Universidade de Aveiro
Departamento de Electrónica,
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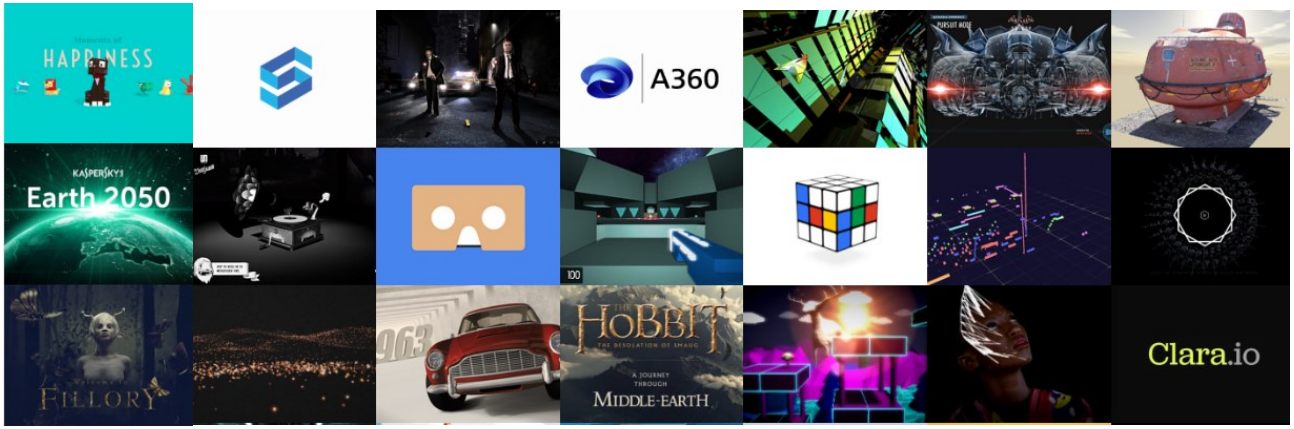
Introduction to Web 3D Graphics and Three.js Examples



https://threejs.org/

Beatriz Sousa Santos 2019

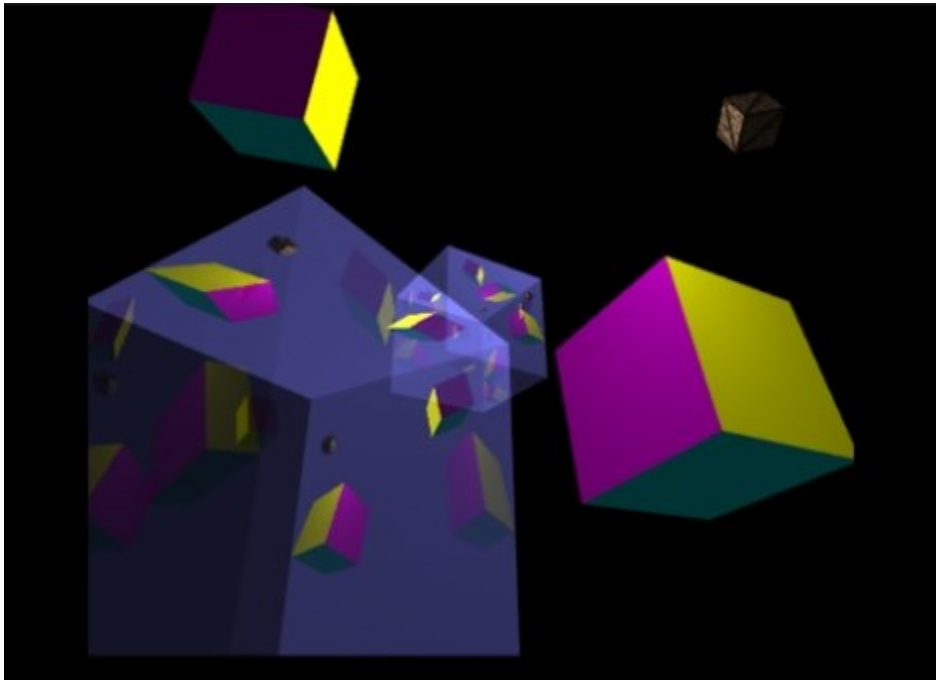
3D Web Graphics

https://www.khronos.org/webgl/

- Most modern browsers adopted WebGL (Web Graphics Library)
- Allowing 2D and 3D graphics using GPUs for better performance
- It is a cross-platform, free web standard for a low-level 3D graphics API based on OpenGL ES, maintained by the Khronos Group
- Can be used in HTML5 <canvas> elements without plug-ins
- Major browser vendors Apple , Google, Microsoft, and Mozilla are members of the WebGL Working Group

WebGL

- It is fully integrated with other web standards
- WebGL programs consist of control code written in JavaScript and shader code written in OpenGL ES Shading Language
- GLSL ES a language similar to C or C++ executed on a GPU
- WebGL 1.0 - 2011
- WebGL 2.0 - 2017



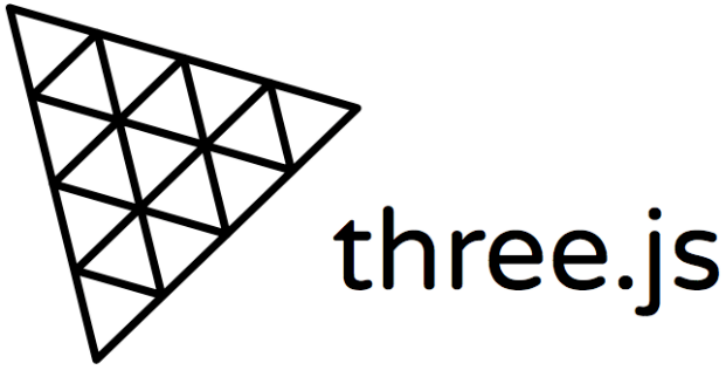
Important 3D open source Graphics Libraries (not Web)

https://www.khronos.org/opengl/

https://www.khronos.org/opengles/

https://www.khronos.org/vulkan/

Three.js



- Is a cross-browser JavaScript library and (API) used to create and display animated 3D computer graphics in a web browser
- Allows GPU-accelerated 3D animations using JavaScript as part of a website without plugins
- Uses WebGL; the source code is hosted in a repository on GitHub
- Allows creating complex 3D computer animations without the effort required for a traditional standalone application or a plugin
- First release in GitHub - 2010

Three.js Main Features

- Effects: Anaglyph, cross-eyed and parallax barrier.
- Scenes: add and remove objects at run-time; fog
- Cameras: perspective and orthographic; controllers: trackball, FPS
- Lights: ambient, direction, point and spot; shadows: cast, receive
- Materials: Lambert, Phong, smooth shading, textures and more
- Shaders: access to full GLSL capabilities
- Objects: meshes, particles, lines, ribbons, bones, etc. (with LOD)
- Geometry: plane, cube, sphere, etc. modifiers: extrude, tube, etc.
- Data loaders: binary, image, JSON and scene
- Export and import: from Blender, openCTM, FBX, Max, and OBJ
- Support: API documentation under construction, public forum
  Virtual reality: accessing WebVR

Light sources

- **Ambient Light** - A simple light whose color is added to the color of an object's material
- **Point Light** - A single point in space that emanates light evenly in all directions
- **Spot Light** - A light with a cone effect, for instance, a spot in the ceiling or a torch
- **Directional Light** - A light that acts like a very remote light source. All light rays run parallel to each other. The sun, for instance, can be seen as an infinite source of light

Materials that react to light sources

- Before creating the lights, it is necessary to change the material to react to light sources:
  - THREE.MeshPhongMaterial
  - THREE.MeshBasicMaterial

  does not

Bibliography

- Jos Dikersen, Learning Three.js: The JavaScript 3D Library for WebGL, Packt Publishing, 2013
- Jos Dirksen, Three.js Essentials, Packt Publishing, 2014

Useful links

- https://threejs.org/
- https://threejsfundamentals.org/threejs/lessons/threejs-fundamentals.html
- https://www.youtube.com/watch?v=Ov7KkDvBakM