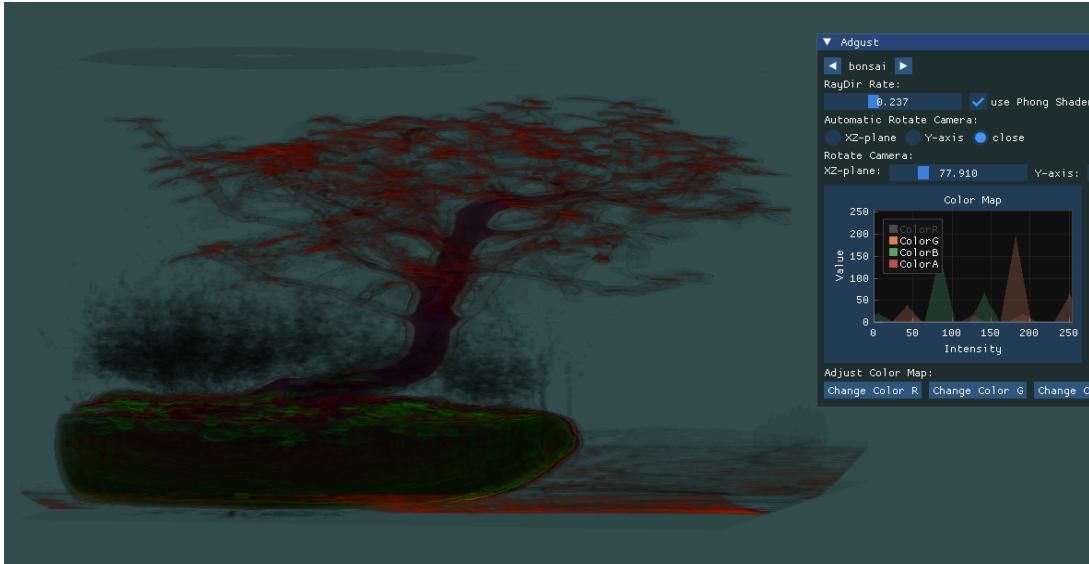


# 科學試算\_HW2:Volume Rendering

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## 完成項目：

- use Gradient create 3DTexture

```
if(z == 0) gradient.z = intensity[x][y][z + 1] - intensity[x][y][z];
else if(z == 255) gradient.z = intensity[x][y][z] - intensity[x][y][z - 1];
else gradient.z = (intensity[x][y][z + 1] - intensity[x][y][z - 1]) / 2.0;
```

- use Transfer Function create 1DTexture

```
glTexImage1D(GL_TEXTURE_1D, 0, GL_RGBA, 256, 0, GL_RGBA, GL_UNSIGNED_BYTE, color);
```

- use Ray Casting Method render the Volume Data

```
vec3 raydir = normalize(rayDir);
float T = 0.0f; //accumulate Opacities|
vec3 P = GLOBAL;
vec3 texCoord = TEXCOORD;
vec3 Color = vec3(0.0f);
//...
```

- 渲染正面與背面

```
glPolygonMode(GL_FRONT_AND_BACK, GL_FILL);
```

- Vertex Shader: get the Vertex and Texture Coordinates

```
GLOBAL = (model * vec4(vertexCor, 1)).xyz;
TEXCOORD = textureCor;
```

- Fragment Shader: accumulate the Color if Ray across the point

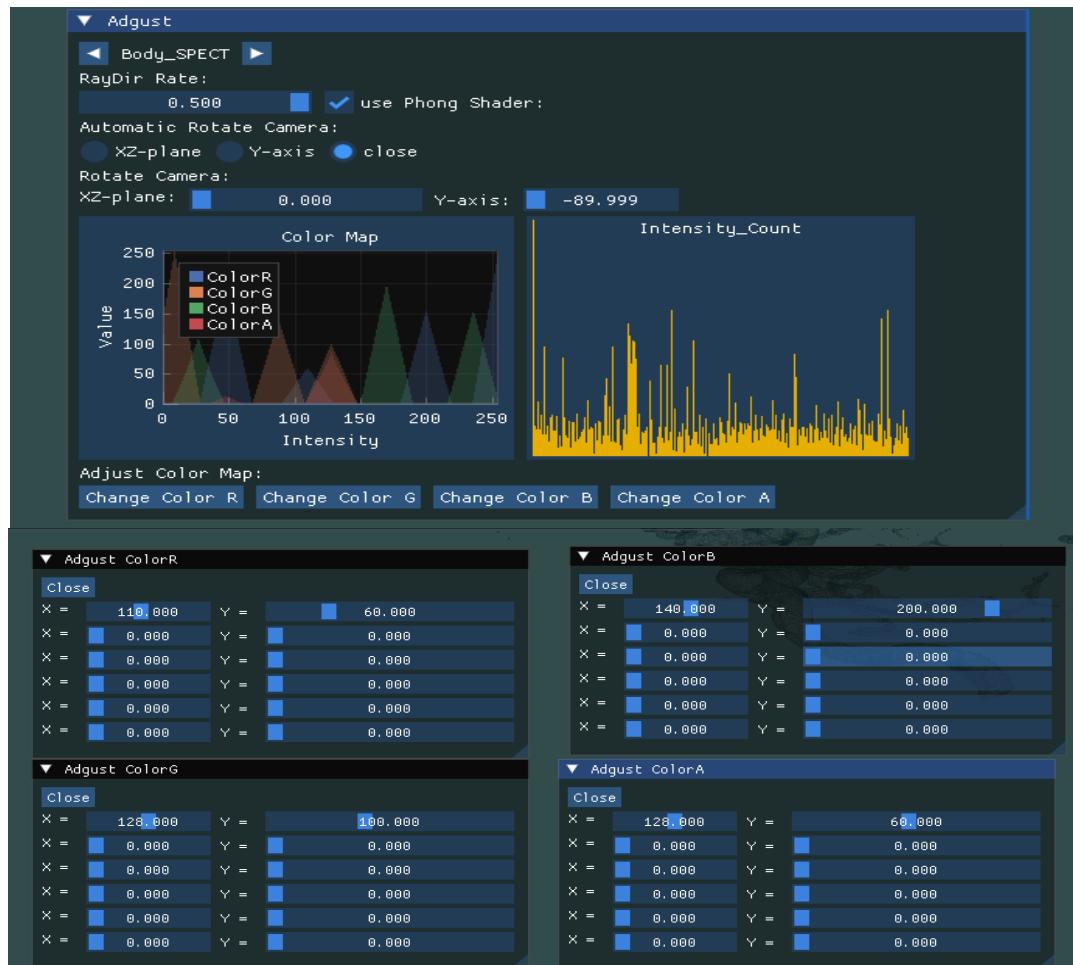
```

while(true){
    vec4 texel0 = texture(texture0, texCoord);
    vec4 texel1 = texture(texture1, texel0.a);
    vec3 myColor = PhongShade(P, texCoord, texel0, texel1);
    if(phong) Color = Color + myColor * (1 - T);
    else Color = texel1.rgb * texel1.a * (1 - T);
    T = T + (1 - T) * texel1.a;
    P = P + raydir * rate;
    texCoord = TEXCOORD + (P - GLOBAL) / 255.0f;
    if(Outside(texCoord)) break;
    if(T >= 1.0f) break;
}
FragColor = vec4(Color, min(T, 1.0f));

```

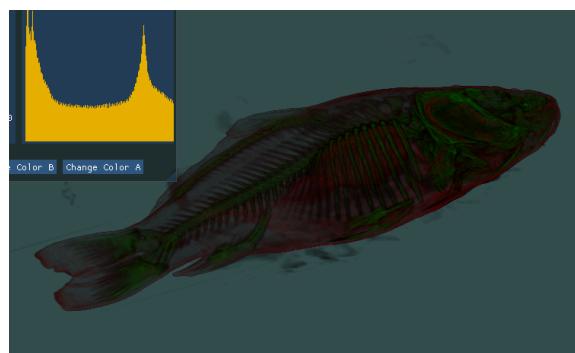
## 功能(可互動項目):

- 切換不同的檔案
- 調整 raydir 的移動速度, 增減通過點取樣數量
- 使用 / 關閉 Phong Shader
- 自動 / 手動旋轉(XY-Plane / Y-axis)
- 預覽 & 調整 ColorMap(8個取樣點)
- 滑鼠滾輪調整投影範圍

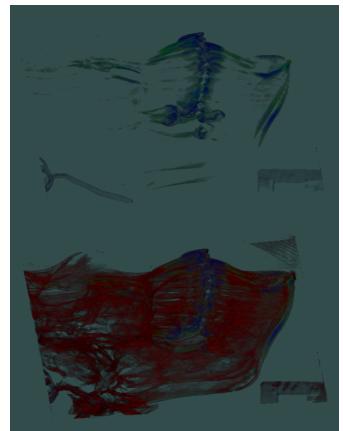
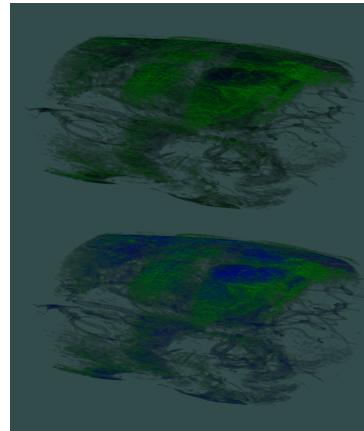
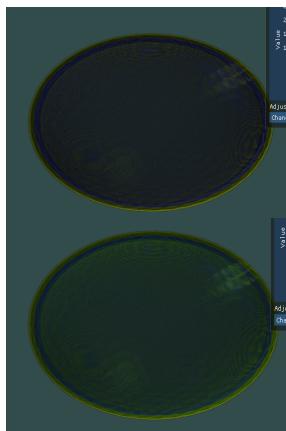
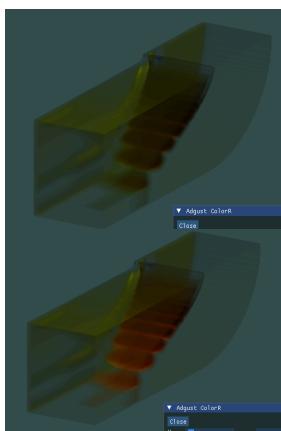


## 成果展示：

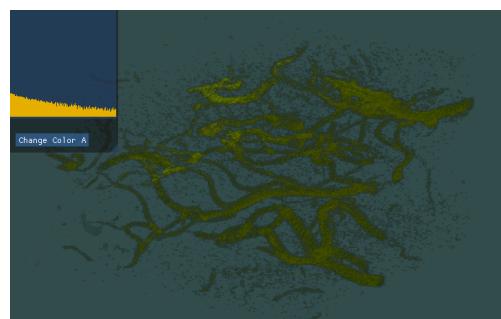
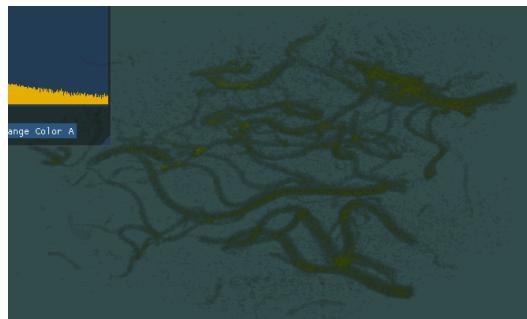
- 一些Render 結果展示



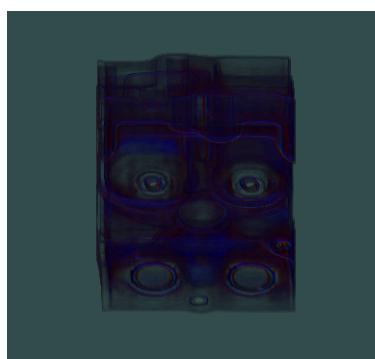
- 挑整color map



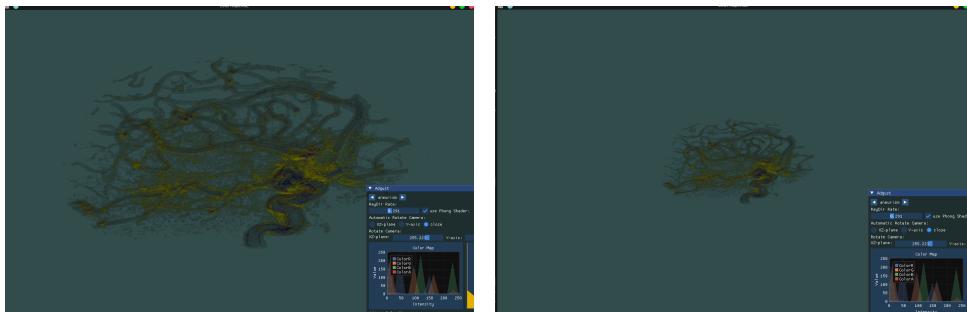
- 不同的顏色取樣頻率(少 -> 多)



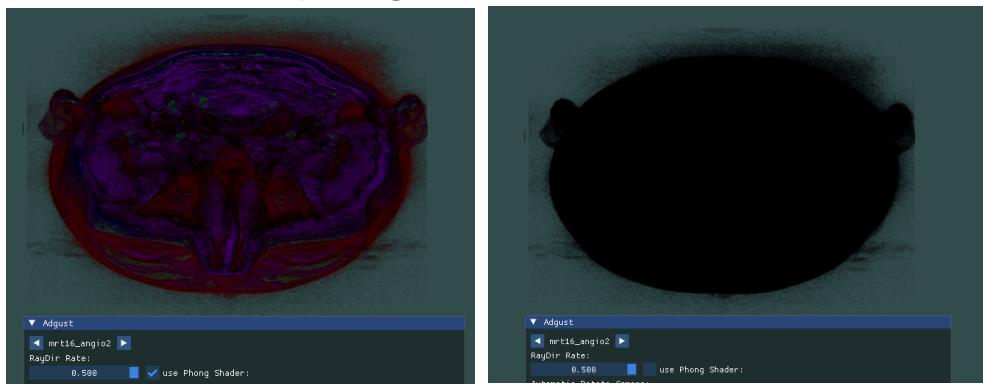
- 不同旋轉方向



- 調整畫面大小



- 使用 / 關閉 phong shader



心得：

覺得 ray casting 很好懂，所以在寫的時候蠻快就完成方法了。反而在基礎的地方遇到困難。因為區域變數我必須透過指標來給 TEXTURE一個空間，結果我分段指派造成空間不連續。感覺有這次的教訓我每次在使用OpenGL都會注意空間的指派。然後特別感謝三雙眼睛(嘉羽、芷柔、恩妮)一起幫我看哪邊寫錯。

本來想用牛頓插值做Color Map，為了讓Sample Pnt 只影響小區域，我在附近加了value = 0 的點使其下降，但這就造成點與點之間形成新的正函數。我只好放棄，轉用現在的方法。