

Introduction to WebGL

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History: OpenGL



- SGI leader in 3D hardware in late 80's
- Decided to transform its proprietary API, IRIS GL, into an open standard call OpenGL in 1991 competing with PHIGS
- Cross platform API to enable the presentation and interaction with 3D scene
- OpenGL Architecture Review Board (ARB) created in 1992



History: OpenGL (cont.)

- Microsoft introduces Direct3D in 1995
- In 1997 MS and SGI launch the Fahrenheit project aiming to provide a unified API
- Fahrenheit abandoned in 1999
- In 2006 ARB votes to transfer control of the OpenGL standard to the Khronos Group

History: OpenGL ES



- Introduced to provide an API specifically tailored to embedded systems such as those present on mobile phones and tablets
- Stripped down capabilities compared to OpenGL addressing speed and memory usage
- Originally focused on giving fast graphics to devices that may not have a floating point unit
- Simplified object representation compared to OpenGL



History: Canvas 3D



- One of the earliest proposals for introducing 3D content in a web page
- Extend the standard canvas HTML elements to support 3D contexts
- Mozilla demonstrated a first prototype in 2006
- Separately implemented in Firefox and in Opera in 2007



WebGL

- Khronos group started work on WebGL in 2009
- Designed to support OpenGL ES 2.0 bindings in JavaScript
- Extends the standard Canvas HTML element to support 3D contexts
- Version 1.0 shipped in 2011.
- Originally supported in desktop versions of Firefox, Chrome, Opera and Safari



WebGL today

- All the latest releases of the major desktop browsers support WebGL, including Internet Explorer 11
- IE 11 support is important because, up until that release you had to provide different support for your web page on IE if you wanted to include 3D content
- Khronos is currently working on the specification of WebGL 2, which is based on OpenGL ES 3.



Learning WebGL



- Tony Parisi has set up an excellent site to learn the concepts surrounding WebGL at <http://LearningWebGL.com/>
- Let's look at the examples from his site to get a sense of what you can do with WebGL
- Overview of lessons from LearningWebGL.com highlighting essential concepts



Essential WebGL Concepts



- Buffers are used to efficiently store data that will potentially be reused on the hardware
- Shaders are expressed in a C-like language that gets compiled by WebGL to be executed efficiently on the hardware
- WebGL has no internal notion of transformation stacks or perspective matrices. It is up to the programmer to manage these explicitly



Building on top of WebGL



- WebGL itself is a fairly low level API intended to be used by graphics savvy programmers, typically those who feel comfortable with OpenGL or OpenGL ES.
- This can pose problems for developers who are not very familiar with graphics and would like to start working in 3D without investing heavily in the underlying concepts.
- Several other approaches exist, built on top of WebGL, in both declarative and imperative modes. We will look at X3Dom and Three.js as examples of such approaches



Three.js



- Three.js is a JavaScript library that was written by Ricardo Cabello to hide the internal complexities of WebGL.
- The library is free to use and is available at <http://Threejs.org/>
- Many helper utilities such as material and matrix libraries make development easier for a new WebGL user.
- A great introductory tutorial by Ilmari Heikkinen from Google is available at <http://fhtr.org/BasicsOfThreeJS/#2>



Three.js examples

- [Oz the Magnificent web site](#)
- [360 car spin](#)
- [Gravity web site](#)



X3Dom



- A declarative interface that uses the Document Object Model to represent the scene graph
- Extra HTML and CSS primitives are added to the page description capabilities to enable web developers who are more comfortable with HTML than JavaScript to create and manage 3D scenes
- Library of materials and light sources
- Many built-in primitives to enable rapid development



X3Dom examples

- [Hello World](#)
- [Museum Viewer](#)



Which should I use?

- Read the introductions and use the tutorials to see which corresponds best to your skills and preferred programming style
- It's all WebGL under the covers. All three are the same engine with different front ends
- Three.js and X3D are easier to begin with
- WebGL gives you full access to the underlying engine



Questions?



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