

# **Shaders for Game Development**

CS-330: Introduction to Game Programming

# What are shaders?

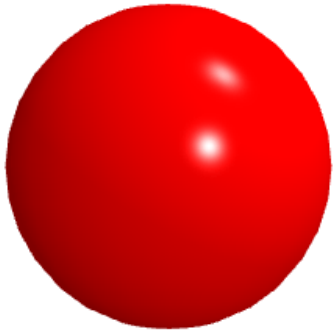
- Shaders are programs designed to run on a Graphics Processor Unit (GPU).
- One programming language for writing Shaders is GLSL (OpenGL Shader Language).
- As a program, shaders typically run as massively parallel-processes to impact the visual aesthetics of a computer graphic image.
- Shaders are categorized as either vertex shaders or fragment shaders.

# Vertex and Fragment shaders

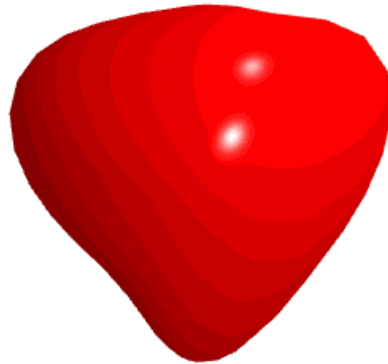
- Vertex shaders:
  - impact the physical shape (geometry) of an object.
- Fragment shaders:
  - impact the color for each pixel of an object once the object is drawn (e.g. after the vertex shader is computed).

Source: <https://p5js.org/tutorials/intro-to-shaders/>

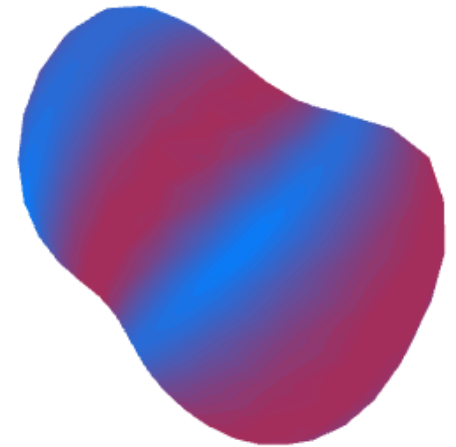
# Vertex and Fragment shaders



Original Sphere with no shaders applied.



Sphere with vertex shader applied.



Sphere with fragment shader and vertex shader applied.

Source: <https://p5js.org/tutorials/intro-to-shaders/>

# Example GLSL shader: simulating the ocean

- Example shader: simulating the ocean:  
<https://www.shadertoy.com/view/Ms2SD1>

# Example GLSL shader: mountainous terrain

- Example shader: mountainous terrain:  
<https://www.shadertoy.com/view/MdX3Rr>

# Example GLSL shader: fire simulation

- Example shader: fire simulation:

<https://www.shadertoy.com/view/MdX3zr>

# Example Godot shader: waving cloth simulation

- Example shader: waving cloth simulation:

<https://godotshaders.com/shader/waving-cloth-90s-anime-style-cloth-physics/>

# Example Godot shader: 2D tree and grass motion

- Example shader: 2D tree and grass motion:

<https://godotshaders.com/shader/2d-wind-sway-tree-grass-motion-shader/>

# Types of shaders in Godot

- Shaders in Godot are separated into five specific categories:
  - Spatial shaders: used for 3D objects in Godot
  - CanvasItem shaders: used for 2D objects in Godot
  - Particle shaders: Godot uses these types of shaders to compute the object's properties (color, position, and rotation) before a 2D or 3D object is drawn or before a Spatial or CanvasItem shader is applied.
  - Sky shaders: used to draw the sky background in Godot.
  - Fog shaders: used for fog simulations in Godot.

# Shader tutorials in Godot

- Writing your first 2D shader in Godot:

[https://docs.godotengine.org/en/stable/tutorials/shaders/your\\_first\\_shader/your\\_first\\_2d\\_shader.html](https://docs.godotengine.org/en/stable/tutorials/shaders/your_first_shader/your_first_2d_shader.html)

- Writing your first 3D shader in Godot:

[https://docs.godotengine.org/en/stable/tutorials/shaders/your\\_first\\_shader/your\\_first\\_3d\\_shader.html](https://docs.godotengine.org/en/stable/tutorials/shaders/your_first_shader/your_first_3d_shader.html)

# Resources

- Godot Shaders:  
<https://godotshaders.com/>
- OpenGL Shading Language:  
<https://learnopengl.com/getting-started/shaders>
- The Book of Shaders  
<https://thebookofshaders.com/>
- Introduction to Shaders  
<https://p5js.org/tutorials/intro-to-shaders/>