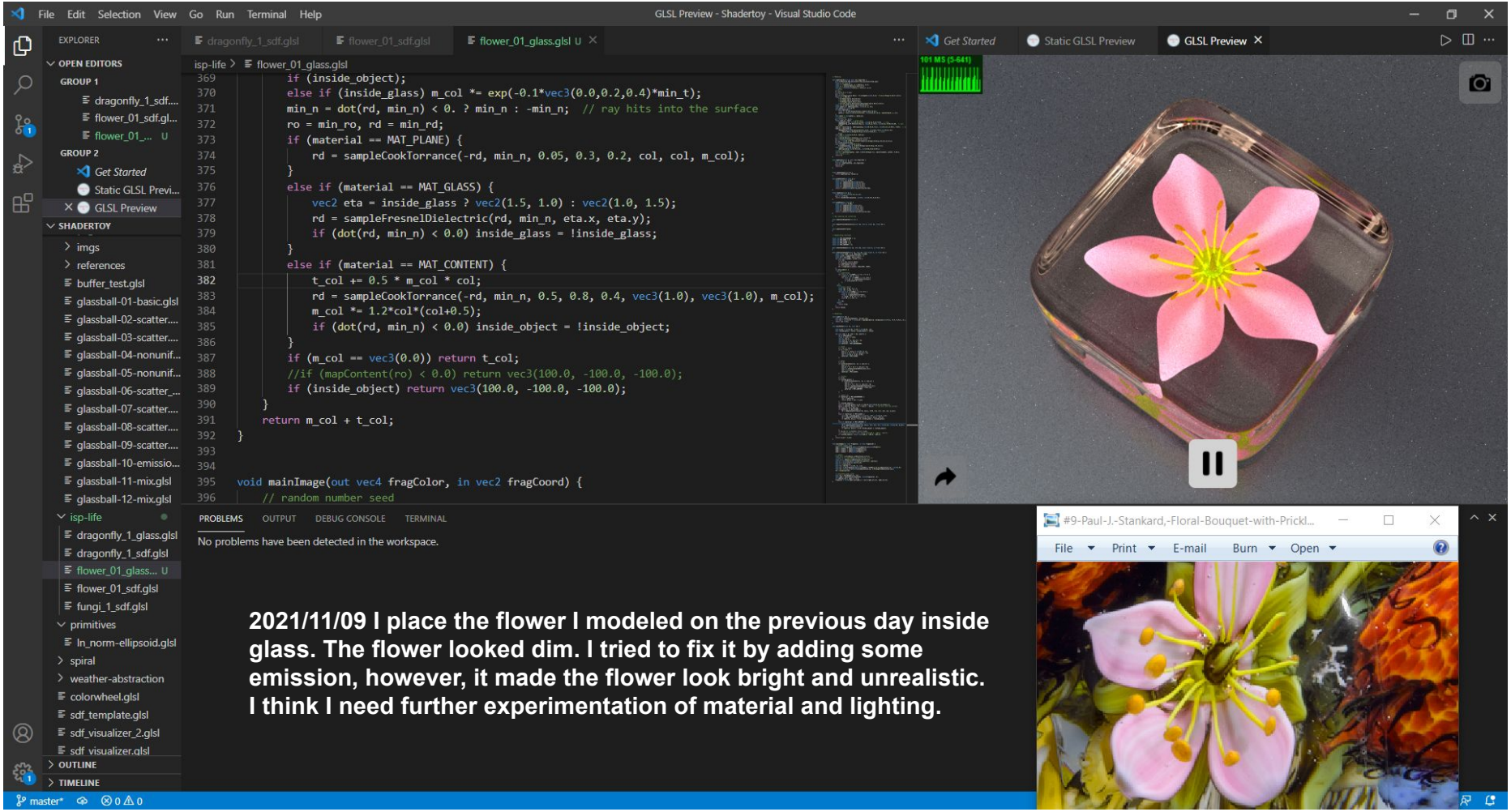
flower_01_sdf.glsl U
dragonfly_1_glass.glsl
isp-life > flower_01_sdf.glsl
sdSegment(q.xz, vec2(0.24,-0.05), vec2(0.32,0.0))-0.05, // ring
sdSegment(q.xz+0.05*sin(8.0*q.z), vec2(0.12,-0.4), vec2(0.22,-0.05))-0.05, // wall
0.05);
leaf_d = smin(leaf_d, sdEllipsoid(p_-vec3(0.55,0,-0.1), vec3(0.4,0.1,0.05)), 0.05); // se
leaf_d = smin(leaf_d,
sdSegment(p-vec3(0.01*sin(10.0*r),0,0), vec3(0,0,-0.6),vec3(0,0,1.0))
-max(0.06/(1.0+exp(10.0*(q.z-0.5)))+0.02,0.), // style
0.1);
vec4 leaf = vec4(0.5,0.7,0, leaf_d);
// filament/anther
a_ = asin(0.99*sin(7.5*atan(p_.y,p_.x)))/7.5;
p_ = vec3(r*vec2(cos(a_), sin(a_)), p.z);
q = p_ - vec3(0.1+(0.7+0.2*sin(7.0*a))/(1.0+exp(-8.0*(p.z-0.2))),0,-0.2);
h = 0.8+0.2*sin(4.0*a);
vec4 filament = vec4(0.85,0.85,0.,
0.5*sdCapsule(q, h, 0.01+0.01*exp(-sqr(4.0*(p.z-0.2)))));
vec4 anther = vec4(0.75,0.55,0.,
sdEllipsoid(q-vec3(0.02,0,h), vec3(0.08,0.04,0.05)));
// put all together
vec4 d = cmin(smin(petal, leaf, 0.05-0.03*exp(-r)), smin(filament, anther, 0.01));
//d = max(d, p.y);
return d;
}
vec4 map(vec3 p, bool col_required) {
p += 0.08*sin(4.0*p.yzx)*cos(4.0*p.xyz)*sin(4.0*p.zxy);
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
No problems have been detected in the workspace.
Get Started
Static GLSL Preview
Static GLSL Preview
33 MS (2-193)
#9-Paul-J.-Stankard,-Floral-Bouquet-with-Prickl...
File Print E-mail Burn Open
master*
Colored flower. Added distortion to make it look asymmetrical like what's in Paul's work.
One of the two flowers in the reference picture misses a petal but still looks natural. Sometimes, having parts missing or distorted doesn't make things look worse.


File Edit Selection View Go Run Terminal Help
GLSL Preview - Shadertoy - Visual Studio Code
EXPLORER
OPEN EDITORS
GROUP 1
dragonfly_1_sdf....
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GROUP 2
Get Started
Static GLSL Previ...
GLSL Preview
SHADERTOY
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glassball-01-basic.glsl
glassball-02-scatter....
glassball-03-scatter....
glassball-04-nonunif...
glassball-05-nonunif...
glassball-06-scatter_...
glassball-07-scatter....
glassball-08-scatter....
glassball-09-scatter....
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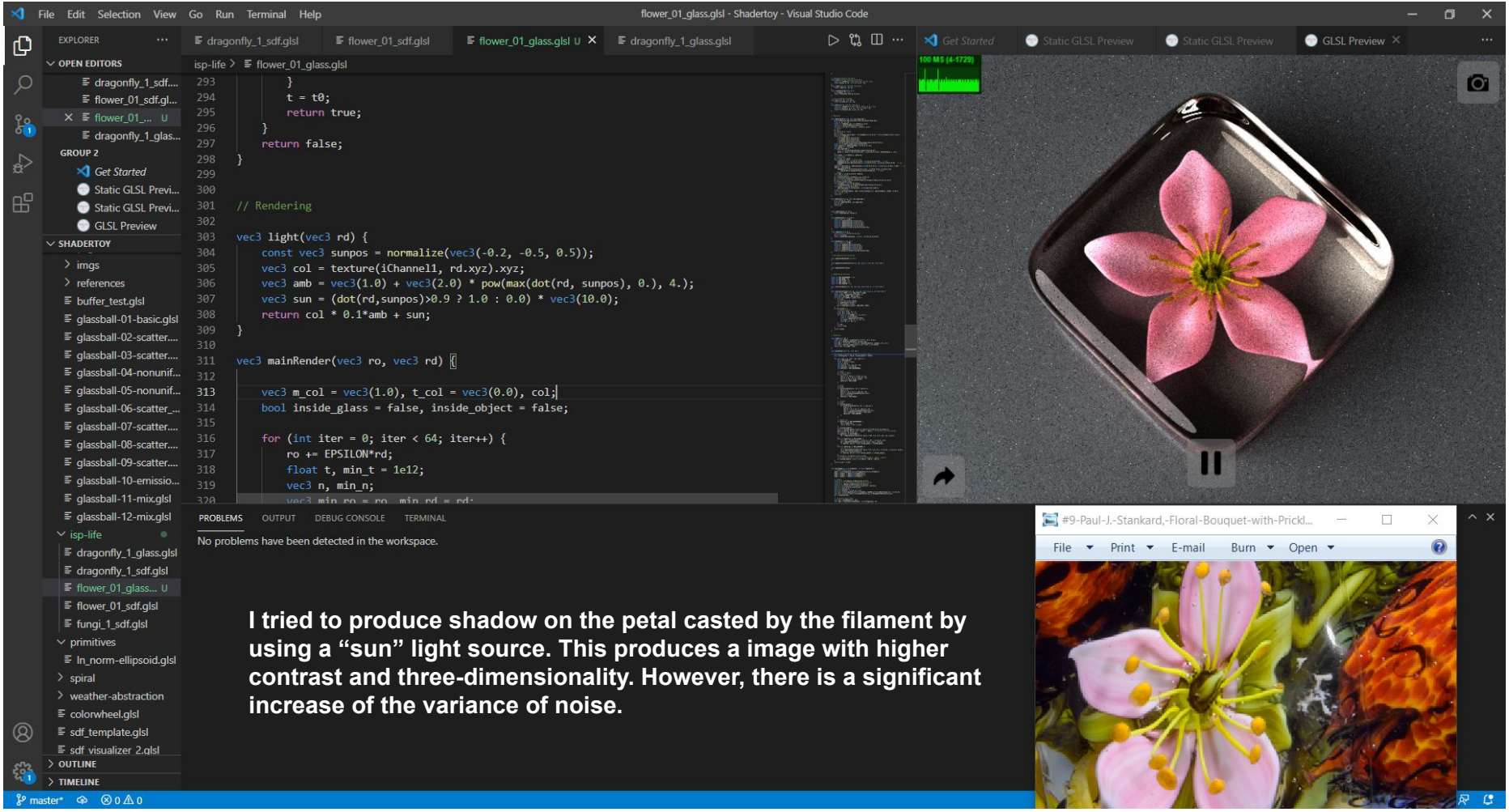
spiral
weather-abstraction
colorwheel.glsl
sdf_template.glsl
sdf_visualizer_2.glsl
sdf_visualizer.glsl
OUTLINE
TIMELINE
dragonfly_1_sdf.glsl
flower_01_sdf.glsl
flower_01_glass.glsl U
isp-life > flower_01_glass.glsl
if (inside_object);
else if (inside_glass) m_col *= exp(-0.1*vec3(0.0,0.2,0.4)*min_t);
min_n = dot(rd, min_n) < 0. ? min_n : -min_n; // ray hits into the surface
ro = min_ro, rd = min_rd;
if (material == MAT_PLANE) {
rd = sampleCookTorrance(-rd, min_n, 0.05, 0.3, 0.2, col, col, m_col);
}
else if (material == MAT_GLASS) {
vec2 eta = inside_glass ? vec2(1.5, 1.0) : vec2(1.0, 1.5);
rd = sampleFresnelDielectric(rd, min_n, eta.x, eta.y);
if (dot(rd, min_n) < 0.0) inside_glass = !inside_glass;
}
else if (material == MAT_CONTENT) {
t_col += 0.5 * m_col * col;
rd = sampleCookTorrance(-rd, min_n, 0.5, 0.8, 0.4, vec3(1.0), vec3(1.0), m_col);
m_col *= 1.2*col*(col+0.5);
if (dot(rd, min_n) < 0.0) inside_object = !inside_object;
}
if (m_col == vec3(0.0)) return t_col;
//if (mapContent(ro) < 0.0) return vec3(100.0, -100.0, -100.0);
if (inside_object) return vec3(100.0, -100.0, -100.0);
}
return m_col + t_col;
}
void mainImage(out vec4 fragColor, in vec2 fragCoord) {
// random number seed
Get Started
Static GLSL Preview
GLSL Preview
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
No problems have been detected in the workspace.
#9-Paul-J.-Stankard,-Floral-Bouquet-with-Prickl...
File Print E-mail Burn Open
2021/11/09 I place the flower I modeled on the previous day inside glass. The flower looked dim. I tried to fix it by adding some emission, however, it made the flower look bright and unrealistic. I think I need further experimentation of material and lighting.
master*
0 0


File Edit Selection View Go Run Terminal Help
flower_01_glass.glsl - Shadertoy - Visual Studio Code
EXPLORER
OPEN EDITORS
GROUP 2
Get Started
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Static GLSL Previ...
GLSL Preview
SHADERTOY
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references
buffer_test.glsl
glassball-01-basic.glsl
glassball-02-scatter....
glassball-03-scatter....
glassball-04-nonunif...
glassball-05-nonunif...
glassball-06-scatter_...
glassball-07-scatter....
glassball-08-scatter....
glassball-09-scatter....
glassball-10-emissio...
glassball-11-mix.glsl
glassball-12-mix.glsl
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flower_01_sdf.glsl
fungi_1_sdf.glsl
primitives
ln_norm-ellipsoid.glsl
spiral
weather-abstraction
colorwheel.glsl
sdf_template.glsl
sdf_visualizer 2.glsl
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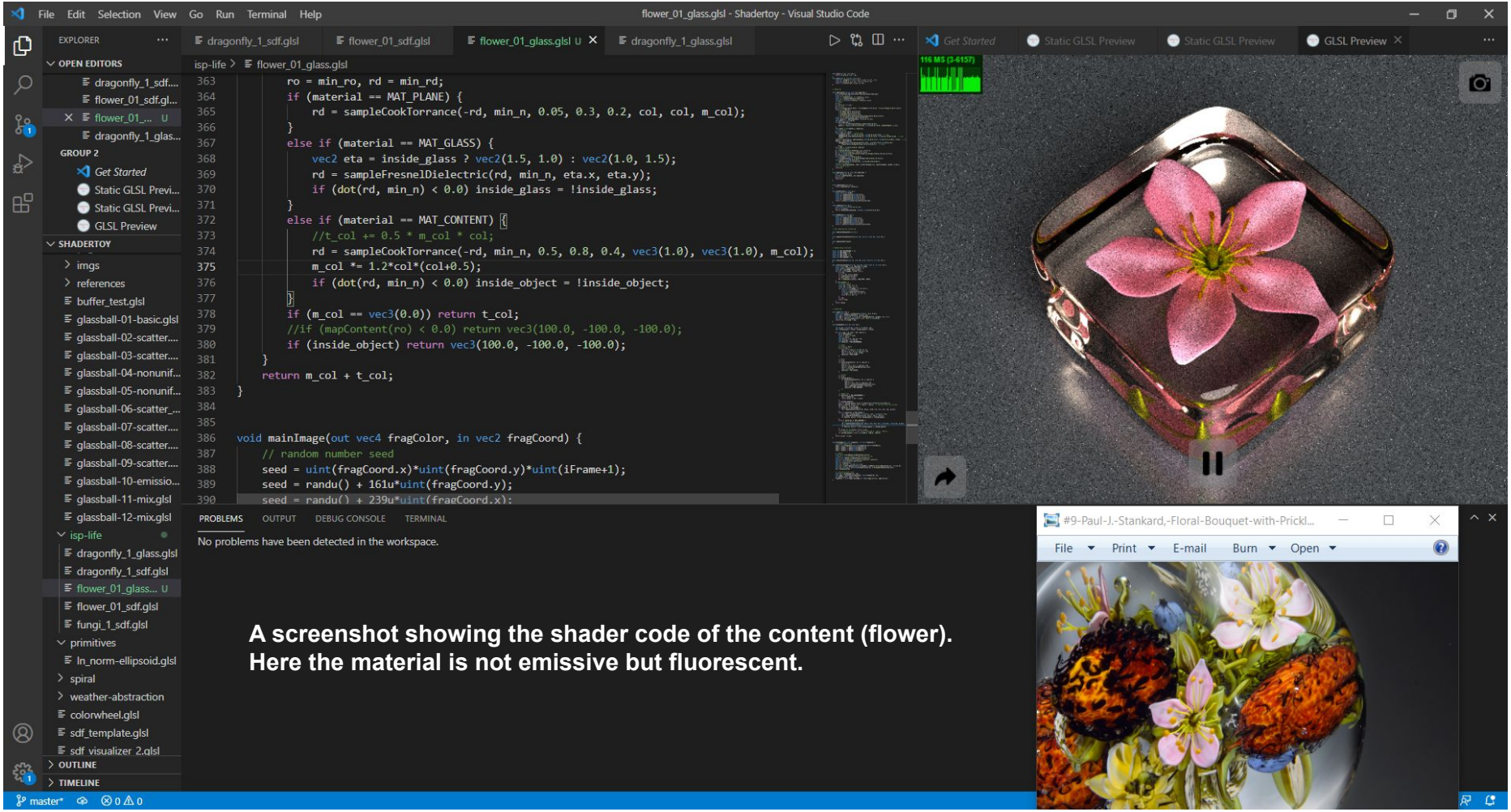
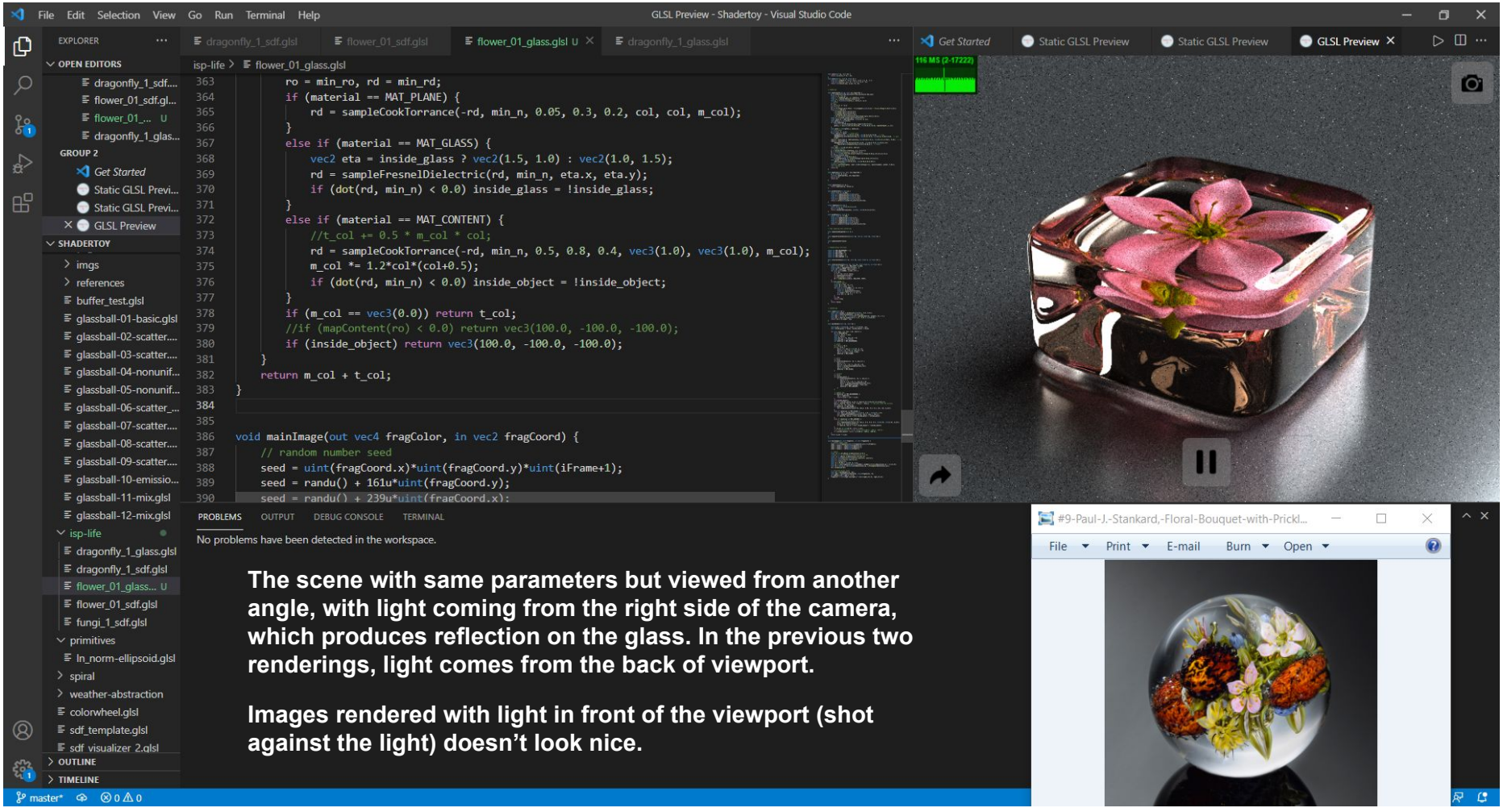
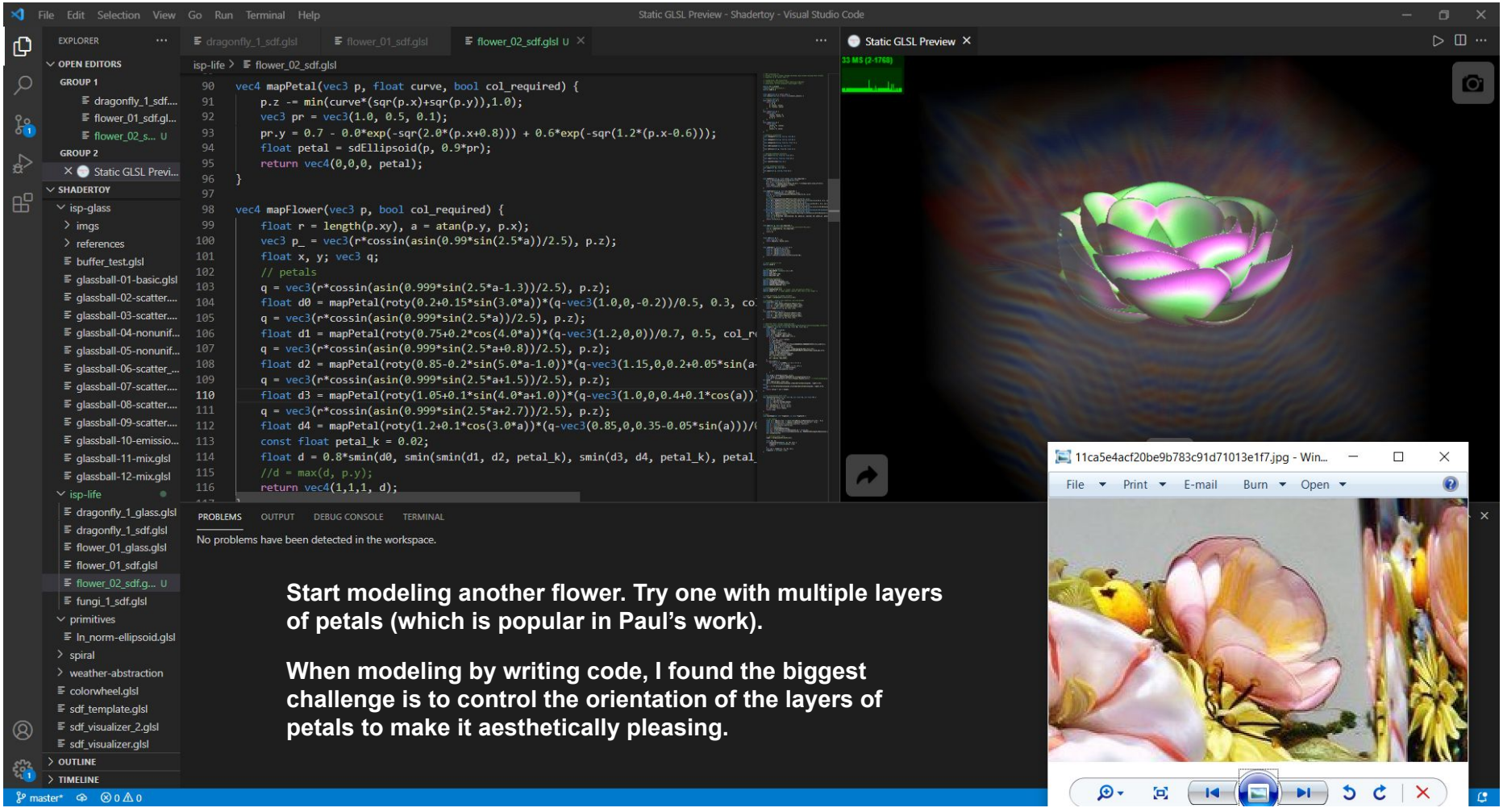
TIMELINE
dragonfly_1_sdf.glsl
flower_01_sdf.glsl
flower_01_glass.glsl U
dragonfly_1_glass.glsl
isp-life > flower_01_glass.glsl
293 }
294 t = t0;
295 return true;
296 }
297 return false;
298 }
299
300
301 // Rendering
302
303 vec3 light(vec3 rd) {
304 const vec3 sunpos = normalize(vec3(-0.2, -0.5, 0.5));
305 vec3 col = texture(iChannel1, rd.xyz).xyz;
306 vec3 amb = vec3(1.0) + vec3(2.0) * pow(max(dot(rd, sunpos), 0.), 4.);
307 vec3 sun = (dot(rd,sunpos)>0.9 ? 1.0 : 0.0) * vec3(10.0);
308 return col * 0.1*amb + sun;
309 }
310
311 vec3 mainRender(vec3 ro, vec3 rd) {
312
313 vec3 m_col = vec3(1.0), t_col = vec3(0.0), col;
314 bool inside_glass = false, inside_object = false;
315
316 for (int iter = 0; iter < 64; iter++) {
317 ro += EPSILON*rd;
318 float t, min_t = 1e12;
319 vec3 n, min_n;
320 vec3 min_ro = ro, min_rd = rd;
Get Started
Static GLSL Preview
Static GLSL Preview
GLSL Preview
100 MS (4-1729)
PROBLEMS
OUTPUT
DEBUG CONSOLE
TERMINAL
No problems have been detected in the workspace.
#9-Paul-J.-Stankard,-Floral-Bouquet-with-Prickl...
File
Print
E-mail
Burn
Open
I tried to produce shadow on the petal casted by the filament by using a “sun” light source. This produces a image with higher contrast and three-dimensionality. However, there is a significant increase of the variance of noise.
master*
0 0

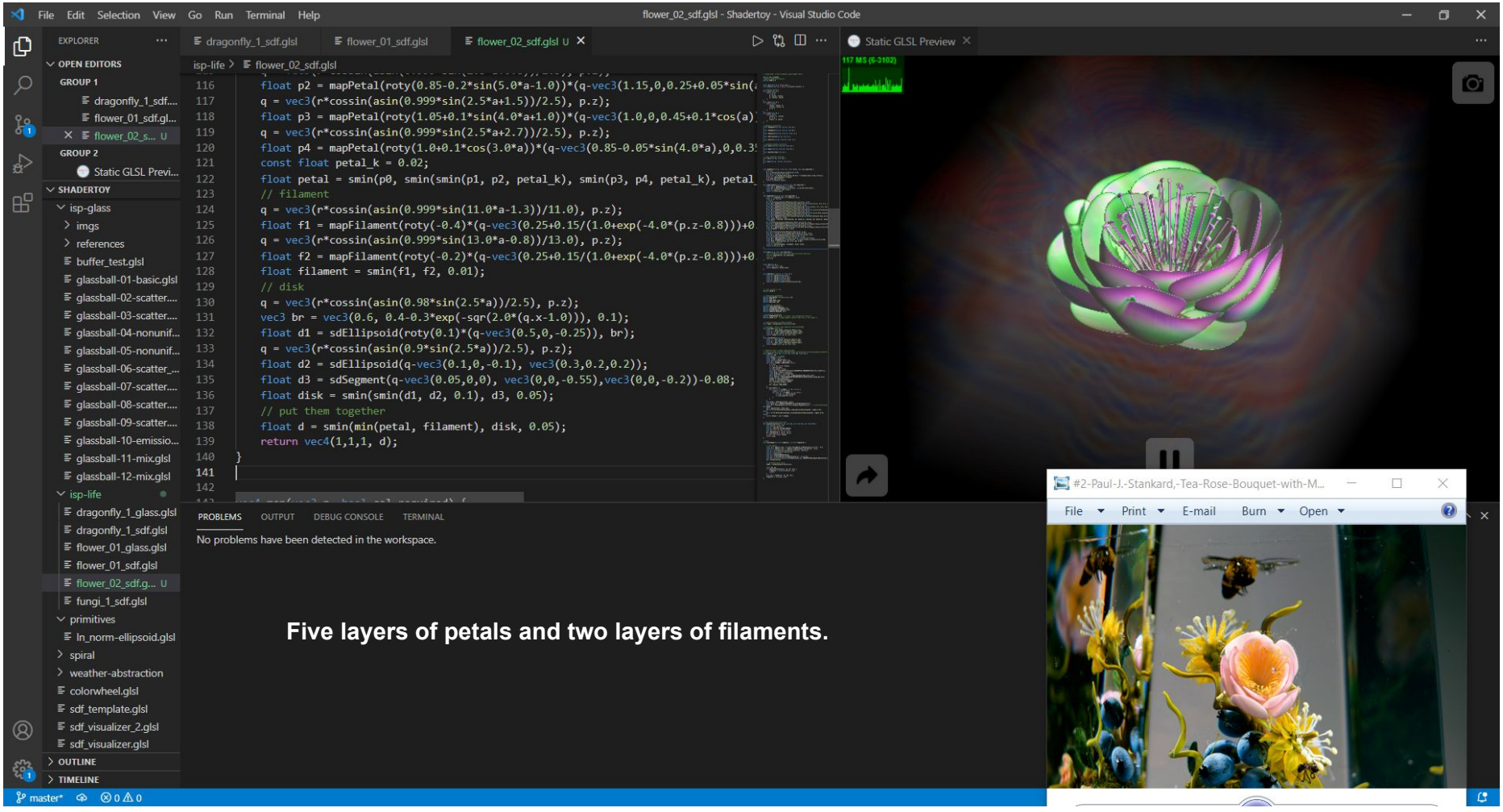

flower_01_glass.glsl - Shadertoy - Visual Studio Code
dragonfly_1_sdf.glsl
flower_01_sdf.glsl
flower_01_glass.glsl U
dragonfly_1_glass.glsl
Get Started
Static GLSL Preview
Static GLSL Preview
GLSL Preview
116 MS (3-6157)
ro = min_ro, rd = min_rd;
if (material == MAT_PLANE) {
rd = sampleCookTorrance(-rd, min_n, 0.05, 0.3, 0.2, col, col, m_col);
}
else if (material == MAT_GLASS) {
vec2 eta = inside_glass ? vec2(1.5, 1.0) : vec2(1.0, 1.5);
rd = sampleFresnelDielectric(rd, min_n, eta.x, eta.y);
if (dot(rd, min_n) < 0.0) inside_glass = !inside_glass;
}
else if (material == MAT_CONTENT) {
//t_col += 0.5 * m_col * col;
rd = sampleCookTorrance(-rd, min_n, 0.5, 0.8, 0.4, vec3(1.0), vec3(1.0), m_col);
m_col *= 1.2*col*(col+0.5);
if (dot(rd, min_n) < 0.0) inside_object = !inside_object;
}
if (m_col == vec3(0.0)) return t_col;
//if (mapContent(ro) < 0.0) return vec3(100.0, -100.0, -100.0);
if (inside_object) return vec3(100.0, -100.0, -100.0);
}
return m_col + t_col;
}
void mainImage(out vec4 fragColor, in vec2 fragCoord) {
// random number seed
seed = uint(fragCoord.x)*uint(fragCoord.y)*uint(iFrame+1);
seed = randu() + 161u*uint(fragCoord.y);
seed = randu() + 239u*uint(fragCoord.x);
PROBLEMS
OUTPUT
DEBUG CONSOLE
TERMINAL
No problems have been detected in the workspace.
#9-Paul-J.-Stankard,-Floral-Bouquet-with-Prickl...
File
Print
E-mail
Burn
Open
A screenshot showing the shader code of the content (flower).
Here the material is not emissive but fluorescent.

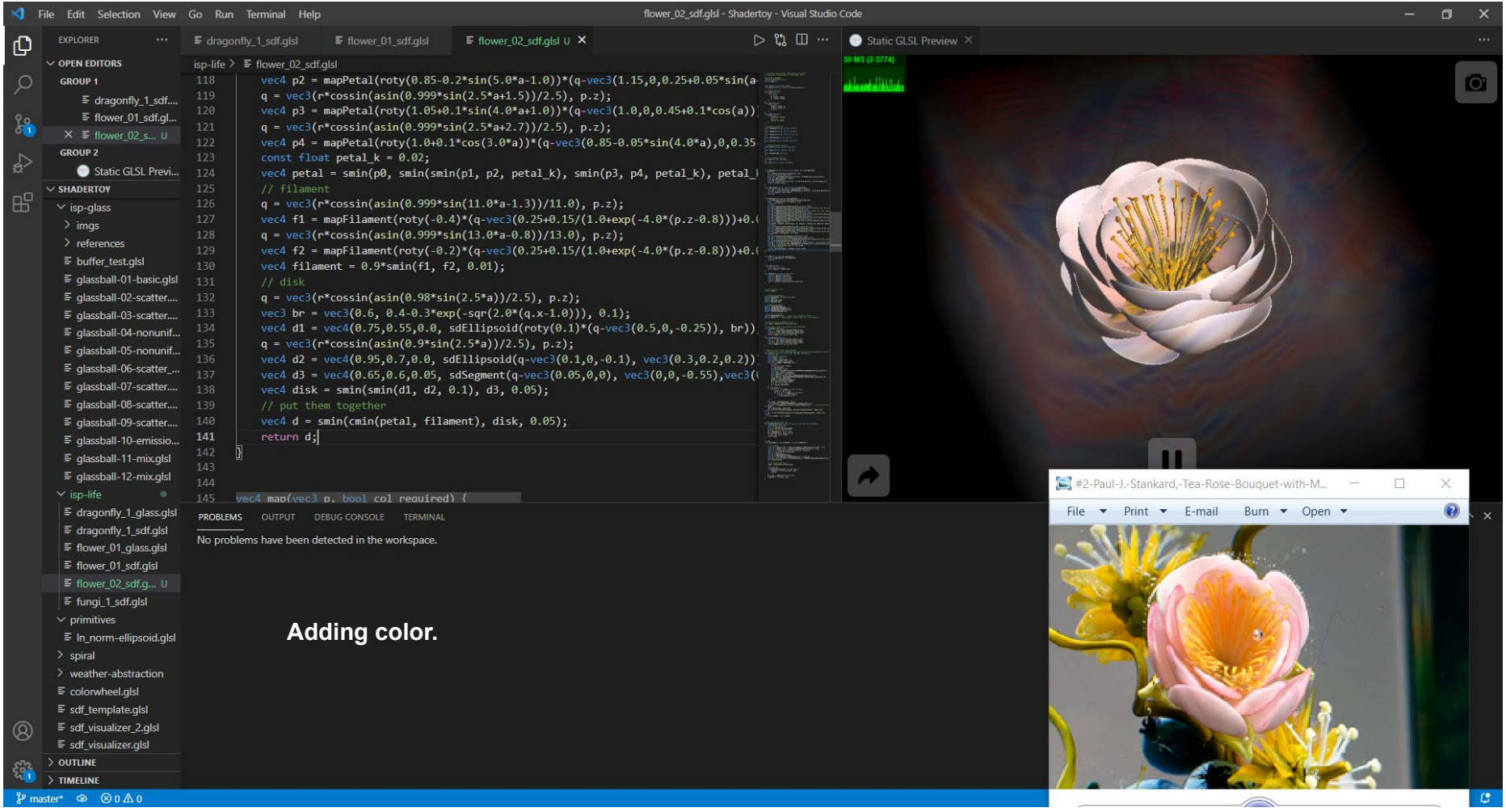


The scene with same parameters but viewed from another angle, with light coming from the right side of the camera, which produces reflection on the glass. In the previous two renderings, light comes from the back of viewport.

Images rendered with light in front of the viewport (shot against the light) doesn't look nice.


Static GLSL Preview - Shadertoy - Visual Studio Code
Static GLSL Preview
11ca5e4acf20be9b783c91d71013e1f7.jpg - Win...
File Print E-mail Burn Open
Start modeling another flower. Try one with multiple layers of petals (which is popular in Paul's work).
When modeling by writing code, I found the biggest challenge is to control the orientation of the layers of petals to make it aesthetically pleasing.


flower_02_sdf.glsl - Shadertoy - Visual Studio Code
dragonfly_1_sdf.glsl
flower_01_sdf.glsl
flower_02_sdf.glsl U
Static GLSL Preview
float p2 = mapPetal(roty(0.85-0.2*sin(5.0*a-1.0))*(q-vec3(1.15,0,0.25+0.05*sin(
q = vec3(r*cossin(asin(0.999*sin(2.5*a+1.5))/2.5), p.z);
float p3 = mapPetal(roty(1.05+0.1*sin(4.0*a+1.0))*(q-vec3(1.0,0,0.45+0.1*cos(a)
q = vec3(r*cossin(asin(0.999*sin(2.5*a+2.7))/2.5), p.z);
float p4 = mapPetal(roty(1.0+0.1*cos(3.0*a))*(q-vec3(0.85-0.05*sin(4.0*a),0,0.3
const float petal_k = 0.02;
float petal = smin(p0, smin(smin(p1, p2, petal_k), smin(p3, p4, petal_k), petal
// filament
q = vec3(r*cossin(asin(0.999*sin(11.0*a-1.3))/11.0), p.z);
float f1 = mapFilament(roty(-0.4)*(q-vec3(0.25+0.15/(1.0+exp(-4.0*(p.z-0.8)))+0
q = vec3(r*cossin(asin(0.999*sin(13.0*a-0.8))/13.0), p.z);
float f2 = mapFilament(roty(-0.2)*(q-vec3(0.25+0.15/(1.0+exp(-4.0*(p.z-0.8)))+0
float filament = smin(f1, f2, 0.01);
// disk
q = vec3(r*cossin(asin(0.98*sin(2.5*a))/2.5), p.z);
vec3 br = vec3(0.6, 0.4-0.3*exp(-sqr(2.0*(q.x-1.0))), 0.1);
float d1 = sdEllipsoid(roty(0.1)*(q-vec3(0.5,0,-0.25)), br);
q = vec3(r*cossin(asin(0.9*sin(2.5*a))/2.5), p.z);
float d2 = sdEllipsoid(q-vec3(0.1,0,-0.1), vec3(0.3,0.2,0.2));
float d3 = sdSegment(q-vec3(0.05,0,0), vec3(0,0,-0.55),vec3(0,0,-0.2))-0.08;
float disk = smin(smin(d1, d2, 0.1), d3, 0.05);
// put them together
float d = smin(min(petal, filament), disk, 0.05);
return vec4(1,1,1, d);
}
PROBLEMS
OUTPUT
DEBUG CONSOLE
TERMINAL
No problems have been detected in the workspace.
#2-Paul-J.-Stankard,-Tea-Rose-Bouquet-with-M...
File
Print
E-mail
Burn
Open
Five layers of petals and two layers of filaments.
master*


File Edit Selection View Go Run Terminal Help
flower_02_sdf.glsl - Shadertoy - Visual Studio Code
EXPLORER
OPEN EDITORS
GROUP 1
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glassball-02-scatter....
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glassball-04-nonunif...
glassball-05-nonunif...
glassball-06-scatter_...
glassball-07-scatter....
glassball-08-scatter....
glassball-09-scatter....
glassball-10-emissio...
glassball-11-mix.glsl
glassball-12-mix.glsl
isp-life
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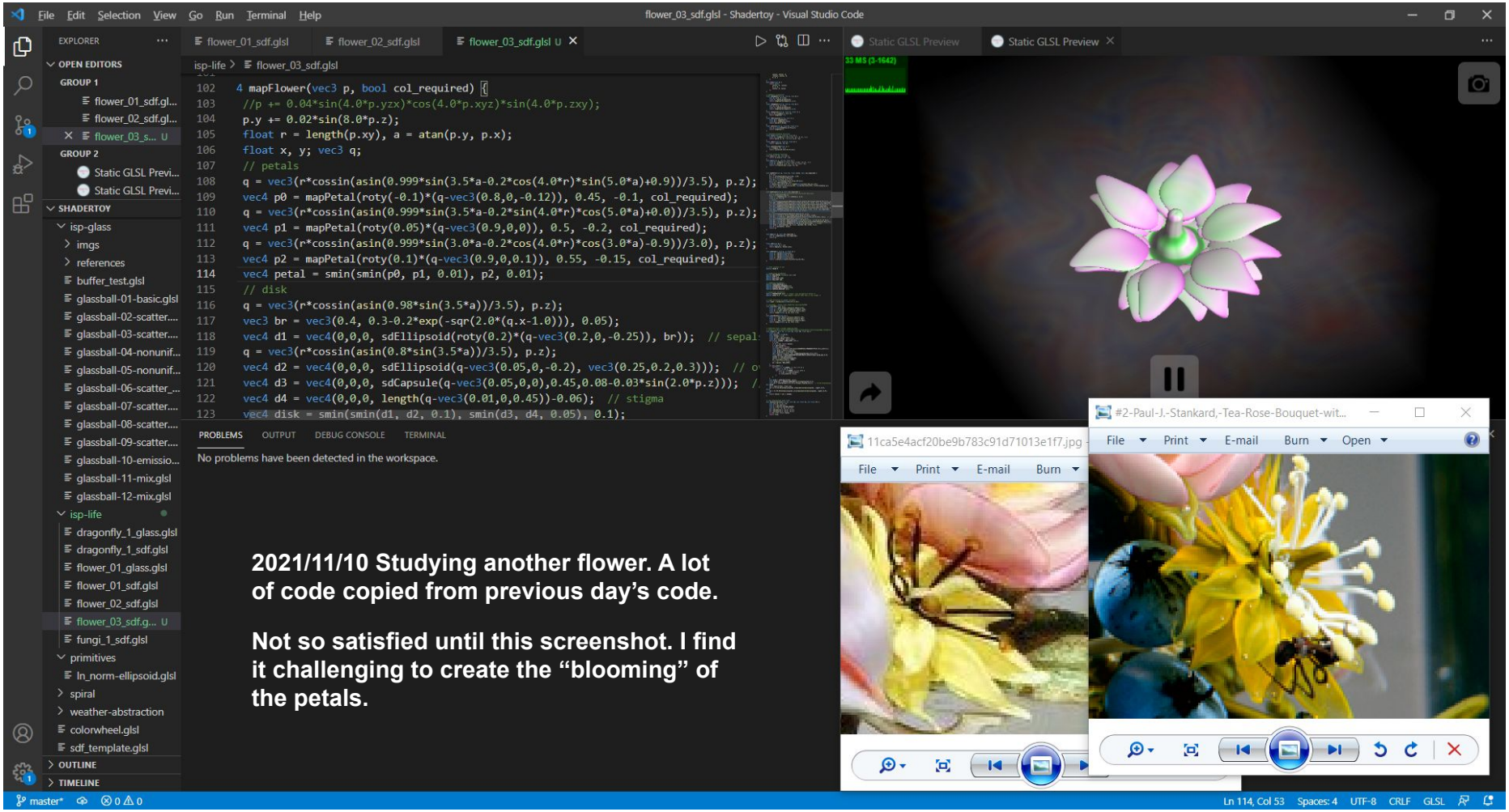
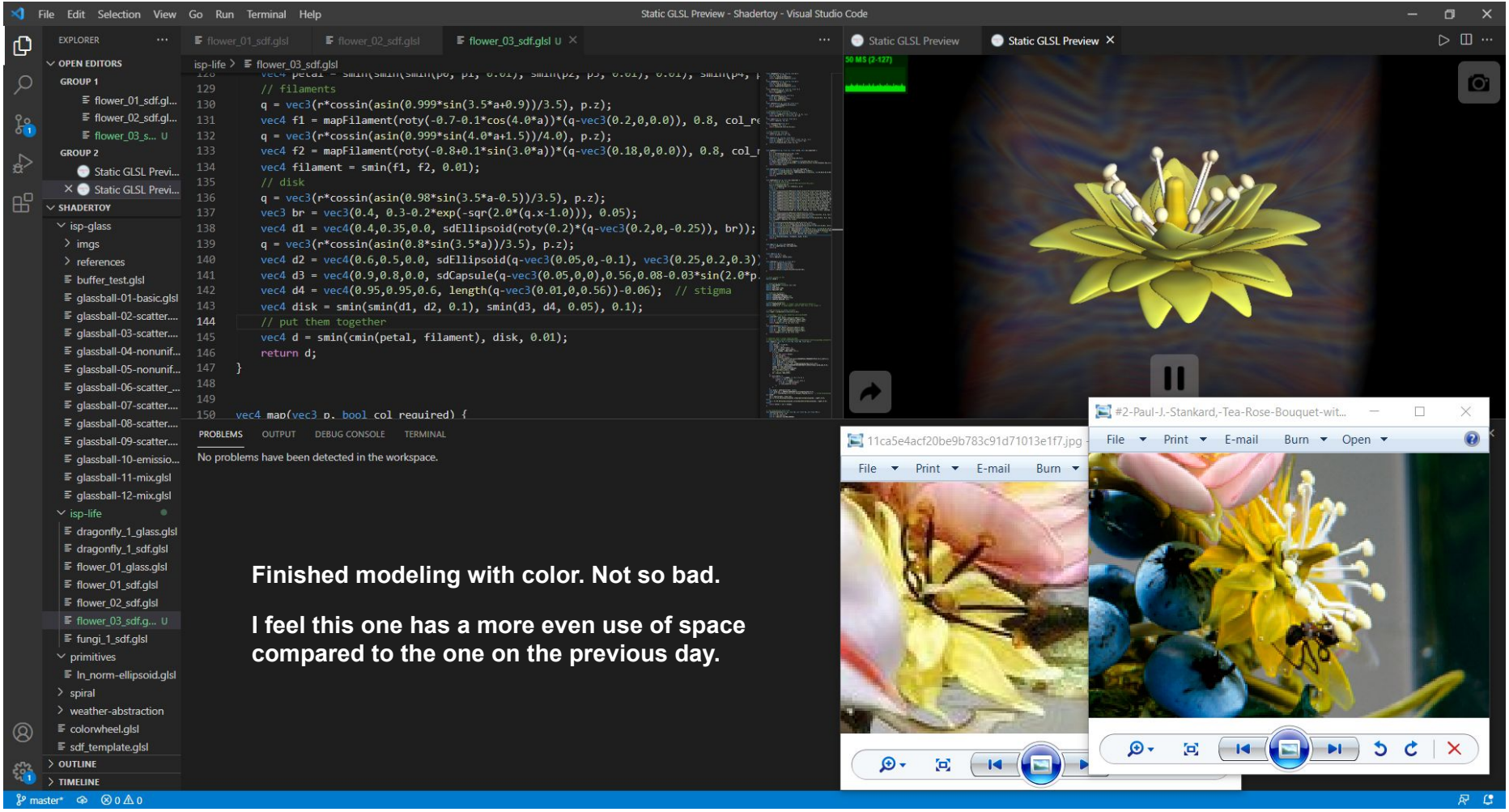
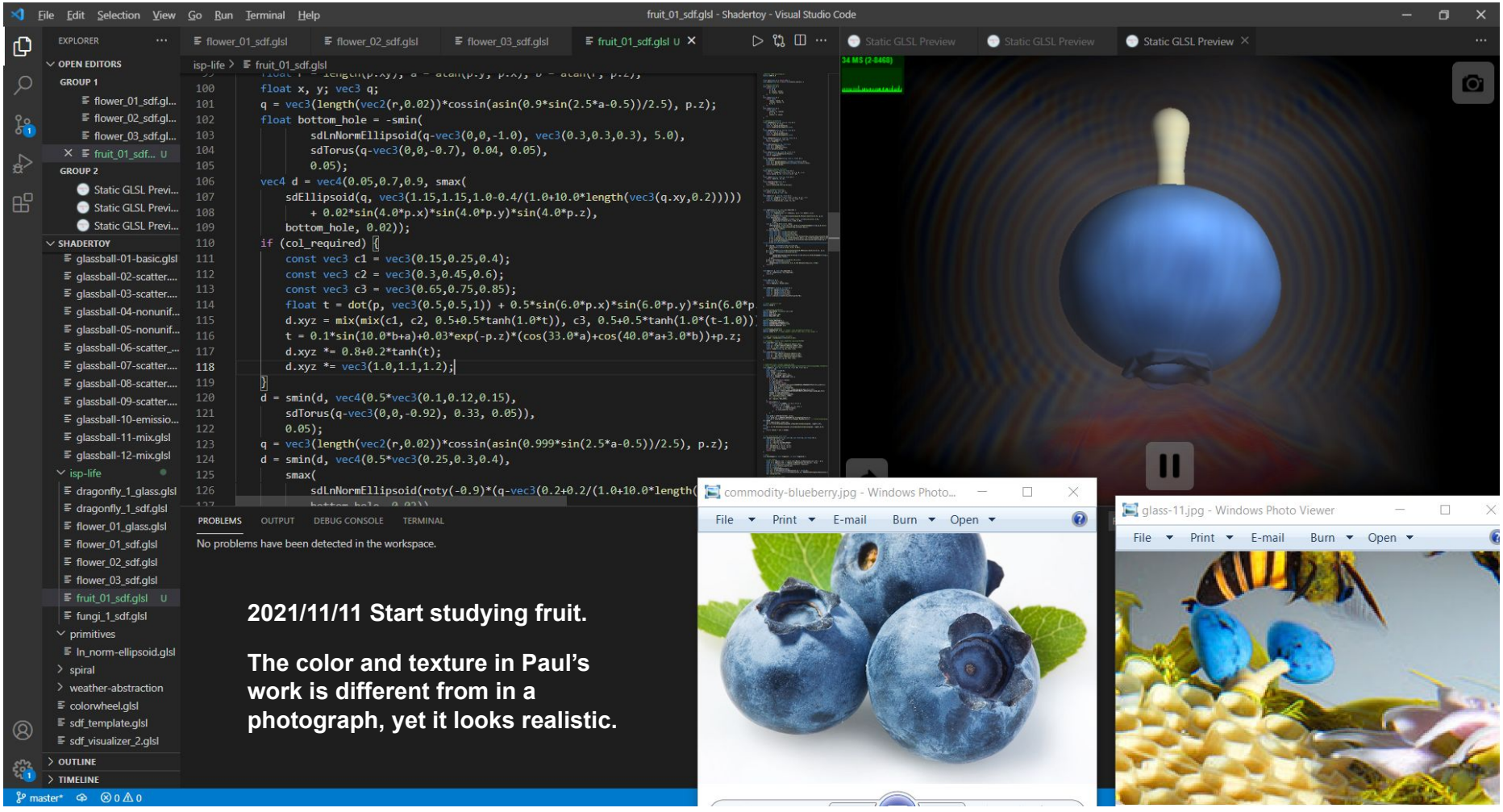
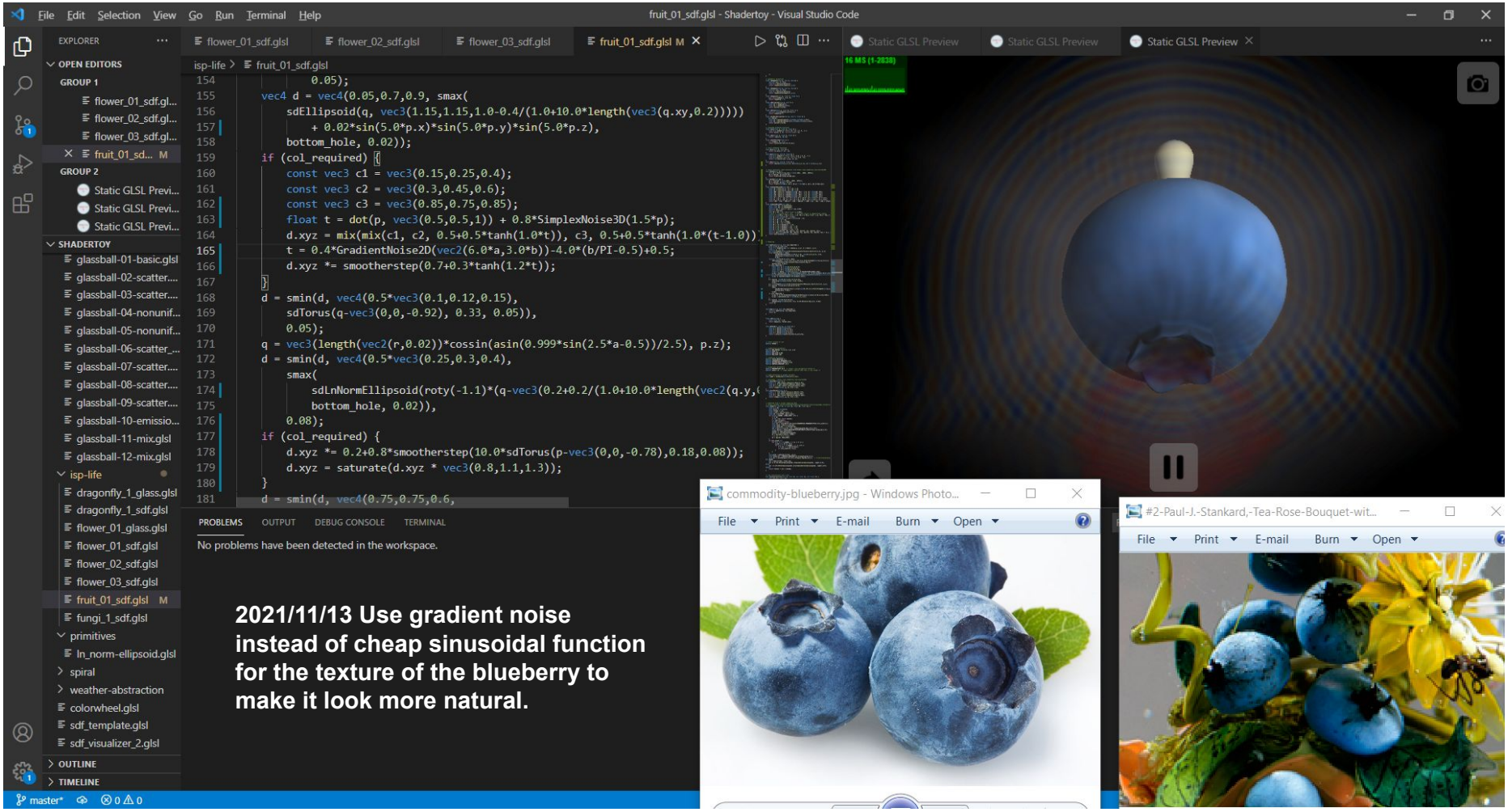
dragonfly_1_sdf.glsl
flower_01_glass.glsl
flower_01_sdf.glsl
flower_02_sdf.g... U
fungi_1_sdf.glsl
primitives
ln_norm-ellipsoid.glsl
spiral
weather-abstraction
colorwheel.glsl
sdf_template.glsl
sdf_visualizer_2.glsl
sdf_visualizer.glsl
OUTLINE
TIMELINE
dragonfly_1_sdf.glsl
flower_01_sdf.glsl
flower_02_sdf.glsl U
isp-life > flower_02_sdf.glsl
vec4 p2 = mapPetal(roty(0.85-0.2*sin(5.0*a-1.0))*(q-vec3(1.15,0,0.25+0.05*sin(a
q = vec3(r*cossin(asin(0.999*sin(2.5*a+1.5))/2.5), p.z);
vec4 p3 = mapPetal(roty(1.05+0.1*sin(4.0*a+1.0))*(q-vec3(1.0,0,0.45+0.1*cos(a))
q = vec3(r*cossin(asin(0.999*sin(2.5*a+2.7))/2.5), p.z);
vec4 p4 = mapPetal(roty(1.0+0.1*cos(3.0*a))*(q-vec3(0.85-0.05*sin(4.0*a),0,0.35
const float petal_k = 0.02;
vec4 petal = smin(p0, smin(smin(p1, p2, petal_k), smin(p3, p4, petal_k), petal_
// filament
q = vec3(r*cossin(asin(0.999*sin(11.0*a-1.3))/11.0), p.z);
vec4 f1 = mapFilament(roty(-0.4)*(q-vec3(0.25+0.15/(1.0+exp(-4.0*(p.z-0.8)))+0.
q = vec3(r*cossin(asin(0.999*sin(13.0*a-0.8))/13.0), p.z);
vec4 f2 = mapFilament(roty(-0.2)*(q-vec3(0.25+0.15/(1.0+exp(-4.0*(p.z-0.8)))+0.
vec4 filament = 0.9*smin(f1, f2, 0.01);
// disk
q = vec3(r*cossin(asin(0.98*sin(2.5*a))/2.5), p.z);
vec3 br = vec3(0.6, 0.4-0.3*exp(-sqr(2.0*(q.x-1.0))), 0.1);
vec4 d1 = vec4(0.75,0.55,0.0, sdEllipsoid(roty(0.1)*(q-vec3(0.5,0,-0.25)), br));
q = vec3(r*cossin(asin(0.9*sin(2.5*a))/2.5), p.z);
vec4 d2 = vec4(0.95,0.7,0.0, sdEllipsoid(q-vec3(0.1,0,-0.1), vec3(0.3,0.2,0.2));
vec4 d3 = vec4(0.65,0.6,0.05, sdSegment(q-vec3(0.05,0,0), vec3(0,0,-0.55),vec3(
vec4 disk = smin(smin(d1, d2, 0.1), d3, 0.05);
// put them together
vec4 d = smin(cmin(petal, filament), disk, 0.05);
return d;
}
vec4 map(vec3 p, bool col required) {
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
No problems have been detected in the workspace.
Static GLSL Preview
50 MS (2-3774)
#2-Paul-J.-Stankard,-Tea-Rose-Bouquet-with-M...
File Print E-mail Burn Open
Adding color.
master*
0 0


File Edit Selection View Go Run Terminal Help
flower_03_sdf.glsl - Shadertoy - Visual Studio Code
EXPLORER
OPEN EDITORS
GROUP 1
flower_01_sdf.gl...
flower_02_sdf.gl...
flower_03_s... U
GROUP 2
Static GLSL Previ...
Static GLSL Previ...
SHADERTOY
isp-glass
imgs
references
buffer_test.glsl
glassball-01-basic.glsl
glassball-02-scatter....
glassball-03-scatter....
glassball-04-nonunif...
glassball-05-nonunif...
glassball-06-scatter_...
glassball-07-scatter....
glassball-08-scatter....
glassball-09-scatter....
glassball-10-emissio...
glassball-11-mix.glsl
glassball-12-mix.glsl
isp-life
dragonfly_1_glass.glsl
dragonfly_1_sdf.glsl
flower_01_glass.glsl
flower_01_sdf.glsl
flower_02_sdf.glsl
flower_03_sdf.g... U
fungi_1_sdf.glsl
primitives
ln_norm-ellipsoid.glsl
spiral
weather-abstraction
colorwheel.glsl
sdf_template.glsl
OUTLINE
TIMELINE
flower_01_sdf.glsl
flower_02_sdf.glsl
flower_03_sdf.glsl U
isp-life > flower_03_sdf.glsl
4 mapFlower(vec3 p, bool col_required) {
//p += 0.04*sin(4.0*p.yzx)*cos(4.0*p.xyz)*sin(4.0*p.zxy);
p.y += 0.02*sin(8.0*p.z);
float r = length(p.xy), a = atan(p.y, p.x);
float x, y; vec3 q;
// petals
q = vec3(r*cossin(asin(0.999*sin(3.5*a-0.2*cos(4.0*r)*sin(5.0*a)+0.9))/3.5), p.z);
vec4 p0 = mapPetal(roty(-0.1)*(q-vec3(0.8,0,-0.12)), 0.45, -0.1, col_required);
q = vec3(r*cossin(asin(0.999*sin(3.5*a-0.2*sin(4.0*r)*cos(5.0*a)+0.0))/3.5), p.z);
vec4 p1 = mapPetal(roty(0.05)*(q-vec3(0.9,0,0)), 0.5, -0.2, col_required);
q = vec3(r*cossin(asin(0.999*sin(3.0*a-0.2*cos(4.0*r)*cos(3.0*a)-0.9))/3.0), p.z);
vec4 p2 = mapPetal(roty(0.1)*(q-vec3(0.9,0,0.1)), 0.55, -0.15, col_required);
vec4 petal = smin(smin(p0, p1, 0.01), p2, 0.01);
// disk
q = vec3(r*cossin(asin(0.98*sin(3.5*a))/3.5), p.z);
vec3 br = vec3(0.4, 0.3-0.2*exp(-sqr(2.0*(q.x-1.0))), 0.05);
vec4 d1 = vec4(0,0,0, sdEllipsoid(roty(0.2)*(q-vec3(0.2,0,-0.25)), br));
q = vec3(r*cossin(asin(0.8*sin(3.5*a))/3.5), p.z);
vec4 d2 = vec4(0,0,0, sdEllipsoid(q-vec3(0.05,0,-0.2), vec3(0.25,0.2,0.3)));
vec4 d3 = vec4(0,0,0, sdCapsule(q-vec3(0.05,0,0),0.45,0.08-0.03*sin(2.0*p.z)));
vec4 d4 = vec4(0,0,0, length(q-vec3(0.01,0.45))-0.06);
vec4 disk = smin(smin(d1, d2, 0.1), smin(d3, d4, 0.05), 0.1);
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
No problems have been detected in the workspace.
Static GLSL Preview
Static GLSL Preview
33 MS (3-1642)
11ca5e4acf20be9b783c91d71013e1f7.jpg
File Print E-mail Burn
#2-Paul-J.-Stankard,-Tea-Rose-Bouquet-wit...
File Print E-mail Burn Open
2021/11/10 Studying another flower. A lot of code copied from previous day's code.
Not so satisfied until this screenshot. I find it challenging to create the "blooming" of the petals.
master*
Ln 114, Col 53 Spaces: 4 UTF-8 CRLF GLSL


File Edit Selection View Go Run Terminal Help
Static GLSL Preview - Shadertoy - Visual Studio Code
EXPLORER
OPEN EDITORS
GROUP 1
flower_01_sdf.glsl
flower_02_sdf.glsl
flower_03_sdf.glsl U
GROUP 2
Static GLSL Previ...
Static GLSL Previ...
SHADERTOY
isp-glass
imgs
references
buffer_test.glsl
glassball-01-basic.glsl
glassball-02-scatter....
glassball-03-scatter....
glassball-04-nonunif...
glassball-05-nonunif...
glassball-06-scatter_...
glassball-07-scatter....
glassball-08-scatter....
glassball-09-scatter....
glassball-10-emissio...
glassball-11-mix.glsl
glassball-12-mix.glsl
isp-life
dragonfly_1_glass.glsl
dragonfly_1_sdf.glsl
flower_01_glass.glsl
flower_01_sdf.glsl
flower_02_sdf.glsl
flower_03_sdf.g... U
fungi_1_sdf.glsl
primitives
ln_norm-ellipsoid.glsl
spiral
weather-abstraction
colorwheel.glsl
sdf_template.glsl
OUTLINE
TIMELINE
flower_01_sdf.glsl
flower_02_sdf.glsl
flower_03_sdf.glsl U
isp-life > flower_03_sdf.glsl
// filaments
q = vec3(r*cossin(asin(0.999*sin(3.5*a+0.9))/3.5), p.z);
vec4 f1 = mapFilament(roty(-0.7-0.1*cos(4.0*a))*(q-vec3(0.2,0,0.0)), 0.8, col_r
q = vec3(r*cossin(asin(0.999*sin(4.0*a+1.5))/4.0), p.z);
vec4 f2 = mapFilament(roty(-0.8+0.1*sin(3.0*a))*(q-vec3(0.18,0,0.0)), 0.8, col_r
vec4 filament = smin(f1, f2, 0.01);
// disk
q = vec3(r*cossin(asin(0.98*sin(3.5*a-0.5))/3.5), p.z);
vec3 br = vec3(0.4, 0.3-0.2*exp(-sqr(2.0*(q.x-1.0))), 0.05);
vec4 d1 = vec4(0.4,0.35,0.0, sdEllipsoid(roty(0.2)*(q-vec3(0.2,0,-0.25)), br));
q = vec3(r*cossin(asin(0.8*sin(3.5*a))/3.5), p.z);
vec4 d2 = vec4(0.6,0.5,0.0, sdEllipsoid(q-vec3(0.05,0,-0.1), vec3(0.25,0.2,0.3)
vec4 d3 = vec4(0.9,0.8,0.0, sdCapsule(q-vec3(0.05,0,0),0.56,0.08-0.03*sin(2.0*p
vec4 d4 = vec4(0.95,0.95,0.6, length(q-vec3(0.01,0,0.56))-0.06); // stigma
vec4 disk = smin(smin(d1, d2, 0.1), smin(d3, d4, 0.05), 0.1);
// put them together
vec4 d = smin(cmin(petal, filament), disk, 0.01);
return d;
}
vec4 map(vec3 p, bool col_required) {
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
No problems have been detected in the workspace.
Static GLSL Preview
Static GLSL Preview
50 MS (2-127)
11ca5e4acf20be9b783c91d71013e1f7.jpg
#2-Paul-J.-Stankard,-Tea-Rose-Bouquet-wit...
File Print E-mail Burn Open
Finished modeling with color. Not so bad.
I feel this one has a more even use of space compared to the one on the previous day.
master*
0 0


fruit_01_sdf.glsl - Shadertoy - Visual Studio Code
flower_01_sdf.glsl
flower_02_sdf.glsl
flower_03_sdf.glsl
fruit_01_sdf.glsl
Static GLSL Preview
Static GLSL Preview
Static GLSL Preview
commodity-blueberry.jpg - Windows Photo...
glass-11.jpg - Windows Photo Viewer
File Print E-mail Burn Open
2021/11/11 Start studying fruit.
The color and texture in Paul's work is different from in a photograph, yet it looks realistic.


fruit_01_sdf.glsl - Shadertoy - Visual Studio Code
flower_01_sdf.glsl
flower_02_sdf.glsl
flower_03_sdf.glsl
fruit_01_sdf.glsl M
Static GLSL Preview
Static GLSL Preview
Static GLSL Preview
isp-life > fruit_01_sdf.glsl
0.05);
vec4 d = vec4(0.05,0.7,0.9, smax(
sdEllipsoid(q, vec3(1.15,1.15,1.0-0.4/(1.0+10.0*length(vec3(q.xy,0.2)))))
+ 0.02*sin(5.0*p.x)*sin(5.0*p.y)*sin(5.0*p.z),
bottom_hole, 0.02));
if (col_required) {
const vec3 c1 = vec3(0.15,0.25,0.4);
const vec3 c2 = vec3(0.3,0.45,0.6);
const vec3 c3 = vec3(0.85,0.75,0.85);
float t = dot(p, vec3(0.5,0.5,1)) + 0.8*SimplexNoise3D(1.5*p);
d.xyz = mix(mix(c1, c2, 0.5+0.5*tanh(1.0*t)), c3, 0.5+0.5*tanh(1.0*(t-1.0)));
t = 0.4*GradientNoise2D(vec2(6.0*a,3.0*b))-4.0*(b/PI-0.5)+0.5;
d.xyz *= smootherstep(0.7+0.3*tanh(1.2*t));
}
d = smin(d, vec4(0.5*vec3(0.1,0.12,0.15),
sdTorus(q-vec3(0,0,-0.92), 0.33, 0.05)),
0.05);
q = vec3(length(vec2(r,0.02))*cossin(asin(0.999*sin(2.5*a-0.5))/2.5), p.z);
d = smin(d, vec4(0.5*vec3(0.25,0.3,0.4),
smax(
sdLnNormEllipsoid(roty(-1.1)*(q-vec3(0.2+0.2/(1.0+10.0*length(vec2(q.y,(
bottom_hole, 0.02)),
0.08);
if (col_required) {
d.xyz *= 0.2+0.8*smootherstep(10.0*sdTorus(p-vec3(0,0,-0.78),0.18,0.08));
d.xyz = saturate(d.xyz * vec3(0.8,1.1,1.3));
}
d = smin(d, vec4(0.75,0.75,0.6,
PROBLEMS
OUTPUT
DEBUG CONSOLE
TERMINAL
No problems have been detected in the workspace.
2021/11/13 Use gradient noise instead of cheap sinusoidal function for the texture of the blueberry to make it look more natural.
commodity-blueberry.jpg - Windows Photo...
File
Print
E-mail
Burn
Open
#2-Paul-J.-Stankard,-Tea-Rose-Bouquet-wit...
master*

File Edit Selection View Go Run Terminal Help — Static GLSL Preview - Shadertoy - Visual Studio Code

EXPLORER

OPEN EDITORS
GROUP 1
flower_02_sdf.gl...
flower_03_sdf.gl...
fruit_01_sd... M
fruit_02_sdf... U
GROUP 2
Static GLSL Previ...
Static GLSL Previ...

SHADERTOY
glassball-01-basic.glsl
glassball-02-scatter....
glassball-03-scatter....
glassball-04-nonunif...
glassball-05-nonunif...
glassball-06-scatter_...
glassball-07-scatter....
glassball-08-scatter....
glassball-09-scatter....
glassball-10-emissio...
glassball-11-mix.glsl
glassball-12-mix.glsl
isp-life
dragonfly_1_glass.glsl
dragonfly_1_sdf.glsl
flower_01_glass.glsl
flower_01_sdf.glsl
flower_02_sdf.glsl
flower_03_sdf.glsl
fruit_01_sdf.glsl M
fruit_02_sdf.glsl U
fungi_1_sdf.glsl
primitives
ln_norm-ellipsoid.glsl
spiral
weather-abstraction
colorwheel.glsl
sdf_template.glsl
sdf_visualizer_2.glsl

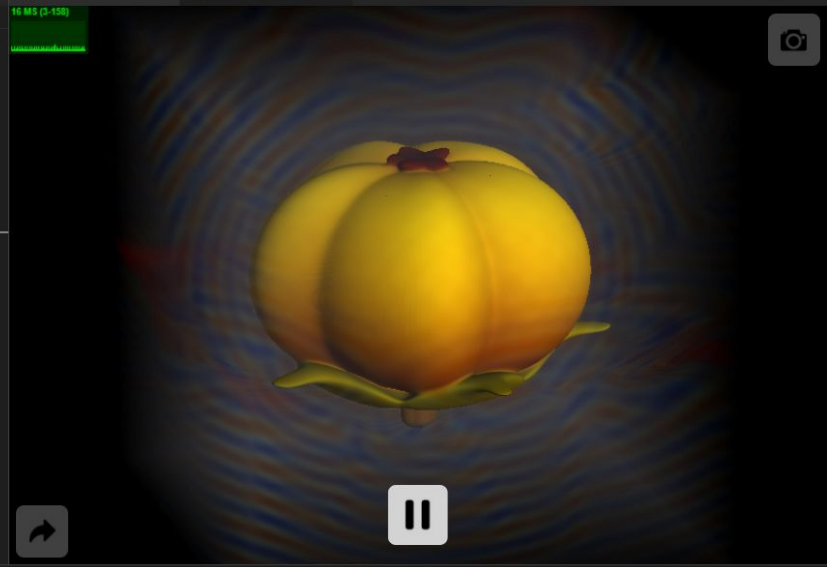
OUTLINE
TIMELINE

flower_02_sdf.glsl | flower_03_sdf.glsl | fruit_01_sdf.glsl M | fruit_02_sdf.glsl U

isp-life > fruit_02_sdf.glsl

```
99          fruit.xyz = mix(vec3(0.55,0.2,0.0),vec3(0.95,0.85,0.0),
100             smoothstep(0.4*(q.z+1.0*(r-0.9)-0.0+smax(q.z-1.2,0.0,0.1))
101                 +0.012*sin(20.0*p.x)*sin(20.0*p.y)*sin(20.0*p.z))
102         );
103     }
104     q = vec3(r*cossin(asin(0.99*sin(2.5*a+0.8))/2.5), p.z);
105     fruit = smin(fruit, vec4(  // hair
106         mix(vec3(0.1,0.02,0.06),vec3(0.25,0.02,0.0),smoothstep(r/0.3)),
107         sdEllipsoid(roty(0.2-0.05*cos(3.0*a))*(q-vec3(0.08,0,1.54)), vec3(0.2+0.03*
108     // disk
109     q = vec3(r*cossin(asin(0.98*sin(2.5*a-1.2))/2.5), p.z);
110     q -= vec3(0.2,0,0);
111     vec3 br;
112     br.x = 1.0+0.05*sin(3.0*a);
113     br.y = 1.2*(0.3-0.2*exp(-sqr(2.0*(q.x-1.0)))+0.2*exp(-sqr(4.0*(q.x-0.7))));
114     br.z = 0.1*pow(smax(br.y,0.0,0.1),0.2);
115     br *= 1.2;
116     q = roty(0.3)*(q-vec3(0.2,0,-0.25));
117     q.z += 0.05*sin(6.0*q.x);
118     vec4 d1 = vec4(0.4,0.35,0.0, sdEllipsoid(q, br));  // sepals
119     q = vec3(r*cossin(asin(0.95*sin(2.5*a-0.9))/2.5), p.z);
120     vec4 d2 = vec4(0.25,0.15,0.05, sdCapsule(q-vec3(0.05,0,-0.6), 1.0, 0.1));  // s
121     vec4 disk = smin(d1, d2, 0.1);
122     // put them together
123     vec4 d = smin(disk, fruit, 0.05);
124     return d;
125 }
126
```

Static GLSL Preview | Static GLSL Preview



PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL

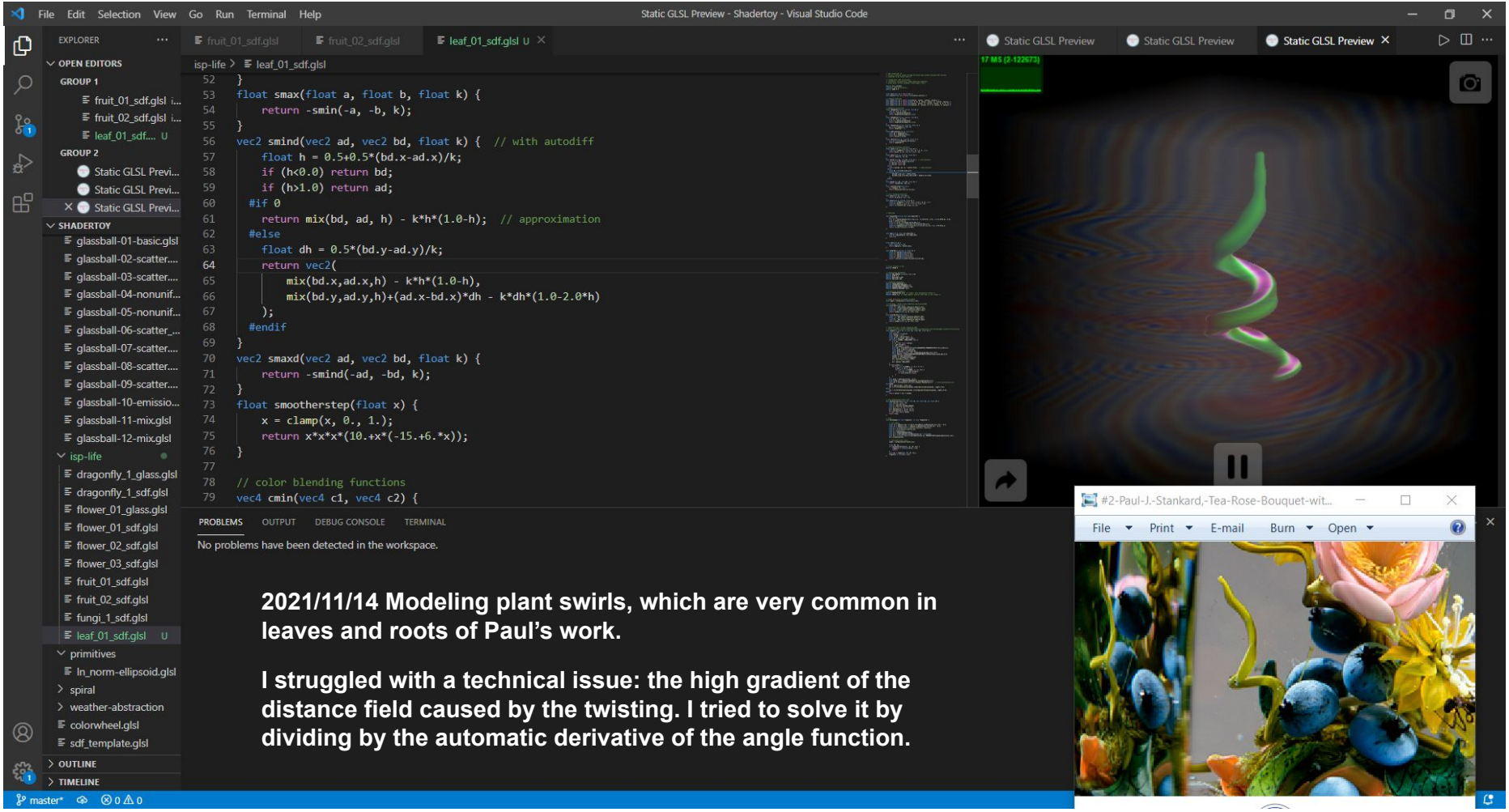
No problems have been detected in the workspace.

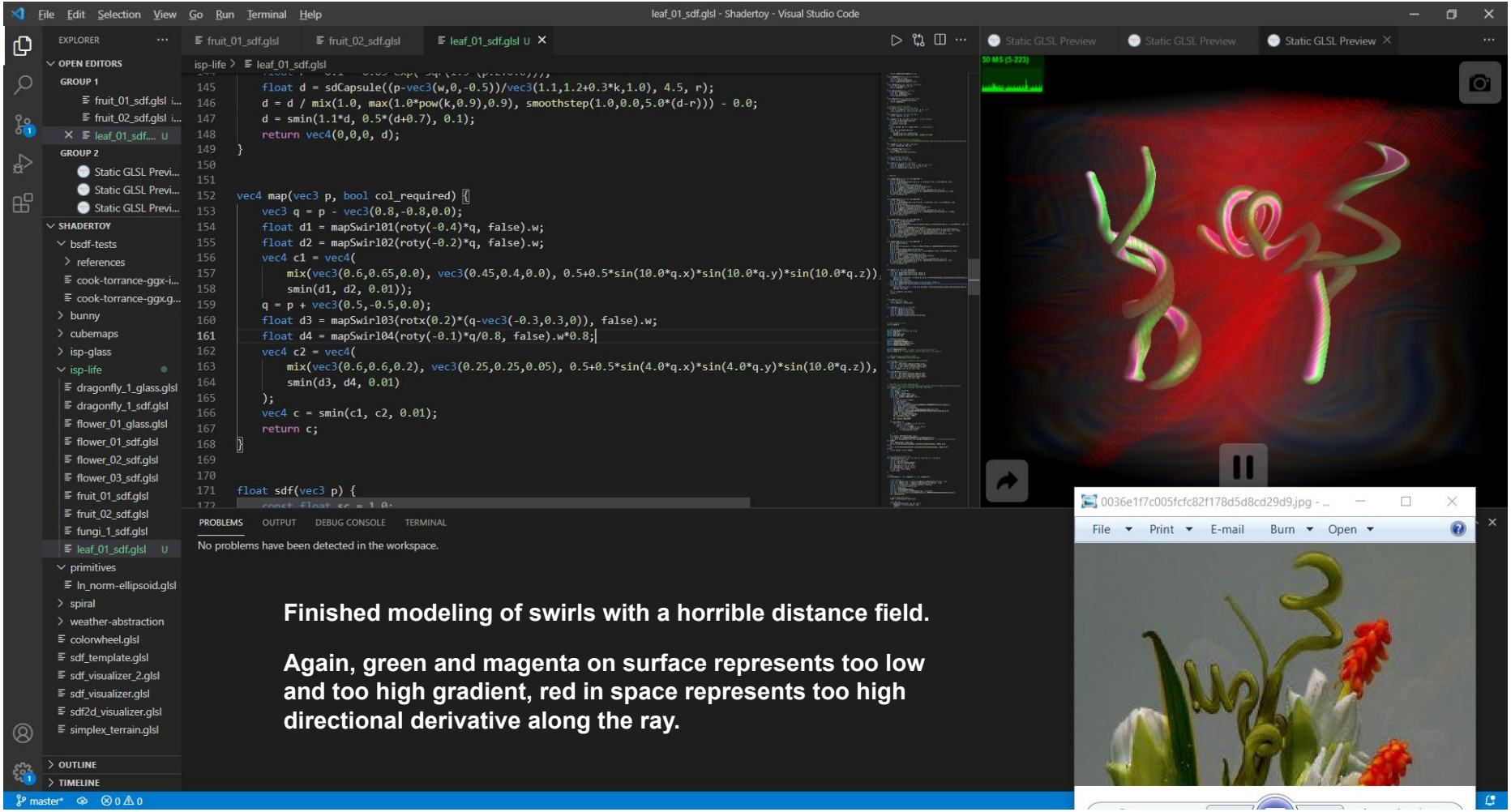
Study another fruit-like plant structure.

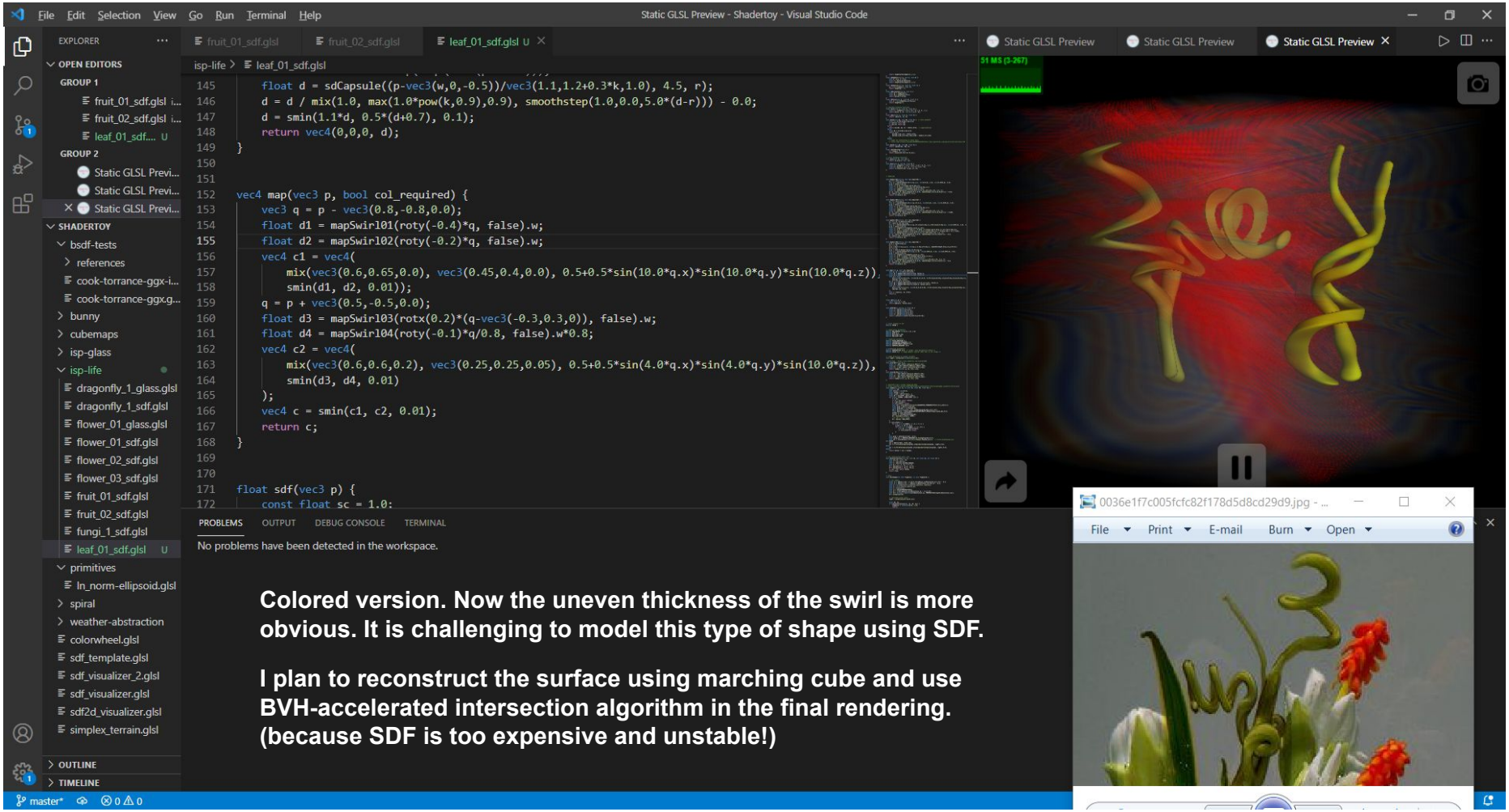
11ca5e4acf20be9b783c91d71013e1f7.jpg - ...

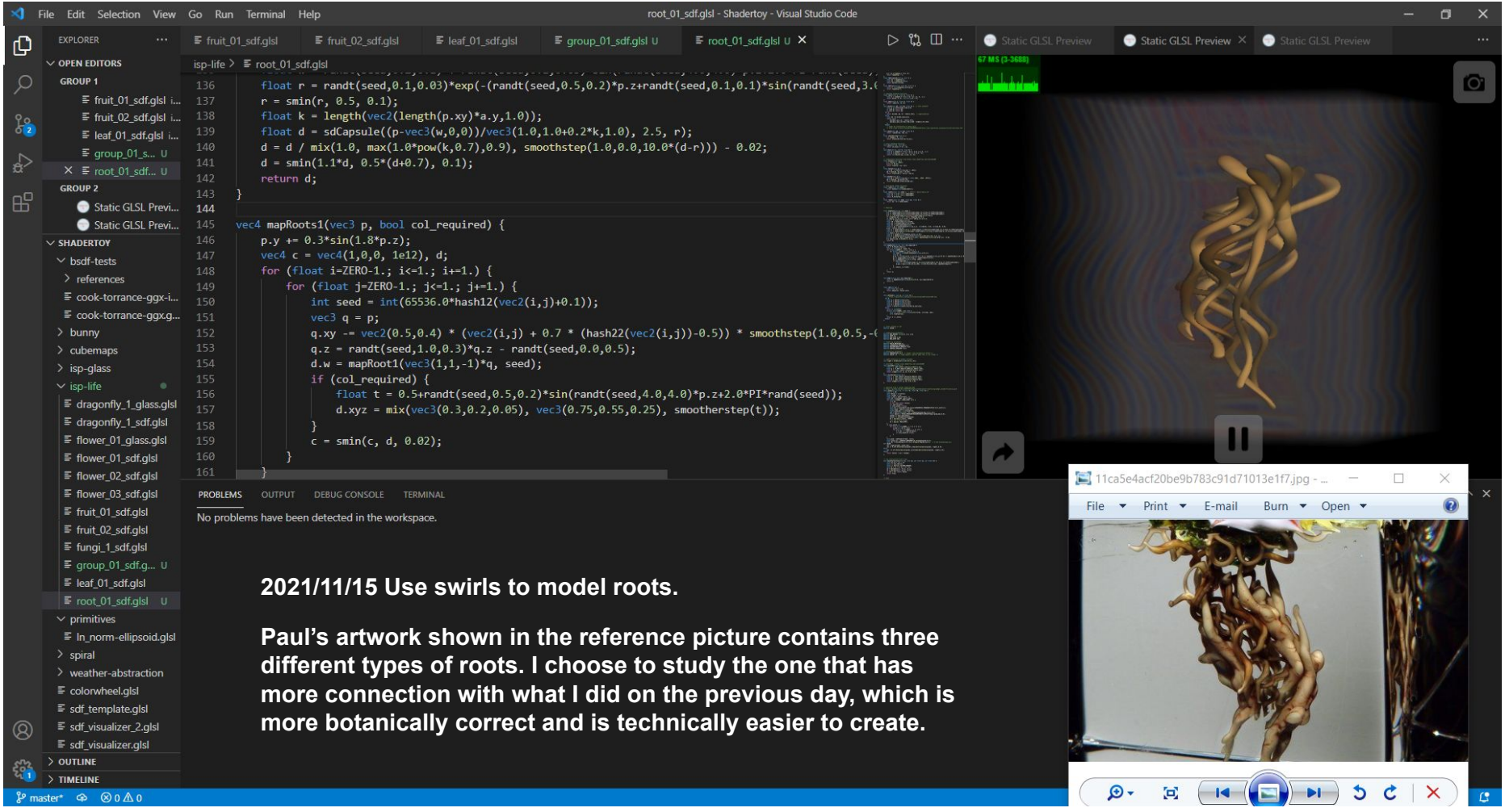
File Print E-mail Burn Open

master*+ ⊗ 0 ⚠ 0


File Edit Selection View Go Run Terminal Help
Static GLSL Preview - Shadertoy - Visual Studio Code
EXPLORER
OPEN EDITORS
GROUP 1
fruit_01_sdf.glsl
fruit_02_sdf.glsl
leaf_01_sdf.... U
GROUP 2
Static GLSL Previ...
Static GLSL Previ...
Static GLSL Previ...
SHADERTOY
glassball-01-basic.glsl
glassball-02-scatter....
glassball-03-scatter....
glassball-04-nonunif...
glassball-05-nonunif...
glassball-06-scatter_...
glassball-07-scatter....
glassball-08-scatter....
glassball-09-scatter....
glassball-10-emissio...
glassball-11-mix.glsl
glassball-12-mix.glsl
isp-life
dragonfly_1_glass.glsl
dragonfly_1_sdf.glsl
flower_01_glass.glsl
flower_01_sdf.glsl
flower_02_sdf.glsl
flower_03_sdf.glsl
fruit_01_sdf.glsl
fruit_02_sdf.glsl
fungi_1_sdf.glsl
leaf_01_sdf.glsl U
primitives
ln_norm-ellipsoid.glsl
spiral
weather-abstraction
colorwheel.glsl
sdf_template.glsl
OUTLINE
TIMELINE
fruit_01_sdf.glsl
fruit_02_sdf.glsl
leaf_01_sdf.glsl U
isp-life > leaf_01_sdf.glsl
52 }
53 float smax(float a, float b, float k) {
54 return -smin(-a, -b, k);
55 }
56 vec2 smind(vec2 ad, vec2 bd, float k) { // with autodiff
57 float h = 0.5+0.5*(bd.x-ad.x)/k;
58 if (h<0.0) return bd;
59 if (h>1.0) return ad;
60 #if 0
61 return mix(bd, ad, h) - k*h*(1.0-h); // approximation
62 #else
63 float dh = 0.5*(bd.y-ad.y)/k;
64 return vec2(
65 mix(bd.x,ad.x,h) - k*h*(1.0-h),
66 mix(bd.y,ad.y,h)+(ad.x-bd.x)*dh - k*dh*(1.0-2.0*h)
67);
68 #endif
69 }
70 vec2 smaxd(vec2 ad, vec2 bd, float k) {
71 return -smind(-ad, -bd, k);
72 }
73 float smootherstep(float x) {
74 x = clamp(x, 0., 1.);
75 return x*x*x*(10.+x*(-15.+6.*x));
76 }
77
78 // color blending functions
79 vec4 cmin(vec4 c1, vec4 c2) {
Static GLSL Preview
Static GLSL Preview
Static GLSL Preview
17 MS (2-122673)
PROBLEMS
OUTPUT
DEBUG CONSOLE
TERMINAL
No problems have been detected in the workspace.
2021/11/14 Modeling plant swirls, which are very common in leaves and roots of Paul's work.
I struggled with a technical issue: the high gradient of the distance field caused by the twisting. I tried to solve it by dividing by the automatic derivative of the angle function.
#2-Paul-J.-Stankard,-Tea-Rose-Bouquet-wit...
File Print E-mail Burn Open
master*
0 0

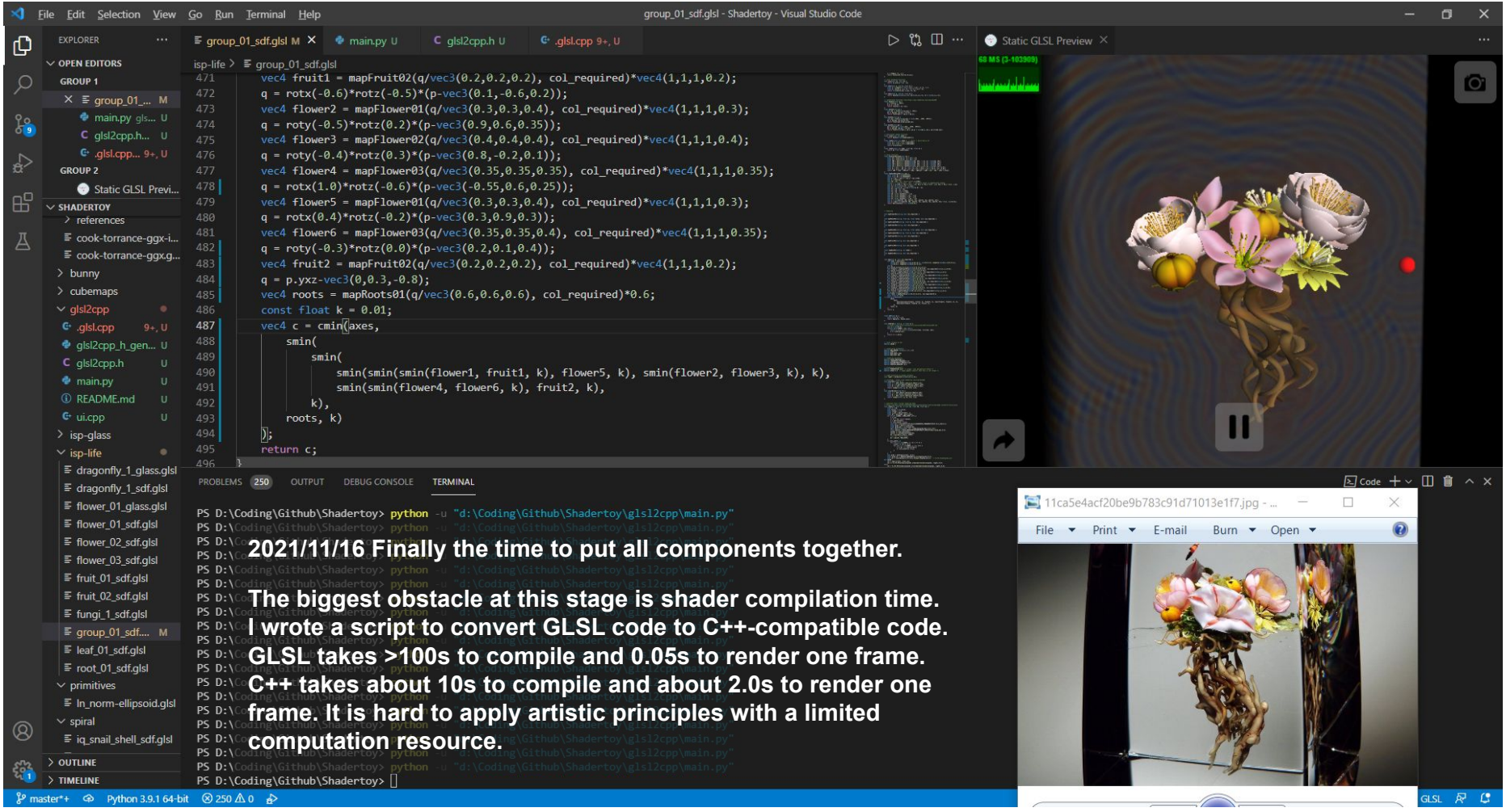

File Edit Selection View Go Run Terminal Help
leaf_01_sdf.glsl - Shadertoy - Visual Studio Code
fruit_01_sdf.glsl
fruit_02_sdf.glsl
leaf_01_sdf.glsl U
Static GLSL Preview
Static GLSL Preview
Static GLSL Preview
isp-life > leaf_01_sdf.glsl
float d = sdCapsule((p-vec3(w,0,-0.5))/vec3(1.1,1.2+0.3*k,1.0), 4.5, r);
d = d / mix(1.0, max(1.0*pow(k,0.9),0.9), smoothstep(1.0,0.0,5.0*(d-r))) - 0.0;
d = smin(1.1*d, 0.5*(d+0.7), 0.1);
return vec4(0,0,0, d);
}
vec4 map(vec3 p, bool col_required) {
vec3 q = p - vec3(0.8,-0.8,0.0);
float d1 = mapSwirl01(roty(-0.4)*q, false).w;
float d2 = mapSwirl02(roty(-0.2)*q, false).w;
vec4 c1 = vec4(
mix(vec3(0.6,0.65,0.0), vec3(0.45,0.4,0.0), 0.5+0.5*sin(10.0*q.x)*sin(10.0*q.y)*sin(10.0*q.z)),
smin(d1, d2, 0.01));
q = p + vec3(0.5,-0.5,0.0);
float d3 = mapSwirl03(rotx(0.2)*(q-vec3(-0.3,0.3,0)), false).w;
float d4 = mapSwirl04(roty(-0.1)*q/0.8, false).w*0.8;
vec4 c2 = vec4(
mix(vec3(0.6,0.6,0.2), vec3(0.25,0.25,0.05), 0.5+0.5*sin(4.0*q.x)*sin(4.0*q.y)*sin(10.0*q.z)),
smin(d3, d4, 0.01)
);
vec4 c = smin(c1, c2, 0.01);
return c;
}
float sdf(vec3 p) {
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
No problems have been detected in the workspace.
0036e1f7c005fcfc82f178d5d8cd29d9.jpg - ...
File Print E-mail Burn Open
Finished modeling of swirls with a horrible distance field.
Again, green and magenta on surface represents too low and too high gradient, red in space represents too high directional derivative along the ray.

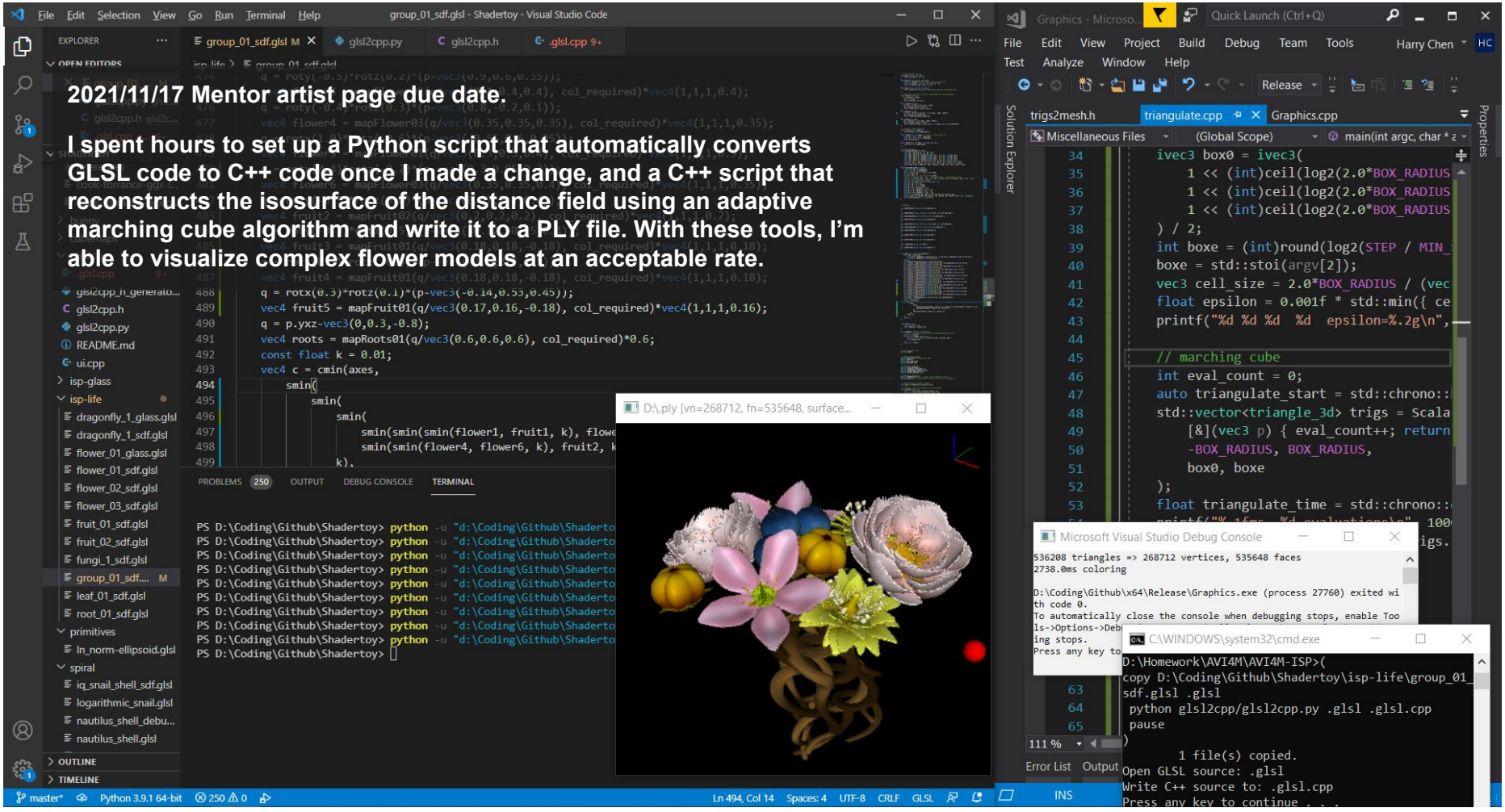

File Edit Selection View Go Run Terminal Help
Static GLSL Preview - Shadertoy - Visual Studio Code
EXPLORER
OPEN EDITORS
GROUP 1
fruit_01_sdf.glsl
fruit_02_sdf.glsl
leaf_01_sdf.glsl U
GROUP 2
Static GLSL Previ...
Static GLSL Previ...
Static GLSL Previ...
SHADERTOY
bsdf-tests
references
cook-torrance-ggx-i...
cook-torrance-ggx.g...
bunny
cubemaps
isp-glass
isp-life
dragonfly_1_glass.glsl
dragonfly_1_sdf.glsl
flower_01_glass.glsl
flower_01_sdf.glsl
flower_02_sdf.glsl
flower_03_sdf.glsl
fruit_01_sdf.glsl
fruit_02_sdf.glsl
fungi_1_sdf.glsl
leaf_01_sdf.glsl U
primitives
ln_norm-ellipsoid.glsl
spiral
weather-abstraction
colorwheel.glsl
sdf_template.glsl
sdf_visualizer_2.glsl
sdf_visualizer.glsl
sdf2d_visualizer.glsl
simplex_terrain.glsl
OUTLINE
TIMELINE
fruit_01_sdf.glsl
fruit_02_sdf.glsl
leaf_01_sdf.glsl U
isp-life > leaf_01_sdf.glsl
145 float d = sdCapsule((p-vec3(w,0,-0.5))/vec3(1.1,1.2+0.3*k,1.0), 4.5, r);
146 d = d / mix(1.0, max(1.0*pow(k,0.9),0.9), smoothstep(1.0,0.0,5.0*(d-r))) - 0.0;
147 d = smin(1.1*d, 0.5*(d+0.7), 0.1);
148 return vec4(0,0,0, d);
149 }
150
151
152 vec4 map(vec3 p, bool col_required) {
153 vec3 q = p - vec3(0.8,-0.8,0.0);
154 float d1 = mapSwirl01(roty(-0.4)*q, false).w;
155 float d2 = mapSwirl02(roty(-0.2)*q, false).w;
156 vec4 c1 = vec4(
157 mix(vec3(0.6,0.65,0.0), vec3(0.45,0.4,0.0), 0.5+0.5*sin(10.0*q.x)*sin(10.0*q.y)*sin(10.0*q.z)),
158 smin(d1, d2, 0.01));
159 q = p + vec3(0.5,-0.5,0.0);
160 float d3 = mapSwirl03(rotx(0.2)*(q-vec3(-0.3,0.3,0)), false).w;
161 float d4 = mapSwirl04(roty(-0.1)*q/0.8, false).w*0.8;
162 vec4 c2 = vec4(
163 mix(vec3(0.6,0.6,0.2), vec3(0.25,0.25,0.05), 0.5+0.5*sin(4.0*q.x)*sin(4.0*q.y)*sin(10.0*q.z)),
164 smin(d3, d4, 0.01)
165);
166 vec4 c = smin(c1, c2, 0.01);
167 return c;
168 }
169
170
171 float sdf(vec3 p) {
172 const float sc = 1.0;
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
No problems have been detected in the workspace.
Static GLSL Preview
Static GLSL Preview
Static GLSL Preview
0036e1f7c005fcfc82f178d5d8cd29d9.jpg - ...
File Print E-mail Burn Open
Colored version. Now the uneven thickness of the swirl is more obvious. It is challenging to model this type of shape using SDF.
I plan to reconstruct the surface using marching cube and use BVH-accelerated intersection algorithm in the final rendering. (because SDF is too expensive and unstable!)
master*
0 0

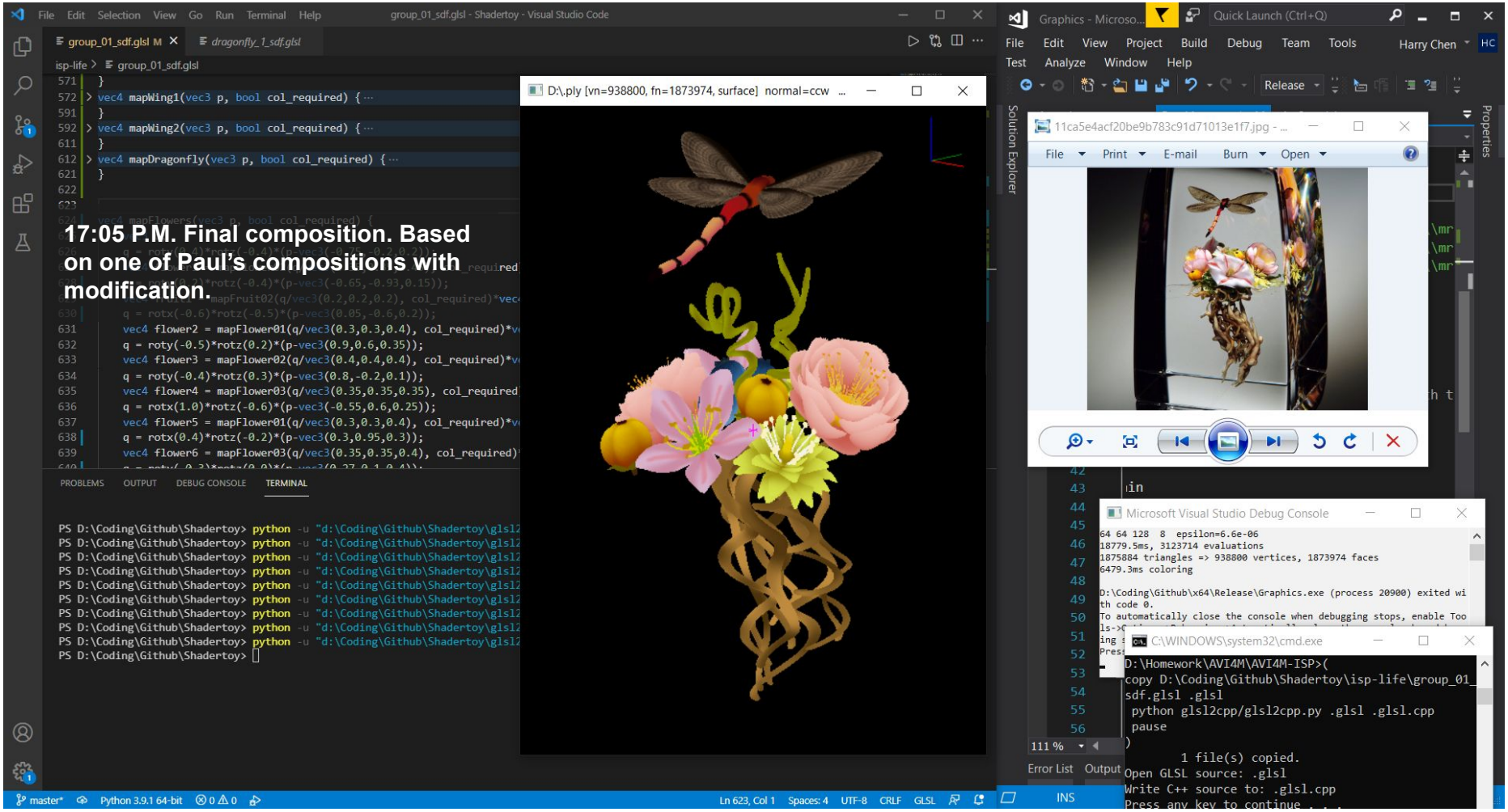


2021/11/15 Use swirls to model roots.

Paul's artwork shown in the reference picture contains three different types of roots. I choose to study the one that has more connection with what I did on the previous day, which is more botanically correct and is technically easier to create.


File Edit Selection View Go Run Terminal Help
group_01_sdf.glsl - Shadertoy - Visual Studio Code
EXPLORER
OPEN EDITORS
GROUP 1
GROUP 2
SHADERTOY
group_01_sdf.glsl M
main.py U
glsl2cpp.h U
.glsl.cpp 9+, U
Static GLSL Preview
isp-life > group_01_sdf.glsl
vec4 fruit1 = mapFruit02(q/vec3(0.2,0.2,0.2), col_required)*vec4(1,1,1,0.2);
q = rotx(-0.6)*rotz(-0.5)*(p-vec3(0.1,-0.6,0.2));
vec4 flower2 = mapFlower01(q/vec3(0.3,0.3,0.4), col_required)*vec4(1,1,1,0.3);
q = roty(-0.5)*rotz(0.2)*(p-vec3(0.9,0.6,0.35));
vec4 flower3 = mapFlower02(q/vec3(0.4,0.4,0.4), col_required)*vec4(1,1,1,0.4);
q = roty(-0.4)*rotz(0.3)*(p-vec3(0.8,-0.2,0.1));
vec4 flower4 = mapFlower03(q/vec3(0.35,0.35,0.35), col_required)*vec4(1,1,1,0.35);
q = rotx(1.0)*rotz(-0.6)*(p-vec3(-0.55,0.6,0.25));
vec4 flower5 = mapFlower01(q/vec3(0.3,0.3,0.4), col_required)*vec4(1,1,1,0.3);
q = rotx(0.4)*rotz(-0.2)*(p-vec3(0.3,0.9,0.3));
vec4 flower6 = mapFlower03(q/vec3(0.35,0.35,0.4), col_required)*vec4(1,1,1,0.35);
q = roty(-0.3)*rotz(0.0)*(p-vec3(0.2,0.1,0.4));
vec4 fruit2 = mapFruit02(q/vec3(0.2,0.2,0.2), col_required)*vec4(1,1,1,0.2);
q = p.yxz-vec3(0,0.3,-0.8);
vec4 roots = mapRoots01(q/vec3(0.6,0.6,0.6), col_required)*0.6;
const float k = 0.01;
vec4 c = cmin(axes,
smin(
smin(
smin(smin(smin(flower1, fruit1, k), flower5, k), smin(flower2, flower3, k), k),
smin(smin(flower4, flower6, k), fruit2, k),
k),
roots, k)
);
return c;
PROBLEMS 250
OUTPUT
DEBUG CONSOLE
TERMINAL
PS D:\Coding\Github\Shadertoy> python -u "d:\Coding\Github\Shadertoy\glsl2cpp\main.py"
2021/11/16 Finally the time to put all components together.
The biggest obstacle at this stage is shader compilation time.
I wrote a script to convert GLSL code to C++-compatible code.
GLSL takes >100s to compile and 0.05s to render one frame.
C++ takes about 10s to compile and about 2.0s to render one
frame. It is hard to apply artistic principles with a limited
computation resource.
11ca5e4acf20be9b783c91d71013e1f7.jpg - ...
File Print E-mail Burn Open
master*+ Python 3.9.1 64-bit 250 0
GLSL

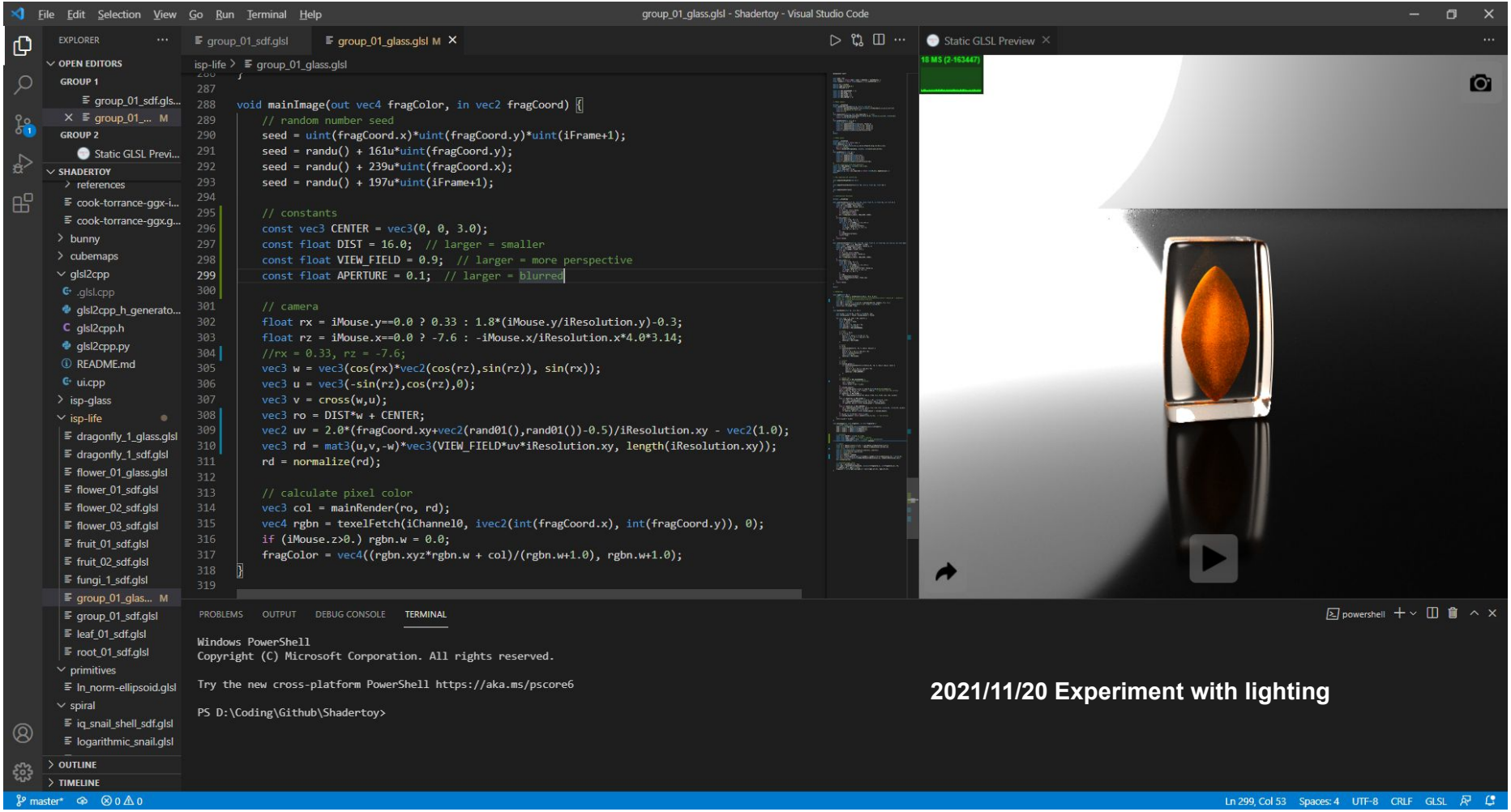

2021/11/17 Mentor artist page due date.
I spent hours to set up a Python script that automatically converts GLSL code to C++ code once I made a change, and a C++ script that reconstructs the isosurface of the distance field using an adaptive marching cube algorithm and write it to a PLY file. With these tools, I'm able to visualize complex flower models at an acceptable rate.
group_01_sdf.glsl - Shadertoy - Visual Studio Code
D:\.ply [vn=268712, fn=535648, surface...
Microsoft Visual Studio Debug Console
536208 triangles => 268712 vertices, 535648 faces
2738.0ms coloring
C:\WINDOWS\system32\cmd.exe
1 file(s) copied.
Open GLSL source: .glsl
Write C++ source to: .glsl.cpp
Press any key to continue . . .


group_01_sdf.glsl - Shadertoy - Visual Studio Code
group_01_sdf.glsl M
dragonfly_1_sdf.glsl
isp-life > group_01_sdf.glsl
vec4 mapWing1(vec3 p, bool col_required) {
vec4 mapWing2(vec3 p, bool col_required) {
vec4 mapDragonfly(vec3 p, bool col_required) {
17:05 P.M. Final composition. Based on one of Paul's compositions with modification.
D:\.ply [vn=938800, fn=1873974, surface] normal=ccw
11ca5e4acf20be9b783c91d71013e1f7.jpg
File Print E-mail Burn Open
Microsoft Visual Studio Debug Console
64 64 128 8 epsilon=6.6e-06
18779.5ms, 3123714 evaluations
1875884 triangles => 938800 vertices, 1873974 faces
6479.3ms coloring
D:\Coding\Github\x64\Release\Graphics.exe (process 20900) exited with code 0.
To automatically close the console when debugging stops, enable Too
C:\WINDOWS\system32\cmd.exe
D:\Homework\AVI4M\AVI4M-ISP>(
copy D:\Coding\Github\Shadertoy\isp-life\group_01_sdf.glsl .glsl
python glsl2cpp/glsl2cpp.py .glsl .glsl.cpp
pause
)
1 file(s) copied.
Open GLSL source: .glsl
Write C++ source to: .glsl.cpp
Press any key to continue . . .
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
PS D:\Coding\Github\Shadertoy> python -u "d:\Coding\Github\Shadertoy\gls12
Graphics - Microso...
Quick Launch (Ctrl+Q)
File Edit View Project Build Debug Team Tools Test Analyze Window Help
Harry Chen
Release
Solution Explorer
Properties
Error List Output
111 %
master* Python 3.9.1 64-bit Ln 623, Col 1 Spaces: 4 UTF-8 CRLF GLSL
INS

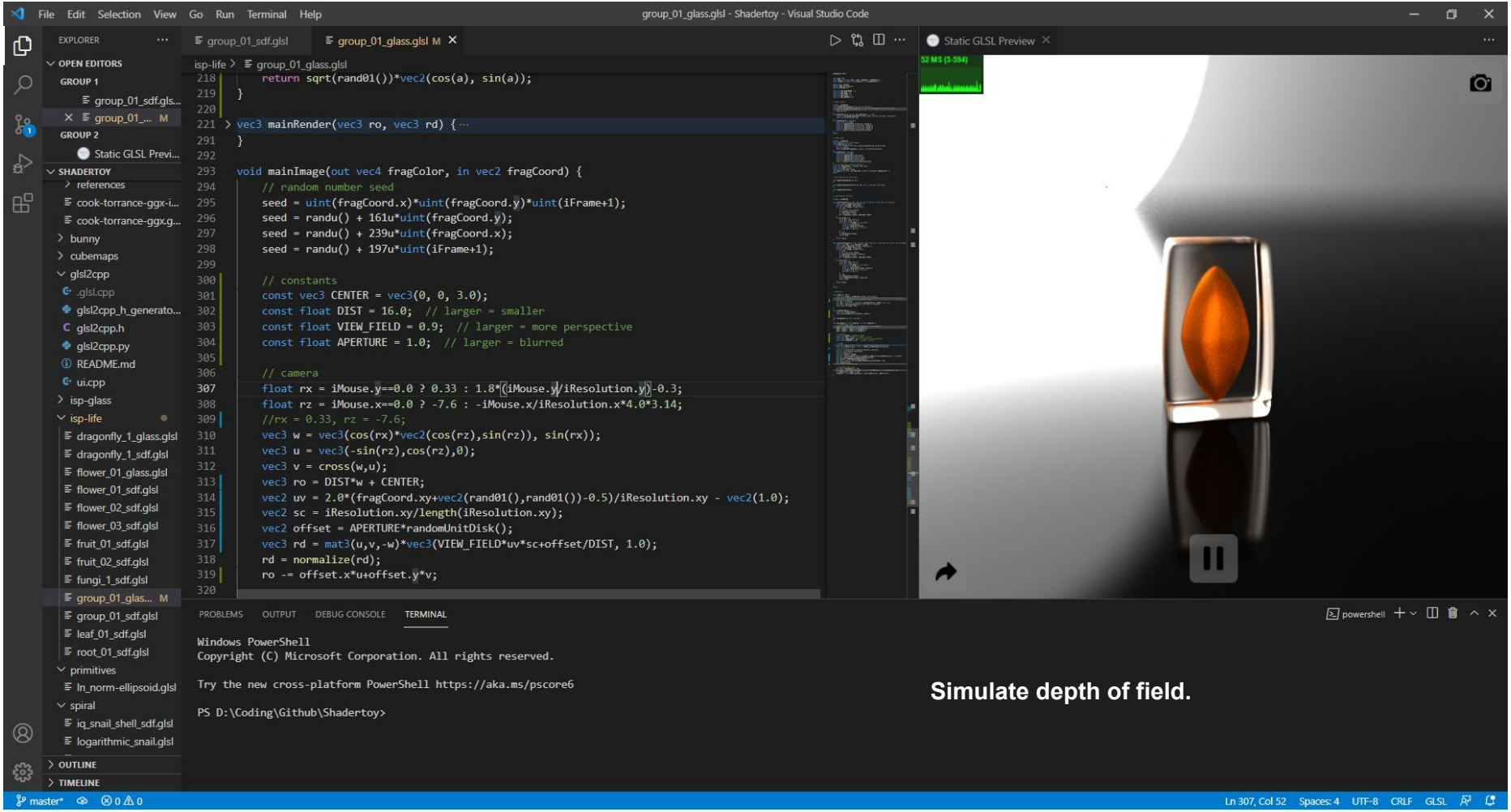
23:54 P.M. First full-resolution path-traced rendering.

I used Bounding Volume Hierarchy (BVH) to accelerate ray-surface intersection.

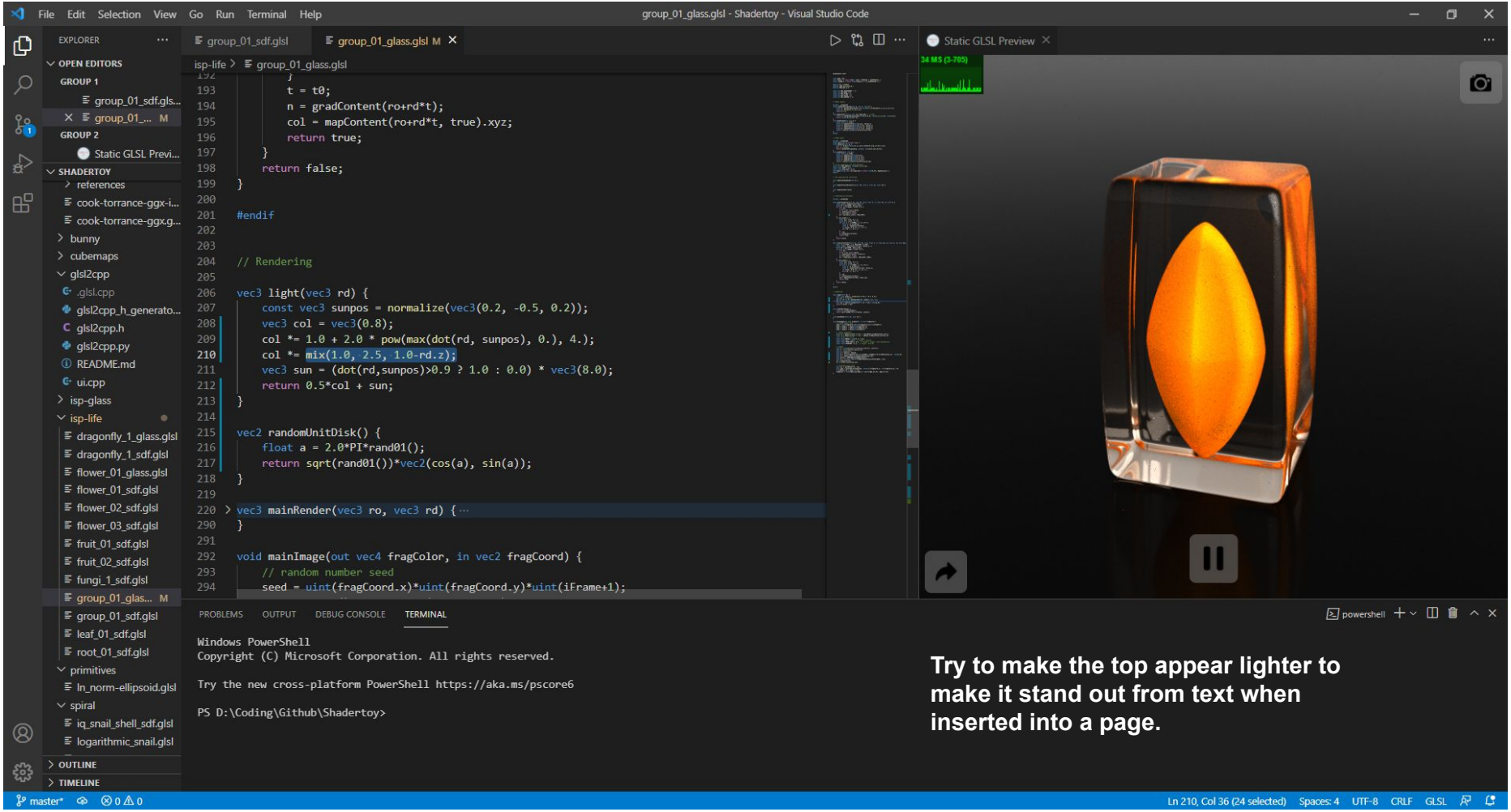
I didn’t have enough time to experiment with surface and lighting. I observed in Paul’s work that there is something light just behind the glass that makes the subject stand out, and there is possibly a depth of field. I may do further experimentations in the future.



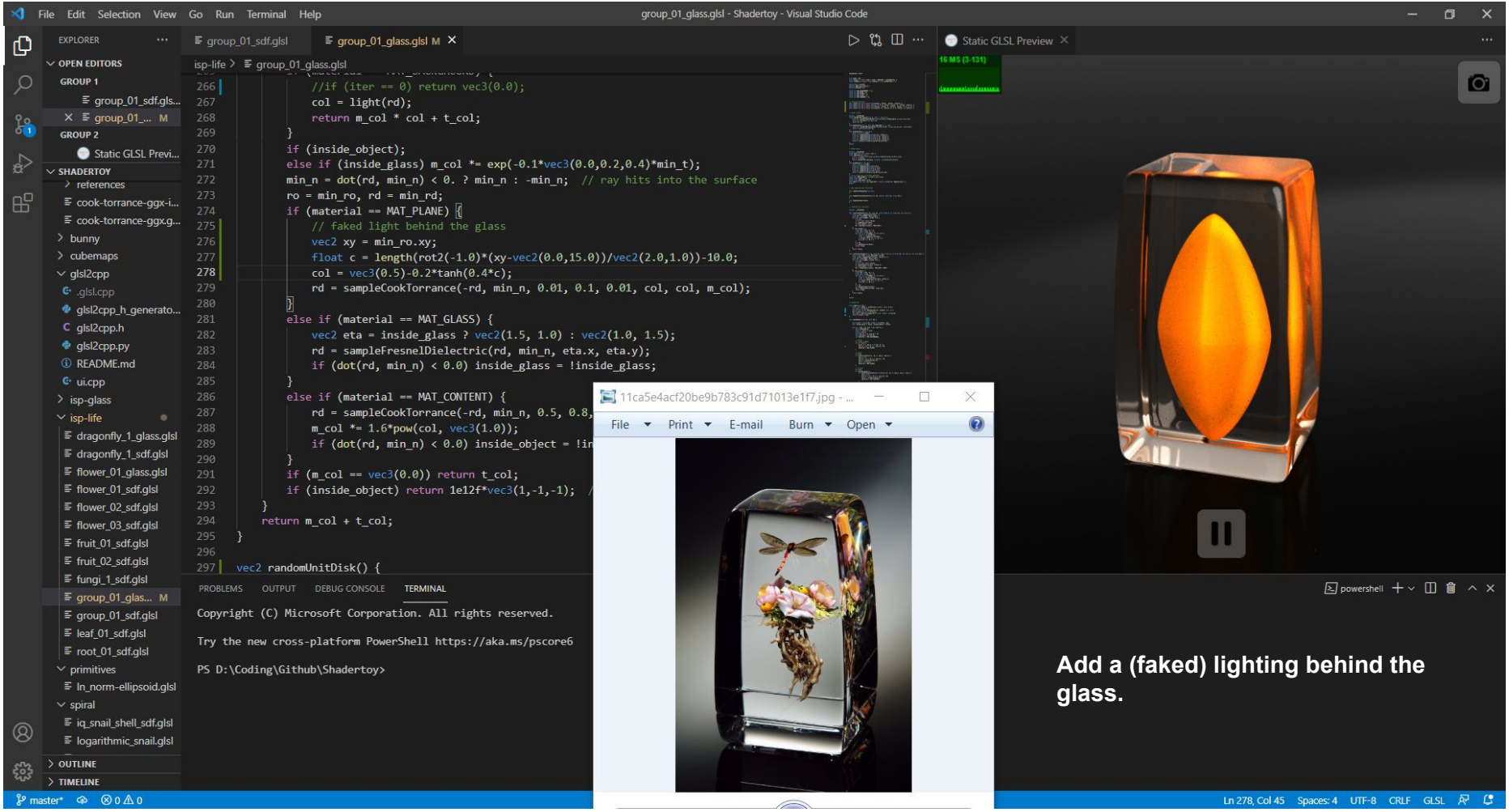
2021/11/20 Experiment with lighting



Simulate depth of field.



Try to make the top appear lighter to make it stand out from text when inserted into a page.

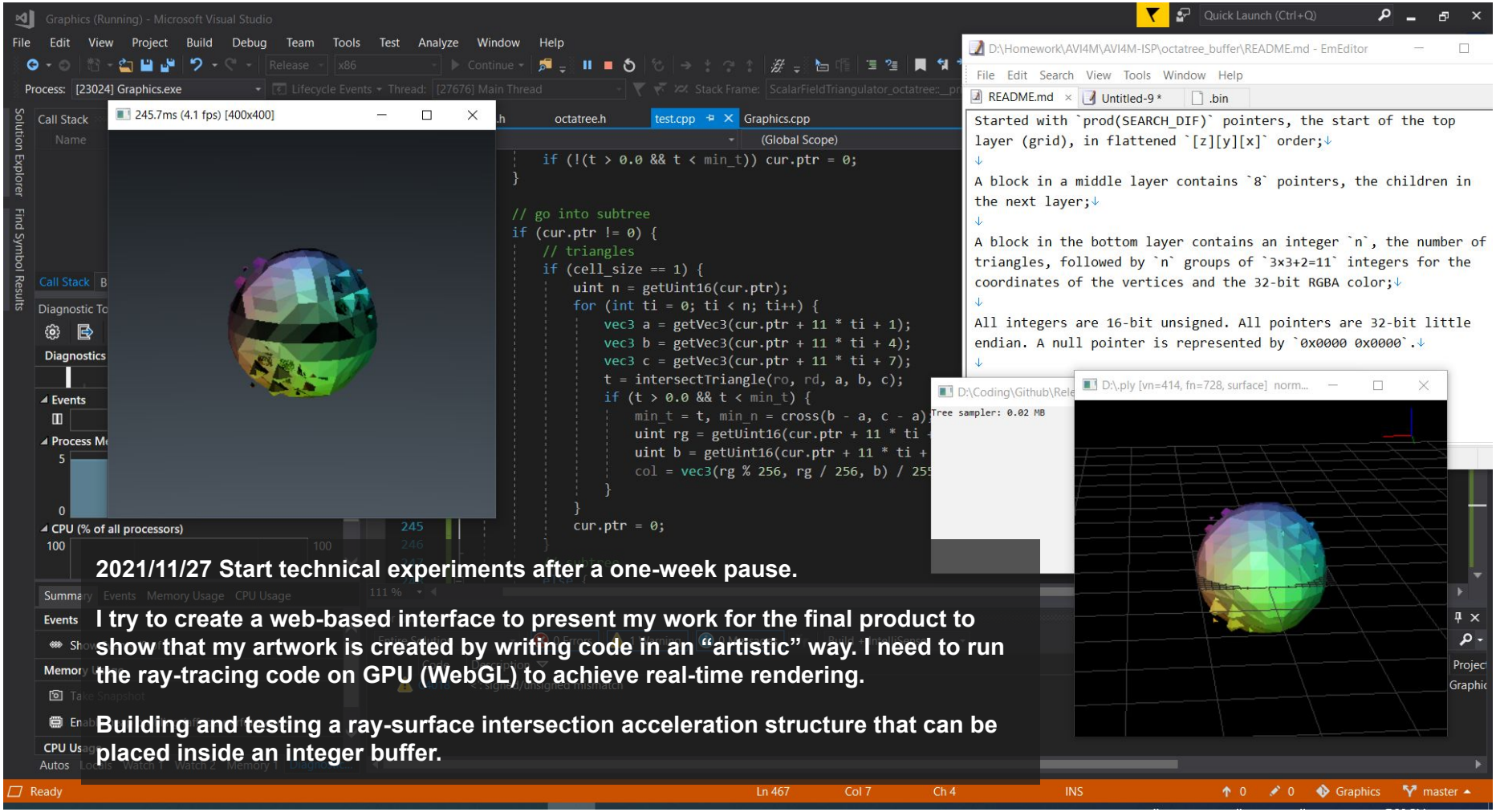

File Edit Selection View Go Run Terminal Help
group_01_glass.glsl - Shadertoy - Visual Studio Code
EXPLORER
OPEN EDITORS
GROUP 1
group_01_sdf.gls...
group_01_... M
GROUP 2
Static GLSL Previ...
SHADERTOY
references
cook-torrance-ggx-i...
cook-torrance-ggx.g...
bunny
cubemaps
glsl2cpp
.glsl.cpp
glsl2cpp_h_generato...
glsl2cpp.h
glsl2cpp.py
README.md
ui.cpp
isp-glass
isp-life
dragonfly_1_glass.glsl
dragonfly_1_sdf.glsl
flower_01_glass.glsl
flower_01_sdf.glsl
flower_02_sdf.glsl
flower_03_sdf.glsl
fruit_01_sdf.glsl
fruit_02_sdf.glsl
fungi_1_sdf.glsl
group_01_glas... M
group_01_sdf.glsl
leaf_01_sdf.glsl
root_01_sdf.glsl
primitives
ln_norm-ellipsoid.glsl
spiral
iq_snail_shell_sdf.glsl
logarithmic_snail.glsl
OUTLINE
TIMELINE
group_01_sdf.glsl
group_01_glass.glsl M
isp-life > group_01_glass.glsl
266 //if (iter == 0) return vec3(0.0);
267 col = light(rd);
268 return m_col * col + t_col;
269 }
270 if (inside_object);
271 else if (inside_glass) m_col *= exp(-0.1*vec3(0.0,0.2,0.4)*min_t);
272 min_n = dot(rd, min_n) < 0. ? min_n : -min_n; // ray hits into the surface
273 ro = min_ro, rd = min_rd;
274 if (material == MAT_PLANE) {
275 // faked light behind the glass
276 vec2 xy = min_ro.xy;
277 float c = length(rot2(-1.0)*(xy-vec2(0.0,15.0))/vec2(2.0,1.0))-10.0;
278 col = vec3(0.5)-0.2*tanh(0.4*c);
279 rd = sampleCookTorrance(-rd, min_n, 0.01, 0.1, 0.01, col, col, m_col);
280 }
281 else if (material == MAT_GLASS) {
282 vec2 eta = inside_glass ? vec2(1.5, 1.0) : vec2(1.0, 1.5);
283 rd = sampleFresnelDielectric(rd, min_n, eta.x, eta.y);
284 if (dot(rd, min_n) < 0.0) inside_glass = !inside_glass;
285 }
286 else if (material == MAT_CONTENT) {
287 rd = sampleCookTorrance(-rd, min_n, 0.5, 0.8,
288 m_col *= 1.6*pow(col, vec3(1.0));
289 if (dot(rd, min_n) < 0.0) inside_object = !in
290 }
291 if (m_col == vec3(0.0)) return t_col;
292 if (inside_object) return 1e12f*vec3(1,-1,-1);
293 }
294 return m_col + t_col;
295 }
296
297 vec2 randomUnitDisk() {
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
Copyright (C) Microsoft Corporation. All rights reserved.
Try the new cross-platform PowerShell https://aka.ms/pscore6
PS D:\Coding\Github\Shadertoy>
11ca5e4acf20be9b783c91d71013e1f7.jpg - ...
File Print E-mail Burn Open
Static GLSL Preview
16 MS (3-131)
powershell
Add a (faked) lighting behind the glass.
master*
Ln 278, Col 45 Spaces: 4 UTF-8 CRLF GLSL

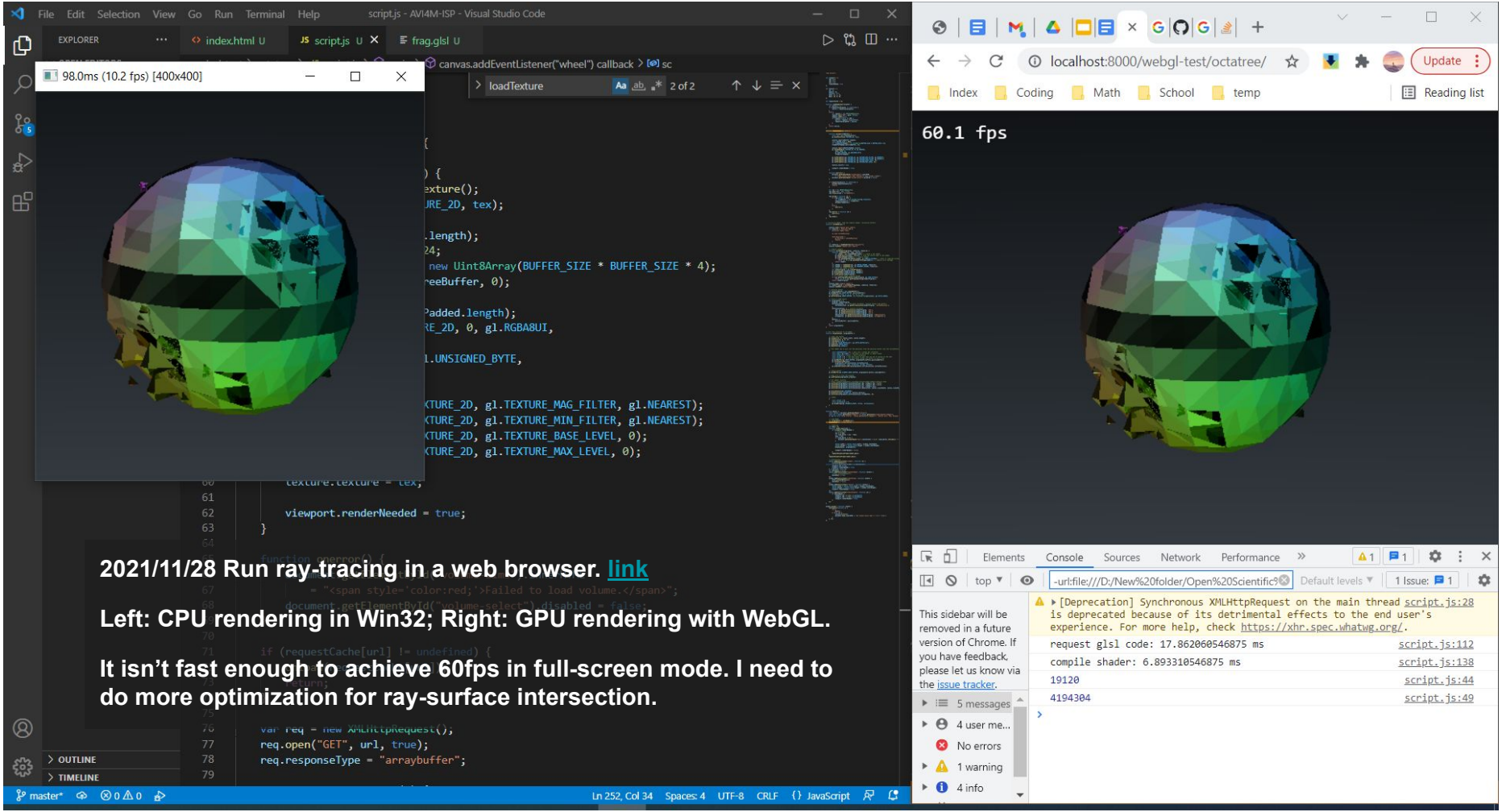
Side-by-side comparison of the new (left) and the original (right) renderings. I fail to reproduce the lighting in the photographs of Paul's work.

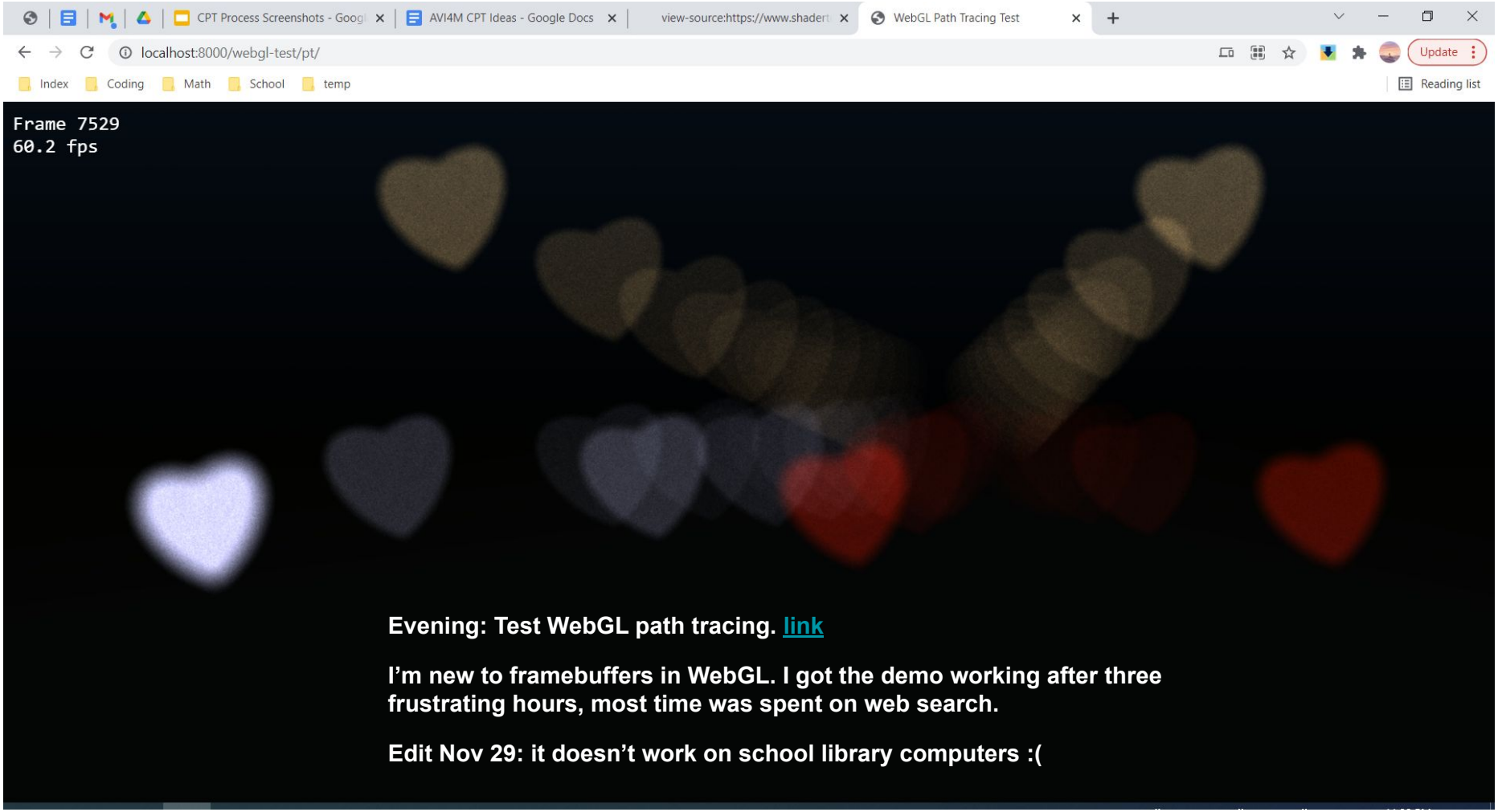
I searched online for photographs of glass paperweights. Some of them are simply placed on paper but look nice. I think I should not limit my lighting experimentation on a dark glossy surface.

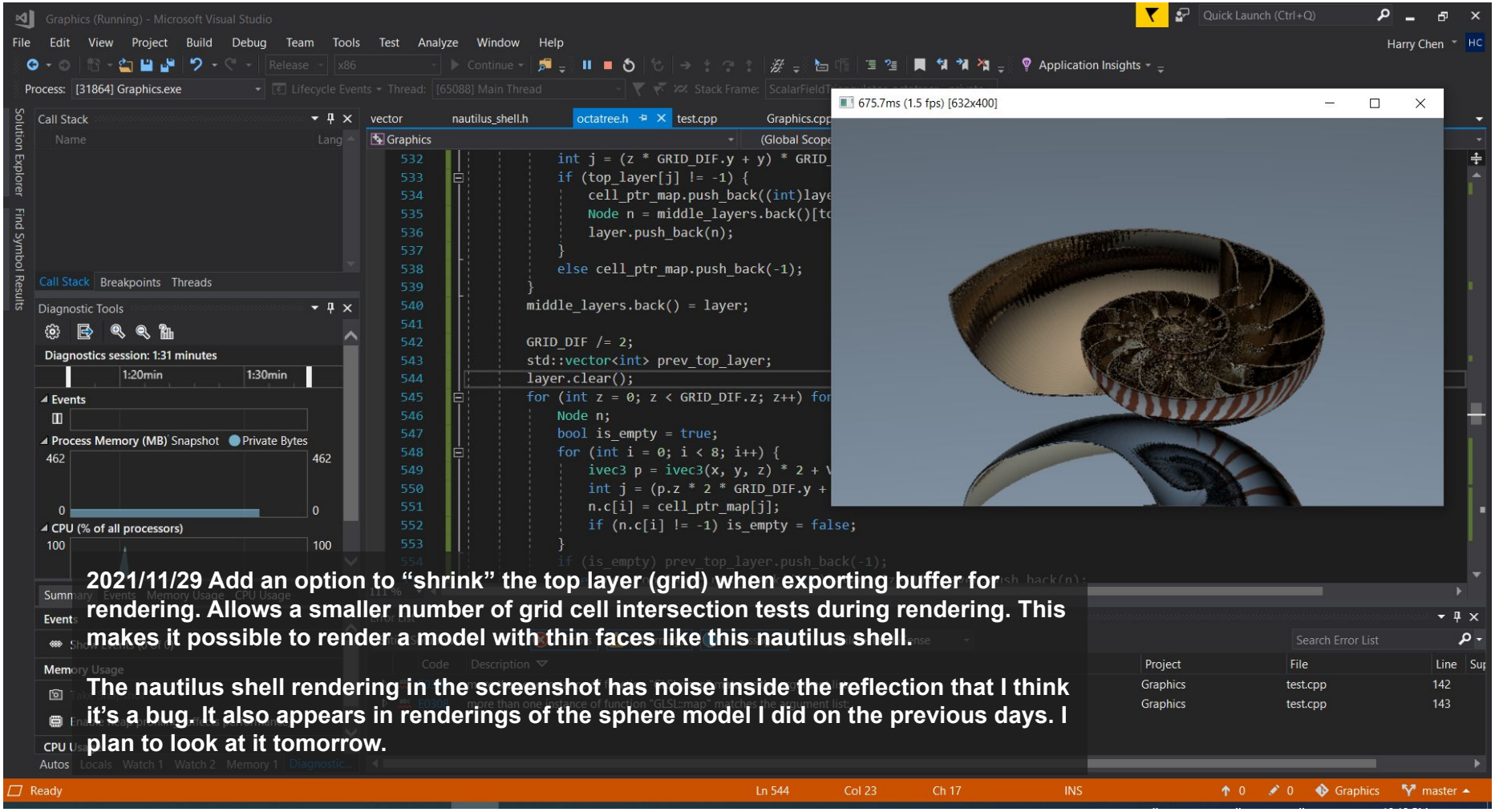
Technical Experiments

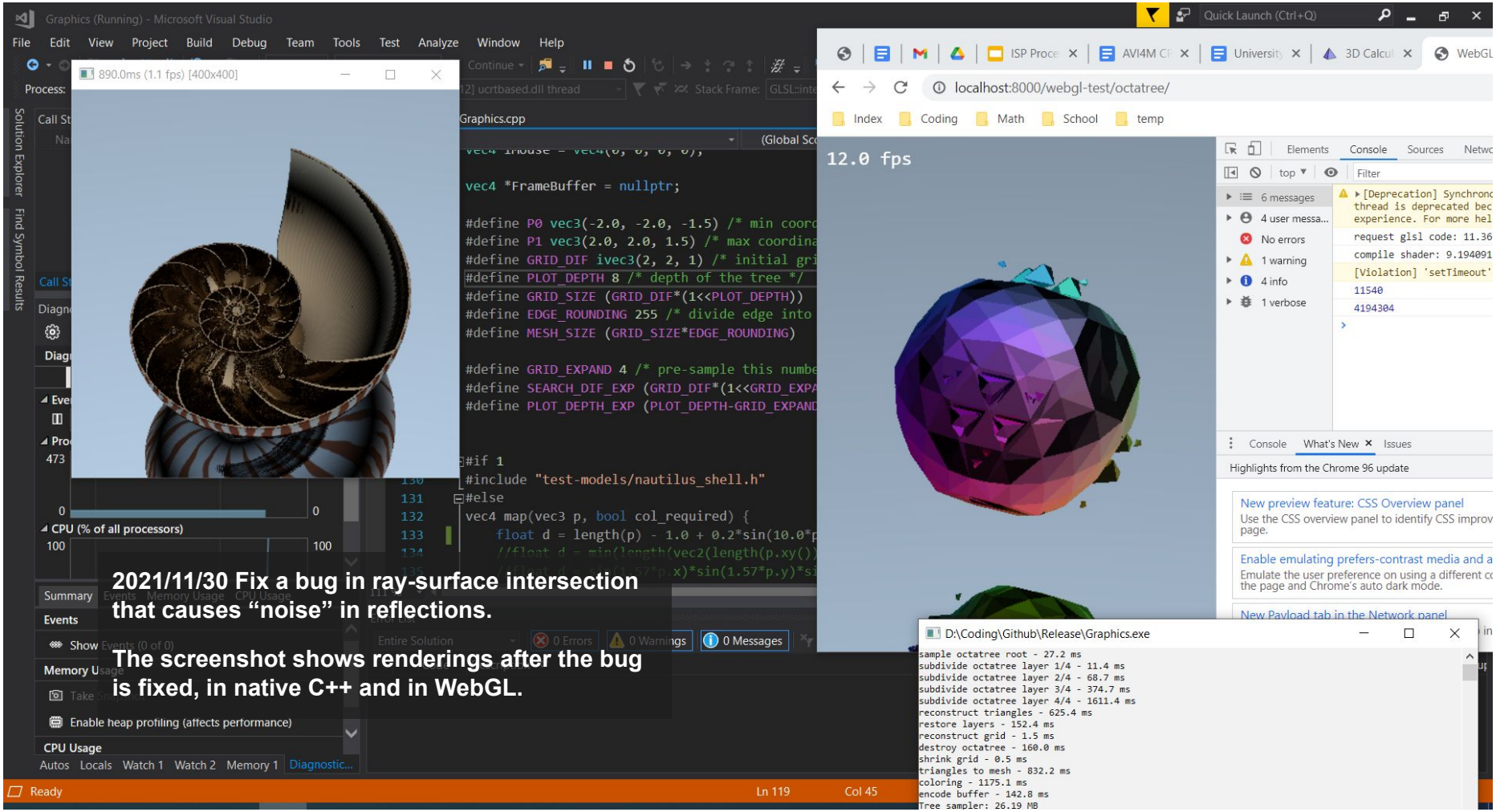
Acceleration structure, WebGL


Graphics (Running) - Microsoft Visual Studio
245.7ms (4.1 fps) [400x400]
D:\Homework\AVI4M\AVI4M-ISP\octatree_buffer\README.md - EmEditor
README.md
Untitled-9 *
.bin
Started with `prod(SEARCH_DIF)` pointers, the start of the top layer (grid), in flattened `[z][y][x]` order;
A block in a middle layer contains `8` pointers, the children in the next layer;
A block in the bottom layer contains an integer `n`, the number of triangles, followed by `n` groups of `3x3+2=11` integers for the coordinates of the vertices and the 32-bit RGBA color;
All integers are 16-bit unsigned. All pointers are 32-bit little endian. A null pointer is represented by `0x0000 0x0000`.
octatree.h
test.cpp
Graphics.cpp
(Global Scope)
if (!(t > 0.0 && t < min_t)) cur.ptr = 0;
// go into subtree
if (cur.ptr != 0) {
// triangles
if (cell_size == 1) {
uint n = getUint16(cur.ptr);
for (int ti = 0; ti < n; ti++) {
vec3 a = getVec3(cur.ptr + 11 * ti + 1);
vec3 b = getVec3(cur.ptr + 11 * ti + 4);
vec3 c = getVec3(cur.ptr + 11 * ti + 7);
t = intersectTriangle(ro, rd, a, b, c);
if (t > 0.0 && t < min_t) {
min_t = t, min_n = cross(b - a, c - a);
uint rg = getUint16(cur.ptr + 11 * ti
uint b = getUint16(cur.ptr + 11 * ti +
col = vec3(rg % 256, rg / 256, b) / 25
}
}
cur.ptr = 0;
Tree sampler: 0.02 MB
D:\.ply [vn=414, fn=728, surface] norm...
2021/11/27 Start technical experiments after a one-week pause.
I try to create a web-based interface to present my work for the final product to show that my artwork is created by writing code in an “artistic” way. I need to run the ray-tracing code on GPU (WebGL) to achieve real-time rendering.
Building and testing a ray-surface intersection acceleration structure that can be placed inside an integer buffer.
Ready
Ln 467
Col 7
Ch 4
INS
Graphics
master


98.0ms (10.2 fps) [400x400]
60.1 fps
2021/11/28 Run ray-tracing in a web browser. link
Left: CPU rendering in Win32; Right: GPU rendering with WebGL.
It isn't fast enough to achieve 60fps in full-screen mode. I need to do more optimization for ray-surface intersection.

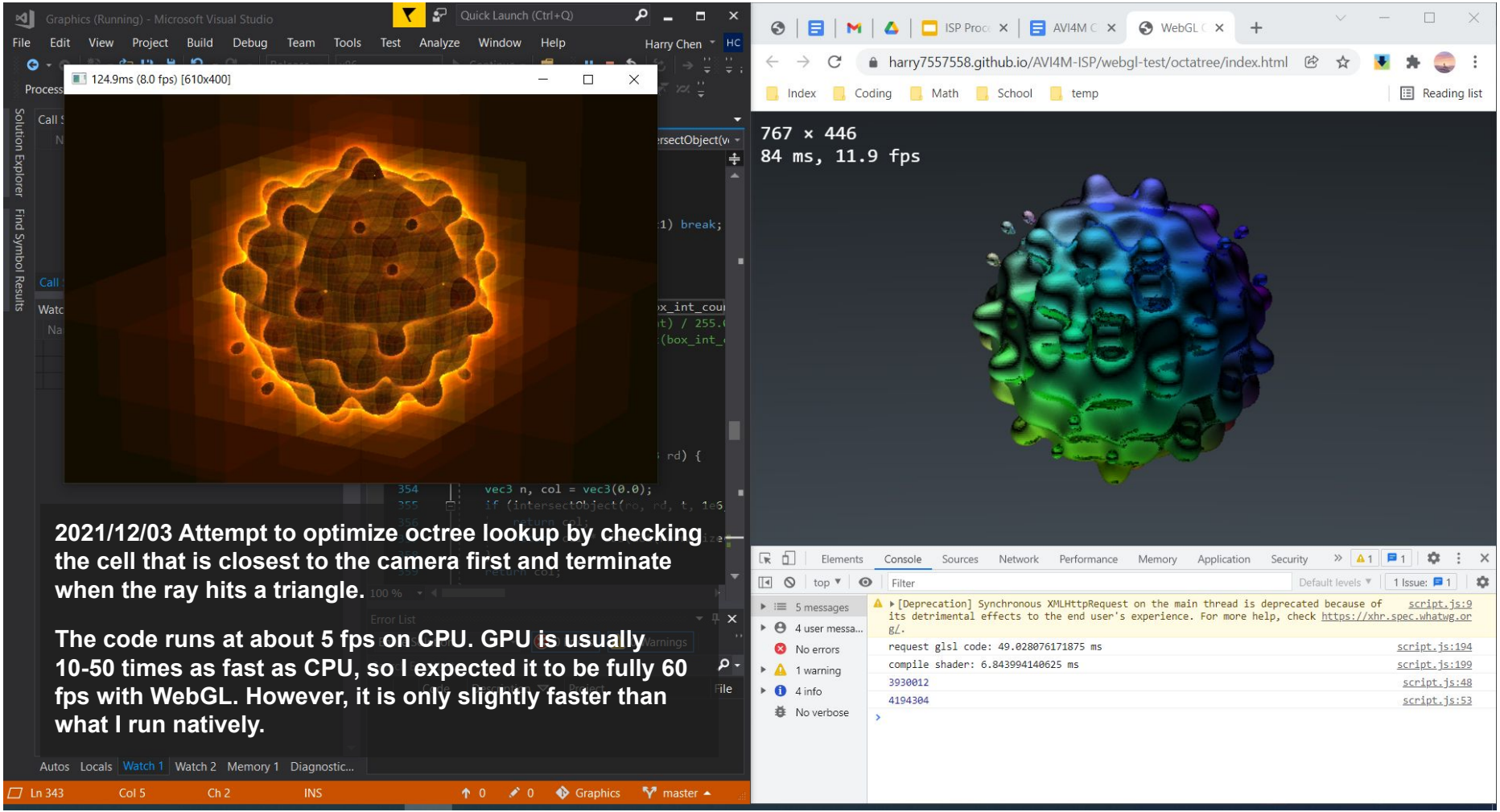

CPT Process Screenshots - Goog
AVI4M CPT Ideas - Google Docs
view-source:https://www.shadert
WebGL Path Tracing Test
localhost:8000/webgl-test/pt/
Update
Index
Coding
Math
School
temp
Reading list
Frame 7529
60.2 fps
Evening: Test WebGL path tracing. link
I'm new to framebuffers in WebGL. I got the demo working after three frustrating hours, most time was spent on web search.
Edit Nov 29: it doesn't work on school library computers :(

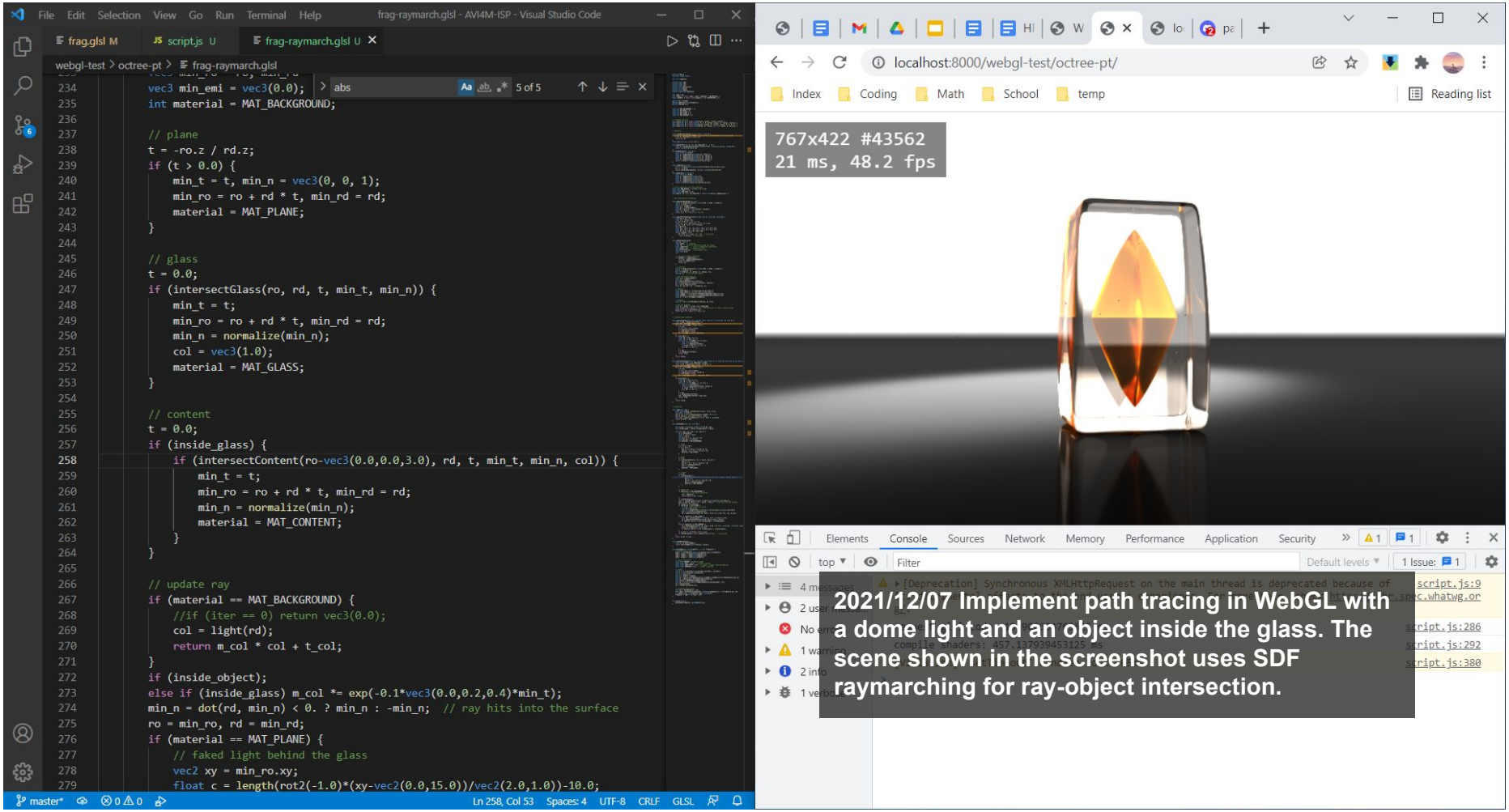

Graphics (Running) - Microsoft Visual Studio
675.7ms (1.5 fps) [632x400]
2021/11/29 Add an option to “shrink” the top layer (grid) when exporting buffer for rendering. Allows a smaller number of grid cell intersection tests during rendering. This makes it possible to render a model with thin faces like this nautilus shell.
The nautilus shell rendering in the screenshot has noise inside the reflection that I think it’s a bug. It also appears in renderings of the sphere model I did on the previous days. I plan to look at it tomorrow.

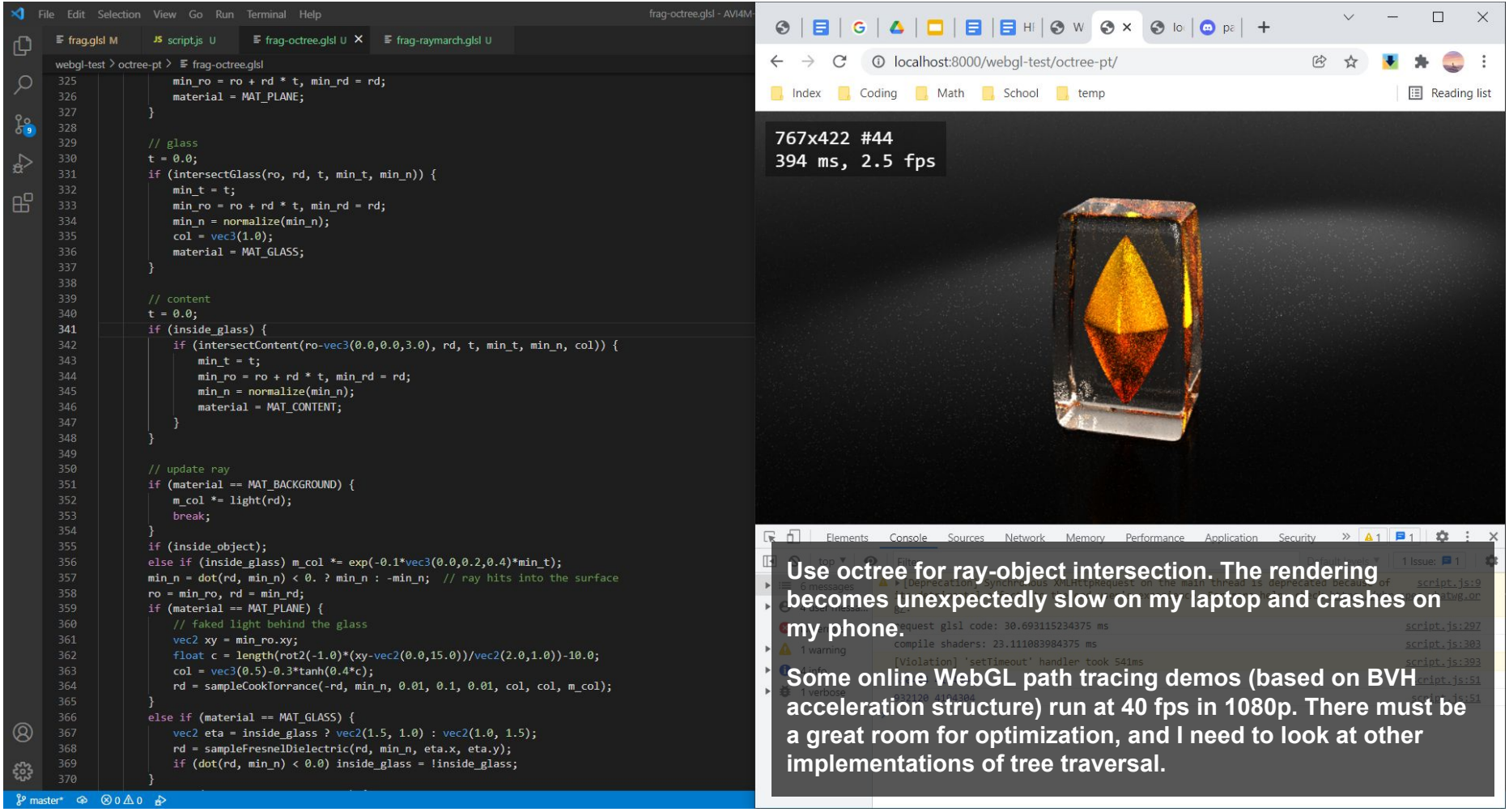


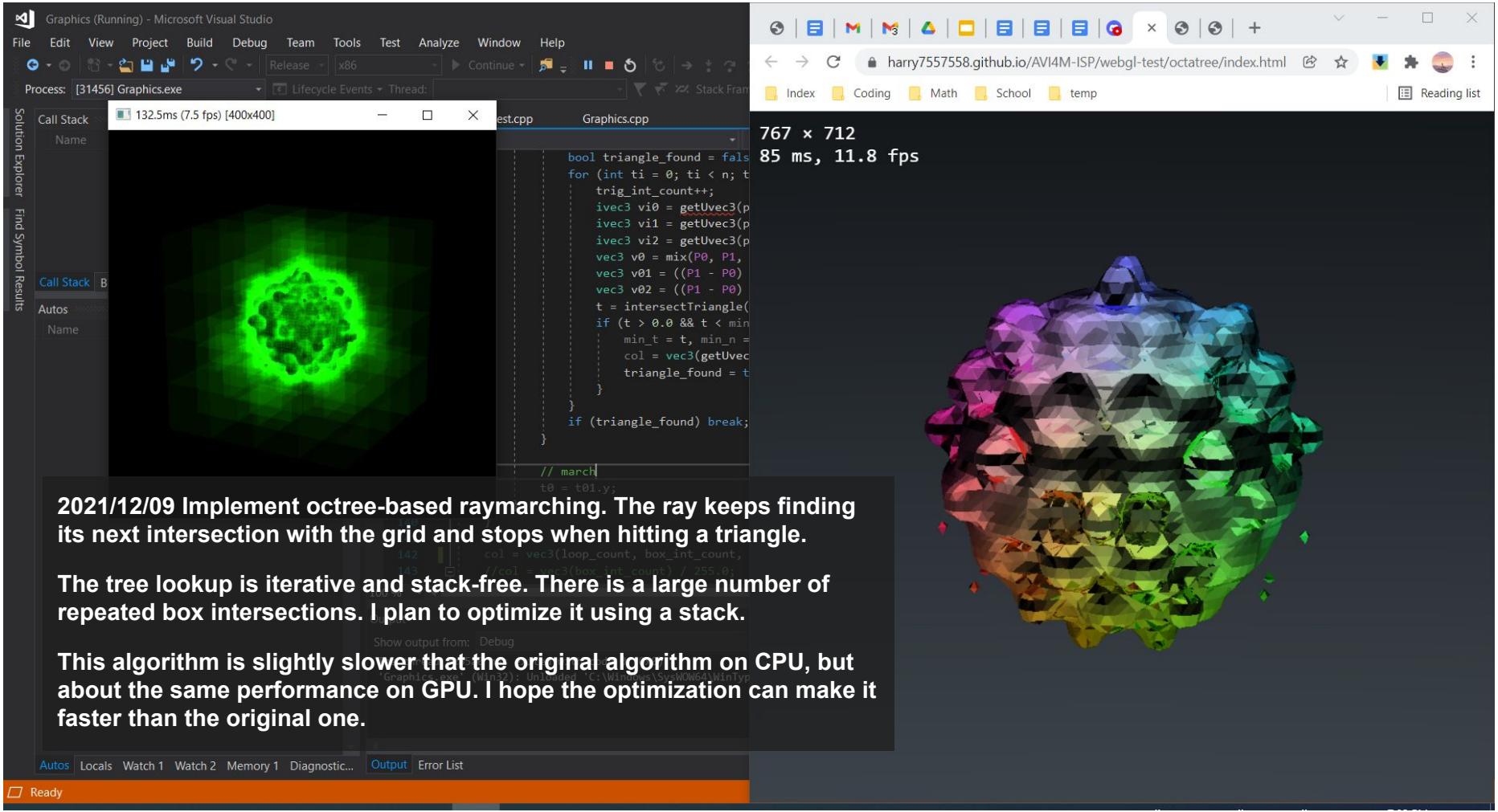
2021/11/30 Fix a bug in ray-surface intersection that causes “noise” in reflections.

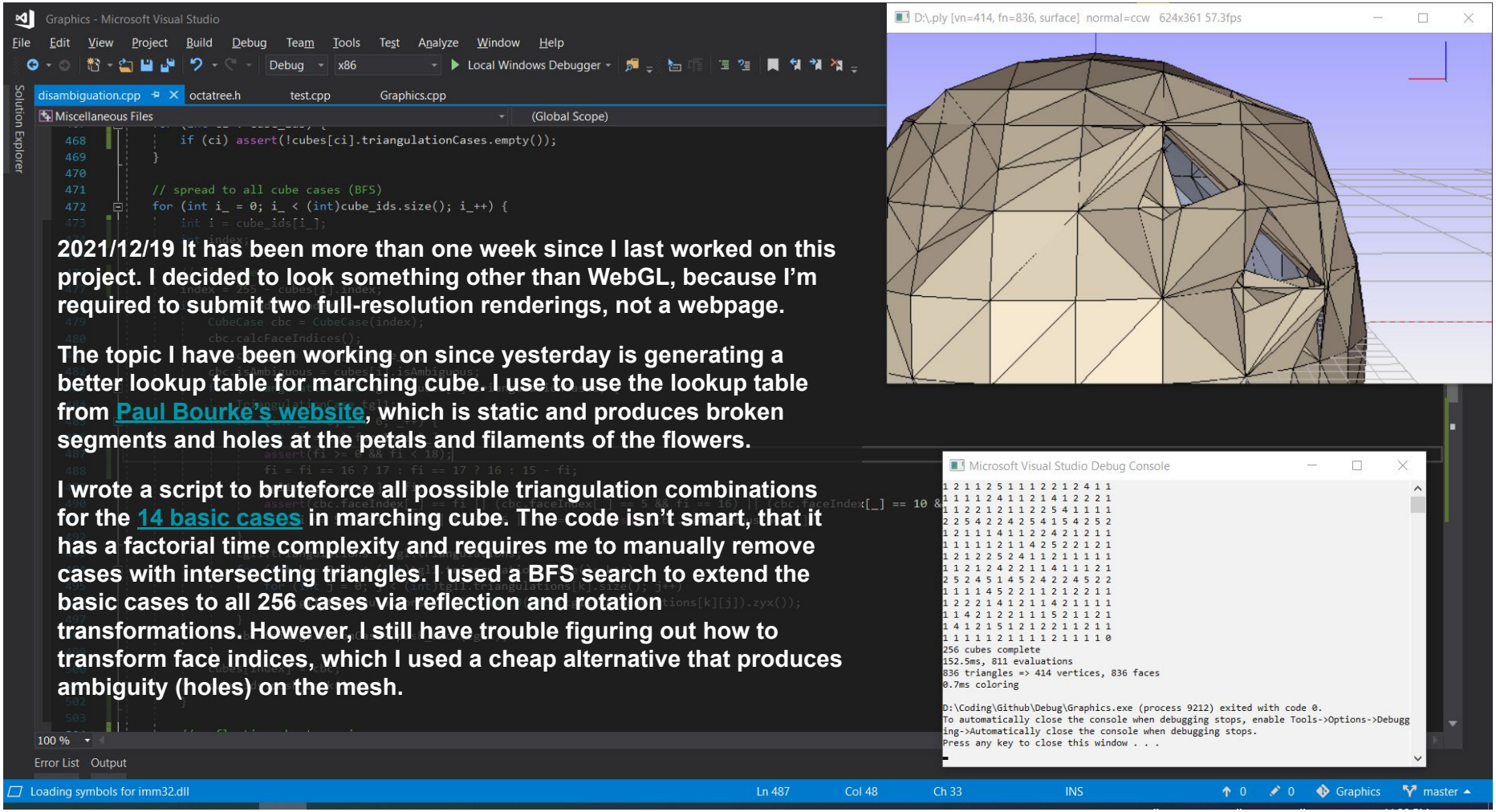
The screenshot shows renderings after the bug is fixed, in native C++ and in WebGL.


Graphics (Running) - Microsoft Visual Studio
124.9ms (8.0 fps) [610x400]
767 × 446
84 ms, 11.9 fps
harry7557558.github.io/AVI4M-ISP/webgl-test/octatree/index.html
2021/12/03 Attempt to optimize octree lookup by checking the cell that is closest to the camera first and terminate when the ray hits a triangle.
The code runs at about 5 fps on CPU. GPU is usually 10-50 times as fast as CPU, so I expected it to be fully 60 fps with WebGL. However, it is only slightly faster than what I run natively.


File Edit Selection View Go Run Terminal Help
frag-raymarch.glsl - AVI4M-ISP - Visual Studio Code
frag.glsl M
script.js U
frag-raymarch.glsl U
webgl-test > octree-pt > frag-raymarch.glsl
vec3 min_emi = vec3(0.0);
int material = MAT_BACKGROUND;
// plane
t = -ro.z / rd.z;
if (t > 0.0) {
min_t = t, min_n = vec3(0, 0, 1);
min_ro = ro + rd * t, min_rd = rd;
material = MAT_PLANE;
}
// glass
t = 0.0;
if (intersectGlass(ro, rd, t, min_t, min_n)) {
min_t = t;
min_ro = ro + rd * t, min_rd = rd;
min_n = normalize(min_n);
col = vec3(1.0);
material = MAT_GLASS;
}
// content
t = 0.0;
if (inside_glass) {
if (intersectContent(ro-vec3(0.0,0.0,3.0), rd, t, min_t, min_n, col)) {
min_t = t;
min_ro = ro + rd * t, min_rd = rd;
min_n = normalize(min_n);
material = MAT_CONTENT;
}
}
// update ray
if (material == MAT_BACKGROUND) {
//if (iter == 0) return vec3(0.0);
col = light(rd);
return m_col * col + t_col;
}
if (inside_object);
else if (inside_glass) m_col *= exp(-0.1*vec3(0.0,0.2,0.4)*min_t);
min_n = dot(rd, min_n) < 0. ? min_n : -min_n; // ray hits into the surface
ro = min_ro, rd = min_rd;
if (material == MAT_PLANE) {
// faked light behind the glass
vec2 xy = min_ro.xy;
float c = length(rot2(-1.0)*(xy-vec2(0.0,15.0))/vec2(2.0,1.0))-10.0;
master*
Ln 258, Col 53 Spaces: 4 UTF-8 CRLF GLSL
localhost:8000/webgl-test/octree-pt/
Index Coding Math School temp
Reading list
767x422 #43562
21 ms, 48.2 fps
Elements Console Sources Network Memory Performance Application Security
top
Filter
Default levels
1 Issue:
2021/12/07 Implement path tracing in WebGL with a dome light and an object inside the glass. The scene shown in the screenshot uses SDF raymarching for ray-object intersection.


File Edit Selection View Go Run Terminal Help
frag-octree.glsl - AVI4M
frag.glsl M
script.js U
frag-octree.glsl U
frag-raymarch.glsl U
webgl-test > octree-pt > frag-octree.glsl
min_ro = ro + rd * t, min_rd = rd;
material = MAT_PLANE;
}
// glass
t = 0.0;
if (intersectGlass(ro, rd, t, min_t, min_n)) {
min_t = t;
min_ro = ro + rd * t, min_rd = rd;
min_n = normalize(min_n);
col = vec3(1.0);
material = MAT_GLASS;
}
// content
t = 0.0;
if (inside_glass) {
if (intersectContent(ro-vec3(0.0,0.0,3.0), rd, t, min_t, min_n, col)) {
min_t = t;
min_ro = ro + rd * t, min_rd = rd;
min_n = normalize(min_n);
material = MAT_CONTENT;
}
}
// update ray
if (material == MAT_BACKGROUND) {
m_col *= light(rd);
break;
}
if (inside_object);
else if (inside_glass) m_col *= exp(-0.1*vec3(0.0,0.2,0.4)*min_t);
min_n = dot(rd, min_n) < 0. ? min_n : -min_n; // ray hits into the surface
ro = min_ro, rd = min_rd;
if (material == MAT_PLANE) {
// faked light behind the glass
vec2 xy = min_ro.xy;
float c = length(rot2(-1.0)*(xy-vec2(0.0,15.0))/vec2(2.0,1.0))-10.0;
col = vec3(0.5)-0.3*tanh(0.4*c);
rd = sampleCookTorrance(-rd, min_n, 0.01, 0.1, 0.01, col, col, m_col);
}
else if (material == MAT_GLASS) {
vec2 eta = inside_glass ? vec2(1.5, 1.0) : vec2(1.0, 1.5);
rd = sampleFresnelDielectric(rd, min_n, eta.x, eta.y);
if (dot(rd, min_n) < 0.0) inside_glass = !inside_glass;
}
master*
localhost:8000/webgl-test/octree-pt/
Index
Coding
Math
School
temp
Reading list
767x422 #44
394 ms, 2.5 fps
Elements
Console
Sources
Network
Memory
Performance
Application
Security
request glsl code: 30.693115234375 ms
compile shaders: 23.111083984375 ms
[Violation] 'setTimeout' handler took 541ms
Use octree for ray-object intersection. The rendering becomes unexpectedly slow on my laptop and crashes on my phone.
Some online WebGL path tracing demos (based on BVH acceleration structure) run at 40 fps in 1080p. There must be a great room for optimization, and I need to look at other implementations of tree traversal.


Graphics (Running) - Microsoft Visual Studio
132.5ms (7.5 fps) [400x400]
harry7557558.github.io/AVI4M-ISP/webgl-test/octatree/index.html
767 × 712
85 ms, 11.8 fps
2021/12/09 Implement octree-based raymarching. The ray keeps finding its next intersection with the grid and stops when hitting a triangle.
The tree lookup is iterative and stack-free. There is a large number of repeated box intersections. I plan to optimize it using a stack.
This algorithm is slightly slower that the original algorithm on CPU, but about the same performance on GPU. I hope the optimization can make it faster than the original one.


Graphics - Microsoft Visual Studio
File Edit View Project Build Debug Team Tools Test Analyze Window Help
Debug x86 Local Windows Debugger
disambiguation.cpp octatree.h test.cpp Graphics.cpp
Miscellaneous Files (Global Scope)
if (ci) assert(!cubes[ci].triangulationCases.empty());
// spread to all cube cases (BFS)
for (int i_ = 0; i_ < (int)cube_ids.size(); i_++) {
int i = cube_ids[i_];
D:\.ply [vn=414, fn=836, surface] normal=ccw 624x361 57.3fps
2021/12/19 It has been more than one week since I last worked on this project. I decided to look something other than WebGL, because I'm required to submit two full-resolution renderings, not a webpage.
The topic I have been working on since yesterday is generating a better lookup table for marching cube. I use to use the lookup table from Paul Bourke's website, which is static and produces broken segments and holes at the petals and filaments of the flowers.
I wrote a script to bruteforce all possible triangulation combinations for the 14 basic cases in marching cube. The code isn't smart, that it has a factorial time complexity and requires me to manually remove cases with intersecting triangles. I used a BFS search to extend the basic cases to all 256 cases via reflection and rotation transformations. However, I still have trouble figuring out how to transform face indices, which I used a cheap alternative that produces ambiguity (holes) on the mesh.
Microsoft Visual Studio Debug Console
1 2 1 1 2 5 1 1 1 2 2 1 2 4 1 1
1 1 1 1 2 4 1 1 2 1 4 1 2 2 2 1
1 1 2 2 1 2 1 1 2 2 5 4 1 1 1 1
2 2 5 4 2 2 4 2 5 4 1 5 4 2 5 2
1 2 1 1 1 4 1 1 2 2 4 2 1 2 1 1
1 1 1 1 1 2 1 1 4 2 5 2 2 1 2 1
1 2 1 2 2 5 2 4 1 1 2 1 1 1 1 1
1 1 2 1 2 4 2 2 1 1 4 1 1 1 2 1
2 5 2 4 5 1 4 5 2 4 2 2 4 5 2 2
1 1 1 1 4 5 2 2 1 1 2 1 2 2 1 1
1 2 2 2 1 4 1 2 1 1 4 2 1 1 1 1
1 1 4 2 1 2 2 1 1 1 5 2 1 1 2 1
1 4 1 2 1 5 1 2 1 2 2 1 1 2 1 1
1 1 1 1 1 2 1 1 1 1 2 1 1 1 1 0
256 cubes complete
152.5ms, 811 evaluations
836 triangles => 414 vertices, 836 faces
0.7ms coloring
D:\Coding\Github\Debug\Graphics.exe (process 9212) exited with code 0.
To automatically close the console when debugging stops, enable Tools->Options->Debugging->Automatically close the console when debugging stops.
Press any key to close this window . . .
Error List Output
Loading symbols for imm32.dll
Ln 487 Col 48 Ch 33 INS
Graphics master

Graphics - Microsoft Visual Studio

File Edit View Project Build Debug Team Tools Test Analyze Window Help

Harry Chen

Release x86 Local Windows Debugger

disambiguation.cpp octatree.h test.cpp Graphics.cpp

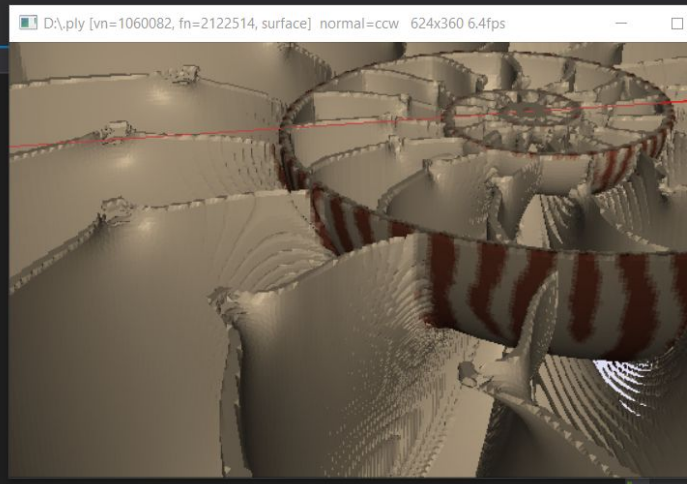
Miscellaneous Files (Global Scope)

```
octatree_main();
#if 0
    for (int i = 0, cn = (int)cells.size(); i < cn; i++) {
        vec3 p[8];
        for (int j = 0; j < 8; j++) p[j] = i2f(cells[i]->p(j));
        auto v_table = TRIG_TABLE[CalcIndex(cells[i]->v)];
        for (int u = 0; ; u += 3) {
            if (v_table[u] == -1) break;
            vec3 a = getInterpolation(p, cells[i]->v, v_table[u]);
            vec3 b = getInterpolation(p, cells[i]->v, v_table[u + 1]);
            vec3 c = getInterpolation(p, cells[i]->v, v_table[u + 2]);
            trigs.push_back(triangle_3d(a, b, c));
        }
    }
#else
// export the entire tree. see `README.md` for details
```

2021/12/20 Resolved yesterday's problem. Test marching cube on a nautilus shell SDF model, and the generated mesh is a perfect manifold.

Although I generated table with the consideration of various face orientation cases, the algorithm has nothing different from the static lookup-table marching cube because I only use the first triangulation case in the lookup table to generate the mesh. There are still "holes" on "thin layers" of the nautilus shell.

Looking forward to have more things done tomorrow.

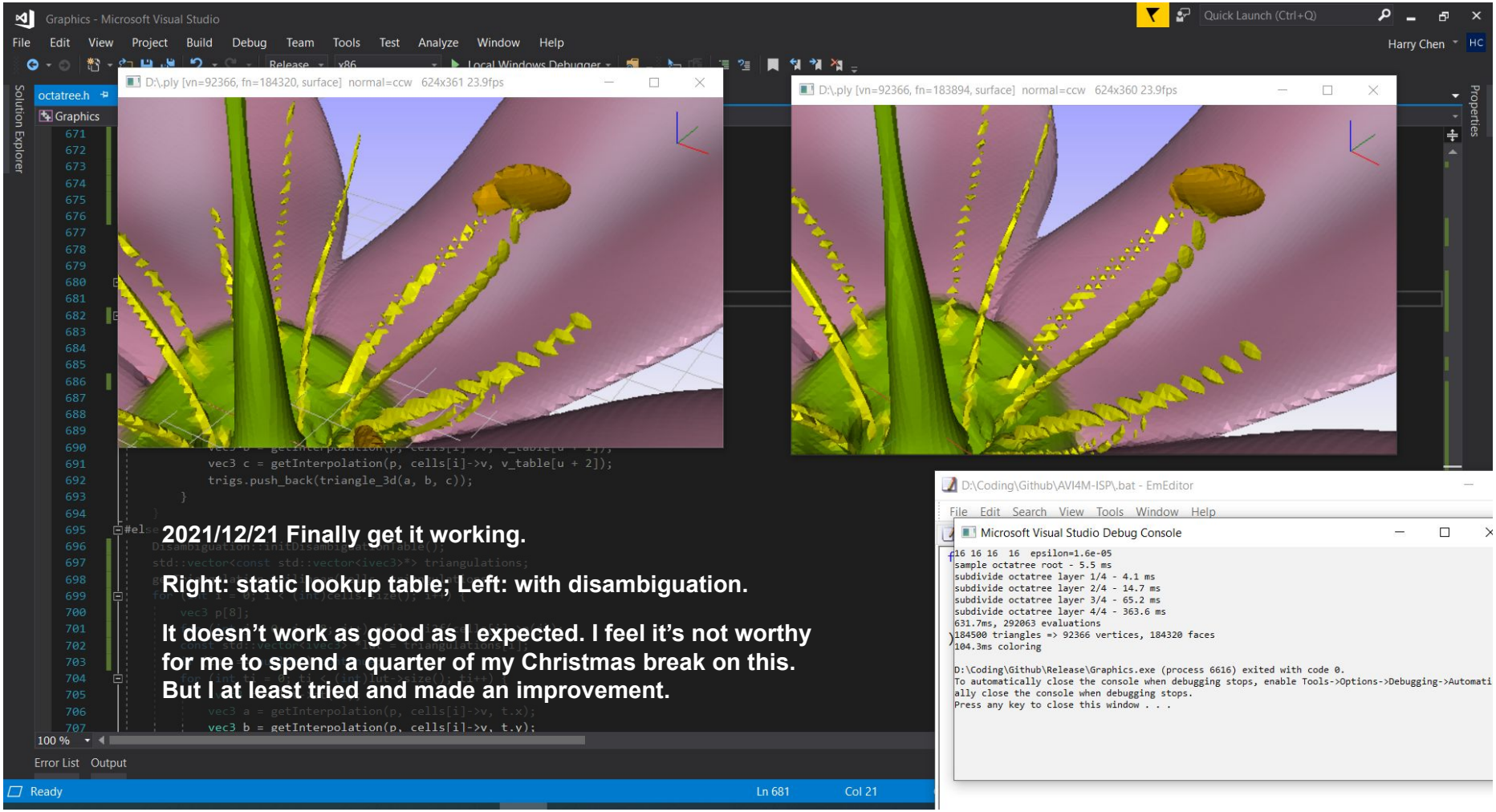


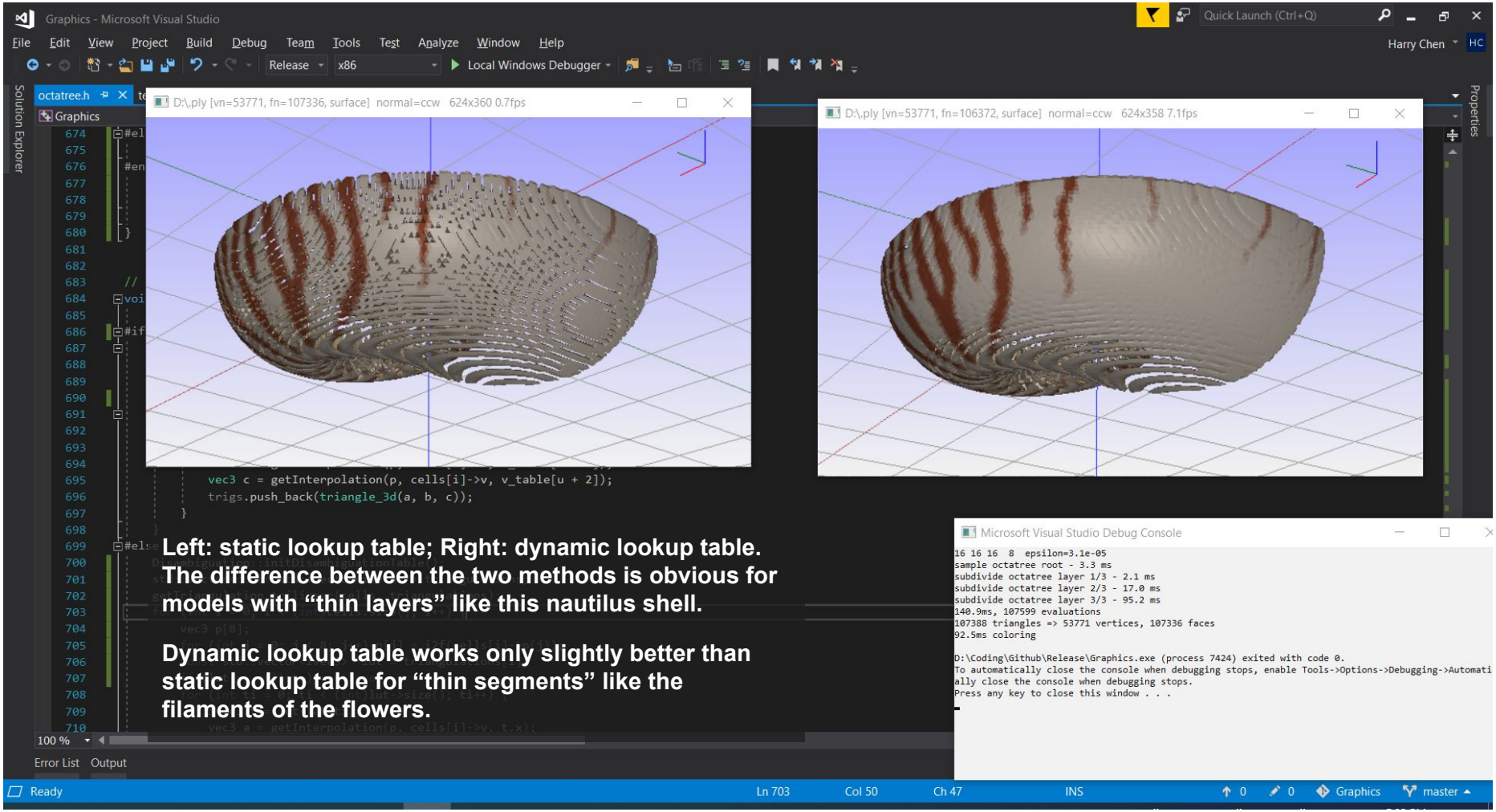
Microsoft Visual Studio Debug Console

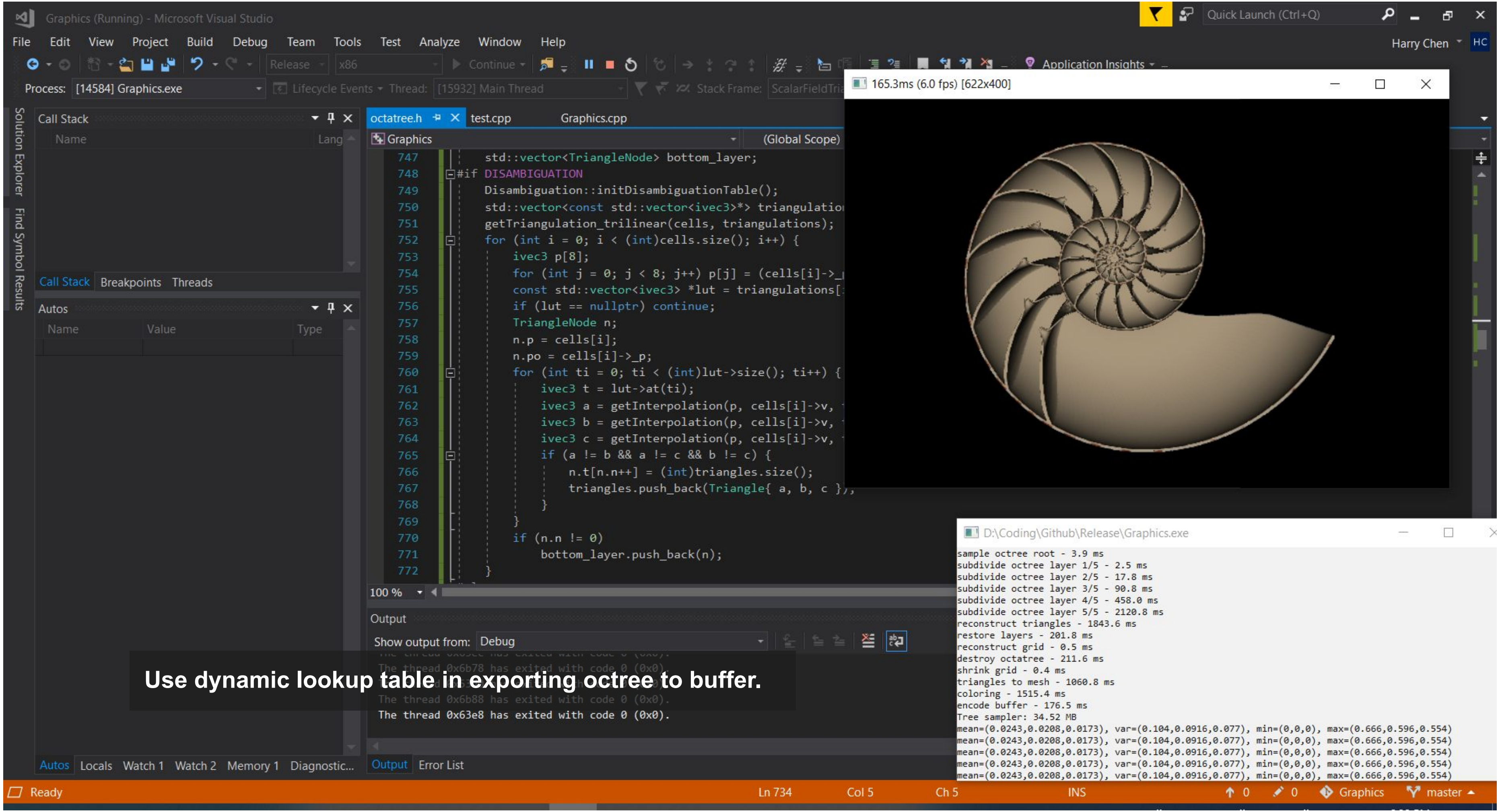
```
subdivide octatree layer 5/5 - 2148.5 ms
0(0) 1(1) 9(2) 14(5) 15(8) 30(12) 39(9) 46(14) 65(4) 71(11) 73(6) 85(10) 88(7) 129(3)
165(13)
0 1 1 1 1 2 1 1 1 1 2 1 1 1 1 1
1 1 2 1 1 2 2 1 2 1 5 1 2 1 4 1
1 2 1 1 2 5 1 1 1 2 2 1 2 4 1 1
1 1 1 1 2 4 1 1 2 1 4 1 2 2 2 1
1 1 2 2 1 2 1 1 1 2 2 5 4 1 1 1 1
2 2 5 4 2 2 4 2 5 4 2 5 4 2 5 2
1 2 1 1 1 4 1 1 2 2 4 2 1 2 1 1
1 1 1 1 1 2 1 1 4 2 5 2 2 1 2 1
1 2 1 2 2 5 2 4 1 1 2 1 1 1 1 1
1 1 2 1 2 4 2 2 1 1 4 1 1 1 2 1
2 5 2 4 5 2 4 5 2 4 2 2 4 5 2 2
1 1 1 1 4 5 2 2 1 1 2 1 2 2 1 1
1 2 2 2 1 4 1 2 1 1 4 2 1 1 1 1
1 1 4 2 1 2 2 1 1 1 5 2 1 1 2 1
1 4 1 2 1 5 1 2 1 2 2 1 1 2 1 1
1 1 1 1 1 2 1 1 1 1 2 1 1 1 1 0
256 cubes complete
3236.7ms, 2714160 evaluations
2124588 triangles => 1060082 vertices, 2122514 faces
1434.5ms coloring
```

Error List Output

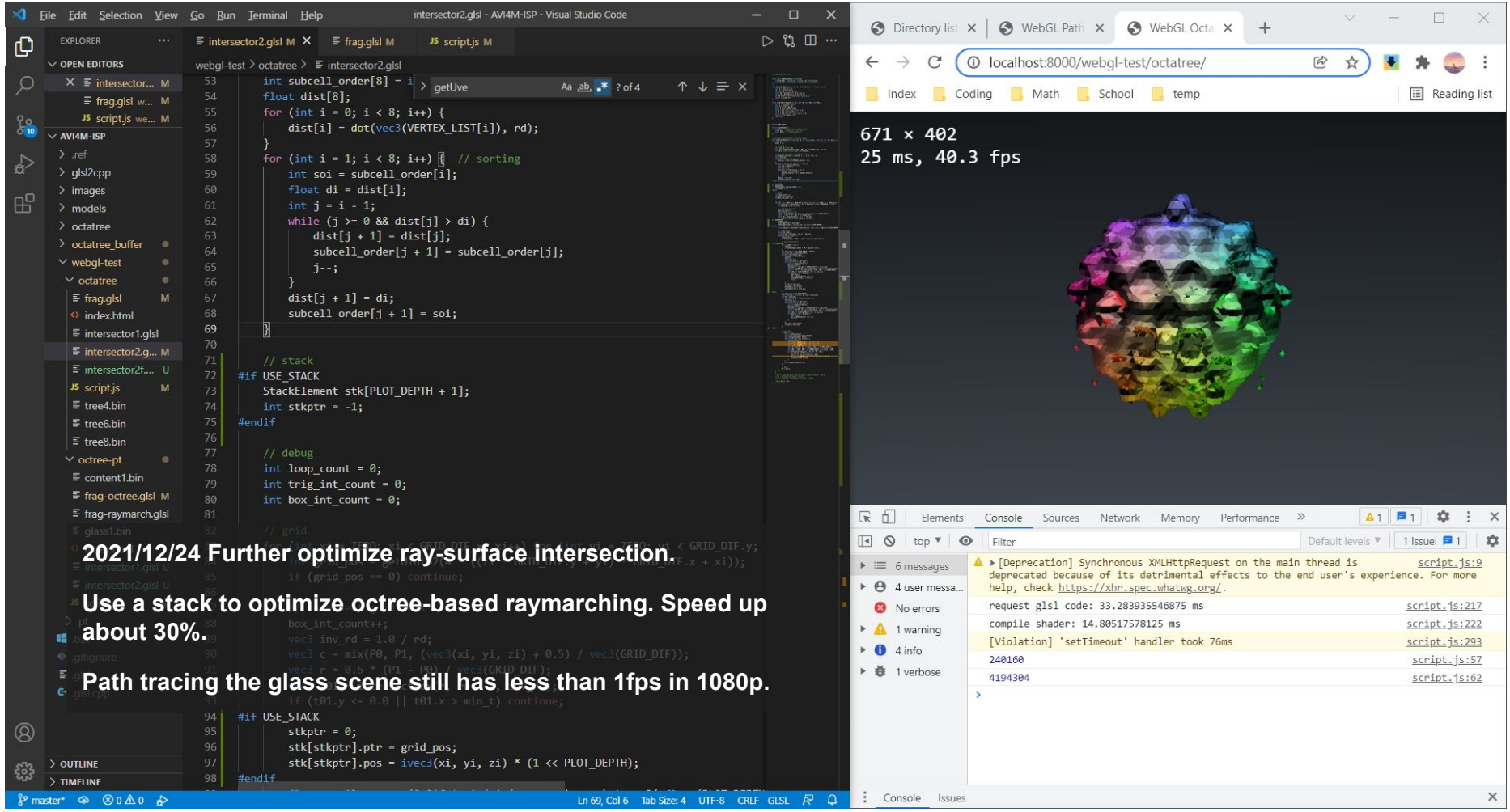
Item(s) Saved Ln 502 Col 104 Ch 98 INS Graphics master


Graphics - Microsoft Visual Studio
File Edit View Project Build Debug Team Tools Test Analyze Window Help
Harry Chen
D:\.ply [vn=92366, fn=184320, surface] normal=ccw 624x361 23.9fps
D:\.ply [vn=92366, fn=183894, surface] normal=ccw 624x360 23.9fps
vec3 c = getInterpolation(p, cells[i]->v, v_table[u + 2]);
trigs.push_back(triangle_3d(a, b, c));
2021/12/21 Finally get it working.
Right: static lookup table; Left: with disambiguation.
It doesn't work as good as I expected. I feel it's not worthy for me to spend a quarter of my Christmas break on this.
But I at least tried and made an improvement.
D:\Coding\Github\AVI4M-ISP\.bat - EmEditor
Microsoft Visual Studio Debug Console
16 16 16 16 epsilon=1.6e-05
sample octatree root - 5.5 ms
subdivide octatree layer 1/4 - 4.1 ms
subdivide octatree layer 2/4 - 14.7 ms
subdivide octatree layer 3/4 - 65.2 ms
subdivide octatree layer 4/4 - 363.6 ms
631.7ms, 292063 evaluations
184500 triangles => 92366 vertices, 184320 faces
104.3ms coloring
D:\Coding\Github\Release\Graphics.exe (process 6616) exited with code 0.
To automatically close the console when debugging stops, enable Tools->Options->Debugging->Automatically close the console when debugging stops.
Press any key to close this window . . .
Ready
Ln 681
Col 21


Graphics - Microsoft Visual Studio
File Edit View Project Build Debug Team Tools Test Analyze Window Help
Release x86 Local Windows Debugger
Harry Chen
octatree.h
Graphics
D:\.ply [vn=53771, fn=107336, surface] normal=ccw 624x360 0.7fps
D:\.ply [vn=53771, fn=106372, surface] normal=ccw 624x358 7.1fps
vec3 c = getInterpolation(p, cells[i]->v, v_table[u + 2]);
trigs.push_back(triangle_3d(a, b, c));
Left: static lookup table; Right: dynamic lookup table.
The difference between the two methods is obvious for models with “thin layers” like this nautilus shell.
Dynamic lookup table works only slightly better than static lookup table for “thin segments” like the filaments of the flowers.
Microsoft Visual Studio Debug Console
16 16 16 8 epsilon=3.1e-05
sample octatree root - 3.3 ms
subdivide octatree layer 1/3 - 2.1 ms
subdivide octatree layer 2/3 - 17.0 ms
subdivide octatree layer 3/3 - 95.2 ms
140.9ms, 107599 evaluations
107388 triangles => 53771 vertices, 107336 faces
92.5ms coloring
D:\Coding\Github\Release\Graphics.exe (process 7424) exited with code 0.
To automatically close the console when debugging stops, enable Tools->Options->Debugging->Automatically close the console when debugging stops.
Press any key to close this window . . .
Error List Output
Ready Ln 703 Col 50 Ch 47 INS Graphics master

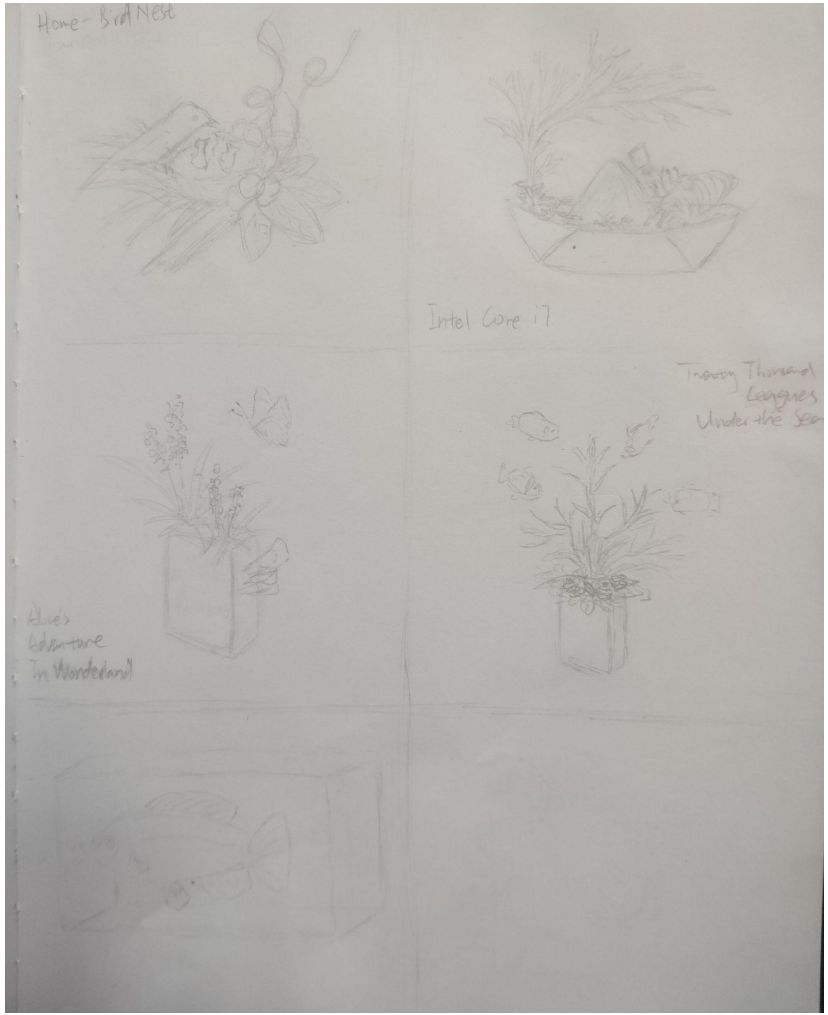


Use dynamic lookup table in exporting octree to buffer.


intersector2.glsl - AVI4M-ISP - Visual Studio Code
671 × 402
25 ms, 40.3 fps
2021/12/24 Further optimize ray-surface intersection.
Use a stack to optimize octree-based raymarching. Speed up about 30%.
Path tracing the glass scene still has less than 1fps in 1080p.

ISP Step 3

Preliminary work



2021/12/07 Brainstorming ideas for final work. I came out with three major ideas.

The first one is a bird's nest and the theme is home and belonging. Inspired by my mentor artist, I placed different types of plants around the nest.

The two on the bottom are lives grow on books, inspired by a fungi growing on book image shown in class. I searched online and saw a picture of fungus growing on *Alice's Adventure in Wonderland* and I added plants and a butterfly to it, but I'm not sure if I can use an idea that is already used by someone else. I considered an underwater scene that a coral tree grows on *Twenty Thousand Leagues Under the Sea* with fishes and mollusks surrounding it.

My teacher gave me an idea of a hermit crab and something with a logo on it. I thought about a paper boat filled with sand that likes an ocean floor, a coral tree, and a hermit crab holding a chip with Nvidia logo on it. I was thinking about the principle of placing things that aren't obviously related together.

After receiving my teacher’s comments, I decided to stick with the bird nest and the hermit crab idea for my final work.

2021/12/09 Explore potential compositions for the artwork as instructed by my teacher.

I was satisfied with the sketch I did previously. But this experimentation enabled me to explore more compositions of the artwork.

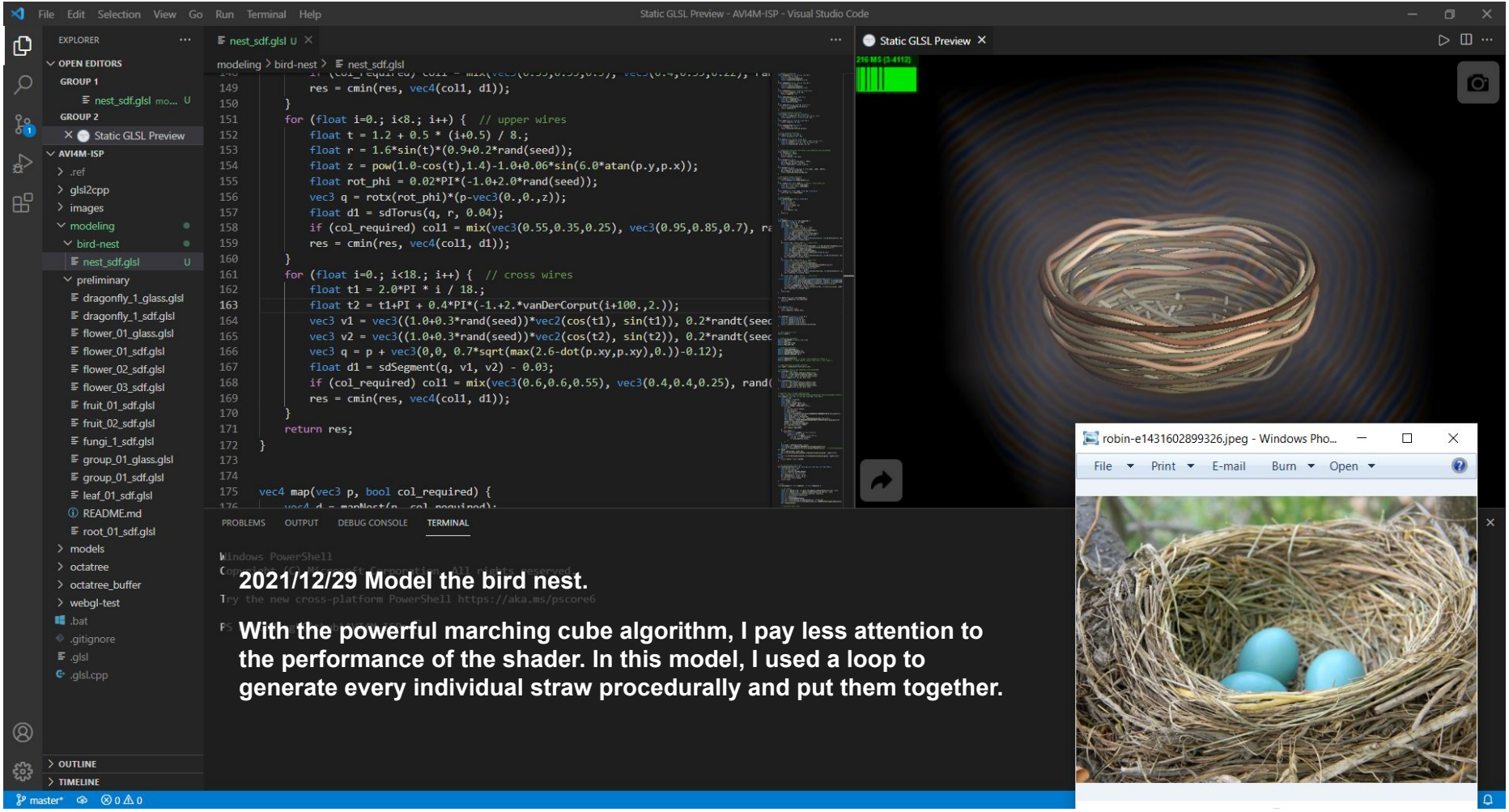
For the bird nest idea, I chose the third composition for the half-page sketch because it looks more dynamic, although I feel the second composition best shows the theme of home and belonging.

2021/12/10 Explore compositions for the hermit crab idea. I tried to include different orientations of the coral tree, the hermit crab, and the paper boat, and see which one works out best.

I chose the fourth composition for the half-page sketch, but later realized it doesn't have a good use of space that some parts look bored and empty. Since it isn't hard to switch composition when working in 3D, I may consider the third composition for the final piece.

ISP Step 4

Final work


Static GLSL Preview - AVI4M-ISP - Visual Studio Code
nest_sdf.glsl
Static GLSL Preview
robin-e1431602899326.jpeg - Windows Pho...
2021/12/29 Model the bird nest.
With the powerful marching cube algorithm, I pay less attention to the performance of the shader. In this model, I used a loop to generate every individual straw procedurally and put them together.

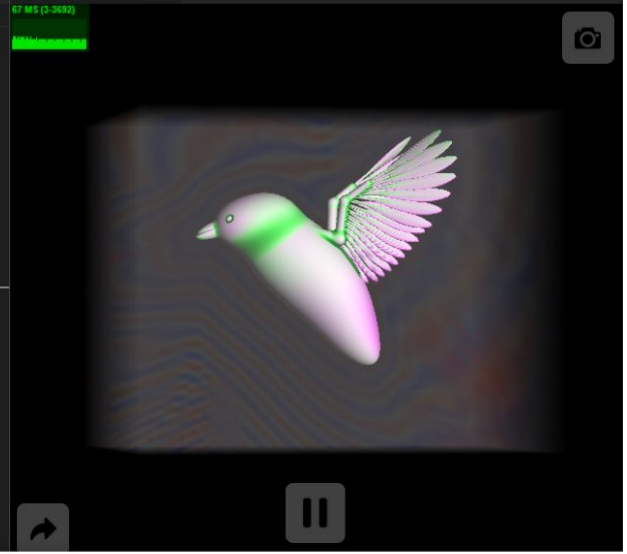
File Edit Selection View Go Run Terminal Help — Static GLSL Preview - AVI4M-ISP - Visual Studio Code

nest_sdf.glsl | bird_sdf.glsl U

modeling > bird-nest > bird_sdf.glsl

```
161         vec4 feather = mapBirdFeather(1.0*transpose(mat3(u,v,w))*(p-q)/s, true)*s;
162         feathers = cmin(feathers, feather);
163     }
164     wing = smin(wing, feathers, 0.05);
165     return wing;
166 }
167
168 vec4 mapBird(vec3 p, bool col_required) {
169     p.y = length(vec2(p.y,0.001));
170     vec4 head = mapBirdHead(roty(0.2)*(p-vec3(-0.75,0,0.75)), col_required);
171     vec4 body = mapBirdBody(roty(0.7)*p, col_required);
172     body = smin(head, body, 0.2);
173     vec4 wing = mapBirdWing(rotz(-0.2)*roty(-0.25)*rotx(0.2)*(p-vec3(-0.1,0.2,0.6))/0.7,
174         vec3(0.5,0.0,0.05),vec3(0.4,0.05,0.7),vec3(0.7,0.1,1.1), col_required)*0.7;
175     body = smin(body, wing, 0.05);
176     return body;
177 }
178
179
180 vec4 map(vec3 p, bool col_required) {
181     //return mapBirdFeather(p+vec3(0,0,1), col_required);
182     //return mapBirdWing(p-vec3(-1,0,-1), vec3(0.5,0.0,0.15), vec3(0.4,0.05,0.8), vec3(0.7,0.1,1.2), col_required);
183     vec4 d = mapBird(p, col_required);
184     return d;
185 }
186
187
188 float sdf(vec3 p) {
```

Static GLSL Preview



PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL

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master* ⊗ 0 ⚠ 0

360_F_107662910_61dGOL84WhtlazoFIDpbqQffM4wbCpG8.jpg - Windows P...

File Print E-mail Burn Open

2022/01/02 I decided to model the subject first, which is the bird.

I modeled the torso of the bird with deformed ellipsoids. Since I may try different compositions, I pay attention to the wing and considered stretched and folded wings. After some research, I learned about the bones and primary/secondary feathers in a bird's wing and modeled them accordingly. I haven't added the skin and the converts of the wings yet.

File Edit Selection View Go Run Terminal Help — bird_sdf.glsl - AVI4M-ISP - Visual Studio Code

nest_sdf.glsl | bird_sdf.glsl M

modeling > bird-nest > bird_sdf.glsl

```
241     return wing;
242 }
243
244 vec4 mapBird(vec3 p, bool col_required) {
245     p.y = length(vec2(p.y,0.001));
246     vec4 head = mapBirdHead(roty(0.2)*(p-vec3(-0.75,0,0.75)), col_required);
247     vec4 body = mapBirdBody(roty(0.7)*p, col_required);
248     body = smin(head, body, 0.2);
249     vec3 rzyx = mix(vec3(-0.2,-0.3,0.3), vec3(-1.2,0.2,0.9), 0.2);
250     vec4 wing = mapBirdWing(rotz(rzyx.x)*roty(rzyx.y)*rotx(rzyx.z)*(p-vec3(-0.1,0.2,0.6))*vec3(1,-1,1)/0.7,
251         vec3(0.5,0.0,0.05),vec3(0.4,0.05,0.7),vec3(0.7,0.1,1.1), col_required)*0.7;
252     body = smin(body, wing, 0.05);
253     return body;
254 }
255
256
257 vec4 map(vec3 p, bool col_required) {
258     //return mapBirdFeather(p+vec3(0,0,1), col_required);
259     //return mapBirdWing(p-vec3(-1,0,-1), vec3(0.5,0.0,0.15), vec3(0.4,0.05,0.8), vec3(0.7,0.1,1.2), col_required);
260     vec4 d = mapBird(p, col_required);
261     return d;
262 }
263
264
265 float sdf(vec3 p) {
266     const float sc = 1.0;
267     return map(p/sc, false).w*sc;
268 }
```

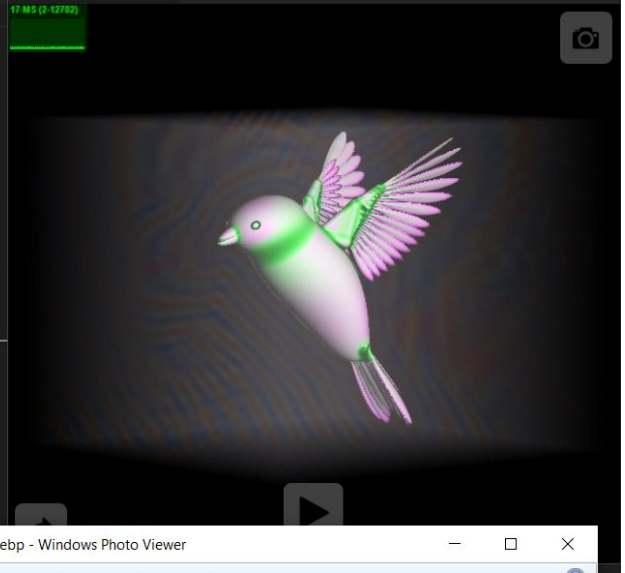
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL

```
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

Try the new cross-platform PowerShell https://aka.ms/pscore6

PS D:\Coding\Github\AVI4M-ISP>
```

Static GLSL Preview



img_6945.webp - Windows Photo Viewer

File Print E-mail Burn Open

2022/01/03 Add skin to the wings of the bird. Model its tail.

master* ⊗ 0 ⚠ 0

File Edit Selection View Go Run Terminal Help

● bird_sdf.glsl - AVI4M-ISP - Visual Studio Code

nest_sdf.glsl | bird_sdf.glsl M ●

modeling > bird-nest > bird_sdf.glsl

```
169
170 > vec4 mapBirdBody(vec3 p, bool col_required) {···
198   }
199
200 > vec4 mapBirdWing(vec3 p, vec3 joint1, vec3 joint2, vec3 tip, bool col_required) {···
267   }
268
269   vec4 mapBird(vec3 p, bool col_required) {
270       p.y = length(vec2(p.y,0.001));
271       vec4 head = mapBirdHead(roty(0.2)*(p-vec3(-0.75,0,0.75)), col_required);
272       vec4 body = mapBirdBody(roty(0.7)*p, col_required);
273       body = smin(head, body, 0.2);
274       vec4 leg = mapBirdLeg(roty(-0.3)*(p-vec3(-0.1,0.2,-0.4))*vec3(1,-1,1)/0.7,
275           vec3(-0.3,0,-0.2), vec3(-0.05,0,-0.4), vec3(-0.2,0,-0.55), 0.12, -0.4, 0.05*PI, 0.1*PI, col_required)*0.7;
276       body = smin(body, leg, 0.2);
277       vec3 rzyx = mix(vec3(-0.2,-0.3,0.3), vec3(-1.2,0.2,0.9), 0.2);
278       vec4 wing = mapBirdWing(rotz(rzyx.x)*roty(rzyx.y)*rotx(rzyx.z)*(p-vec3(-0.1,0.25,0.55))*vec3(1,-1,1)/0.7,
279           vec3(0.5,0.0,0.05),vec3(0.4,0.05,0.7),vec3(0.7,0.1,1.1), col_required)*0.7;
280       body = smin(body, wing, 0.05);
281       return body;
282   }
283
284
285   vec4 map(vec3 p, bool col_required) {
286       //return mapBirdFeather(p+vec3(0,0,1), col_required);
287       //return mapBirdWing(p-vec3(-1,0,-1), vec3(0.5,0.0,0.15), vec3(0.4,0.05,0.8), vec3(0.7,0.1,1.2), col_required);
288       vec4 d = mapBird(p, col_required);
289       return d;
```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL

```
Windows PowerShell
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Try the new cross-platform PowerShell https://aka.ms/pscore6

PS D:\Coding\Github\AVI4M-ISP>
```

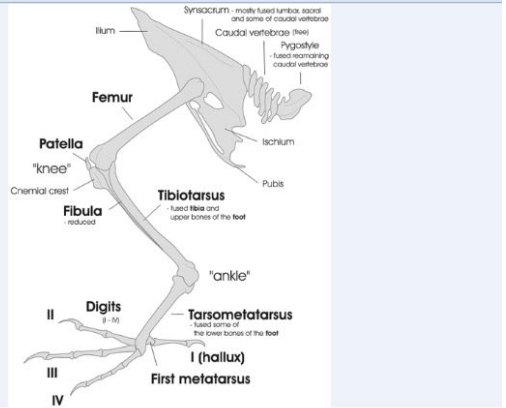
Model the feet of the bird.

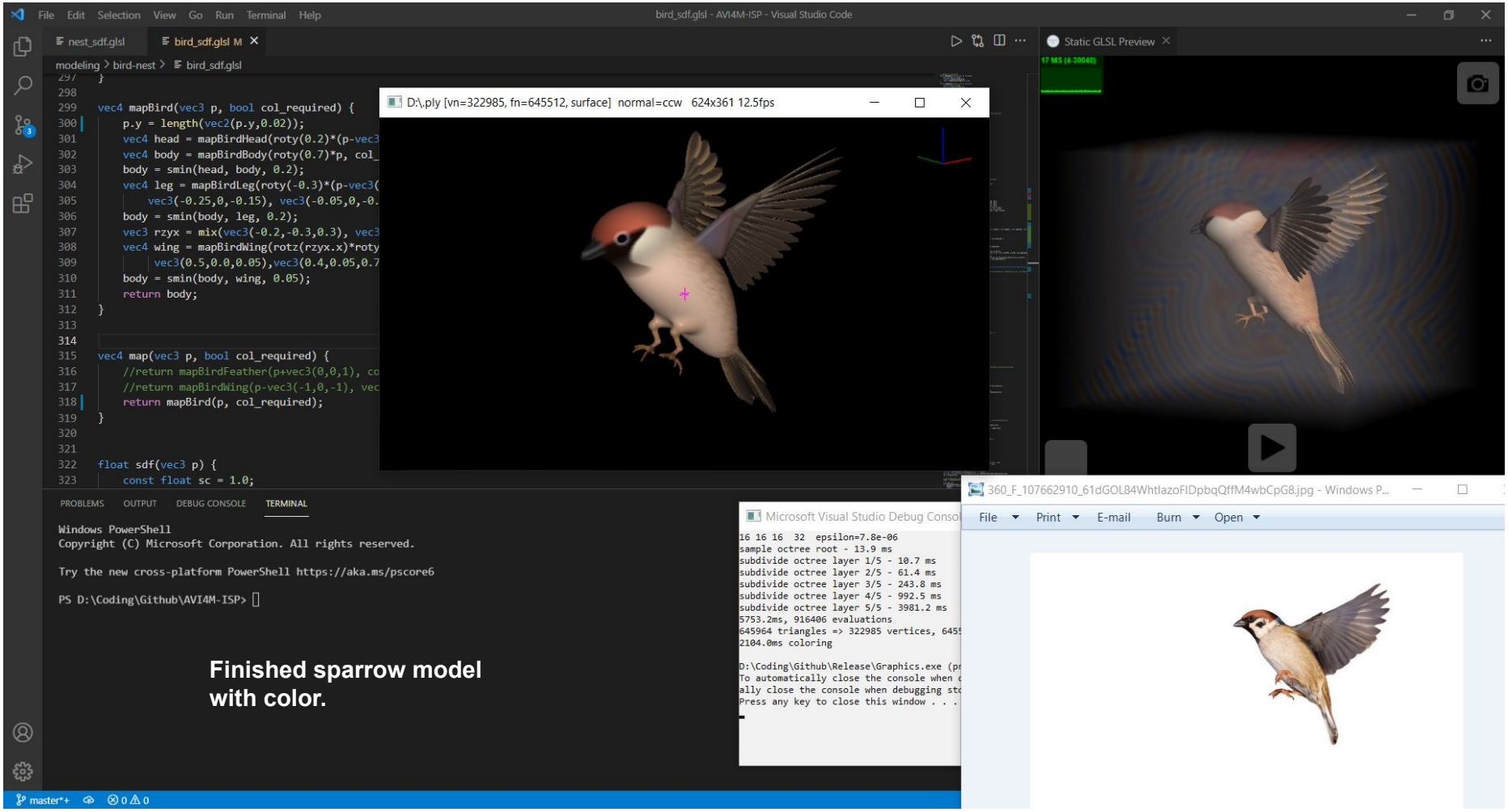
master* ⊗ 0 ⚠ 0

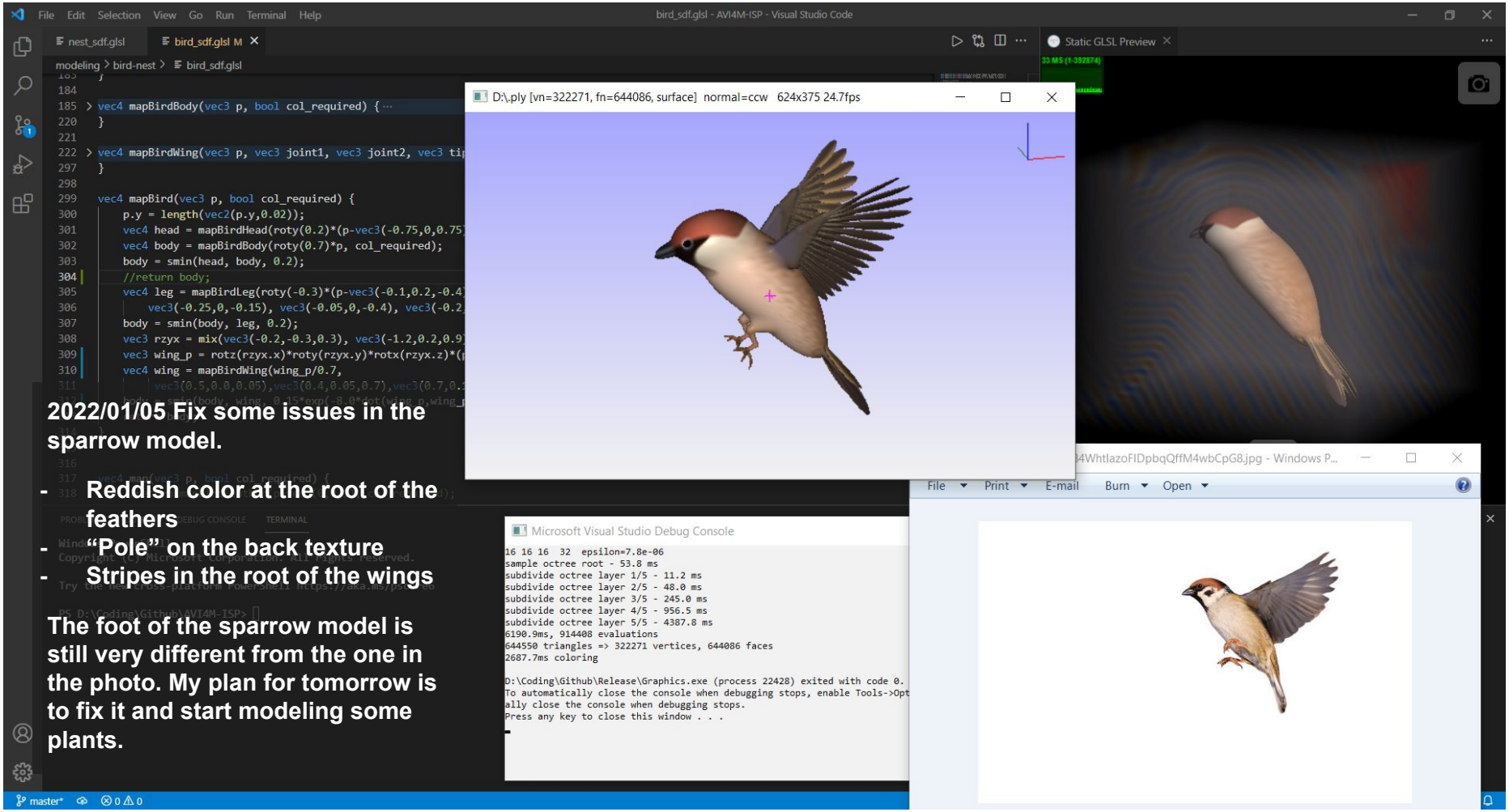
Static GLSL Preview

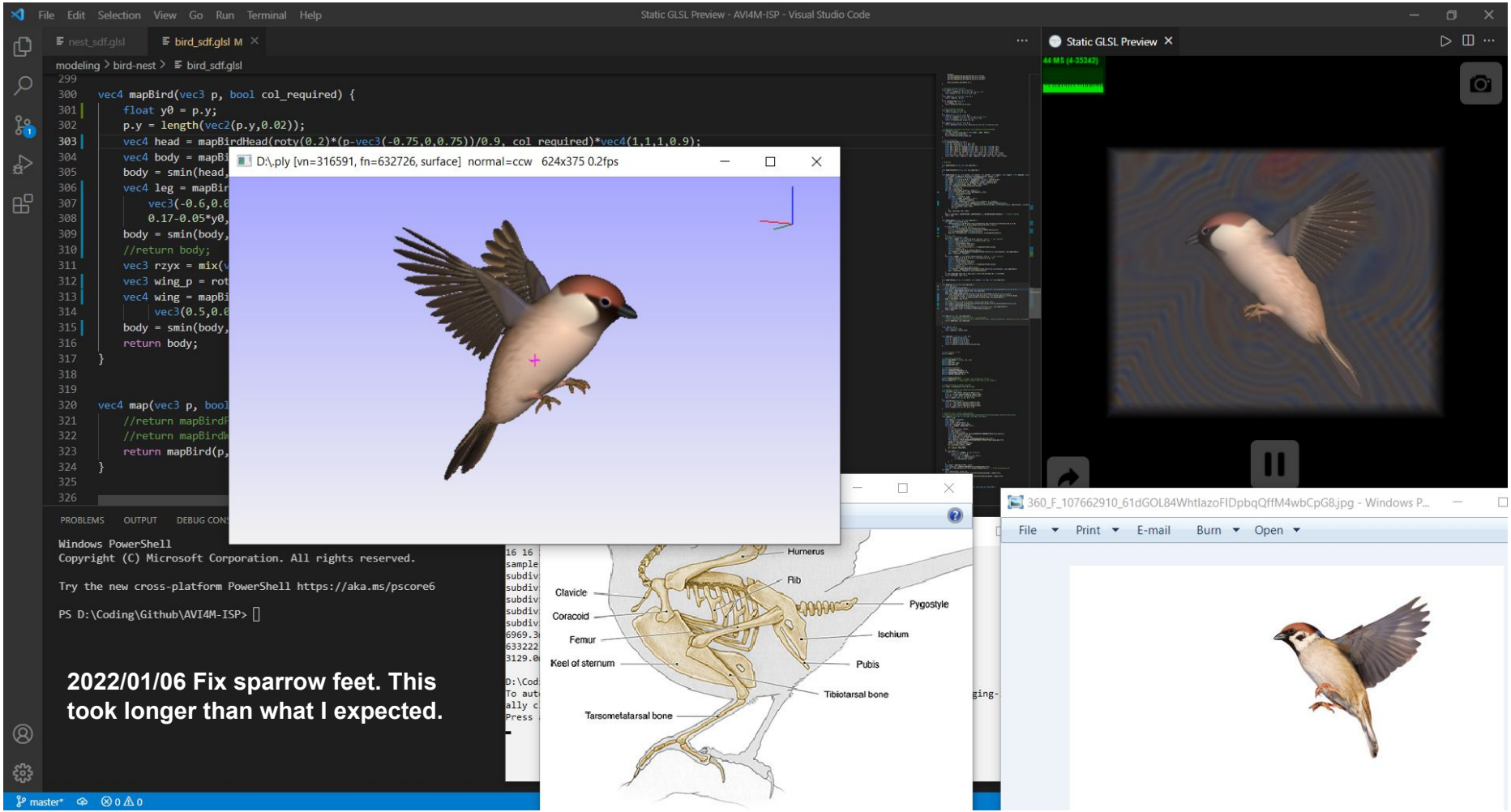
Bird_leg_and_pelvic_girdle_skeleton_EN.gif - Windows Photo Viewer

File Print E-mail Burn Open




File Edit Selection View Go Run Terminal Help
bird_sdf.glsl - AVI4M-ISP - Visual Studio Code
nest_sdf.glsl
bird_sdf.glsl M
modeling > bird-nest > bird_sdf.glsl
vec4 mapBird(vec3 p, bool col_required) {
p.y = length(vec2(p.y,0.02));
vec4 head = mapBirdHead(roty(0.2)*(p-vec3
vec4 body = mapBirdBody(roty(0.7)*p, col_
body = smin(head, body, 0.2);
vec4 leg = mapBirdLeg(roty(-0.3)*(p-vec3(
vec3(-0.25,0,-0.15), vec3(-0.05,0,-0.
body = smin(body, leg, 0.2);
vec3 rzyx = mix(vec3(-0.2,-0.3,0.3), vec3
vec4 wing = mapBirdWing(rotz(rzyx.x)*roty
vec3(0.5,0.0,0.05),vec3(0.4,0.05,0.7
body = smin(body, wing, 0.05);
return body;
}
vec4 map(vec3 p, bool col_required) {
//return mapBirdFeather(p+vec3(0,0,1), co
//return mapBirdWing(p-vec3(-1,0,-1), vec
return mapBird(p, col_required);
}
float sdf(vec3 p) {
const float sc = 1.0;
D:\.ply [vn=322985, fn=645512, surface] normal=ccw 624x361 12.5fps
Static GLSL Preview
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.
Try the new cross-platform PowerShell https://aka.ms/pscore6
PS D:\Coding\Github\AVI4M-ISP>
Microsoft Visual Studio Debug Conso
16 16 16 32 epsilon=7.8e-06
sample octree root - 13.9 ms
subdivide octree layer 1/5 - 10.7 ms
subdivide octree layer 2/5 - 61.4 ms
subdivide octree layer 3/5 - 243.8 ms
subdivide octree layer 4/5 - 992.5 ms
subdivide octree layer 5/5 - 3981.2 ms
5753.2ms, 916406 evaluations
645964 triangles => 322985 vertices, 6455
2104.0ms coloring
D:\Coding\Github\Release\Graphics.exe (pr
To automatically close the console when d
ally close the console when debugging sto
Press any key to close this window . . .
360_F_107662910_61dGOL84WhtlazoFIDpbqQffM4wbCpG8.jpg - Windows P...
File Print E-mail Burn Open
master*+
Finished sparrow model with color.


bird_sdf.glsl - AVI4M-ISP - Visual Studio Code
nest_sdf.glsl
bird_sdf.glsl M
modeling > bird-nest > bird_sdf.glsl
vec4 mapBirdBody(vec3 p, bool col_required) {
vec4 mapBirdWing(vec3 p, vec3 joint1, vec3 joint2, vec3 ti
vec4 mapBird(vec3 p, bool col_required) {
p.y = length(vec2(p.y,0.02));
vec4 head = mapBirdHead(roty(0.2)*(p-vec3(-0.75,0,0.75
vec4 body = mapBirdBody(roty(0.7)*p, col_required);
body = smin(head, body, 0.2);
//return body;
vec4 leg = mapBirdLeg(roty(-0.3)*(p-vec3(-0.1,0.2,-0.4
vec3(-0.25,0,-0.15), vec3(-0.05,0,-0.4), vec3(-0.2
body = smin(body, leg, 0.2);
vec3 rzyx = mix(vec3(-0.2,-0.3,0.3), vec3(-1.2,0.2,0.9
vec3 wing_p = rotz(rzyx.x)*roty(rzyx.y)*rotx(rzyx.z)*(
vec4 wing = mapBirdWing(wing_p/0.7,
vec3(0.5,0.0,0.05),vec3(0.4,0.05,0.7),vec3(0.7,0.1
D:\.ply [vn=322271, fn=644086, surface] normal=ccw 624x375 24.7fps
Static GLSL Preview
2022/01/05 Fix some issues in the sparrow model.
- Reddish color at the root of the feathers
- “Pole” on the back texture
- Stripes in the root of the wings
The foot of the sparrow model is still very different from the one in the photo. My plan for tomorrow is to fix it and start modeling some plants.
Microsoft Visual Studio Debug Console
16 16 16 32 epsilon=7.8e-06
sample octree root - 53.8 ms
subdivide octree layer 1/5 - 11.2 ms
subdivide octree layer 2/5 - 48.0 ms
subdivide octree layer 3/5 - 245.0 ms
subdivide octree layer 4/5 - 956.5 ms
subdivide octree layer 5/5 - 4387.8 ms
6190.9ms, 914408 evaluations
644550 triangles => 322271 vertices, 644086 faces
2687.7ms coloring
D:\Coding\Github\Release\Graphics.exe (process 22428) exited with code 0.
To automatically close the console when debugging stops, enable Tools->Opt
ally close the console when debugging stops.
Press any key to close this window . . .
File Print E-mail Burn Open
master*


File Edit Selection View Go Run Terminal Help
Static GLSL Preview - AVI4M-ISP - Visual Studio Code
nest_sdf.glsl
bird_sdf.glsl M
modeling > bird-nest > bird_sdf.glsl
vec4 mapBird(vec3 p, bool col_required) {
float y0 = p.y;
p.y = length(vec2(p.y,0.02));
vec4 head = mapBirdHead(roty(0.2)*(p-vec3(-0.75,0,0.75))/0.9, col_required)*vec4(1,1,1,0.9);
body = smin(body,
return body;
vec4 map(vec3 p, bool
return mapBird(p,
D:\.ply [vn=316591, fn=632726, surface] normal=ccw 624x375 0.2fps
Static GLSL Preview
PROBLEMS OUTPUT DEBUG CONS
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.
Try the new cross-platform PowerShell https://aka.ms/pscore6
PS D:\Coding\Github\AVI4M-ISP>
2022/01/06 Fix sparrow feet. This took longer than what I expected.
Humerus
Rib
Clavicle
Pygostyle
Coracoid
Ischium
Femur
Pubis
Keel of sternum
Tibiotarsal bone
Tarsometatarsal bone
360_F_107662910_61dGOL84WhtlazoFIDpbqQffM4wbCpG8.jpg - Windows P...
File Print E-mail Burn Open
master*

File Edit Selection View Go Run Terminal Help — Static GLSL Preview - AVI4M-ISP - Visual Studio Code

nest_sdf.glsl | bird_sdf.glsl | berries.glsl U | group_01_sdf.glsl

modeling > bird-nest > berries.glsl

```
164     br.x = 1.6;
165     br.y = 0.85 -0.45*exp(-sqr(1.2*(p.x-1.5))) -0.3*exp(-sqr(2.5*(p.x+1.6)));
166     br.z = 0.08;
167     float dqz = 0.0;
168     float d2e = abs( br.y*sqrt(smax(br.x*br.x-p.x*p.x,0.0,0.1))/br.x - abs(p.y) );
169     float veins = asin(0.9*sin((16.0+2.0*p.x)*(p.x-0.5*abs(p.y)-0.5*pow(abs(p.y),1.3)+0.2*pow(d2e,0.4))+sign(p.y)*0.4*PI));
170     float veins_fade = (1.0-exp(-(6.0/br.y)*abs(p.y))) * (1.0-exp(-(2.0/br.y)*d2e)) * (exp(-0.2*p.x));
171     dqz += 0.01 * veins*veins_fade;
172     dqz += 0.05 * smax(veins_fade*(veins-0.9),0.0,0.1);
173     float midrib = abs(p.y)-1.0;
174     float midrib_fade = (1.0-exp(-(4.0/br.y)*abs(p.y))) * (exp(-0.4*p.x));
175     dqz += 0.05 * midrib*midrib_fade;
176     vec3 q = p;
177     q.z -= 0.5*(1.0-exp(-0.5*length(vec2(p.y,0.01))));
178     q.z -= 0.1*cos(p.x);
179     vec4 leaf = vec4(0,0,0, sdEllipsoid(q+vec3(0,0,dqz), br));
180     if (col_required) leaf.xyz = mix(vec3(0.3,0.45,0.05), vec3(0.55,0.7,0.15), -0.5-20.0*dqz);
181     vec4 stem = vec4(0.3,0.35,0.05, sdSegment(q-vec3(0,0,-0.00), vec3(-1.8,0,0), vec3(1.0,0,0)) - 0.06*exp(-0.2*abs(p.x+1.8)));
182     return smin(leaf, stem, mix(0.05,0.001,clamp(p.x+1.8,0.,1.)));
183 }
184
185 vec4 mapBerries(vec3 p, bool col_required) {
186     vec4 res = vec4(0, 0, 0, 1e8);
187     return mapBerriesFruit(p, col_required);
```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL

```
Windows PowerShell
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Try the new cross-platform PowerShell https://aka.ms/pscore6

PS D:\Coding\Github\AVI4M-ISP>
```

master* ⊗0 ⚠0

Static GLSL Preview

Duchesnea_indica-1024x837.jpg - Windows Photo Viewer

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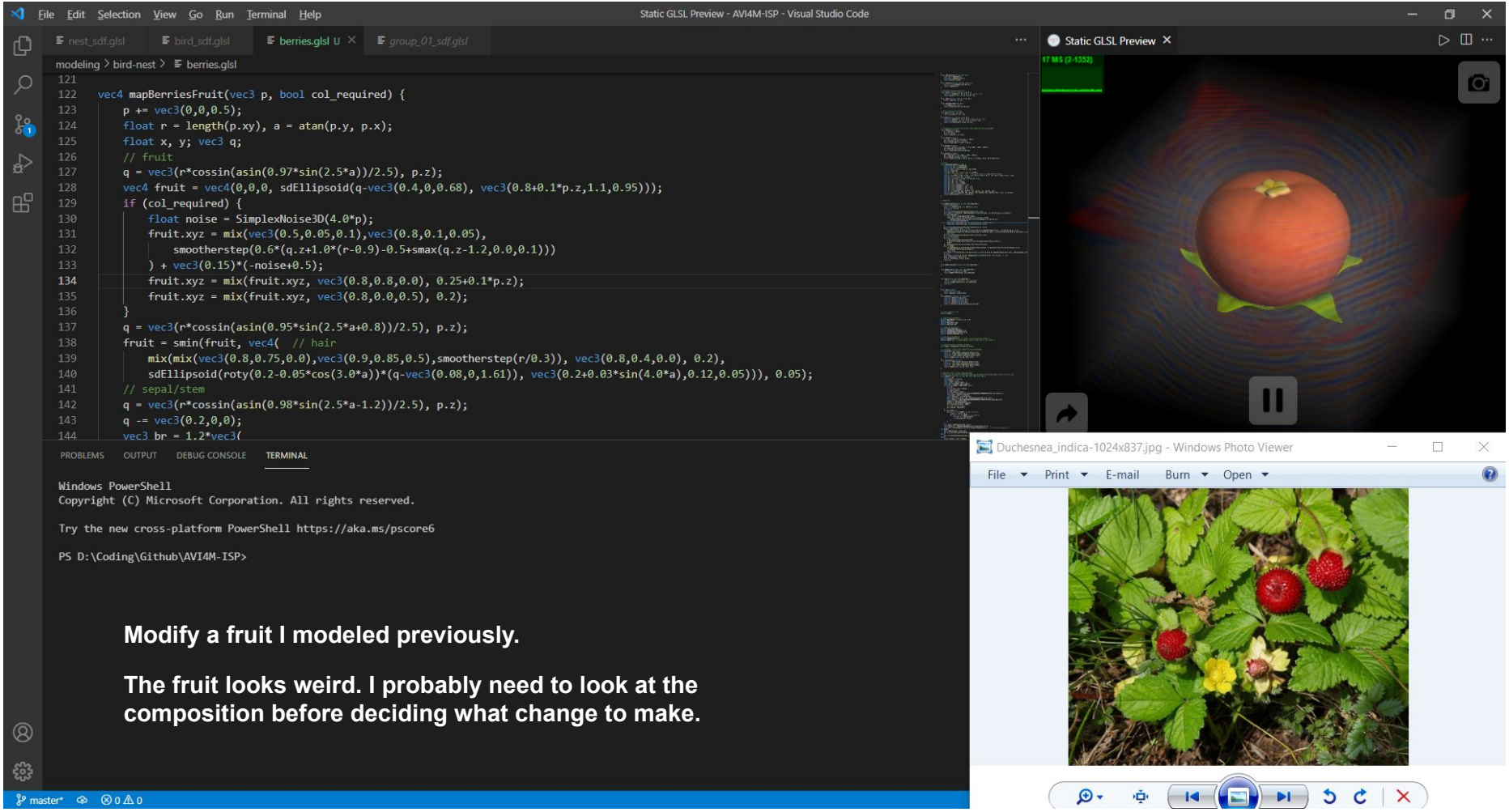
2022/01/07 Start modeling plants.

Model a leaf. It is more from imagination than from observation.



Modify a fruit I modeled previously.

The fruit looks weird. I probably need to look at the composition before deciding what change to make.

File Edit Selection View Go Run Terminal Help — liriope.glsl - AVI4M-ISP - Visual Studio Code

nest_sdf.glsl | bird_sdf.glsl | berries.glsl | liriope.glsl U

modeling > bird-nest > liriope.glsl

```
128     vec4 flower = vec4(mix(vec3(0.65,0.45,0.7), vec3(0.85,0.75,0.95), (3.0*(q1.x-1.0)+0.5)+0.15*sin(5.0*a1)),
129         sdEllipsoid(q1-vec3(1.0,0.0,0.05), vec3(0.45,vec2(0.3+0.1*(q1.x-1.0)))));
130     vec4 d = smin(stem, flower, 0.1);
131     return d;
132 }
133
134 vec4 mapLiriopeFlowers(vec3 p, bool col_required) {
135     p.x += 0.1*cos(p.z);
136     vec4 bound = vec4(1,1,1, max(length(p.xy)-1.0, max(p.z-2.6, -3.5-p.z))), boundw = vec4(0,0,0,0.4);
137     if (bound.w > 0.0) return bound+boundw;  // clipping
138     vec4 stem = vec4(0,0,0, sdSegment(p, vec3(0,0,-3.0), vec3(0,0,2))-0.06);
139     if (col_required) {
140         stem.xyz = mix(vec3(0.6,0.35,0.65), vec3(0.9,0.8,0.95), smootherstep((p.z+1.0)/3.0));
141         stem.xyz *= mix(vec3(0.35,0.2,0.25), vec3(1.0), 0.2+0.8*smootherstep((p.z+2.5)/2.5));
142     }
143     float seed = 0.0;
144     for (float t=0.0; t<1.0; t+=1.0/11.0) {
145         float h = mix(-1.5, 2.0, 1.0-pow(1.0-t,1.2));
146         h += 0.5*t*(1.0-t)*(2.0*rand(seed)-1.0);
147         vec3 q = p-vec3(0,0,h);
148         q.xy = rot2(2.0*PI*rand(seed))*q.xy;
149         float elev = 0.05*PI + 0.15*PI*t + mix(0.05*PI, 0.2*PI, rand(seed));
150         float sc = 0.08*(1.0+0.3*t-1.3*t*t) + mix(0.25, 0.4, smoothstep(0.,1.,(p.x+1.0)/2.0)) * (1.0+0.1*rand(seed));
151         vec4 d = mapLiriopeFlowersLayer(elev, q/sc, col_required)*vec4(1,1,1,sc);
152         if (col_required) d.xyz = mix(d.xyz, mix(vec3(0.65,0.45,0.75), vec3(0.8,0.7,0.9), t), 0.2);
153         stem = smin(stem, d, 0.05);
154     }
155     //stem = mix(stem, bound+boundw, smoothstep(0.,1.,(bound.w+boundw.w)/boundw.w));  // smooth clipping
156     return stem;
157 }
```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL

```
Windows PowerShell
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Try the new cross-platform PowerShell https://aka.ms/pscore6

PS D:\Coding\Github\AVI4M-ISP>
```
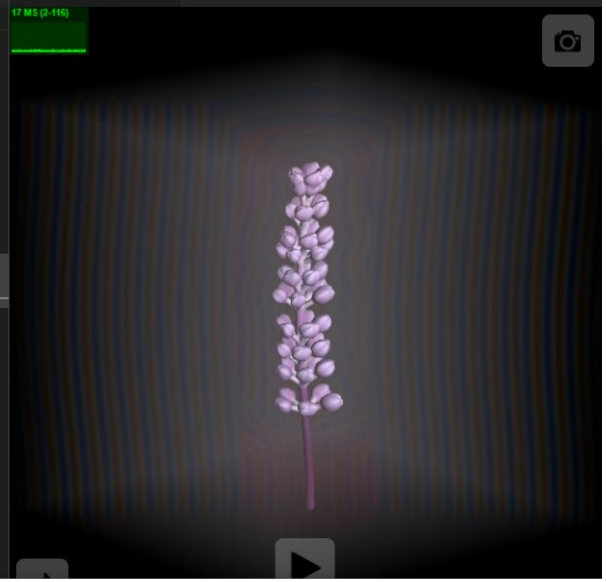

master* ⊗0 ⚠0

Static GLSL Preview

17 MS (2-116)

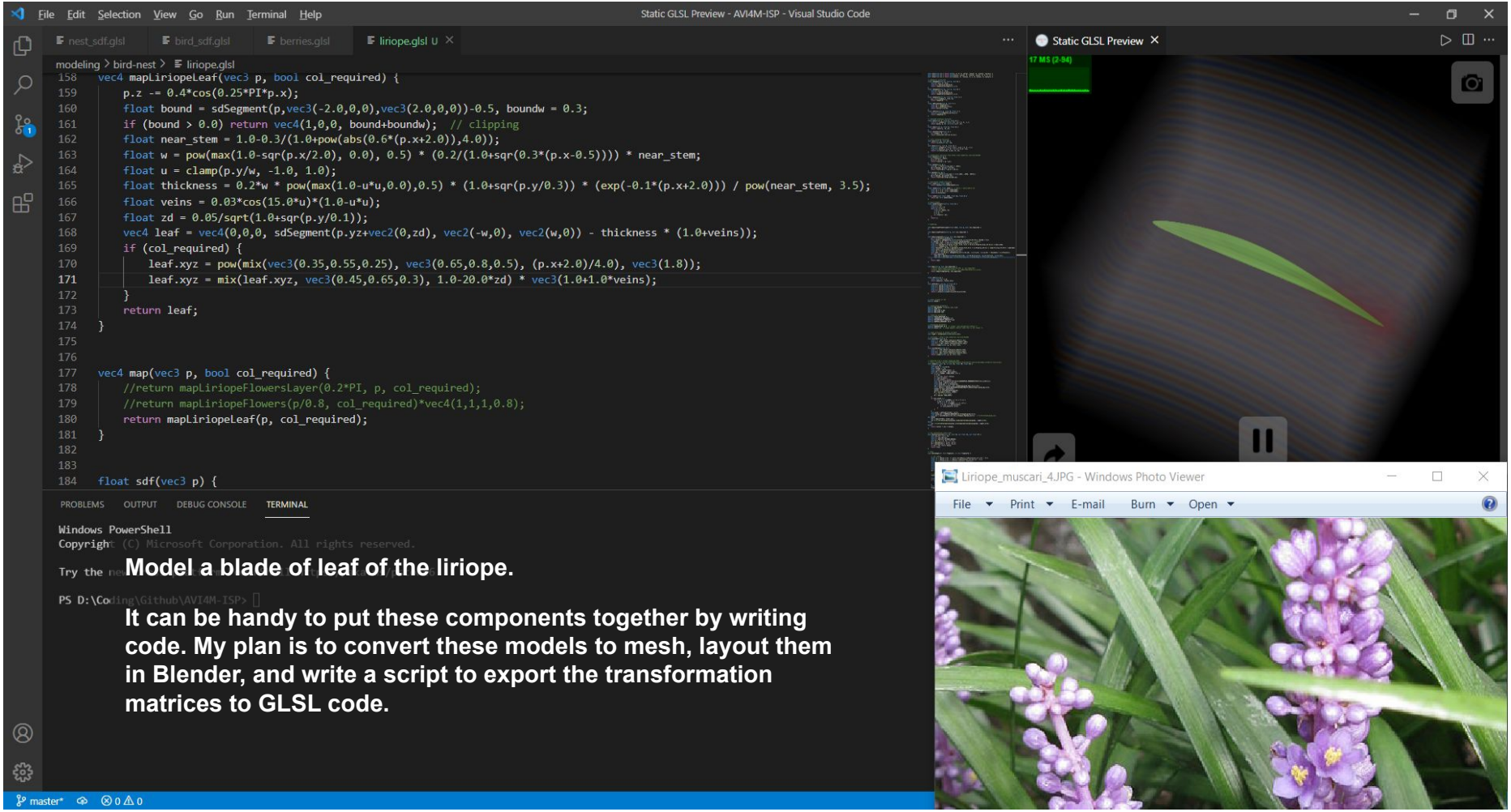


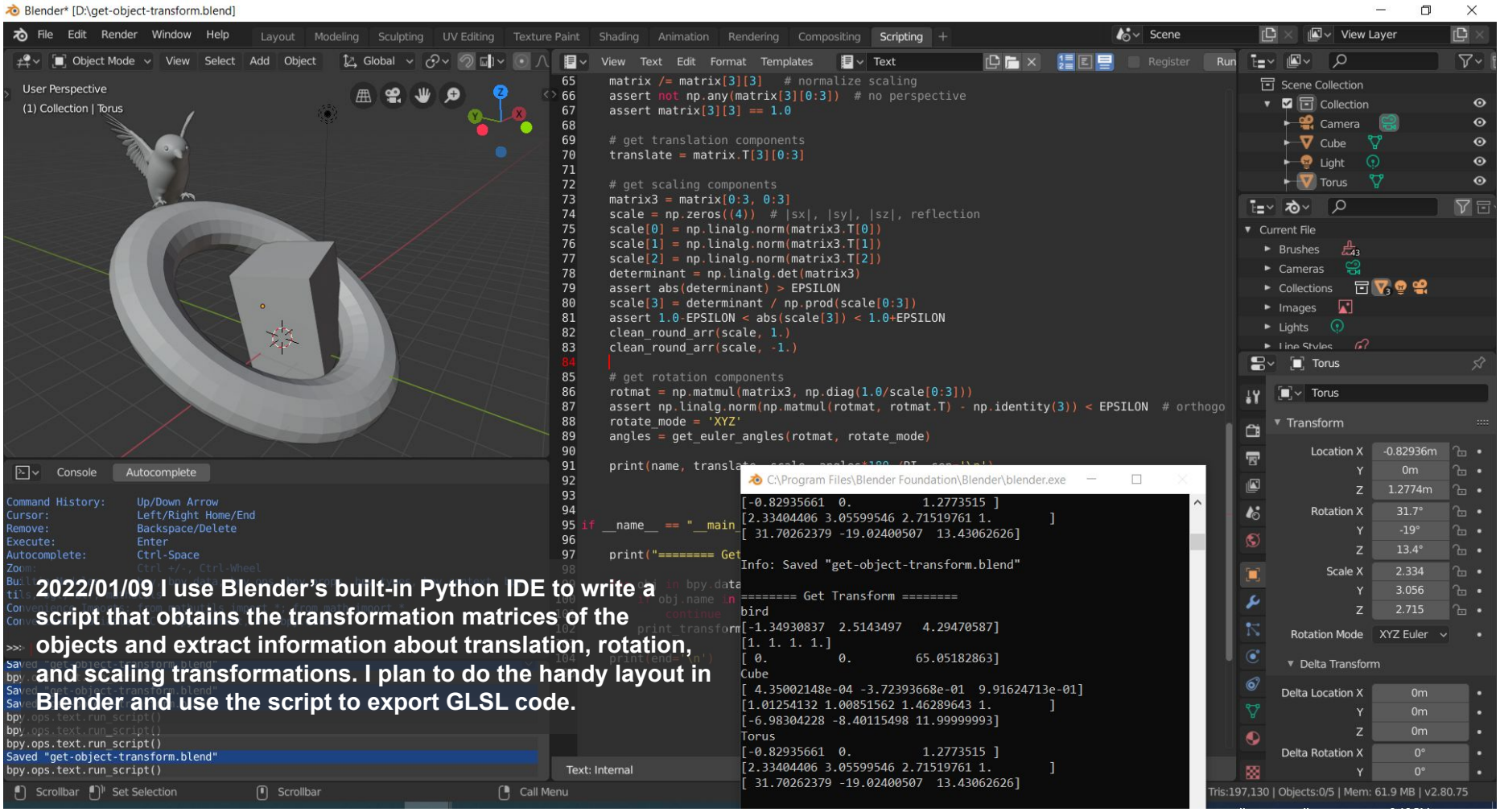
Liriope_muscari_4.JPG - Windows Photo Viewer

File Print E-mail Burn Open

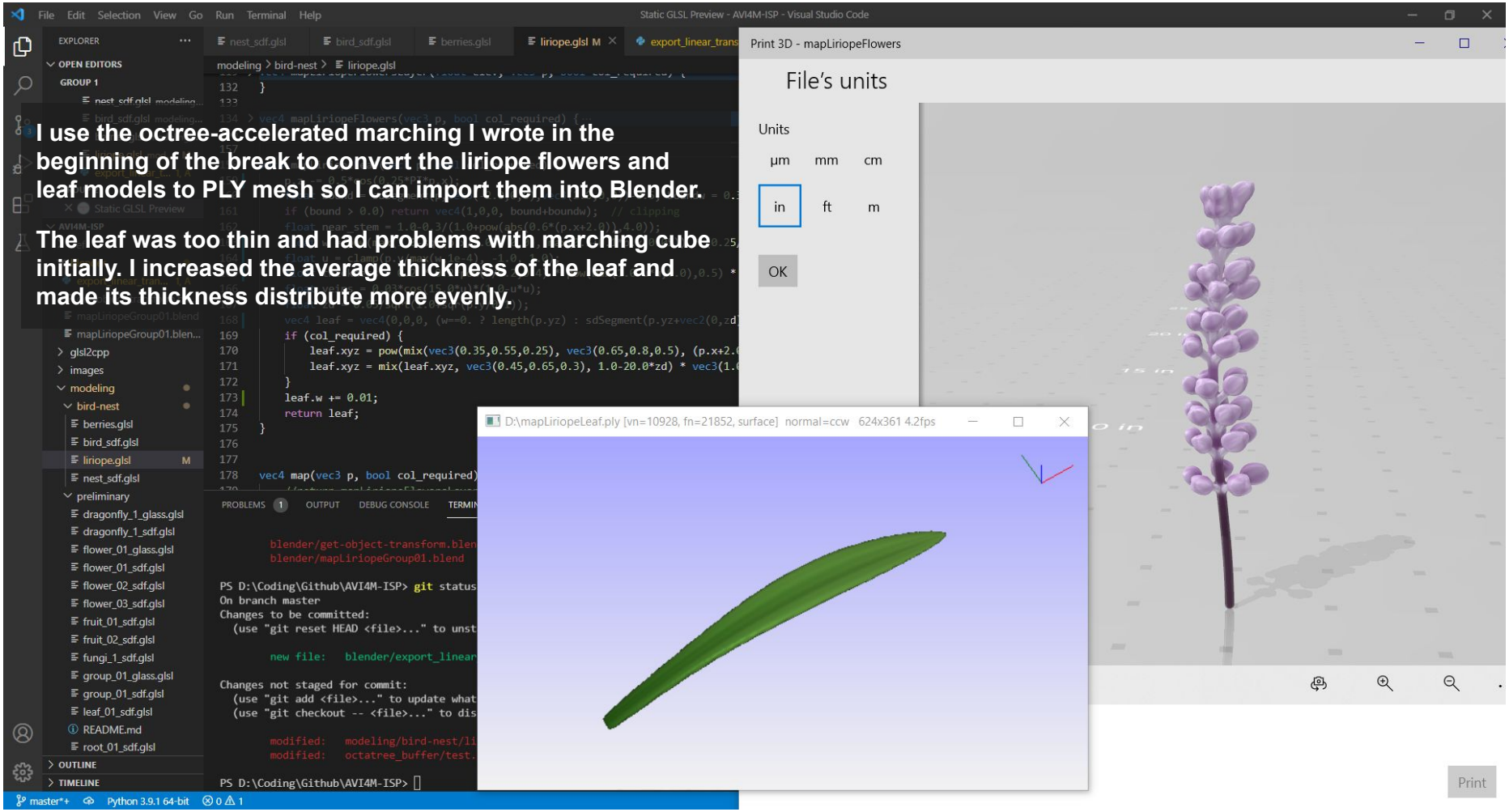
2022/01/08 Model another type of plant that surrounds the bird nest.

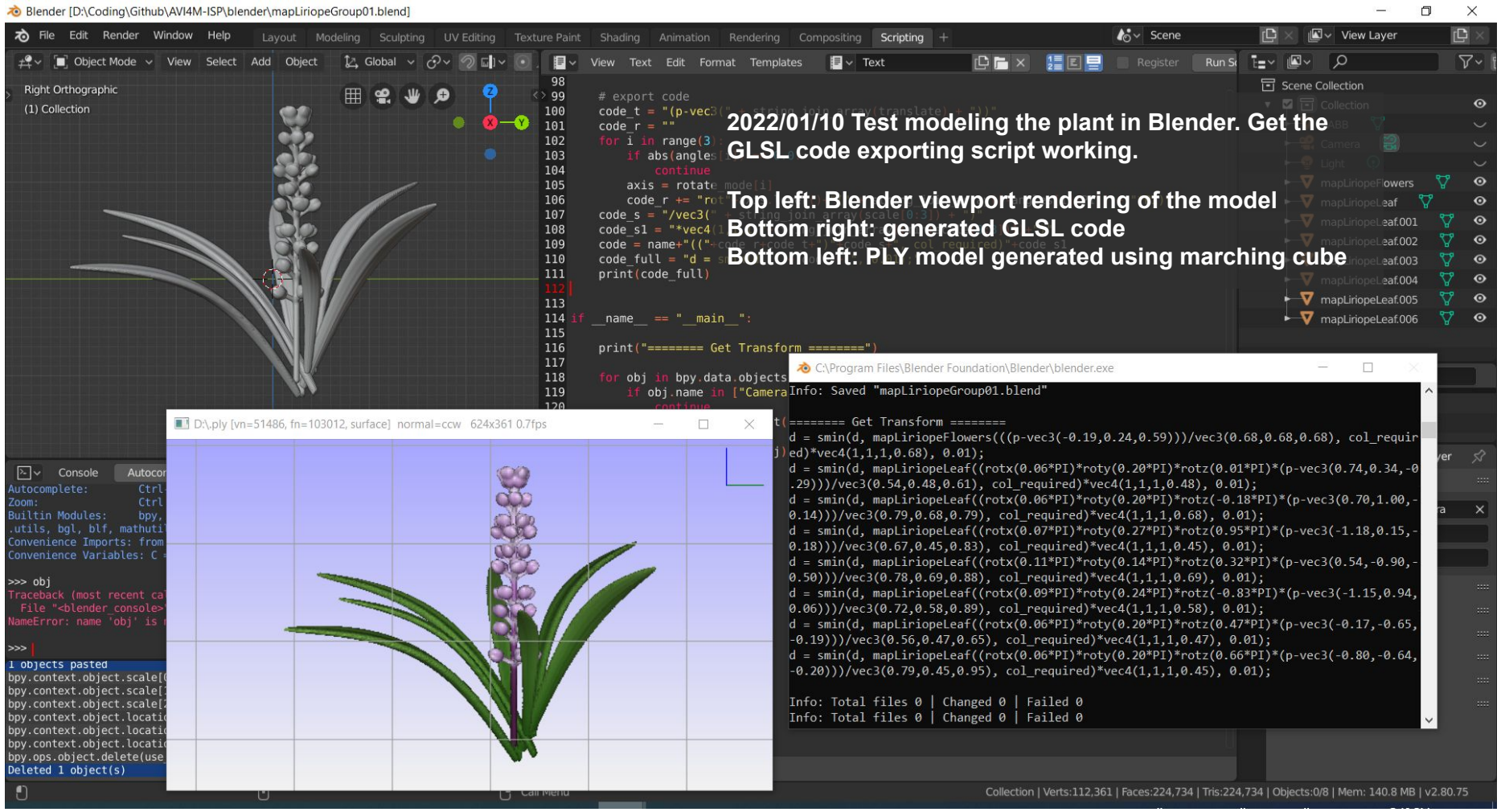
Google tells me the name of this plant is “liriope”.

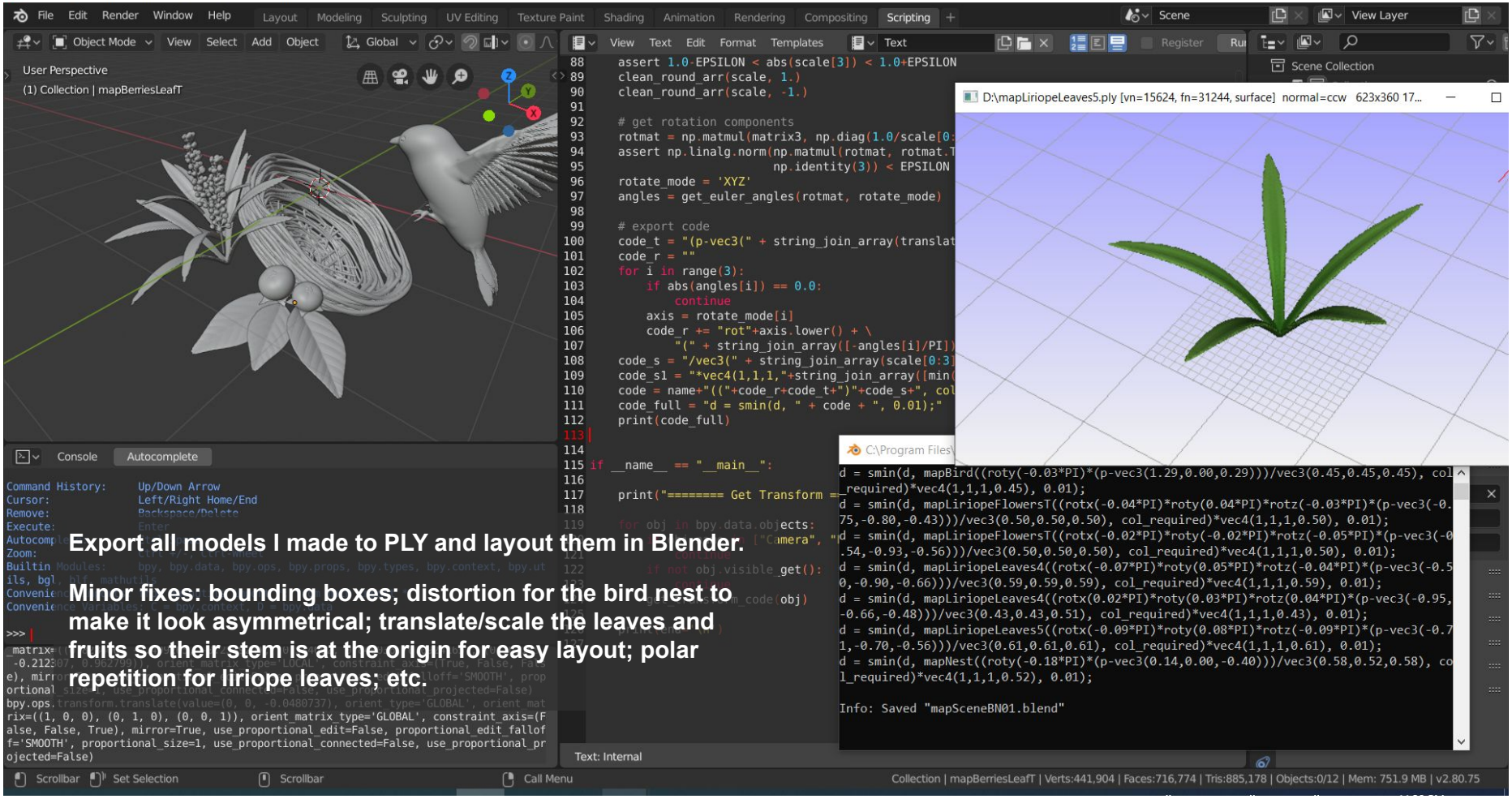

File Edit Selection View Go Run Terminal Help
Static GLSL Preview - AVI4M-ISP - Visual Studio Code
nest_sdf.glsl
bird_sdf.glsl
berries.glsl
liriope.glsl U
modeling > bird-nest > liriope.glsl
158 vec4 mapLiriopeLeaf(vec3 p, bool col_required) {
159 p.z -= 0.4*cos(0.25*PI*p.x);
160 float bound = sdSegment(p,vec3(-2.0,0,0),vec3(2.0,0,0))-0.5, boundw = 0.3;
161 if (bound > 0.0) return vec4(1,0,0, bound+boundw); // clipping
162 float near_stem = 1.0-0.3/(1.0+pow(abs(0.6*(p.x+2.0)),4.0));
163 float w = pow(max(1.0-sqr(p.x/2.0), 0.0), 0.5) * (0.2/(1.0+sqr(0.3*(p.x-0.5)))) * near_stem;
164 float u = clamp(p.y/w, -1.0, 1.0);
165 float thickness = 0.2*w * pow(max(1.0-u*u,0.0),0.5) * (1.0+sqr(p.y/0.3)) * (exp(-0.1*(p.x+2.0))) / pow(near_stem, 3.5);
166 float veins = 0.03*cos(15.0*u)*(1.0-u*u);
167 float zd = 0.05/sqrt(1.0+sqr(p.y/0.1));
168 vec4 leaf = vec4(0,0,0, sdSegment(p.yz+vec2(0,zd), vec2(-w,0), vec2(w,0)) - thickness * (1.0+veins));
169 if (col_required) {
170 leaf.xyz = pow(mix(vec3(0.35,0.55,0.25), vec3(0.65,0.8,0.5), (p.x+2.0)/4.0), vec3(1.8));
171 leaf.xyz = mix(leaf.xyz, vec3(0.45,0.65,0.3), 1.0-20.0*zd) * vec3(1.0+1.0*veins);
172 }
173 return leaf;
174 }
175
176
177 vec4 map(vec3 p, bool col_required) {
178 //return mapLiriopeFlowersLayer(0.2*PI, p, col_required);
179 //return mapLiriopeFlowers(p/0.8, col_required)*vec4(1,1,1,0.8);
180 return mapLiriopeLeaf(p, col_required);
181 }
182
183
184 float sdf(vec3 p) {
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.
Try the new
PS D:\Coding\Github\AVI4M-ISP>
master*
Static GLSL Preview
17 MS (2-94)
Liriope_muscari_4.JPG - Windows Photo Viewer
File Print E-mail Burn Open
Model a blade of leaf of the liriope.
It can be handy to put these components together by writing code. My plan is to convert these models to mesh, layout them in Blender, and write a script to export the transformation matrices to GLSL code.

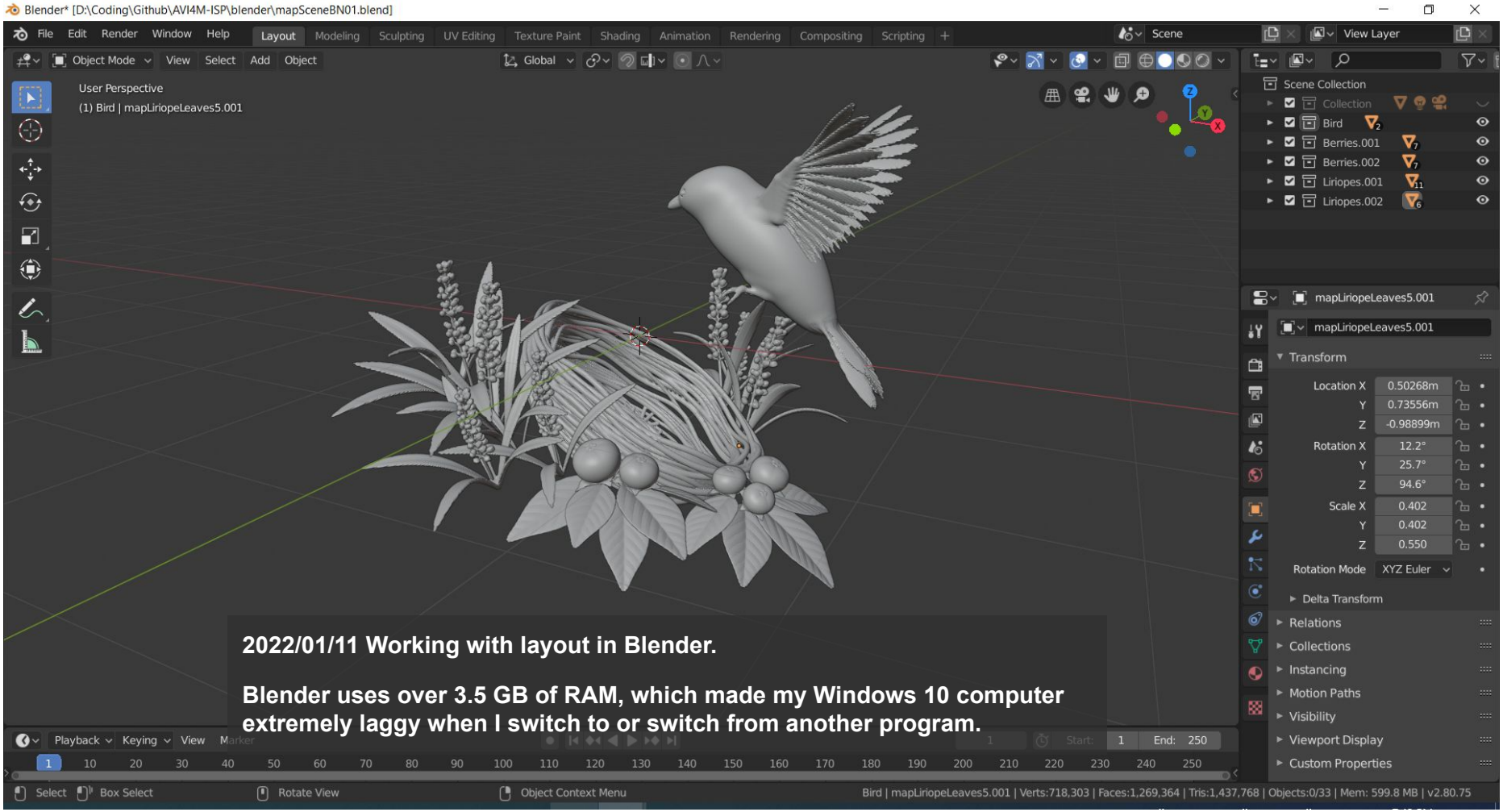


2022/01/09 I use Blender's built-in Python IDE to write a script that obtains the transformation matrices of the objects and extract information about translation, rotation, and scaling transformations. I plan to do the handy layout in Blender and use the script to export GLSL code.


I use the octree-accelerated marching I wrote in the beginning of the break to convert the liriope flowers and leaf models to PLY mesh so I can import them into Blender.
The leaf was too thin and had problems with marching cube initially. I increased the average thickness of the leaf and made its thickness distribute more evenly.
Static GLSL Preview - AVI4M-ISP - Visual Studio Code
Print 3D - mapLiriopeFlowers
File's units
Units
µm mm cm
in ft m
OK
D:\mapLiriopeLeaf.ply [vn=10928, fn=21852, surface] normal=ccw 624x361 4.2fps
Print

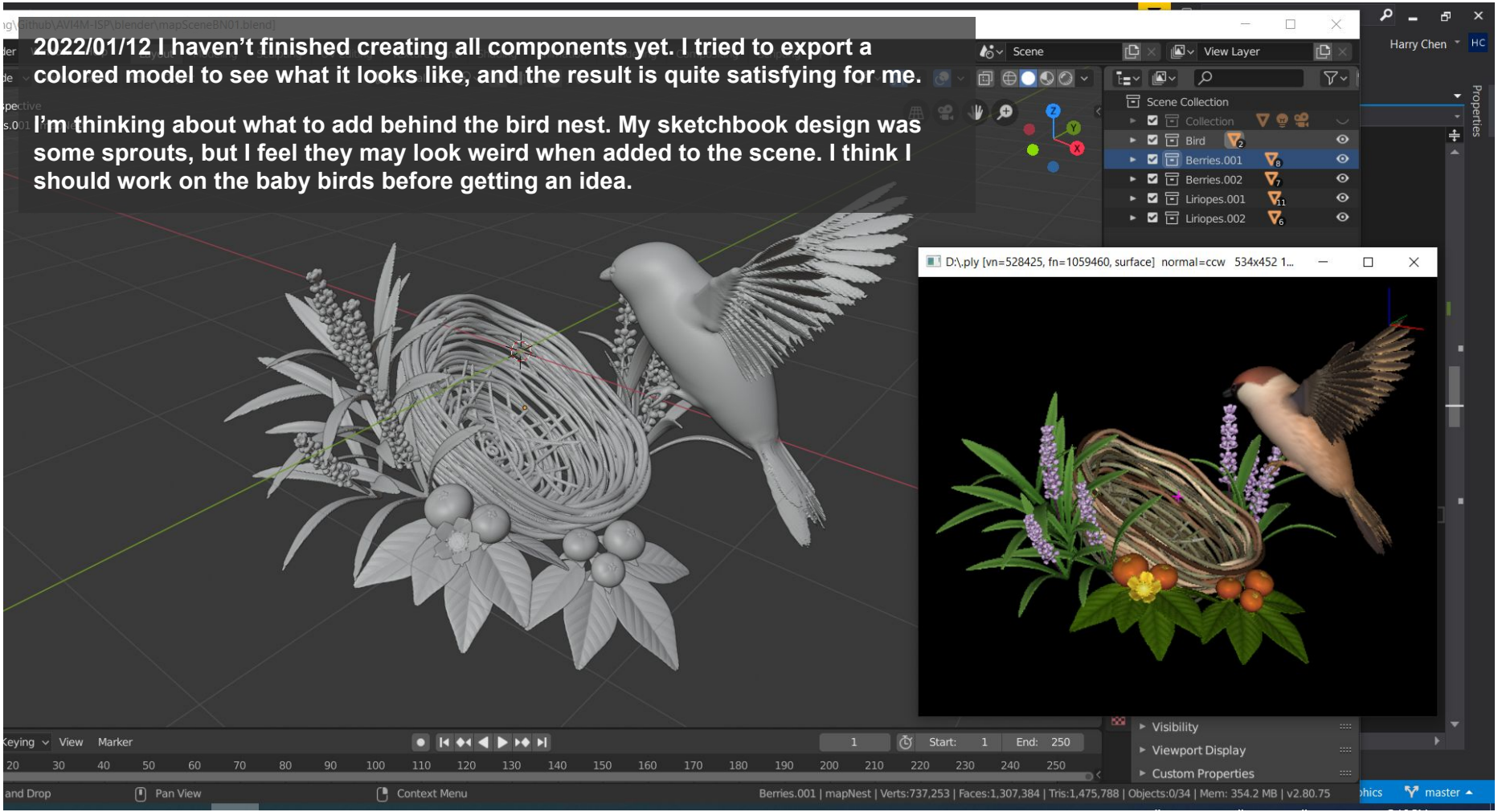

2022/01/10 Test modeling the plant in Blender. Get the GLSL code exporting script working.
Top left: Blender viewport rendering of the model
Bottom right: generated GLSL code
Bottom left: PLY model generated using marching cube

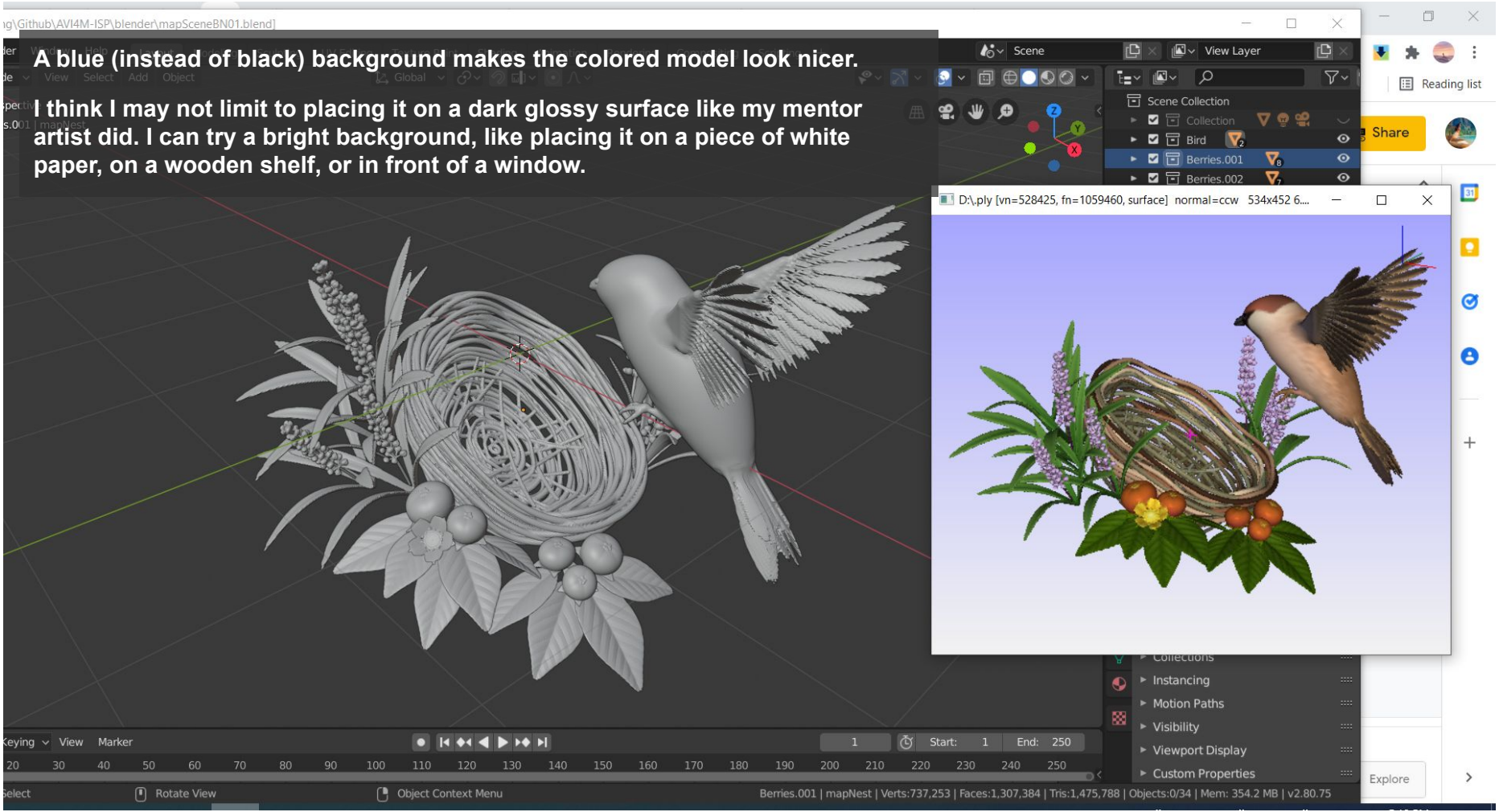

Export all models I made to PLY and layout them in Blender.
Minor fixes: bounding boxes; distortion for the bird nest to make it look asymmetrical; translate/scale the leaves and fruits so their stem is at the origin for easy layout; polar repetition for liriope leaves; etc.

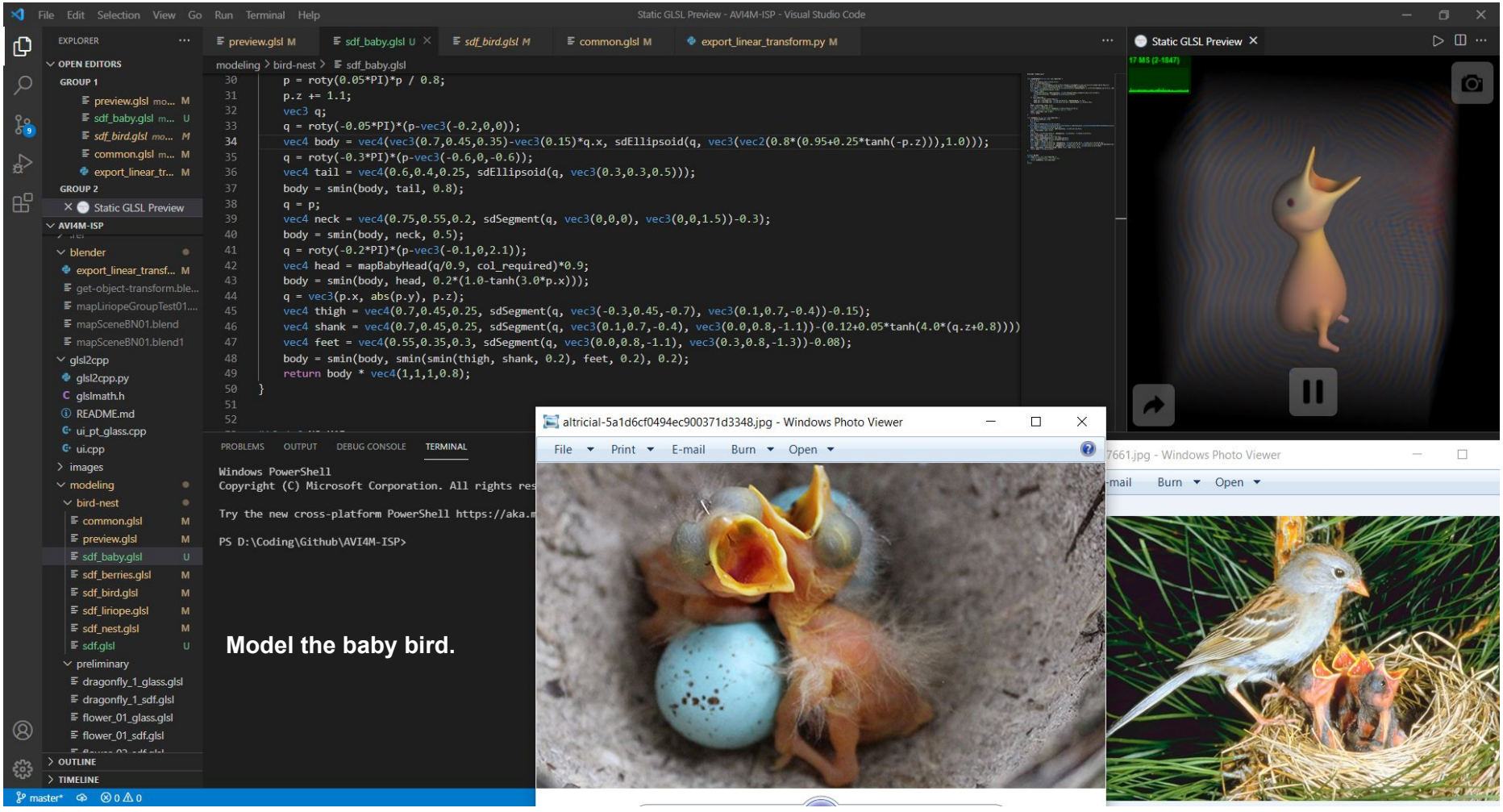

Blender* [D:\Coding\Github\AVI4M-ISP\blender\mapSceneBN01.blend]
File Edit Render Window Help
Layout Modeling Sculpting UV Editing Texture Paint Shading Animation Rendering Compositing Scripting
Scene
View Layer
Object Mode View Select Add Object
Global
User Perspective
(1) Bird | mapLiriopeLeaves5.001
Scene Collection
Collection
Bird
Berries.001
Berries.002
Liriopes.001
Liriopes.002
mapLiriopeLeaves5.001
Transform
Location X 0.50268m
Y 0.73556m
Z -0.98899m
Rotation X 12.2°
Y 25.7°
Z 94.6°
Scale X 0.402
Y 0.402
Z 0.550
Rotation Mode XYZ Euler
Delta Transform
Relations
Collections
Instancing
Motion Paths
Visibility
Viewport Display
Custom Properties
2022/01/11 Working with layout in Blender.
Blender uses over 3.5 GB of RAM, which made my Windows 10 computer extremely laggy when I switch to or switch from another program.
Playback Keying View Marker
Start: 1 End: 250
Select Box Select Rotate View Object Context Menu
Bird | mapLiriopeLeaves5.001 | Verts:718,303 | Faces:1,269,364 | Tris:1,437,768 | Objects:0/33 | Mem: 599.8 MB | v2.80.75

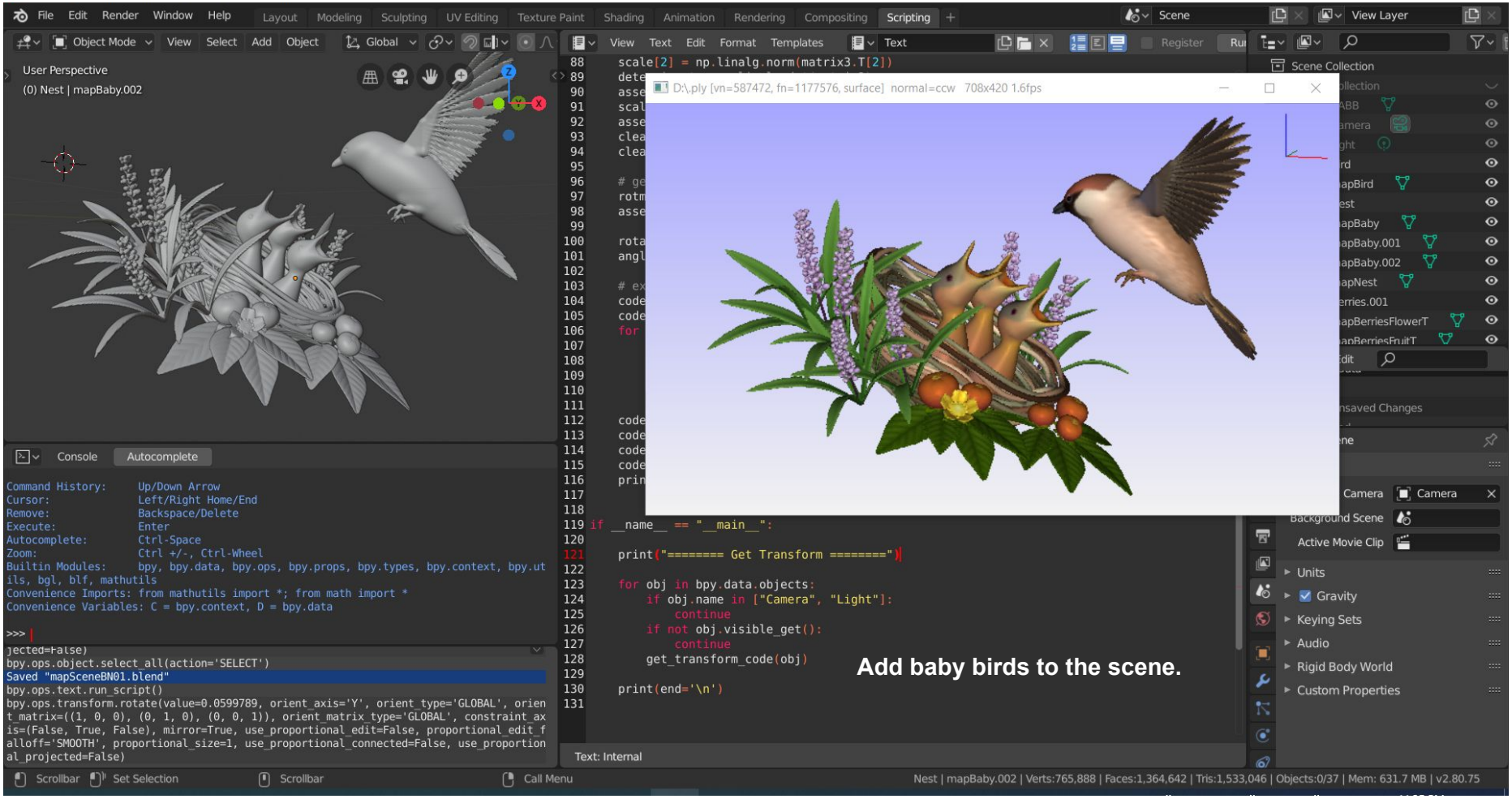
2022/01/12 I haven't finished creating all components yet. I tried to export a colored model to see what it looks like, and the result is quite satisfying for me.

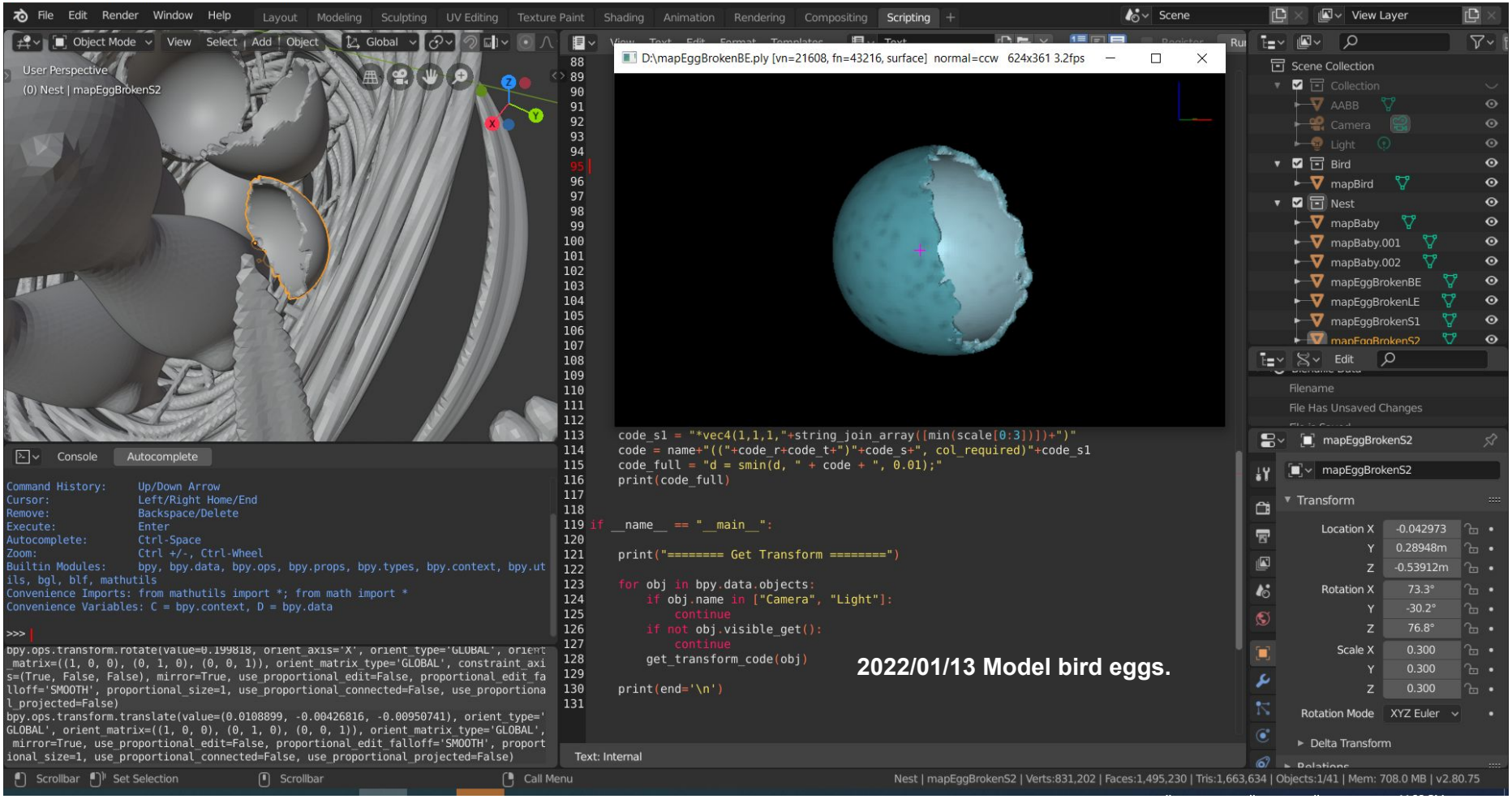
I'm thinking about what to add behind the bird nest. My sketchbook design was some sprouts, but I feel they may look weird when added to the scene. I think I should work on the baby birds before getting an idea.

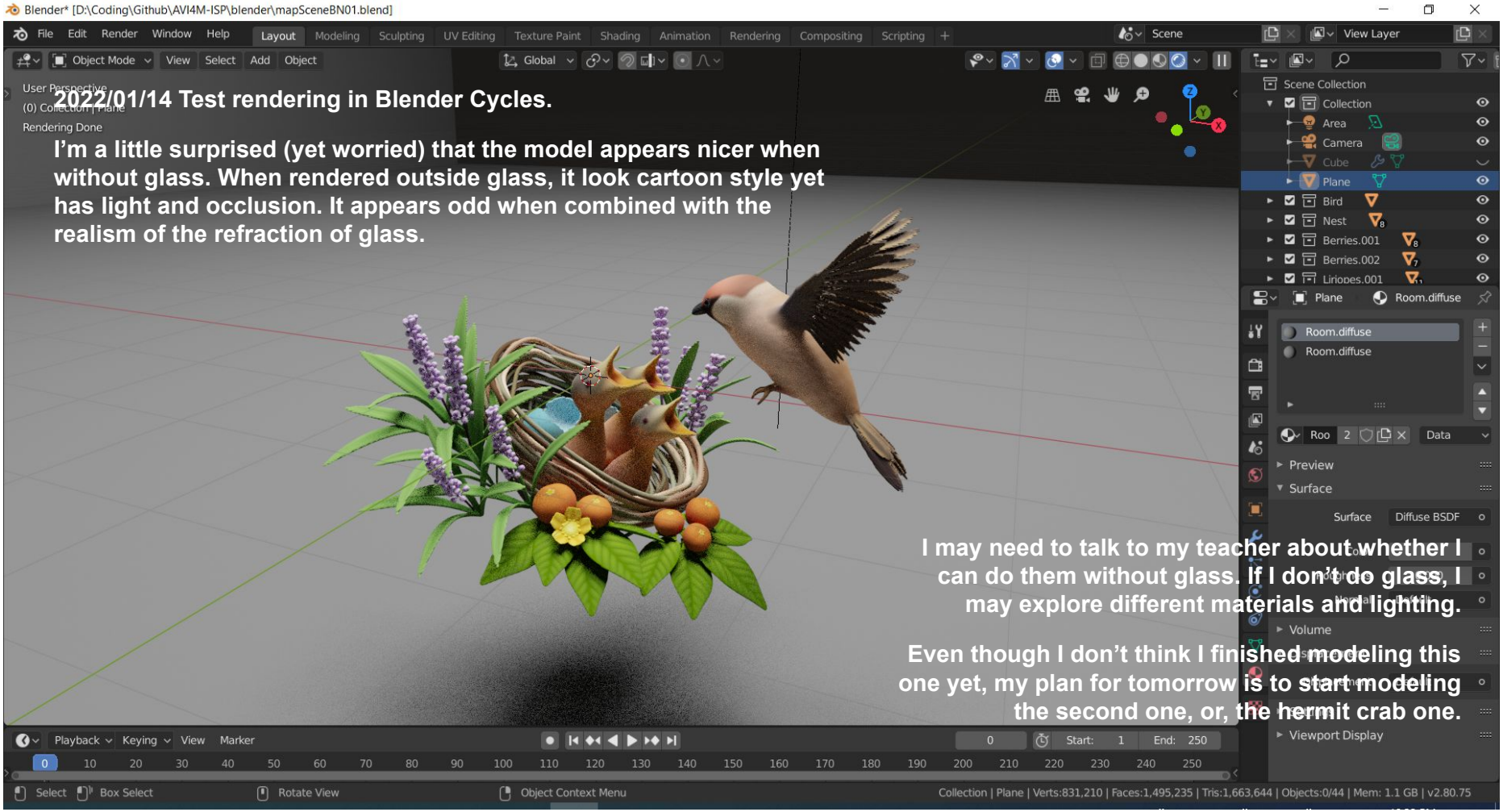


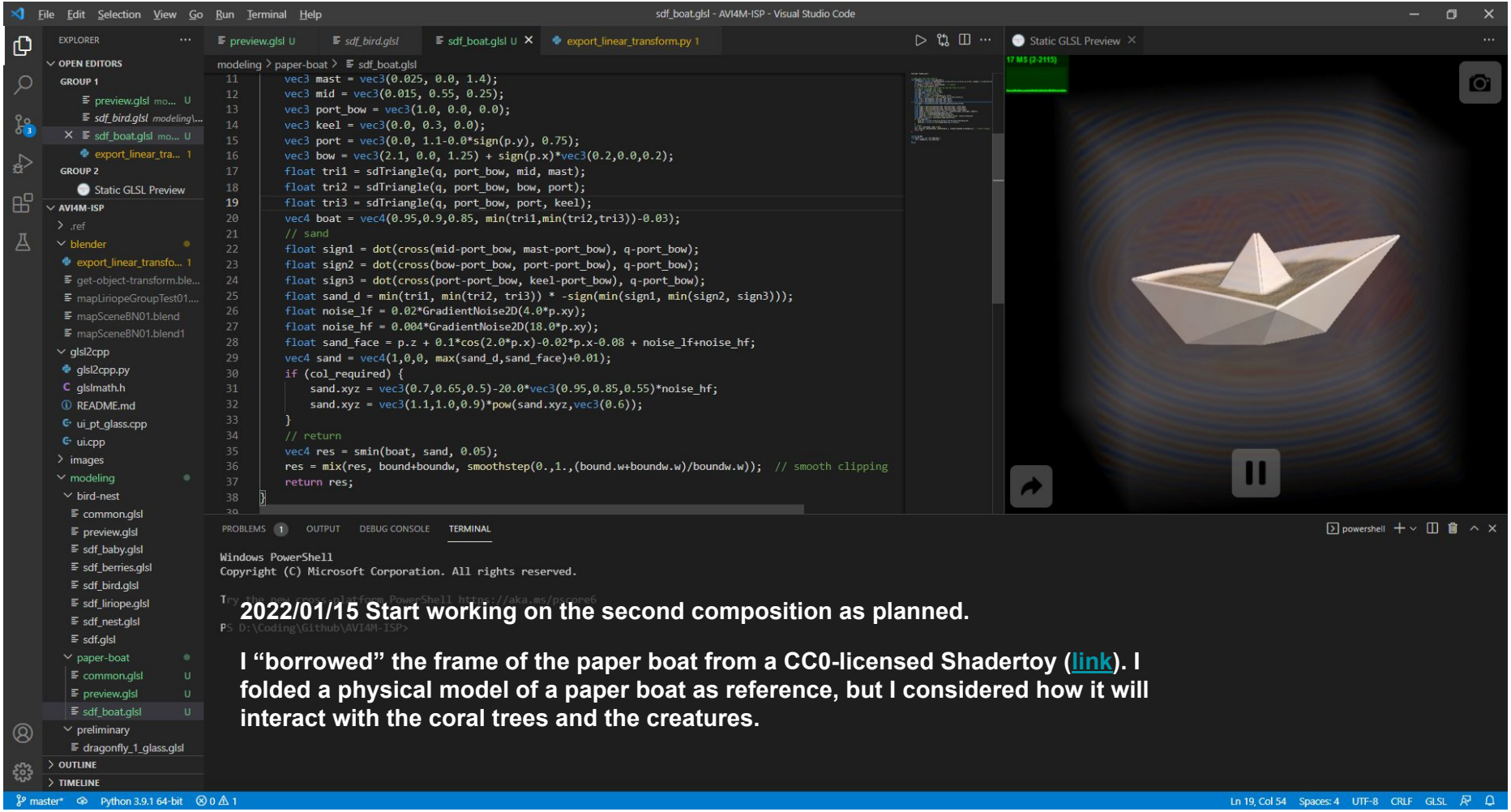

A blue (instead of black) background makes the colored model look nicer.
I think I may not limit to placing it on a dark glossy surface like my mentor artist did. I can try a bright background, like placing it on a piece of white paper, on a wooden shelf, or in front of a window.
D:\.ply [vn=528425, fn=1059460, surface] normal=ccw 534x452 6....
Scene
View Layer
Scene Collection
Collection
Bird
Berries.001
Berries.002
Instancing
Motion Paths
Visibility
Viewport Display
Custom Properties
Reading list
Share
Explore
Start: 1
End: 250
Rotate View
Object Context Menu
Berries.001 | mapNest | Verts:737,253 | Faces:1,307,384 | Tris:1,475,788 | Objects:0/34 | Mem: 354.2 MB | v2.80.75


File Edit Selection View Go Run Terminal Help
Static GLSL Preview - AVI4M-ISP - Visual Studio Code
EXPLORER
OPEN EDITORS
GROUP 1
preview.glsl M
sdf_baby.glsl U
sdf_bird.glsl M
common.glsl M
export_linear_tr... M
GROUP 2
Static GLSL Preview
AVI4M-ISP
blender
export_linear_transf... M
get-object-transform.ble...
mapLiriopeGroupTest01....
mapSceneBN01.blend
mapSceneBN01.blend1
glsl2cpp
glsl2cpp.py
glslmath.h
README.md
ui_pt_glass.cpp
ui.cpp
images
modeling
bird-nest
common.glsl M
preview.glsl M
sdf_baby.glsl U
sdf_berries.glsl M
sdf_bird.glsl M
sdf_liriope.glsl M
sdf_nest.glsl M
sdf.glsl U
preliminary
dragonfly_1_glass.glsl
dragonfly_1_sdf.glsl
flower_01_glass.glsl
flower_01_sdf.glsl
OUTLINE
TIMELINE
master*
preview.glsl M
sdf_baby.glsl U
sdf_bird.glsl M
common.glsl M
export_linear_transform.py M
modeling > bird-nest > sdf_baby.glsl
30 p = roty(0.05*PI)*p / 0.8;
31 p.z += 1.1;
32 vec3 q;
33 q = roty(-0.05*PI)*(p-vec3(-0.2,0,0));
34 vec4 body = vec4(vec3(0.7,0.45,0.35)-vec3(0.15)*q.x, sdEllipsoid(q, vec3(vec2(0.8*(0.95+0.25*tanh(-p.z))),1.0)));
35 q = roty(-0.3*PI)*(p-vec3(-0.6,0,-0.6));
36 vec4 tail = vec4(0.6,0.4,0.25, sdEllipsoid(q, vec3(0.3,0.3,0.5)));
37 body = smin(body, tail, 0.8);
38 q = p;
39 vec4 neck = vec4(0.75,0.55,0.2, sdSegment(q, vec3(0,0,0), vec3(0,0,1.5))-0.3);
40 body = smin(body, neck, 0.5);
41 q = roty(-0.2*PI)*(p-vec3(-0.1,0,2.1));
42 vec4 head = mapBabyHead(q/0.9, col_required)*0.9;
43 body = smin(body, head, 0.2*(1.0-tanh(3.0*p.x)));
44 q = vec3(p.x, abs(p.y), p.z);
45 vec4 thigh = vec4(0.7,0.45,0.25, sdSegment(q, vec3(-0.3,0.45,-0.7), vec3(0.1,0.7,-0.4))-0.15);
46 vec4 shank = vec4(0.7,0.45,0.25, sdSegment(q, vec3(0.1,0.7,-0.4), vec3(0.0,0.8,-1.1))-(0.12+0.05*tanh(4.0*(q.z+0.8))));
47 vec4 feet = vec4(0.55,0.35,0.3, sdSegment(q, vec3(0.0,0.8,-1.1), vec3(0.3,0.8,-1.3))-0.08);
48 body = smin(body, smin(smin(thigh, shank, 0.2), feet, 0.2), 0.2);
49 return body * vec4(1,1,1,0.8);
50 }
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights res
Try the new cross-platform PowerShell https://aka.m
PS D:\Coding\Github\AVI4M-ISP>
Model the baby bird.
Static GLSL Preview
17 MS (2-1847)
altricial-5a1d6cf0494ec900371d3348.jpg - Windows Photo Viewer
File Print E-mail Burn Open
7661.jpg - Windows Photo Viewer
Burn Open


Blender [D:\Coding\Github\AVI4M-ISP\blender\mapSceneBN01.blend]
File Edit Render Window Help
Layout Modeling Sculpting UV Editing Texture Paint Shading Animation Rendering Compositing Scripting
Scene
View Layer
Object Mode View Select Add Object
Global
User Perspective
(0) Nest | mapBaby.002
View Text Edit Format Templates
Text
Register
D:\.ply [vn=587472, fn=1177576, surface] normal=ccw 708x420 1.6fps
Scene Collection
mapBird
mapBaby
mapBaby.001
mapBaby.002
mapNest
mapBerriesFlowerT
Camera
Background Scene
Active Movie Clip
Units
Gravity
Keying Sets
Audio
Rigid Body World
Custom Properties
Console Autocomplete
Command History: Up/Down Arrow
Cursor: Left/Right Home/End
Remove: Backspace/Delete
Execute: Enter
Autocomplete: Ctrl-Space
Zoom: Ctrl +/-, Ctrl-Wheel
Builtin Modules: bpy, bpy.data, bpy.ops, bpy.props, bpy.types, bpy.context, bpy.utils, bgl, blf, mathutils
Convenience Imports: from mathutils import *; from math import *
Convenience Variables: C = bpy.context, D = bpy.data
>>>
bpy.ops.object.select_all(action='SELECT')
Saved "mapSceneBN01.blend"
bpy.ops.text.run_script()
bpy.ops.transform.rotate(value=0.0599789, orient_axis='Y', orient_type='GLOBAL', orient_matrix=((1, 0, 0), (0, 1, 0), (0, 0, 1)), orient_matrix_type='GLOBAL', constraint_axis=(False, True, False), mirror=True, use_proportional_edit=False, proportional_edit_falloff='SMOOTH', proportional_size=1, use_proportional_connected=False, use_proportional_projected=False)
if __name__ == "__main__":
print("======== Get Transform ========")
for obj in bpy.data.objects:
if obj.name in ["Camera", "Light"]:
continue
if not obj.visible_get():
continue
get_transform_code(obj)
print(end='\n')
Add baby birds to the scene.
Text: Internal
Scrollbar Set Selection Scrollbar Call Menu
Nest | mapBaby.002 | Verts:765,888 | Faces:1,364,642 | Tris:1,533,046 | Objects:0/37 | Mem: 631.7 MB | v2.80.75

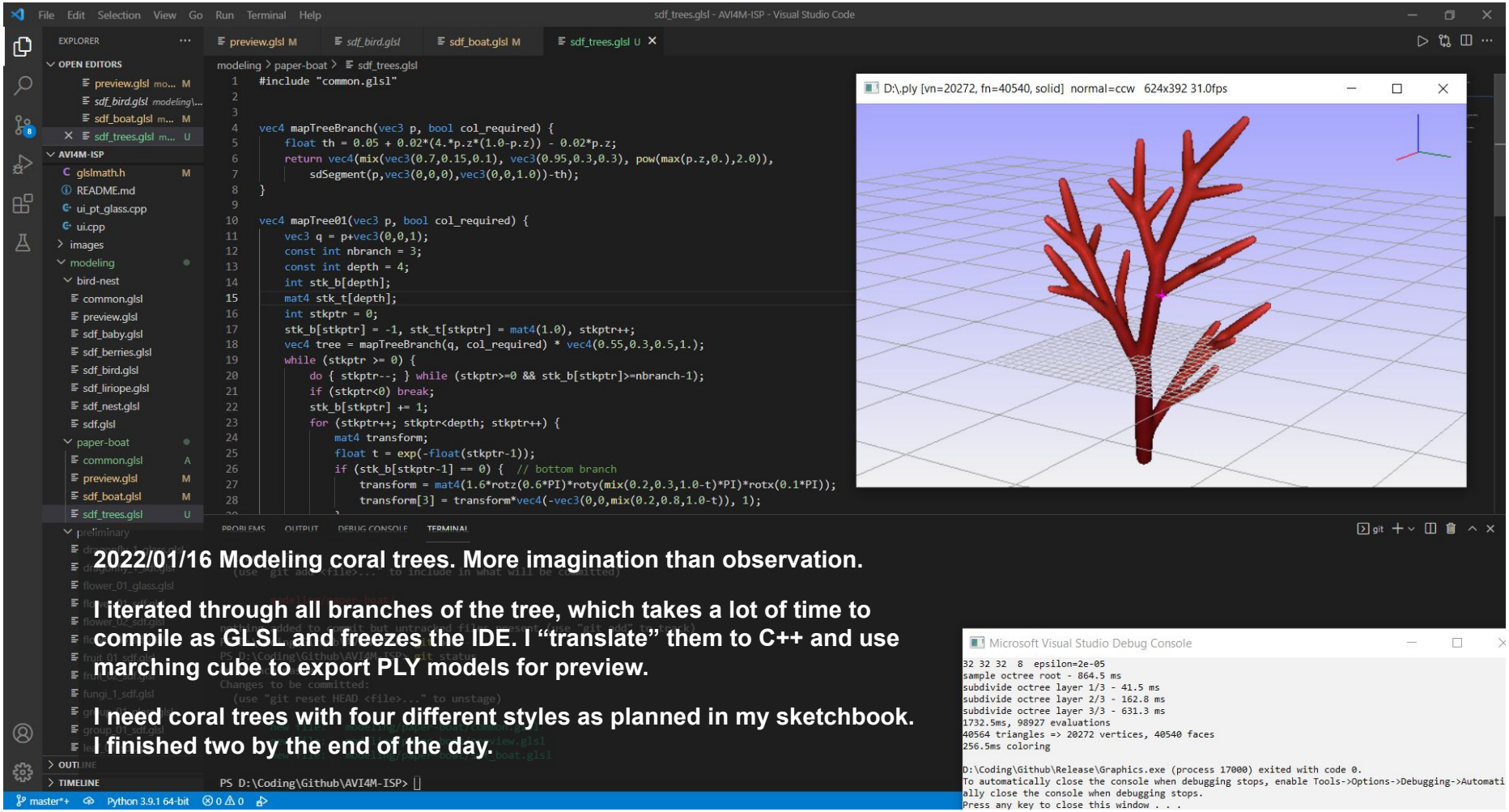

Blender [D:\Coding\Github\AVI4M-ISP\blender\mapSceneBN01.blend]
File Edit Render Window Help
Layout Modeling Sculpting UV Editing Texture Paint Shading Animation Rendering Compositing Scripting
Scene
View Layer
Object Mode View Select Add Object Global
User Perspective
(0) Nest | mapEggBrokenS2
D:\mapEggBrokenBE.ply [vn=21608, fn=43216, surface] normal=ccw 624x361 3.2fps
code_s1 = "*vec4(1,1,1,"+string_join_array([min(scale[0:3])])+")"
code = name+"(("+code_r+code_t+")"+code_s+", col_required)"+code_s1
code_full = "d = smin(d, " + code + ", 0.01);"
print(code_full)
if __name__ == "__main__":
print("======== Get Transform ========")
for obj in bpy.data.objects:
if obj.name in ["Camera", "Light"]:
continue
if not obj.visible_get():
continue
get_transform_code(obj)
print(end='\n')
2022/01/13 Model bird eggs.
Scene Collection
Collection
AABB
Camera
Light
Bird
mapBird
Nest
mapBaby
mapBaby.001
mapBaby.002
mapEggBrokenBE
mapEggBrokenLE
mapEggBrokenS1
mapEggBrokenS2
Edit
Filename
File Has Unsaved Changes
mapEggBrokenS2
Transform
Location X -0.042973
Y 0.28948m
Z -0.53912m
Rotation X 73.3°
Y -30.2°
Z 76.8°
Scale X 0.300
Y 0.300
Z 0.300
Rotation Mode XYZ Euler
Delta Transform
Console Autocomplete
Command History: Up/Down Arrow
Cursor: Left/Right Home/End
Remove: Backspace/Delete
Execute: Enter
Autocomplete: Ctrl-Space
Zoom: Ctrl +/-, Ctrl-Wheel
Builtin Modules: bpy, bpy.data, bpy.ops, bpy.props, bpy.types, bpy.context, bpy.utils, bgl, blf, mathutils
Convenience Imports: from mathutils import *; from math import *
Convenience Variables: C = bpy.context, D = bpy.data
>>>
bpy.ops.transform.rotate(value=0.199818, orient_axis='X', orient_type='GLOBAL', orient_matrix=((1, 0, 0), (0, 1, 0), (0, 0, 1)), orient_matrix_type='GLOBAL', constraint_axis=(True, False, False), mirror=True, use_proportional_edit=False, proportional_edit_falloff='SMOOTH', proportional_size=1, use_proportional_connected=False, use_proportional_projected=False)
bpy.ops.transform.translate(value=(0.0108899, -0.00426816, -0.00950741), orient_type='GLOBAL', orient_matrix=((1, 0, 0), (0, 1, 0), (0, 0, 1)), orient_matrix_type='GLOBAL', mirror=True, use_proportional_edit=False, proportional_edit_falloff='SMOOTH', proportional_size=1, use_proportional_connected=False, use_proportional_projected=False)
Text: Internal
Scrollbar Set Selection Scrollbar Call Menu
Nest | mapEggBrokenS2 | Verts:831,202 | Faces:1,495,230 | Tris:1,663,634 | Objects:1/41 | Mem: 708.0 MB | v2.80.75


Blender* [D:\Coding\Github\AVI4M-ISP\blender\mapSceneBN01.blend]
File Edit Render Window Help
Layout Modeling Sculpting UV Editing Texture Paint Shading Animation Rendering Compositing Scripting
Scene
View Layer
Object Mode View Select Add Object
Global
User Perspective
(0) Collection | Plane
Rendering Done
2022/01/14 Test rendering in Blender Cycles.
I'm a little surprised (yet worried) that the model appears nicer when without glass. When rendered outside glass, it look cartoon style yet has light and occlusion. It appears odd when combined with the realism of the refraction of glass.
Scene Collection
Collection
Area
Camera
Cube
Plane
Bird
Nest
Berries.001
Berries.002
Plane
Room.diffuse
Room.diffuse
Room.diffuse
Data
Preview
Surface
Surface
Diffuse BSDF
Volume
Viewport Display
I may need to talk to my teacher about whether I can do them without glass. If I don't do glass, I may explore different materials and lighting.
Even though I don't think I finished modeling this one yet, my plan for tomorrow is to start modeling the second one, or, the hermit crab one.
Playback Keying View Marker
Start: 1
End: 250
Select
Box Select
Rotate View
Object Context Menu
Collection | Plane | Verts:831,210 | Faces:1,495,235 | Tris:1,663,644 | Objects:0/44 | Mem: 1.1 GB | v2.80.75



2022/01/15 Start working on the second composition as planned.

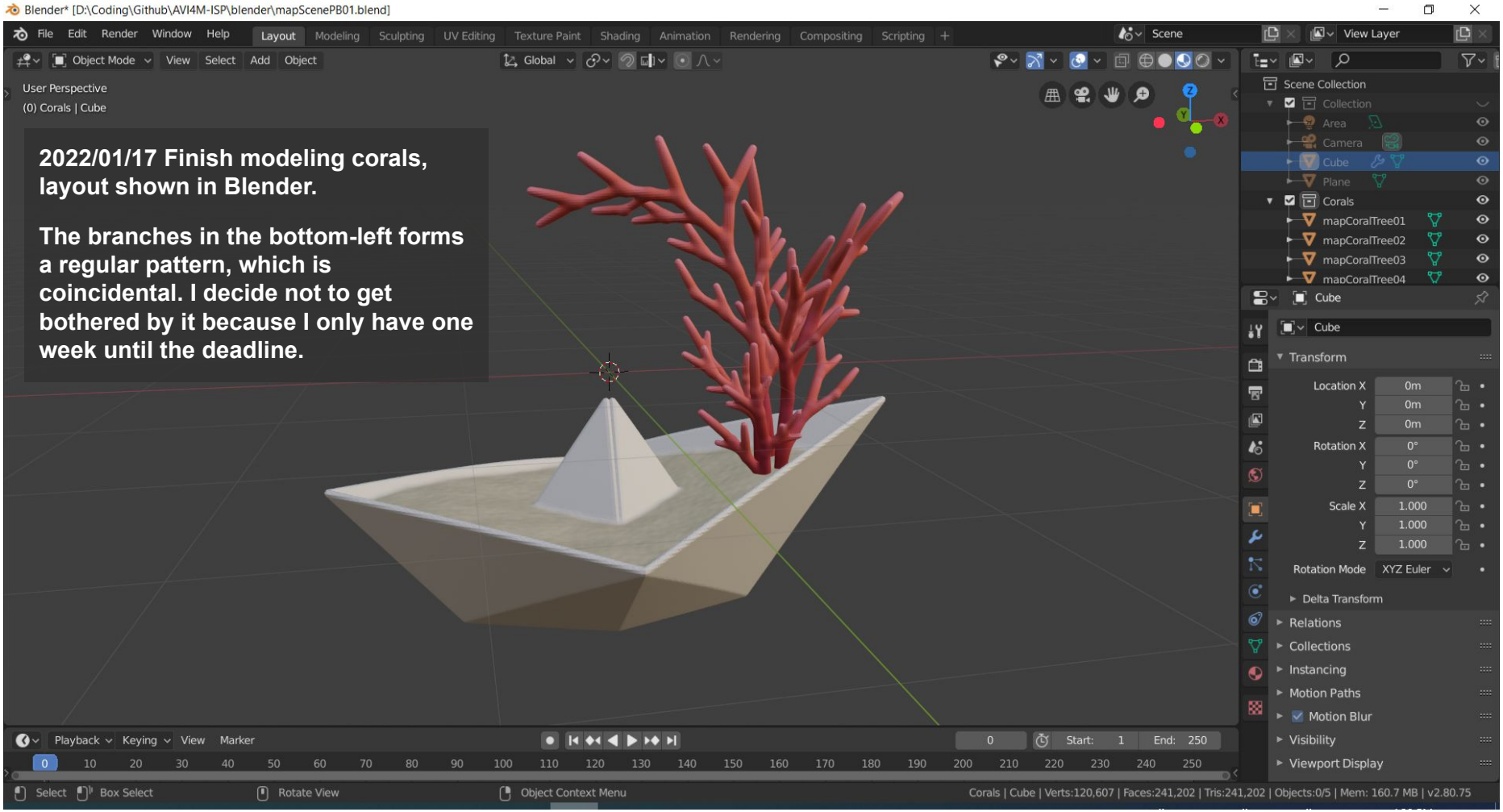
I "borrowed" the frame of the paper boat from a CC0-licensed Shadertoy (link). I folded a physical model of a paper boat as reference, but I considered how it will interact with the coral trees and the creatures.

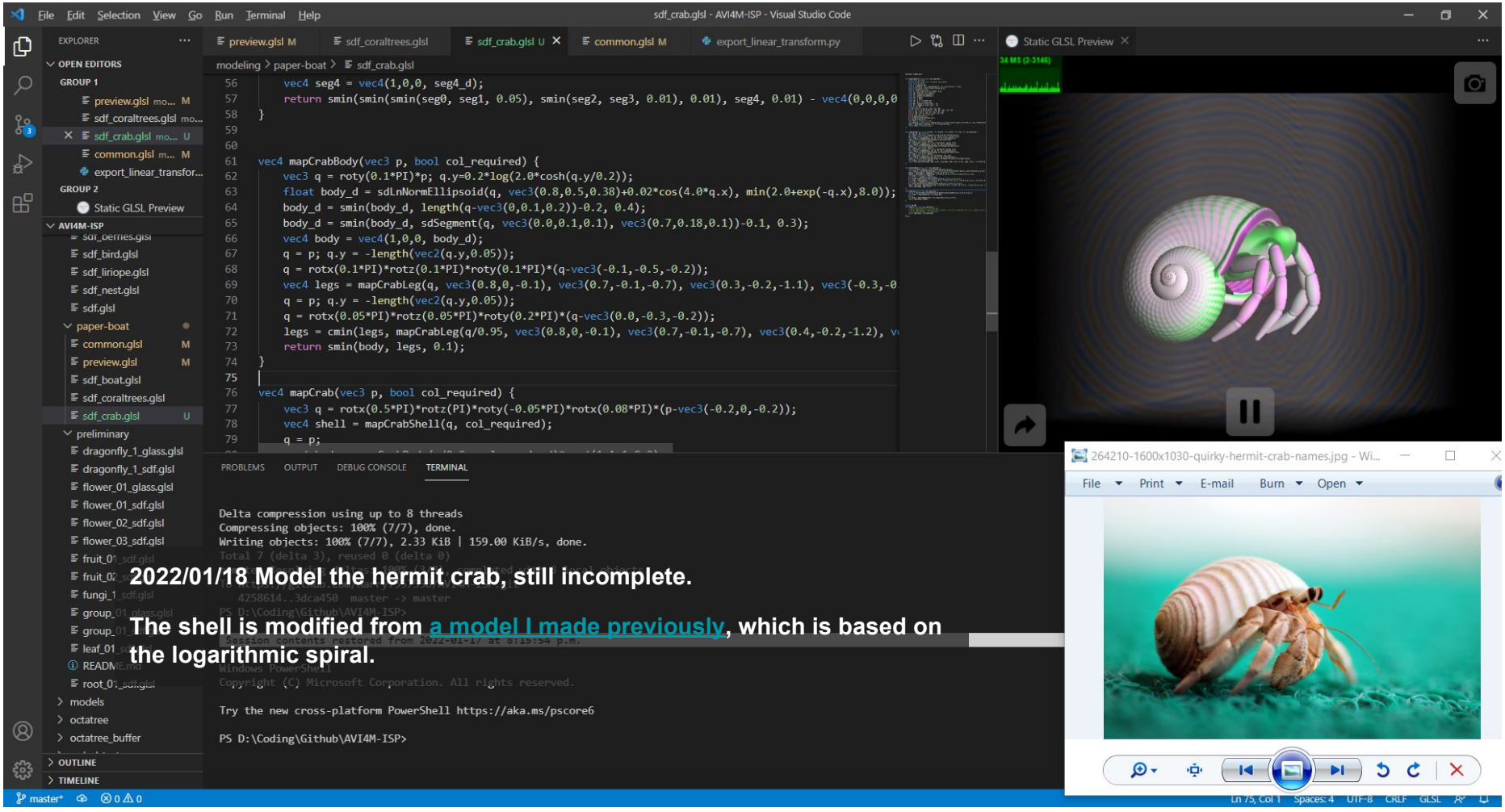


2022/01/16 Modeling coral trees. More imagination than observation.

I iterated through all branches of the tree, which takes a lot of time to compile as GLSL and freezes the IDE. I "translate" them to C++ and use marching cube to export PLY models for preview.

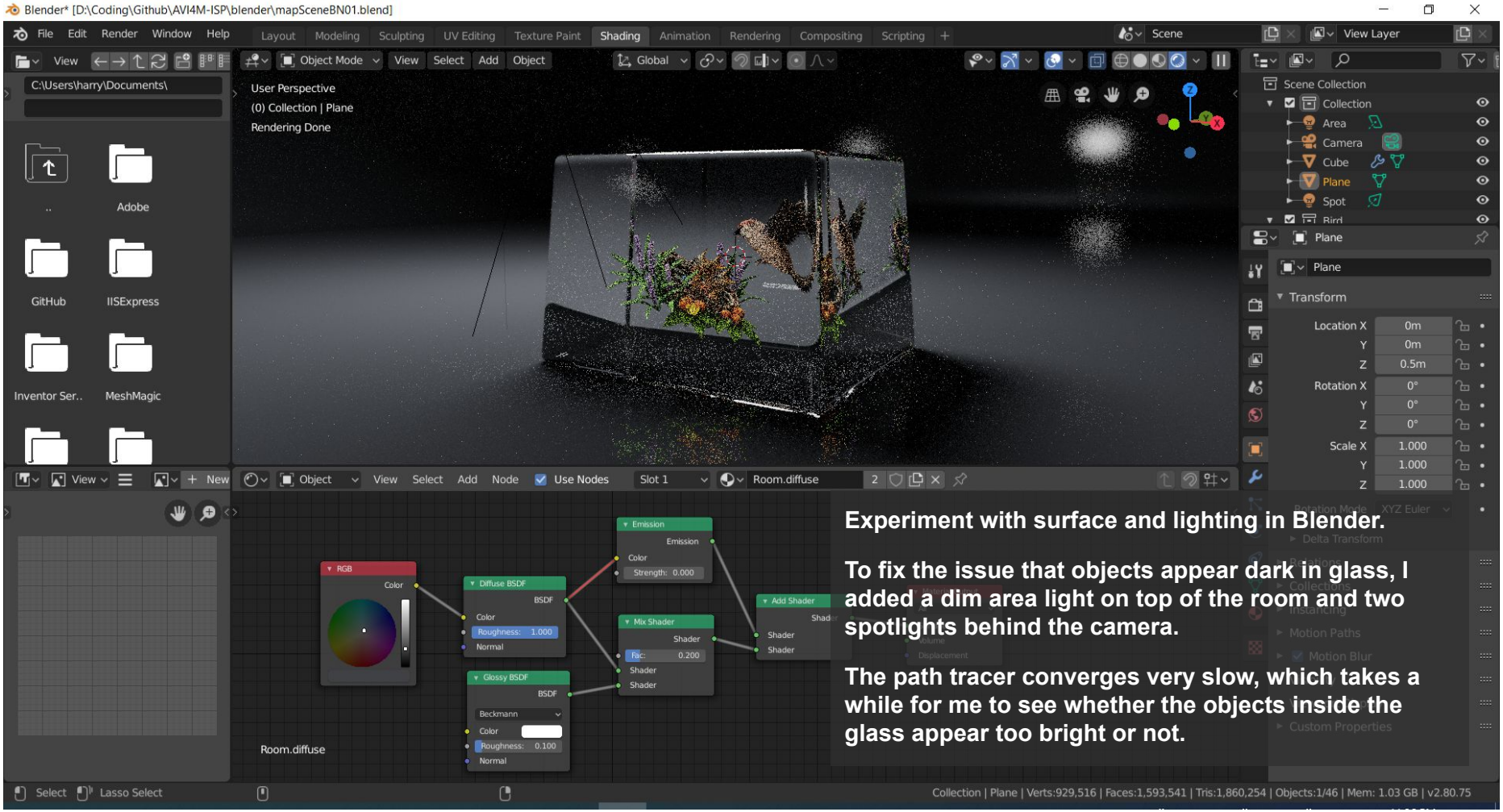
I need coral trees with four different styles as planned in my sketchbook. I finished two by the end of the day.


Blender* [D:\Coding\Github\AVI4M-ISP\blender\mapScenePB01.blend]
File Edit Render Window Help
Layout Modeling Sculpting UV Editing Texture Paint Shading Animation Rendering Compositing Scripting
Scene
View Layer
Object Mode View Select Add Object
Global
User Perspective
(0) Corals | Cube
2022/01/17 Finish modeling corals, layout shown in Blender.
The branches in the bottom-left forms a regular pattern, which is coincidental. I decide not to get bothered by it because I only have one week until the deadline.
Scene Collection
Collection
Area
Camera
Cube
Plane
Corals
mapCoralTree01
mapCoralTree02
mapCoralTree03
mapCoralTree04
Cube
Cube
Transform
Location X 0m
Y 0m
Z 0m
Rotation X 0°
Y 0°
Z 0°
Scale X 1.000
Y 1.000
Z 1.000
Rotation Mode XYZ Euler
Delta Transform
Relations
Collections
Instancing
Motion Paths
Motion Blur
Visibility
Viewport Display
Playback Keying View Marker
0
Start: 1
End: 250
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250
Select
Box Select
Rotate View
Object Context Menu
Corals | Cube | Verts:120,607 | Faces:241,202 | Tris:241,202 | Objects:0/5 | Mem: 160.7 MB | v2.80.75



2022/01/18 Model the hermit crab, still incomplete.

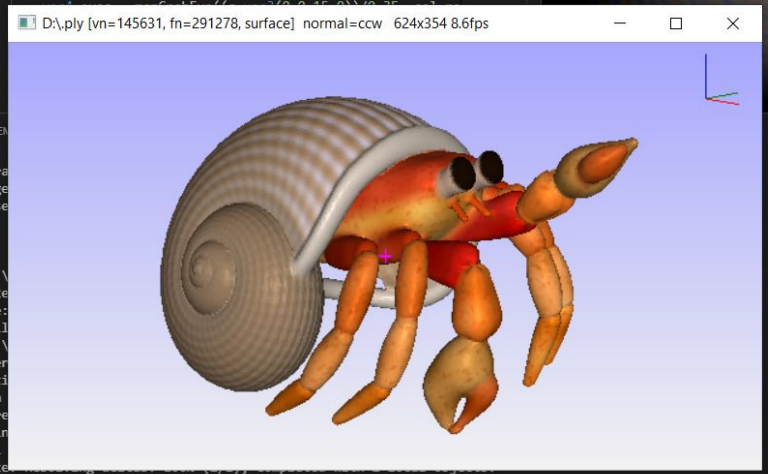
The shell is modified from a model I made previously, which is based on the logarithmic spiral.

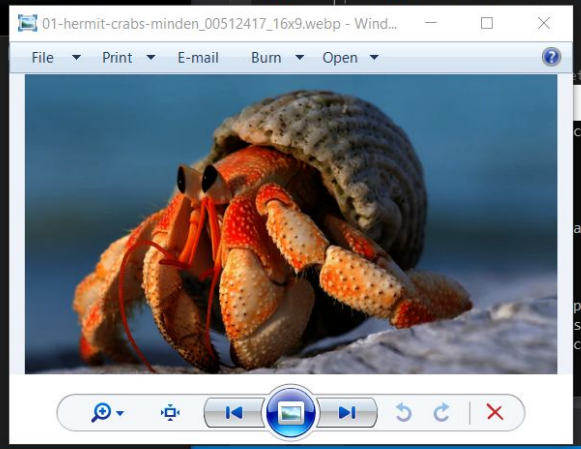

Blender* [D:\Coding\Github\AVI4M-ISP\blender\mapSceneBN01.blend]
File Edit Render Window Help
Layout Modeling Sculpting UV Editing Texture Paint Shading Animation Rendering Compositing Scripting
Scene
View Layer
Object Mode View Select Add Object
Global
User Perspective
(0) Collection | Plane
Rendering Done
C:\Users\harry\Documents\
Adobe
GitHub
IISExpress
Inventor Ser..
MeshMagic
Scene Collection
Collection
Area
Camera
Cube
Plane
Spot
Transform
Location X 0m
Y 0m
Z 0.5m
Rotation X 0°
Y 0°
Z 0°
Scale X 1.000
Y 1.000
Z 1.000
Object View Select Add Node Use Nodes Slot 1 Room.diffuse
RGB
Color
Diffuse BSDF
BSDF
Color
Roughness: 1.000
Normal
Emission
Emission
Color
Strength: 0.000
Mix Shader
Shader
Fac: 0.200
Shader
Shader
Add Shader
Shader
Shader
Glossy BSDF
BSDF
Beckmann
Color
Roughness: 0.100
Normal
Room.diffuse
Experiment with surface and lighting in Blender.
To fix the issue that objects appear dark in glass, I added a dim area light on top of the room and two spotlights behind the camera.
The path tracer converges very slow, which takes a while for me to see whether the objects inside the glass appear too bright or not.
Select Lasso Select
Collection | Plane | Verts:929,516 | Faces:1,593,541 | Tris:1,860,254 | Objects:1/46 | Mem: 1.03 GB | v2.80.75

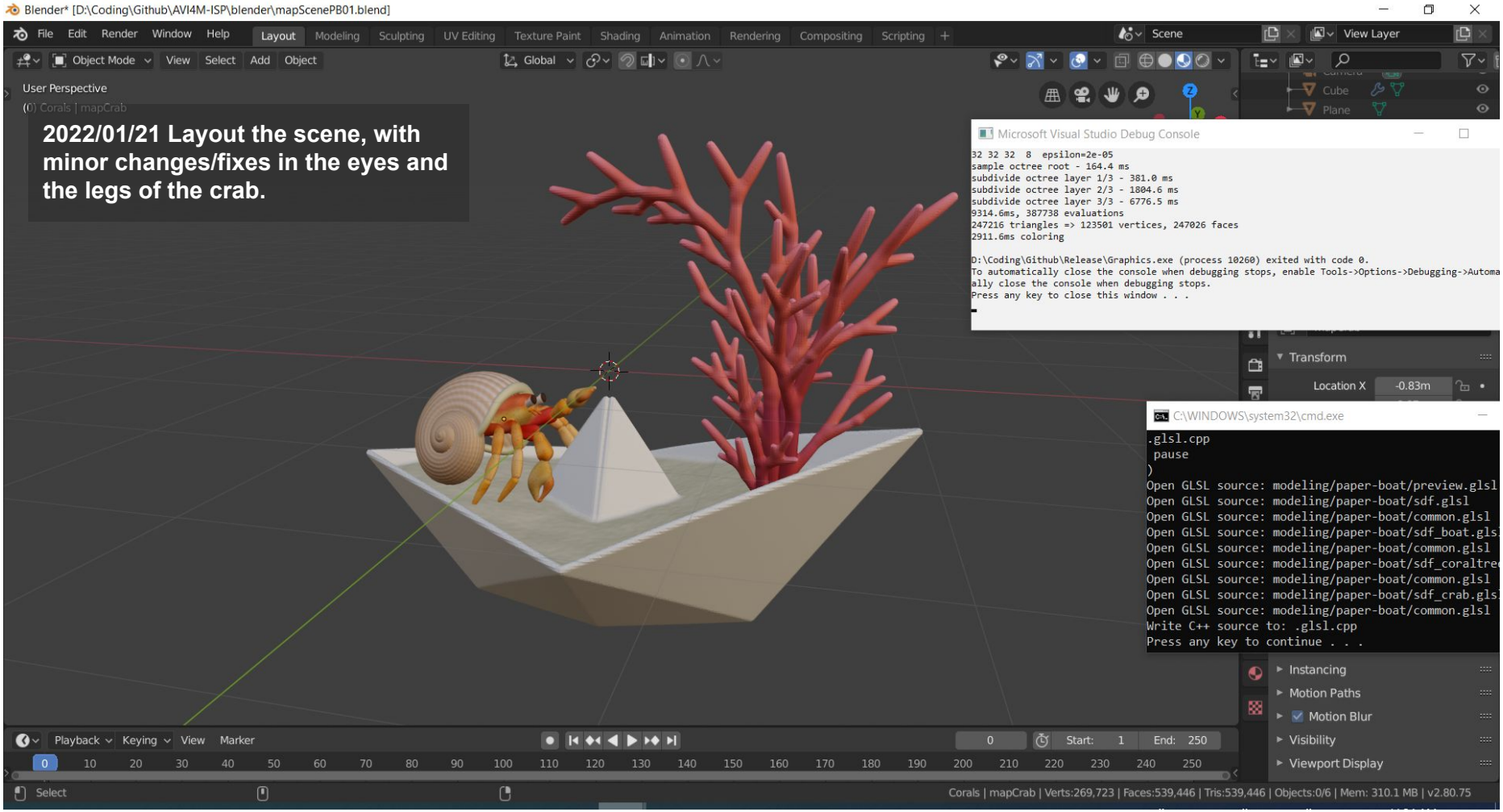
2022/01/19 Finish modeling the hermit crab.

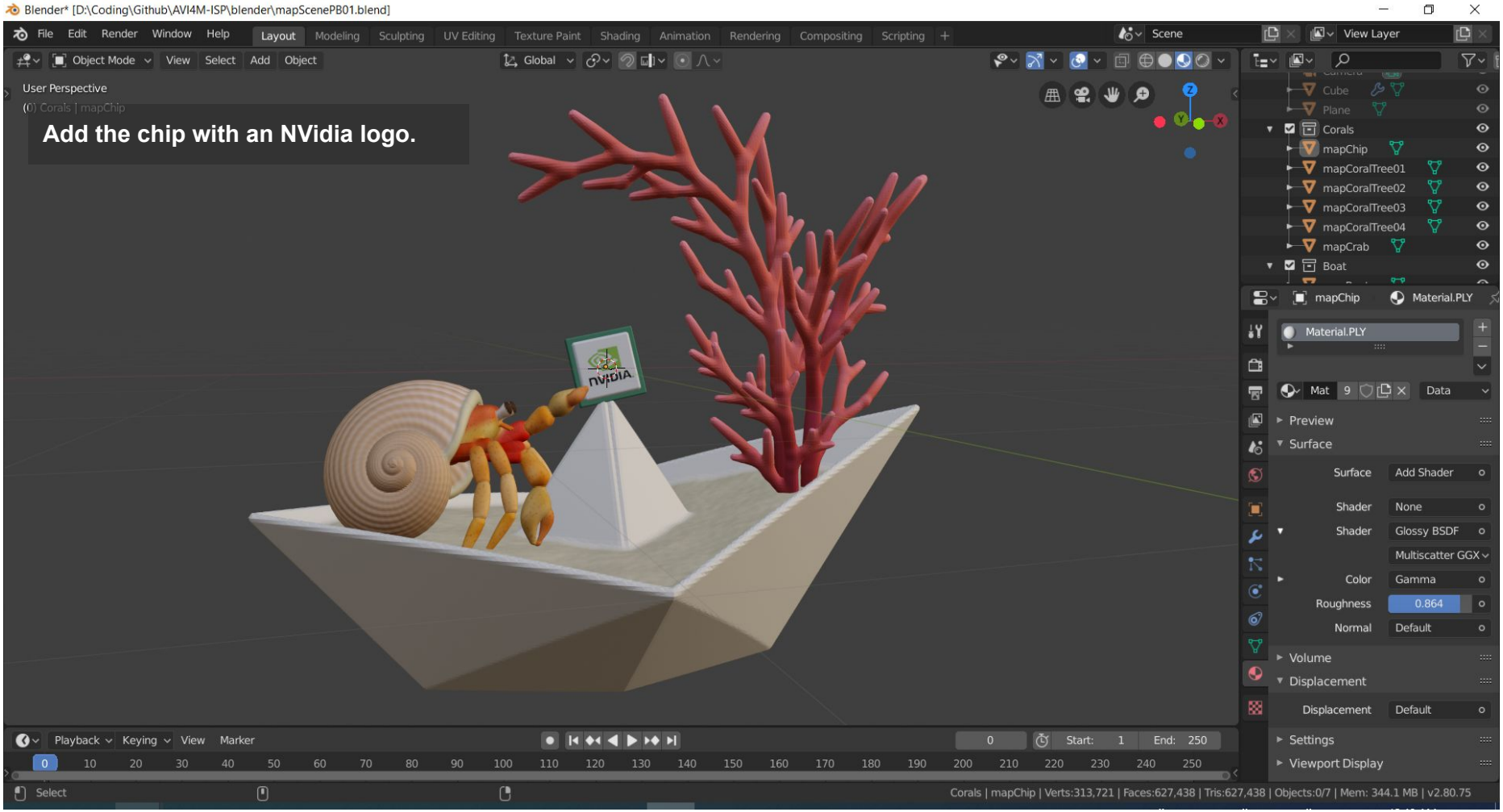
I'm not sure if a real hermit crab can stretch its claw like that because I didn't find any picture of a hermit crab doing that. I intended to make it holding a chip with a NVidia logo on it.

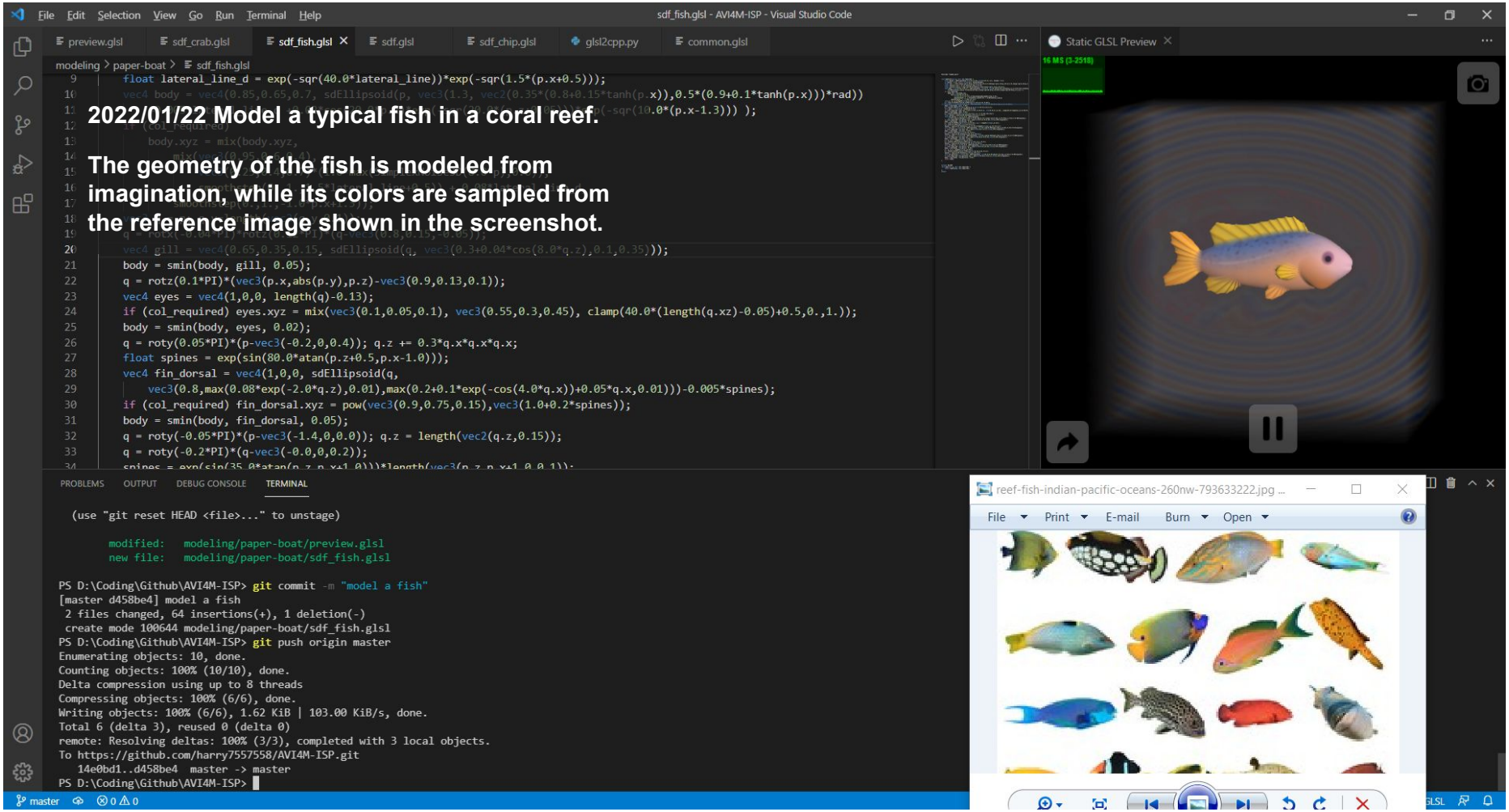
I feel the color of the shell is still off.

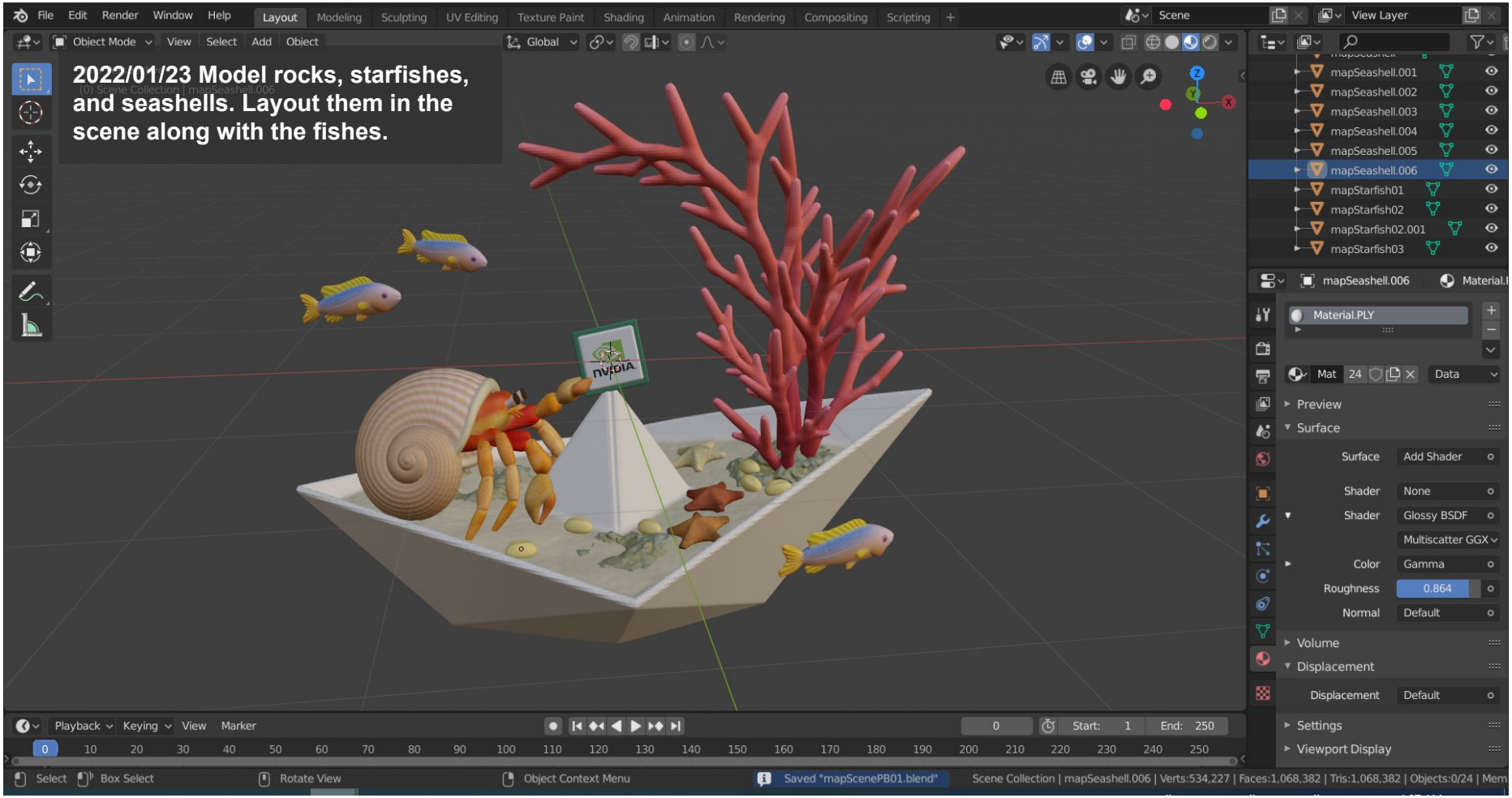





Blender* [D:\Coding\Github\AVI4M-ISP\blender\mapScenePB01.blend]
File Edit Render Window Help
Layout Modeling Sculpting UV Editing Texture Paint Shading Animation Rendering Compositing Scripting
Scene
View Layer
Object Mode View Select Add Object
Global
User Perspective
(0) Corals | mapCrab
2022/01/21 Layout the scene, with minor changes/fixes in the eyes and the legs of the crab.
Microsoft Visual Studio Debug Console
32 32 32 8 epsilon=2e-05
sample octree root - 164.4 ms
subdivide octree layer 1/3 - 381.0 ms
subdivide octree layer 2/3 - 1804.6 ms
subdivide octree layer 3/3 - 6776.5 ms
9314.6ms, 387738 evaluations
247216 triangles => 123501 vertices, 247026 faces
2911.6ms coloring
D:\Coding\Github\Release\Graphics.exe (process 10260) exited with code 0.
To automatically close the console when debugging stops, enable Tools->Options->Debugging->Automatically close the console when debugging stops.
Press any key to close this window . . .
Cube
Plane
Transform
Location X -0.83m
C:\WINDOWS\system32\cmd.exe
.glsl.cpp
pause
)
Open GLSL source: modeling/paper-boat/preview.glsl
Open GLSL source: modeling/paper-boat/sdf.glsl
Open GLSL source: modeling/paper-boat/common.glsl
Open GLSL source: modeling/paper-boat/sdf_boat.glsl
Open GLSL source: modeling/paper-boat/common.glsl
Open GLSL source: modeling/paper-boat/sdf_coraltree
Open GLSL source: modeling/paper-boat/common.glsl
Open GLSL source: modeling/paper-boat/sdf_crab.glsl
Open GLSL source: modeling/paper-boat/common.glsl
Write C++ source to: .glsl.cpp
Press any key to continue . . .
Instancing
Motion Paths
Motion Blur
Visibility
Viewport Display
Playback Keying View Marker
0 Start: 1 End: 250
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250
Select
Corals | mapCrab | Verts:269,723 | Faces:539,446 | Tris:539,446 | Objects:0/6 | Mem: 310.1 MB | v2.80.75


Blender* [D:\Coding\Github\AVI4M-ISP\blender\mapScenePB01.blend]
File Edit Render Window Help
Layout Modeling Sculpting UV Editing Texture Paint Shading Animation Rendering Compositing Scripting
Scene
View Layer
Object Mode View Select Add Object
Global
User Perspective
(0) Corals | mapChip
Add the chip with an NVidia logo.
Cube
Plane
Corals
mapChip
mapCoralTree01
mapCoralTree02
mapCoralTree03
mapCoralTree04
mapCrab
Boat
mapChip
Material.PLY
Material.PLY
Mat 9
Data
Preview
Surface
Surface
Add Shader
Shader
None
Shader
Glossy BSDF
Multiscatter GGX
Color
Gamma
Roughness
0.864
Normal
Default
Volume
Displacement
Displacement
Default
Settings
Viewport Display
Playback Keying View Marker
0
Start: 1
End: 250
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250
Select
Corals | mapChip | Verts:313,721 | Faces:627,438 | Tris:627,438 | Objects:0/7 | Mem: 344.1 MB | v2.80.75


File Edit Selection View Go Run Terminal Help
sdf_fish.glsl - AVI4M-ISP - Visual Studio Code
preview.glsl
sdf_crab.glsl
sdf_fish.glsl
sdf.glsl
sdf_chip.glsl
glsl2cpp.py
common.glsl
modeling > paper-boat > sdf_fish.glsl
2022/01/22 Model a typical fish in a coral reef.
The geometry of the fish is modeled from imagination, while its colors are sampled from the reference image shown in the screenshot.
Static GLSL Preview
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
(use "git reset HEAD <file>..." to unstage)
modified: modeling/paper-boat/preview.glsl
new file: modeling/paper-boat/sdf_fish.glsl
PS D:\Coding\Github\AVI4M-ISP> git commit -m "model a fish"
[master d458be4] model a fish
2 files changed, 64 insertions(+), 1 deletion(-)
create mode 100644 modeling/paper-boat/sdf_fish.glsl
PS D:\Coding\Github\AVI4M-ISP> git push origin master
Enumerating objects: 10, done.
Counting objects: 100% (10/10), done.
Delta compression using up to 8 threads
Compressing objects: 100% (6/6), done.
Writing objects: 100% (6/6), 1.62 KiB | 103.00 KiB/s, done.
Total 6 (delta 3), reused 0 (delta 0)
remote: Resolving deltas: 100% (3/3), completed with 3 local objects.
To https://github.com/harry7557558/AVI4M-ISP.git
14e0bd1..d458be4 master -> master
PS D:\Coding\Github\AVI4M-ISP>
master
reef-fish-indian-pacific-oceans-260nw-793633222.jpg ...
File Print E-mail Burn Open

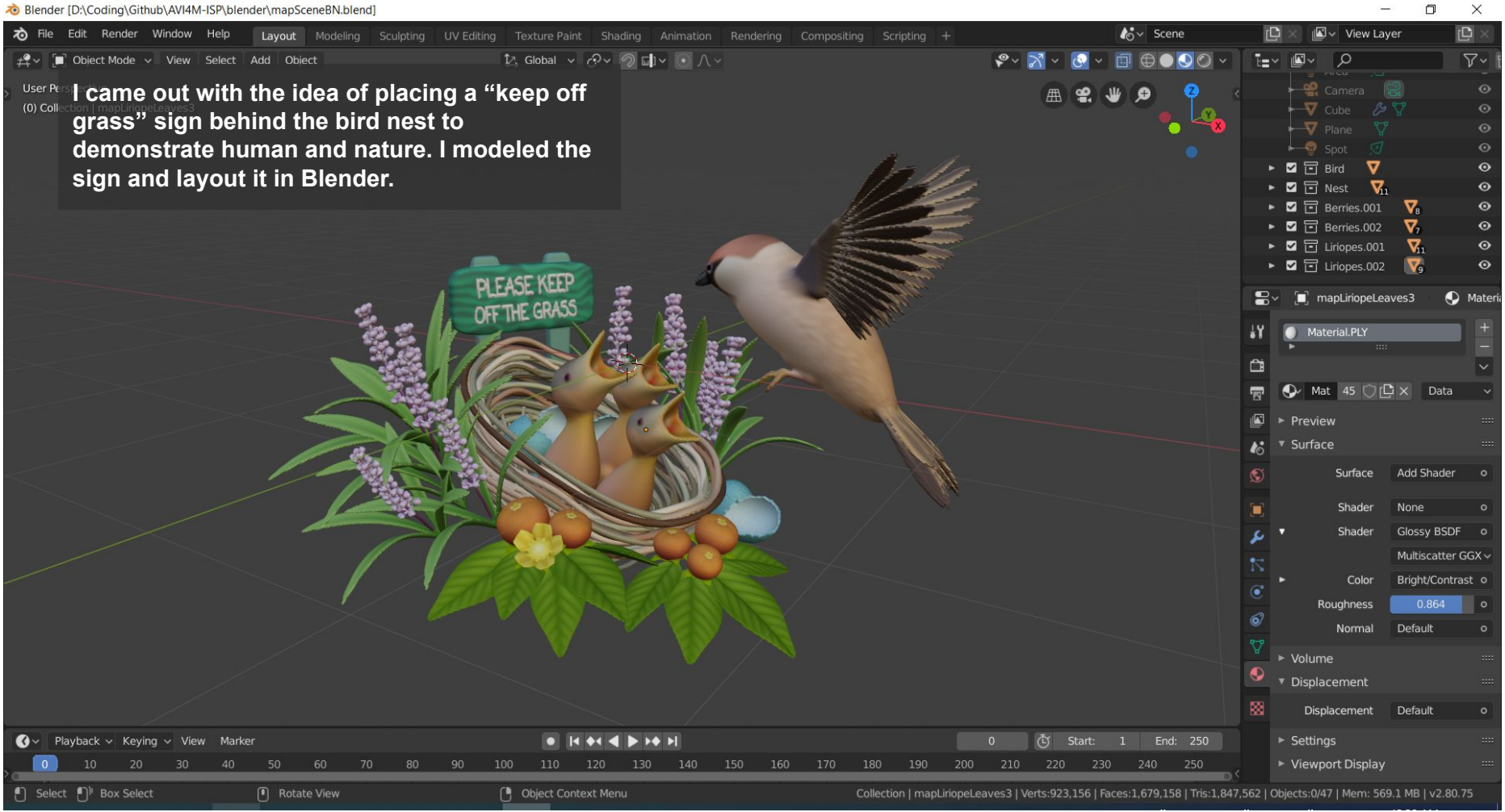

Blender [D:\Coding\Github\AVI4M-ISP\blender\mapScenePB01.blend]
File Edit Render Window Help
Layout Modeling Sculpting UV Editing Texture Paint Shading Animation Rendering Compositing Scripting
Scene
View Layer
Object Mode View Select Add Object
Global
2022/01/23 Model rocks, starfishes, and seashells. Layout them in the scene along with the fishes.
mapSeashell.001
mapSeashell.002
mapSeashell.003
mapSeashell.004
mapSeashell.005
mapSeashell.006
mapStarfish01
mapStarfish02
mapStarfish02.001
mapStarfish03
mapSeashell.006
Material.PLY
Mat 24
Data
Preview
Surface
Surface Add Shader
Shader None
Shader Glossy BSDF
Multiscatter GGX
Color Gamma
Roughness 0.864
Normal Default
Volume
Displacement
Displacement Default
Settings
Viewport Display
Playback Keying View Marker
Start: 1 End: 250
Select Box Select Rotate View Object Context Menu
Saved "mapScenePB01.blend"
Scene Collection | mapSeashell.006 | Verts:534,227 | Faces:1,068,382 | Tris:1,068,382 | Objects:0/24 | Mem

2022/01/24 Setup the scene in Blender. I made the glass smaller at the bottom to accompany with the shape of the paper boat, which works with the graphics card that appears “geeky”. I considered the positions and angles of lights and camera to make the subject stand out while there isn’t a strong reflection on the glass.

Test rendering in Blender at 2560x2560, 256 spp with AI denoising. It took about 40 minutes to render. Looks nicer on a monitor that has a higher contrast.

The light and reflection of the glass on the plane works out pretty well. The objects inside are illuminated by carefully-considered lighting instead of hacky glowing like I did in the mentor artist study. It is still off compared to the photographs of Paul's work but I'm quite satisfied with it.

I feel it is kind of sad that I spent a lot of time trying to render them interactively in WebGL but ended up using Blender. I was too ambitious in the first place. I'm not sure what my art teacher would say but at least this saves me a lot of time.


I came out with the idea of placing a “keep off grass” sign behind the bird nest to demonstrate human and nature. I modeled the sign and layout it in Blender.
PLEASE KEEP OFF THE GRASS

2022/01/25 I left my computer render it overnight and went to sleep last night because it was late. This is the finished rendering I check this morning.

This image appears to have a higher contrast compared to the paper boat one. I feel the stick of the sign is too high that looks strange, but I try not to be bothered by it.

I’m thinking about creating one more rendering for each image, if I have time. The entire project is due end of this day and I need to work on my artist’s statement.