
WebGL™

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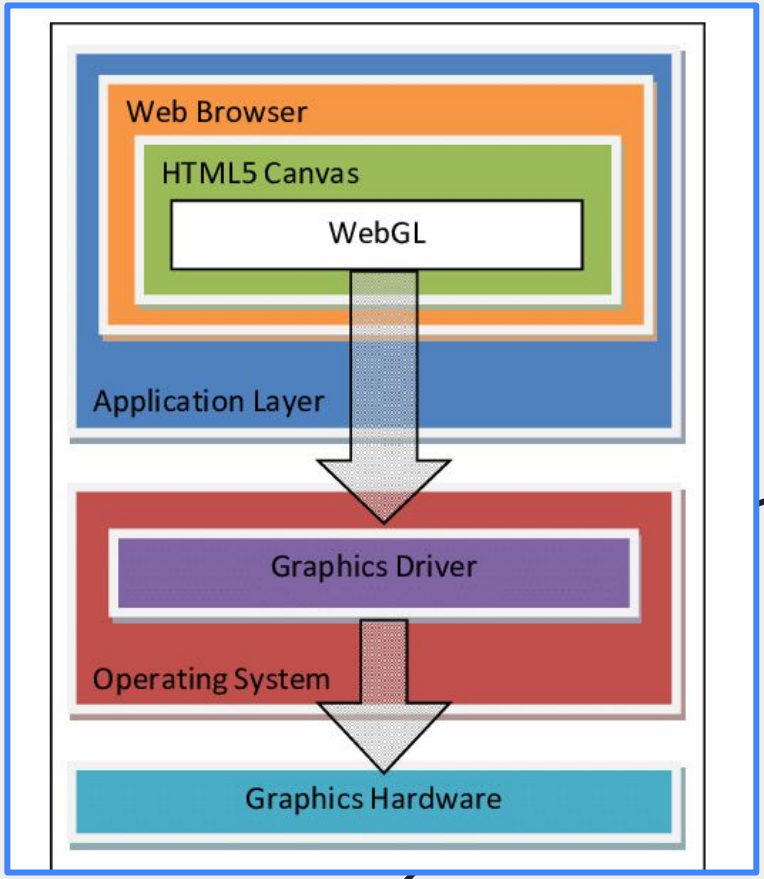
Introduction

What ‘s WebGL?

Introduction

What ’s WebGL?

- JavaScript API
- 2D and 3D graphics on canvas
- Uses user GPU
- It is a useful tool for frontend



Introduction

Why we should learn something about WebGL?

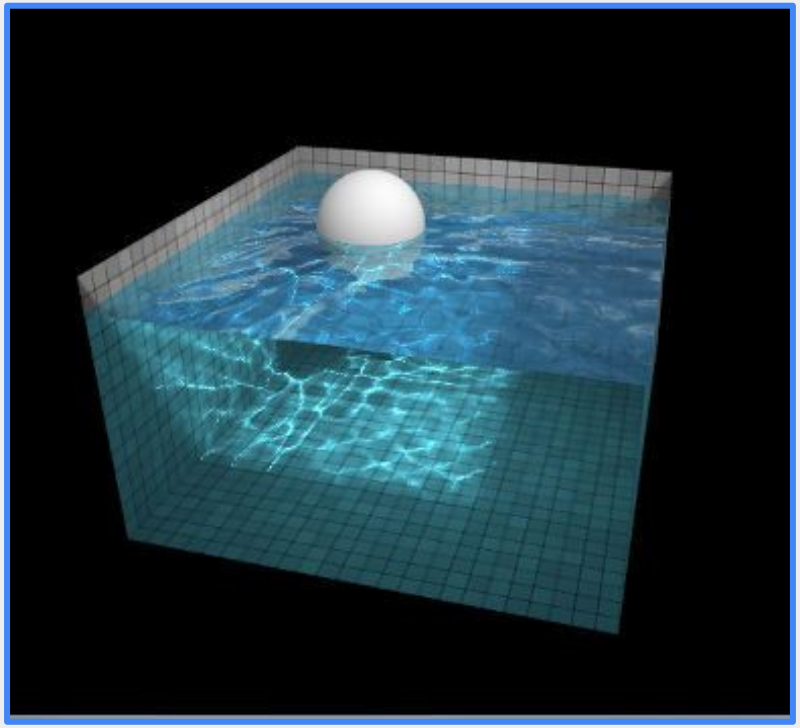
- You can create amazings experiences that would be impossible with JS and CSS
- WebGL benefits from being designed at a low level, very close to the GPU

02

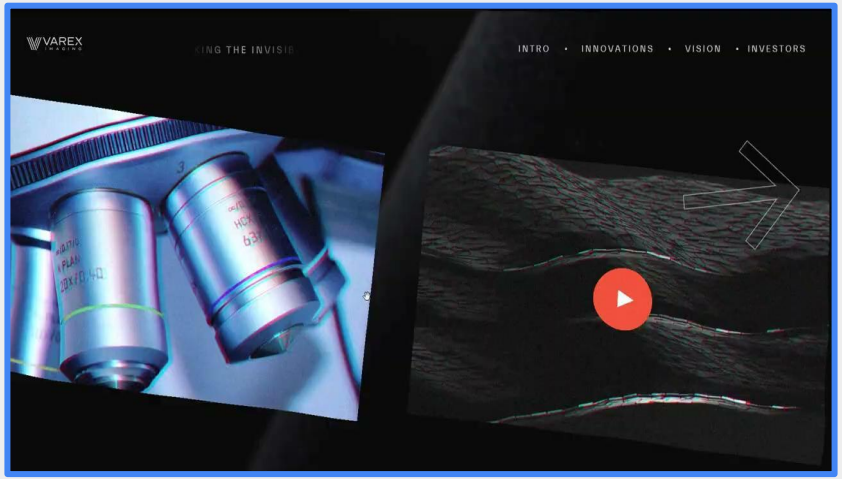
Motivation

What could you do?

Motivation



Motivation



https://innovations.vareximaging.com

https://www.hape.io

Best WebGL websites

03

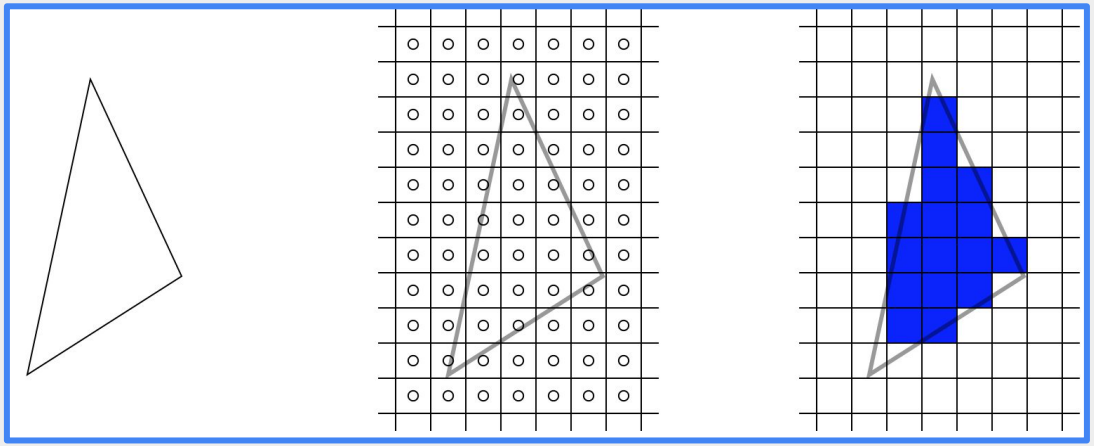
Basic concepts

What we need to learn before coding?

Vertex Shaders

Rasterization:

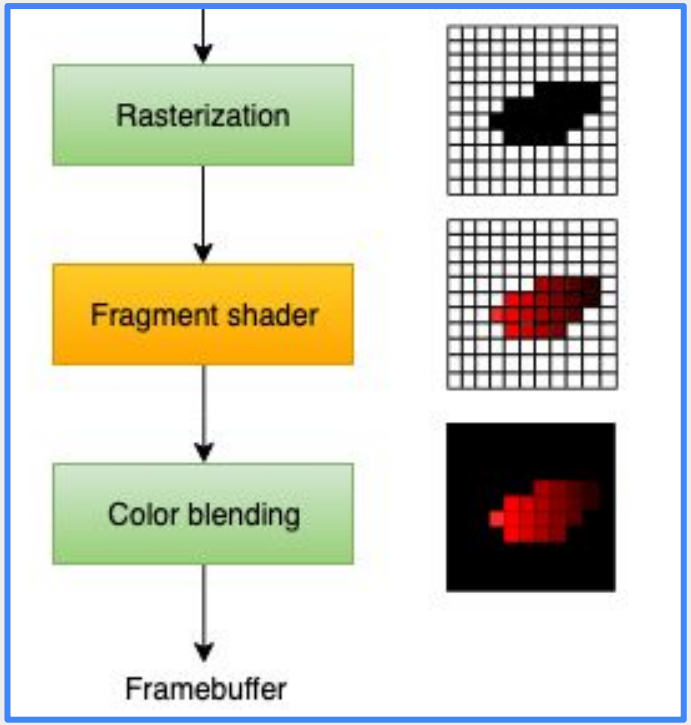
Turn vertices into pixels



Fragment Shaders

Colors each pixel individually

Then returns the image to the framebuffer to be displayed



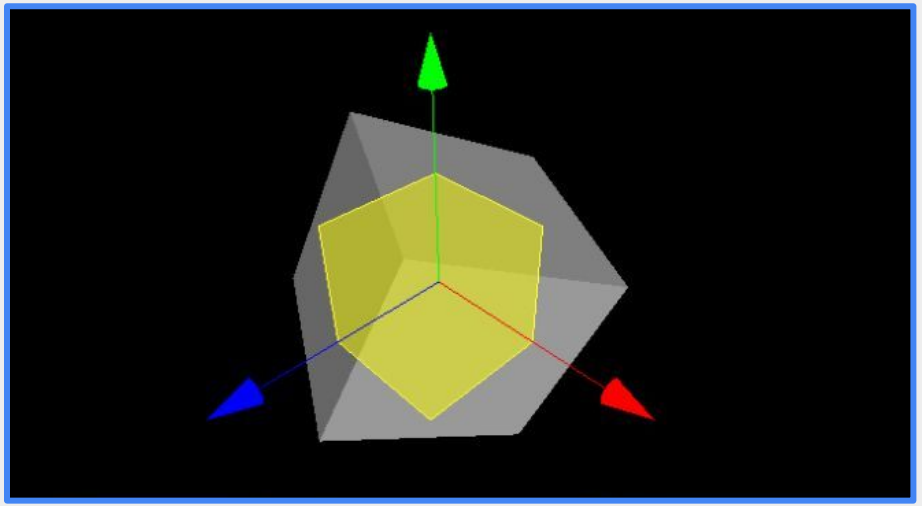
Buffers

What is a "buffer" in WebGL?

- Types:
  - VertexBuffer: vertex of a 3D Object
  - IndexBuffer: vertex that form a triangle of a 3D Object
  - TextureBuffer: texture of 3D Objects
  - FrameBuffer: render textures
- Sintaxis:
  - bindBuffer()
  - bufferData()

Matrix Operations

- Manipulating 3D objects
- Displaying 3D elements in a 2 plane (a screen)
- We will be using a library for matrix operations



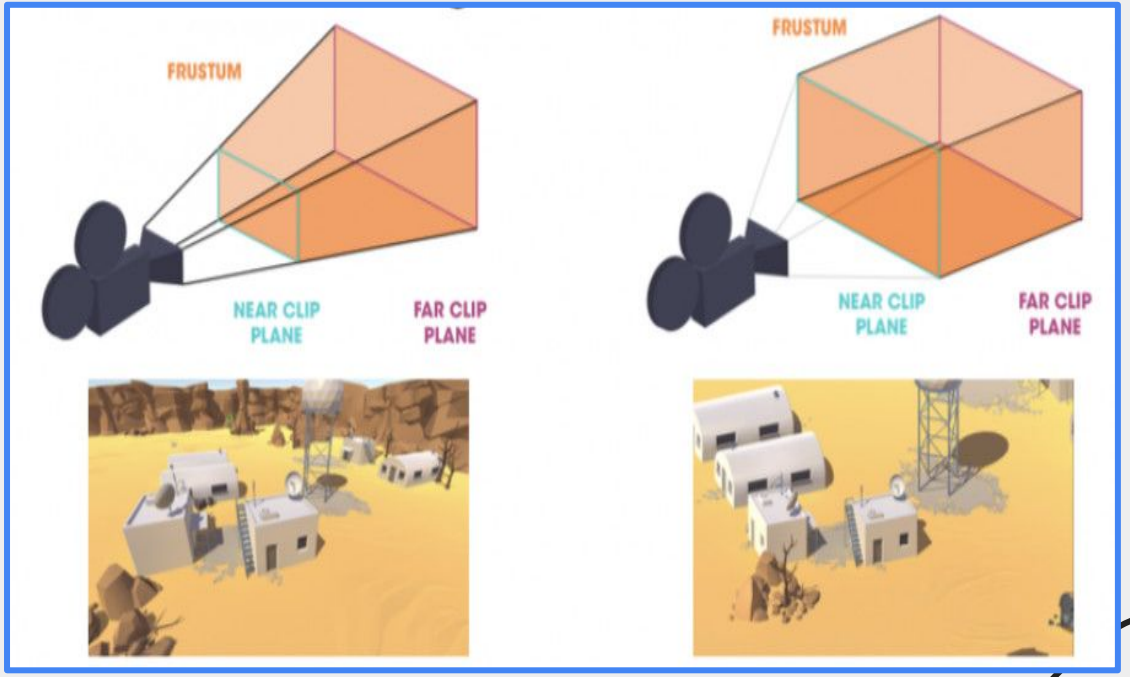
Camera

Main components:

- View Matrix
- Projection Matrix

What we can modify?

- Movement
- Rotation
- Zoom
- Perspective



04

Tutorial

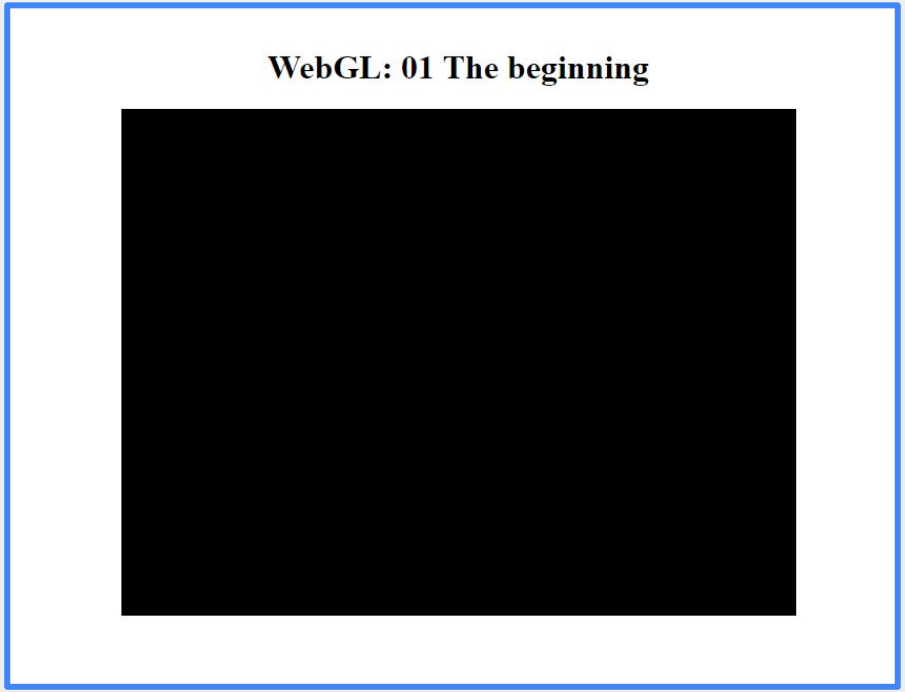
First steps

01 The beginning

Elementos esenciales:

https://github.com/ULL-ESIT-PAI-2023-2024/2023-2024-pai-WebGL-jaime-martin-adrian-suarez/tree/master/src/01-the-beginning

01 The beginning

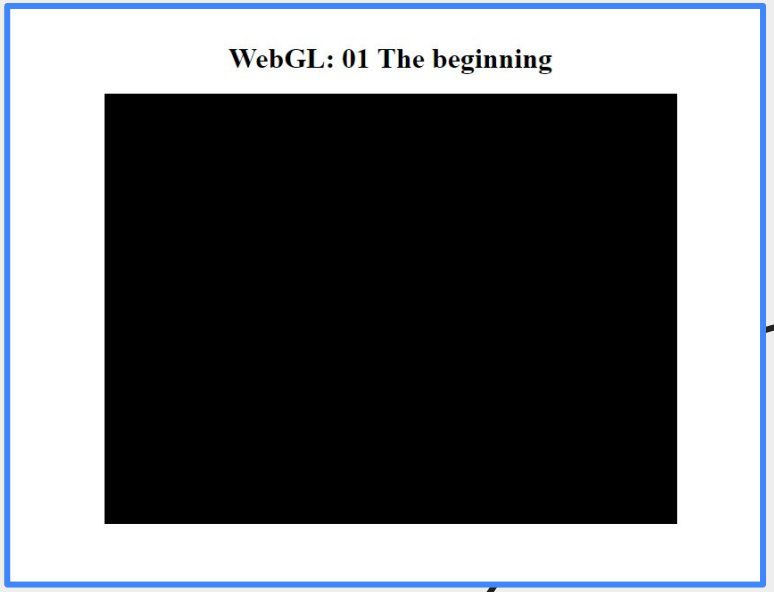


https://github.com/ULL-ESIT-PAI-2023-2024/2023-2024-pai-WebGL-jaime-martin-adrian-suarez/tree/master/src/01-the-beginning

01 The beginning

- Create HTML file
- Use a canvas element

- Get WebGL context
- Change color using clearColor()



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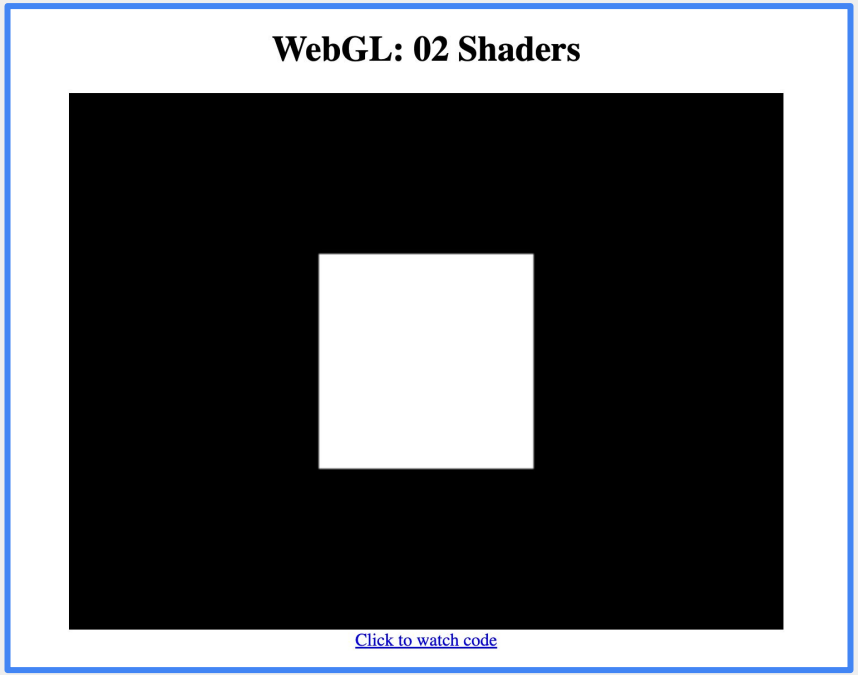
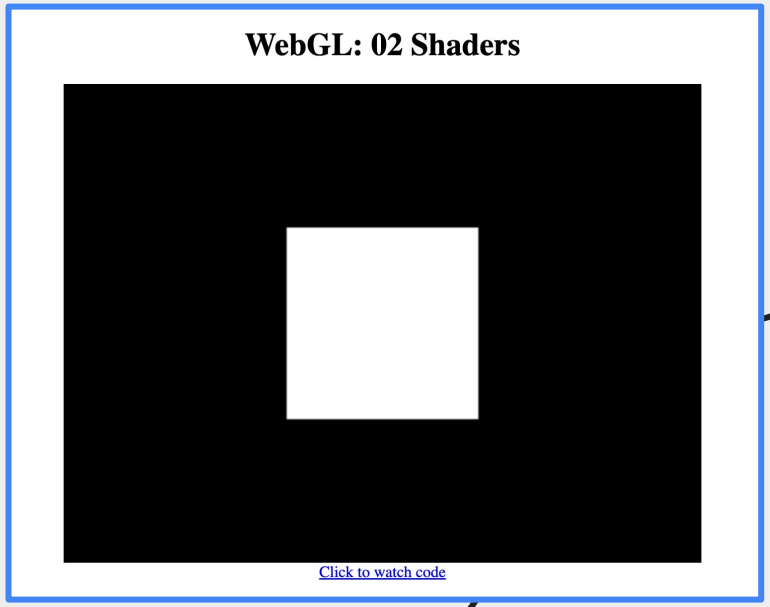
02 Adding 2D elements



https://github.com/ULL-ESIT-PAI-2023-2024/2023-2024-pai-WebGL-jaime-martin-adrian-suarez/tree/master/src/02_2D_content

02 Adding 2D elements

- Define shaders
- Create a buffer to store the vertices
- Set the camera



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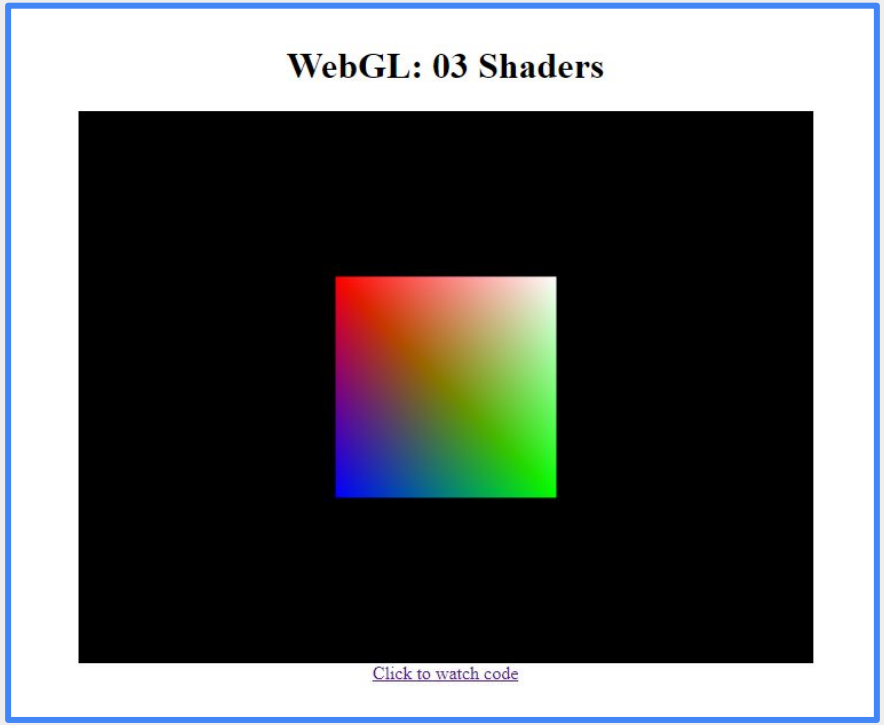
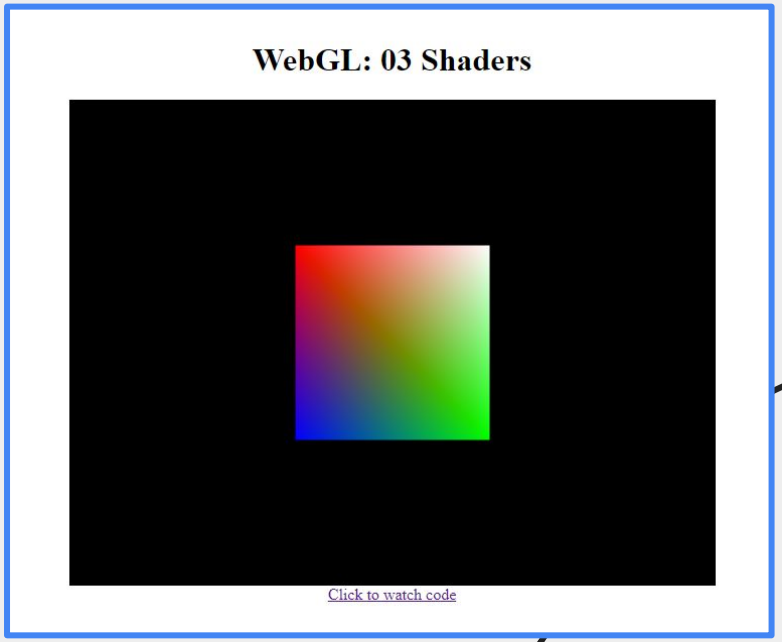
03 Shaders



https://github.com/ULL-ESIT-PAI-2023-2024/2023-2024-pai-WebGL-jaime-martin-adrian-suarez/tree/master/src/03-shaders

03 Shaders

- Code of 02 2D content
- Define a new buffer (colorBuffer)
- Use varaying variable
- Initialize a color attribute



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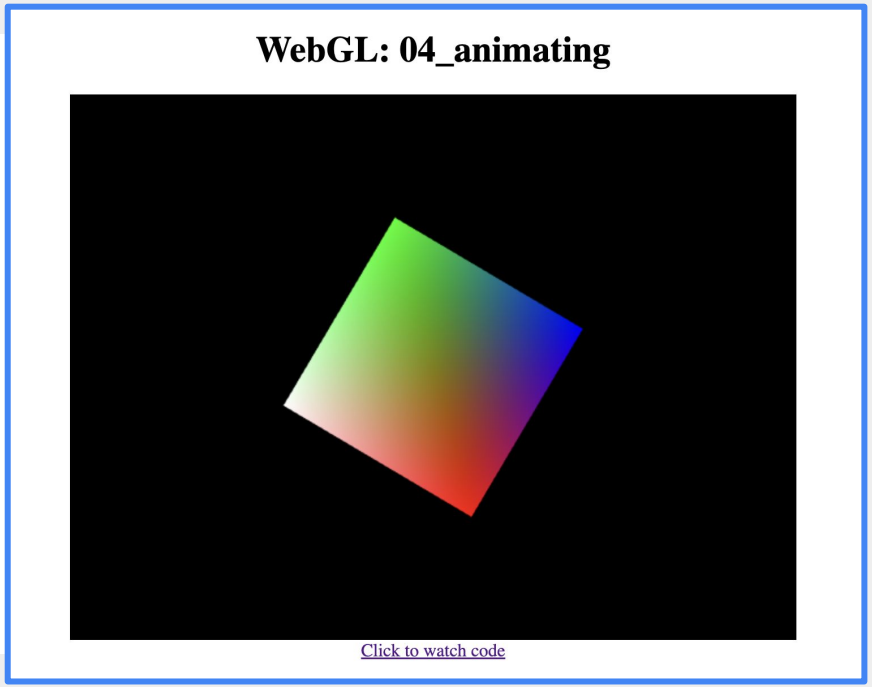
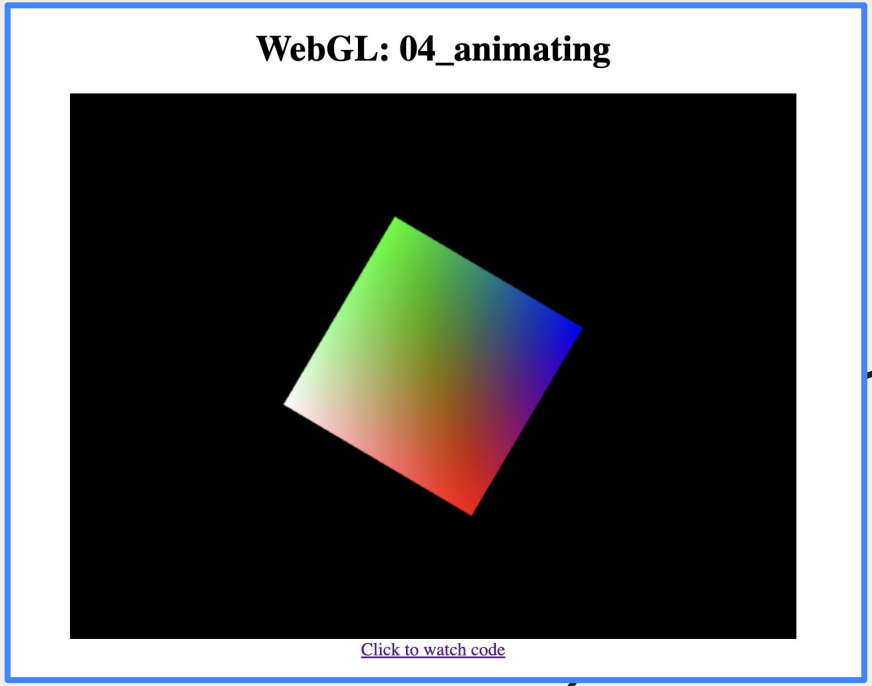
04 Animating



https://github.com/ULL-ESIT-PAI-2023-2024/2023-2024-pai-WebGL-jaime-martin-adrian-suarez/tree/master/src/04_animating

04 Animating

- Change the position of the camera every frame
- Start an animation loop



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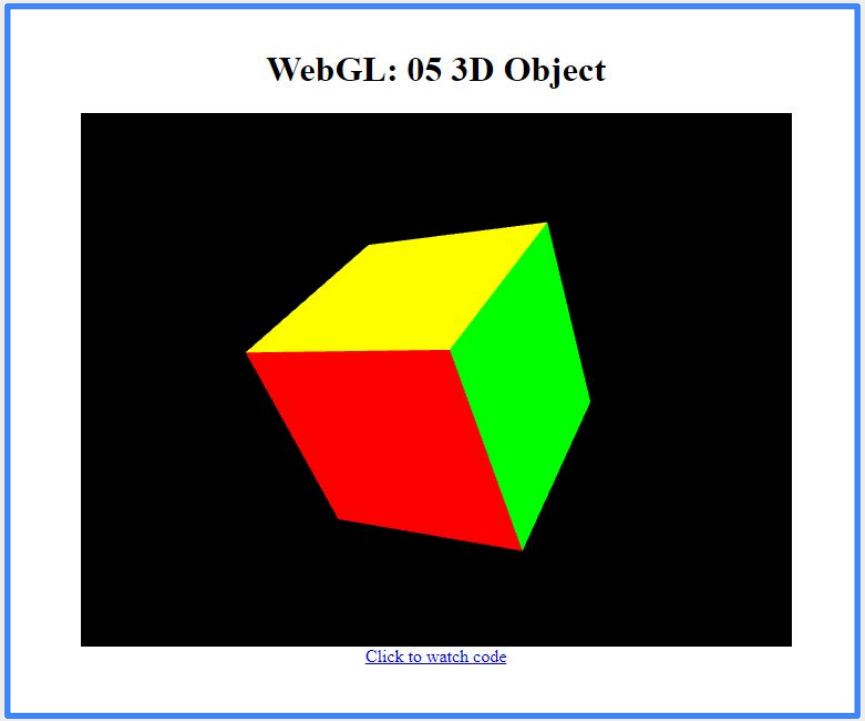
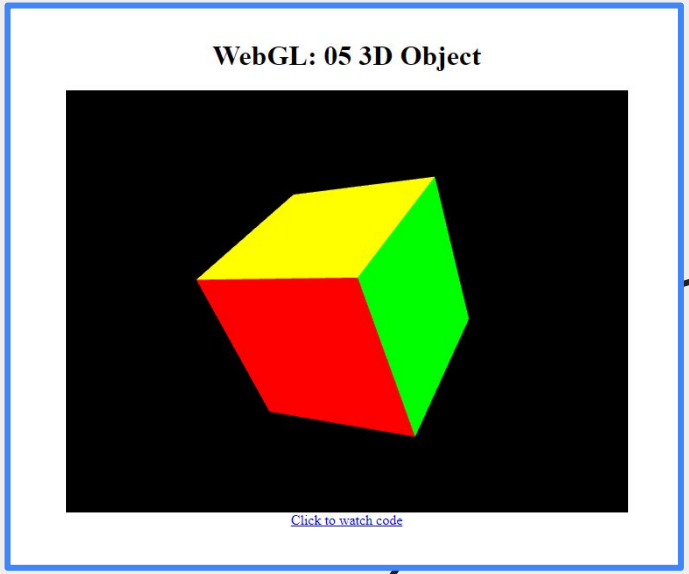
05 3D objects



https://github.com/ULL-ESIT-PAI-2023-2024/2023-2024-pai-WebGL-jaime-martin-adrian-suarez/tree/master/src/05-3D-objects

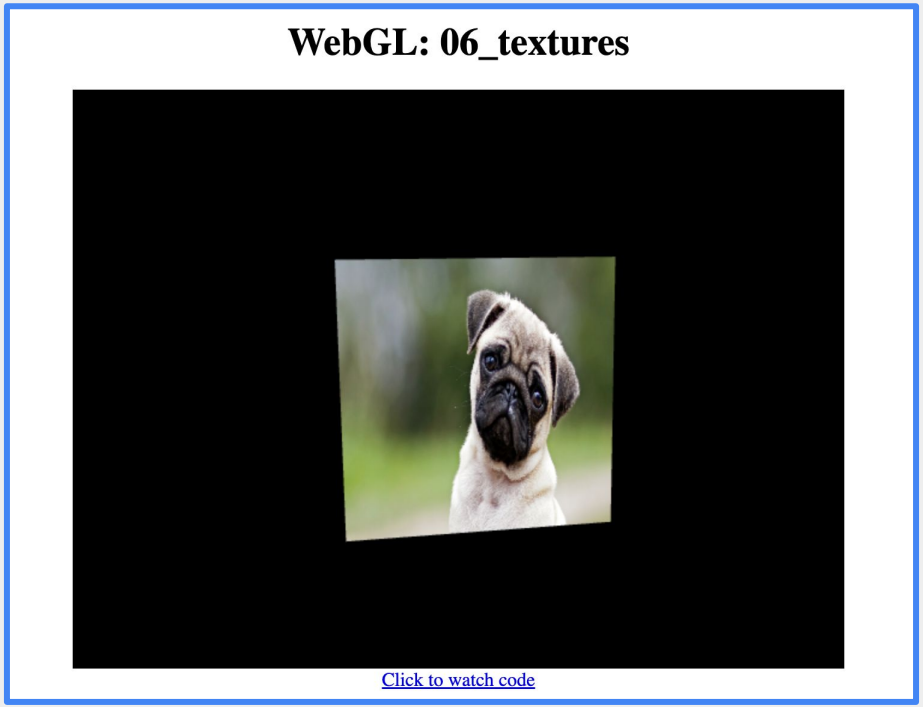
05 3D objects

- Code of 04 Animating
- Define vertex position
- Create a new positionBuffer
- Define vertex colors
- Create a new colorBuffer
- Define vertexs indexs
- Use gl.drawElements() instead of drawArrays()



https://github.com/ULL-ESIT-PAI-2023-2024/2023-2024-pai-WebGL-jaime-martin-adrian-suarez/tree/master/src/05-3D-objects

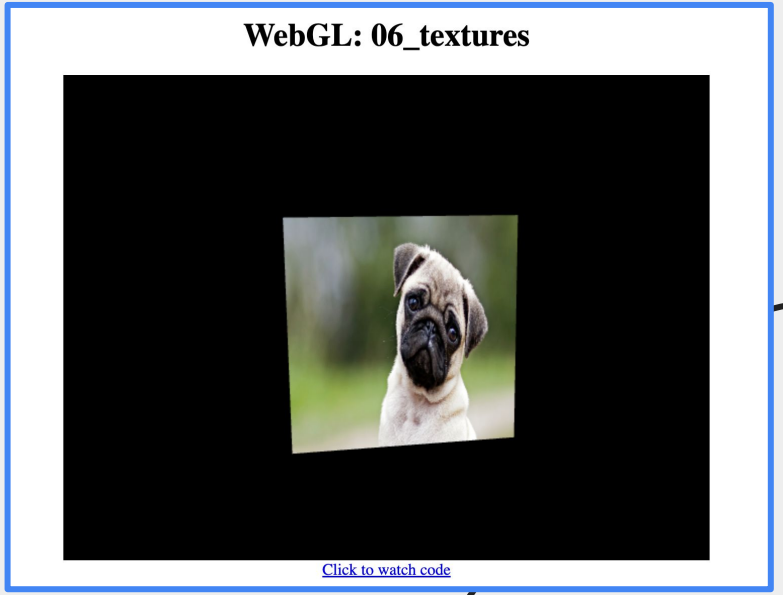
06 Textures



https://github.com/ULL-ESIT-PAI-2023-2024/2023-2024-pai-WebGL-jaime-martin-adrian-suarez/tree/master/src/06_textures

06 Textures

- Load the texture image
- Map the image to the proper coordinates in a buffer
- Update the shaders
- Add the texture while drawing the cube



https://github.com/ULL-ESIT-PAI-2023-2024/2023-2024-pai-WebGL-jaime-martin-adrian-suarez/tree/master/src/06_textures

05

Conclusion

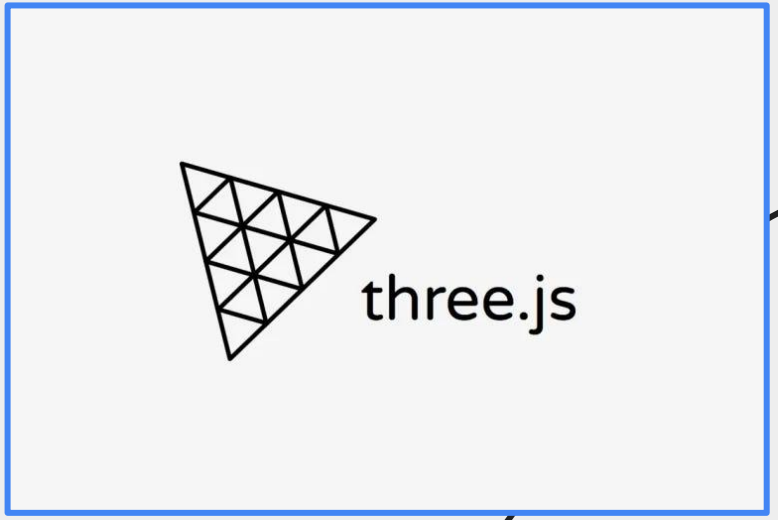
Is it really easy and useful?

Conclusion

- Significant relevance in modern web development
- Hard to learn
- Very low level

Libraries:

- Three.js
- stack.gl
- PixiJs



“A journey of a thousand miles begins with a single step”

—Lao Tzu (philosopher)

06

Bibliography

What has been used?

Bibliography

[1] Tutorial of WebGL by MDN

[2] All Methods at WebGL

[3] The best WebGL sites

[4] Perspective in WebGL