

## **3D GRAPHICS FOR THE WEB USING WEBGL**

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### **ABSTRACT**

*When you look at things, you should be honest and say that Web applications are still appropriate restrictions for various reasons. One limitation relates to the fact that user interfaces for Web applications are not as "rich" in relation to the parent application. This situation changed when it appeared language HTML5, which enabled the creation of advanced 2D graphics within Web applications. But the initial HTML5 is good for 2D graphics, but does not support 3D graphics. Here comes into play WebGL, which enables the use of 3D graphics within a browser. WebGL has the following great features - open standard; accelerated rendering, which means that it is really fast; works in most browsers; since it is based on OpenGL ES 2.0, with him can work all who have already worked with OpenGL. It should be noted that WebGL standards provide great opportunities for students and others to experiment with 3D graphics and learn the essential elements.*

**Keywords:** 3D graphics, Web, WebGL, HTML5

### **1. INTRODUCTION**

Computer graphics (CG) is an area whose time has come, regardless of the costly hardware requirements to computer resources and specific software packages. CG became ready to fulfill pledges regarding communication using pictures and became a mainstay in the interaction between people and computers. It should be noted that the computer graphics has become an integral part of everyday life, so that even preschool children good luck with it. At the same time, computer graphics has become an inseparable part of the user interface and data visualization objects, while rendering objects and scenes became much more realistic.

### **2. GENERALLY ABOUT COMPUTER GRAPHICS**

Computer graphics is not entirely original theme, because to define and solve problems using some already established techniques such as geometry, algebra, optics and psychology. Geometry provides a framework for describing 2D and 3D space, while the algebraic methods used for defining and evaluating equality related to the placement. The science of optics allows the use of models to describe the behavior of light, while psychology provides models for visualization and color perception.

Computer graphics has remained one of the most exciting areas of modern technology, and is the area that the fastest progressing and growing. It has become an integral part of how application software, and computer systems in general. Computer graphics are routinely applied in the design of many products, simulators for training, produced music videos and television commercials, in movies, in analyzing the data in scientific studies, in medical procedures in many other applications.

### 3. WEBGL

WebGL (*Web Graphics Library*) is a JavaScript application programming interface (API), which allows you to render interactive 2D and 3D graphics within compatible Web browser, without using and the subsequent installation of plugins. WebGL is fully integrated into Web standards in terms of continuous operation when it comes to the image processing and effects, as part of the Web canvas. WebGL elements were combined with other HTML elements and embedded with other parts of the Website, or background on a Web page.

WebGL is based on OpenGL ES 2.0 API and enables the implementation of 3D graphics. It uses HTML5 canvas element and uses the DOM (*Document Object Model*) interfaces. HTML5 canvas element is part of the HTML5 language and allows dynamic rendering of 2D shapes and bitmap images (this is extremely helpful for rendering 3D objects).

OpenGL ES is an acronym of *OpenGL for Embedded Systems* and is based on the OpenGL interface for computer rendering. OpenGL is represented primarily environment in the development of interactive 2D and 3D graphics applications. Name OpenGL represents the acronym of *Open Graphic Language*, which means that it is an open graphical language, ie. the graphic language that is accessible to all. OpenGL interface contains many commands that can be used to manipulate objects and execute operations necessary to run interactive applications. OpenGL is the industry API which is prevalent in the development of 2D and 3D graphics applications and which was originally developed by SGI (*Silicon Graphics, Inc.*). Unlike his predecessor, a predecessor of IRIS GL, OpenGL is by design and platform independent of the operating system. It should be noted that the most famous OpenGL environment for the development of portable and interactive 2D and 3D graphics applications.

Describing capabilities of WebGL can be done via its library of functions. All functions can be divided into five categories:

- Functions to describe the primitives defined objects lower level of the hierarchy (primitive), which is a graphical subsystem capable of displaying.
- Functions to describe the sources of light are used to describe the position and parameters of the light source, which are arranged in 3D scene.
- Functions of assigning attributes by which a programmer defines how the screen look displayed object. In other words, if you are using the primitives defines what appears on the screen to define how attributes are displayed on the screen. Over attributes WebGL allows setting the color, characteristics of materials, textures, illumination parameters, etc.
- Visualization functions make it possible to define the position of the viewer in the virtual space, as well as the parameters of the camera lens. Knowing these parameters, the system can not only correctly display device, but also to cut objects that are out of sight.
- A set of functions for geometric transformations allows developers to perform various transformations of objects – rotate, shift (translation), scaling (resizing).

### 4. HTML

HTML (*HyperText Markup Language*) is a standardized language used to structure the text, media and objects embedded in Web pages and e-mail. As a modified and simplified version of SGML language, HTML standardize and maintain World Wide Web Consortium. The original version of HTML was created by Tim Berners-Lee, the first official version was released in June 1993.

Language HTML is made up of plain text and tags (characters or symbols). Although HTML symbols (tags) are often referred to as code, is not technically HTML code as computer codes are instructions that the computer required to perform a particular operation. The purpose of HTML tags that structure the document "mark" so that the user agent (*Internet browser*) could recognize the structure of the document and properly displayed in the Internet browser window that the user uses.

The latest version of HTML is HTML5. As each new version, HTML5 has brought some novelties compared to the previous version, but these innovations are reflected in the new semantics of the elements, new control attributes for forms, new graphic elements (the most effective is CANVAS) and new multimedia elements.

For further modifying Web pages are:

- CSS or *Cascading Style Sheets* for layout and positioning of the presentation;
- scripting languages (JavaScript, VBScript) to enable the dynamism and interactivity to Web presentations;
- DOM or *Document Object Model*, which refers to the relationship between script and elements on the page.

## 5. WEBGL AND HTML

Coupling HTML and WebGL is a normal thing that had to happen. In this way it is possible to ordinary users to create interactive 2D and 3D graphics, but it is enough to know simple HTML syntax as well as WebGL syntax. Figure 1 shows the redistribution of colors in 2D space (in this case it is the equilateral triangle), figure 2 shows RGB color model on wireframe cube and figure 3 shows redistribution of colors in 3D space.

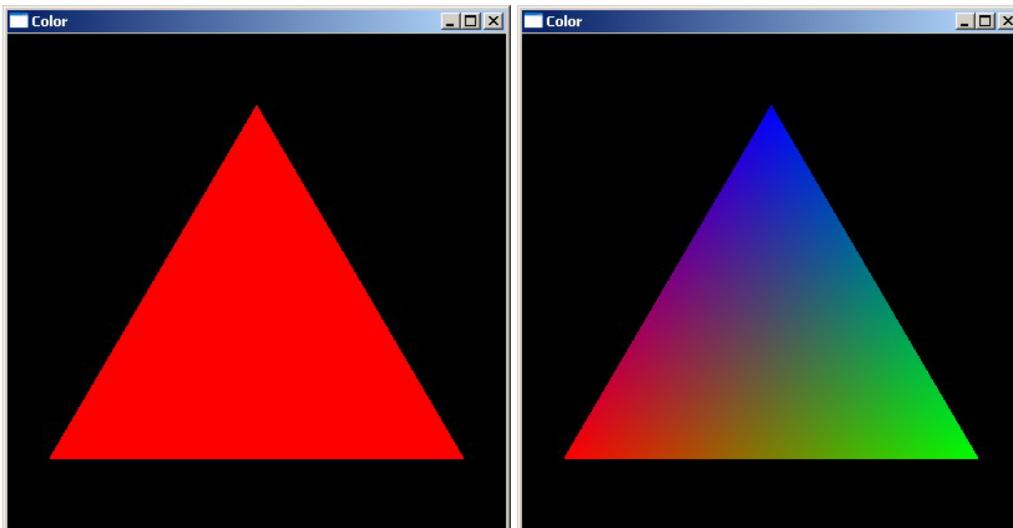


Figure 1. Redistribution of colors in 2D space

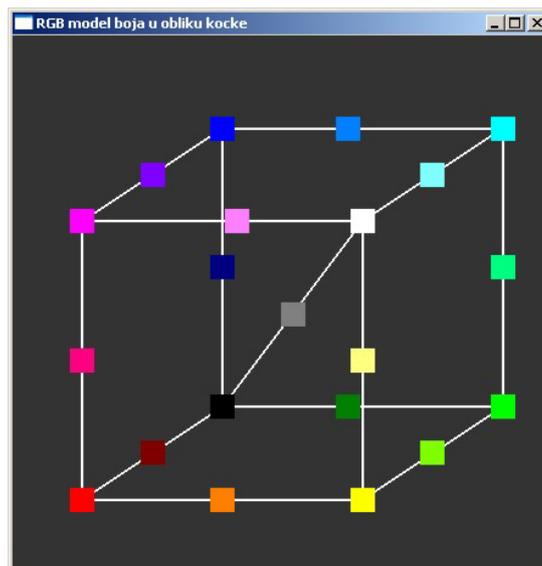


Figure 2. RGB color model shown in wireframe cube

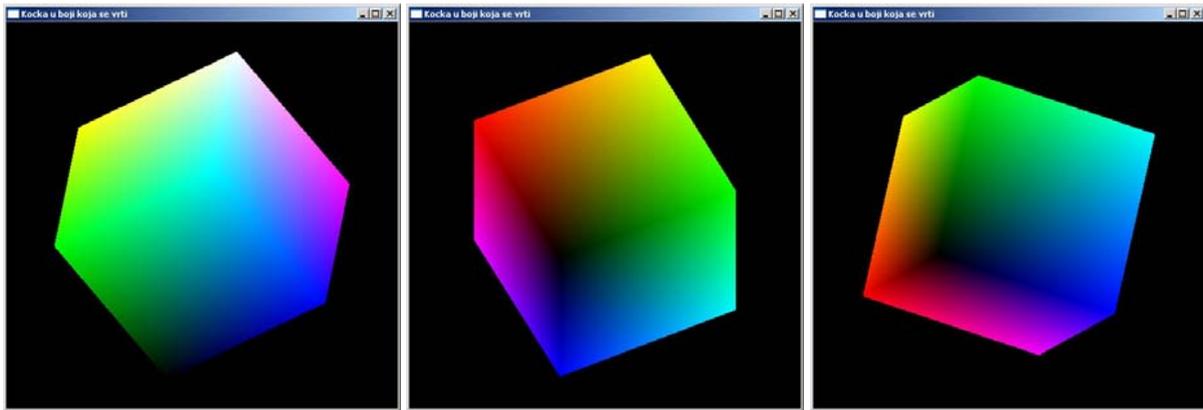


Figure 3. Redistribution of colors in 3D space

## 6. INSTEAD OF A CONCLUSION

This paper presents a brief overview of what is happening in the world of computer graphics. Connection between HTML and WebGL is something that allows inexperienced users to try to play and to make graphics and even interactive. Maybe these people can and to make lightweight computer games !? There should especially mention and link existing HTML, CSS and JavaScript, and what will happen when WebGL fully establish themselves in this environment? The images shown were made within the environment HTML5 and WebGL, and it should be noted that most web browsers able to display them. Syntax below displayed image is successfully displayed within *Internet Explorer* (version 11), *Mozilla Firefox* (version 38.0.1), *Google Chrome* (version 43.0.2357.81 m) and *Apple Safari* (version 5.1.7). The images shown are "removed" with from *Internet Explorer*.

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