

# SOME ISSUES OF 3D WEBPAGES

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## 1. ABSTRACT

In this article we are going to summarize our main results in three dimensional web development. First of all we give a short introduction to some 3D representation methods that we applied on our first three dimensional webpage. Following that we describe the transformation techniques, that we used, and with which we can convert traditional two dimensional webpages into three dimensions. These methods are based on HTML, CSS, and JavaScript techniques. After that we shortly describe the applied principle of automatic conversion, with which we can convert almost any 2D webpage into three dimensional, with minimal manual interaction. Finally we show some test sites, and provide future plans and conclusions.

## 2. INTRODUCTION

The main goal of our work is to create 3D websites that provide spatial three-dimensional real space experience. There are several options for the three-dimensional visualization that we have applied in our webpage, but our websites are unique, because they can display spatial effects of both text and images.

First we tried the so-called 3D side-by-side technique. The technique needs special tools, active or passive glasses and a monitor capable of displaying three dimensions, but this method is the most effective for 3D immersion. The color saturation is not reduced, the pictures are very realistic.

Another method that we applied is the well-known anaglyph (usually called red-cyan) technique, where we have applied minimal changes to the original HTML code, and we have extended the original cascading style sheets to turn web pages into three-dimensional.

We used other 3D representations that do not require any special tool. First of all the so-called stereograms, with which certain three-dimensional images can be rendered, using a special watching technique. Stereograms do not support long text or small details. Because of this drawback, just some parts of the entire webpage can be displayed in stereograms.

## 3. 3D REPRESENTATION

3D representation today is available for several devices like TV sets, monitors and laptop computers, etc. There are several methods of 3D rendering, some of them will be briefly introduced in the next sections.

### 3.1 Side-by-Side representation

A rather wide-spread technology is the stereoscopic view of 3D content, where the entire content is doubled, one side to the left and one side to the right eye. A rendering software of active 3D monitors or TV sets puts the images together and controls the 3D glasses that separate the image to the left and right eye causing 3D view.

### 3.2 Anaglyph method

The so-called anaglyph (usually red-cyan) method requires special glasses with (red and cyan) colour filters respectively in front of the left and right eyes. The colour filtered content is sent dedicated to the left and right eye respectively, which result 3D effect for the viewer. For watching it we need very cheap, usually paper framed glasses.

### 3.3 Animated GIF images

Animated GIF images can also provide 3D-like feeling, where the image to the left eye and to the right eye alters each other in a certain speed. The human brain can put the image together and see it as a slightly moving 3D object. The main advantage of this method that it doesn't require special equipment for displaying the 3D image, however the 3D content is limited to big objects only.

### 3.4 Stereograms

Another 3D imaging method that doesn't require any special tool is the so-called stereograms. This method however expects some training for the eyes and for the human brains until the 3D image becomes visible. The main drawback of stereograms is that small details cannot be displayed.

## 4. DEVELOPED METHODS

### 4.1 Transformation of the style sheets

For each of the methods described above, we use HTML, CSS and some JavaScript to change among the style sheets.

Two cases may occur. We can create a 3D website from scratch, or we can convert an existing 2D website into three-dimensional. In the first case, first we create a working HTML website. From this point the method of adding three-dimensional effect is the same.

Among the methods applied by us, the anaglyph and side-by-side is appropriate to turn all elements of the website to three-dimensional. Therefore these two methods are going to be used.

#### 4.1.1 Anaglyph transformation

First of all we analyze the original HTML code, and we set the position of the elements of the website on the Z-axis (that is orthogonal to the plane of the screen). We decide the measure of the protrusion of the different website elements or that of sinking in. Along the Z-axis 6 discrete planes are distinguished. The planes extend from class = "z-2" to class = "z+3", among which the "z-2" and "z-1" sink compared to the plane of the screen, the z-0 settles in the plane of the monitor and the remaining 3 planes are raising from the plane of the monitor. Generally, titles with the largest font size are highlighted the most. For example: `<h1 class="z+3"> main title </ h1>`.

The next step is to double the original content of the body. We supply the original content with "left id", indicating that visual components for the left eye are included. The copied contents are supplied with "right id" because it shows the right-eye view. The diversity of the ids can be assured so that all id ="right" is augmented with a prefix "right\_". The HTML code conversion is now complete.

We copy the original style sheets, then rename them, and afterward supplement with a "right\_" prefix relevant to the ids definition and with #right space definitions concerning the classes. The "left" and "right" content is positioned exactly to overlap each other.

Our goal is to turn the webpage's elements to a visible for both eyes, so we remove the background of the upper content. The offset is usually solved with a "margin-left" CSS statement.

The amount of shift determines the distance from the plane of the monitor, while the direction of the offset decides whether the website's components will sink behind or stand out from the plane of the screen.

The definitions of colours are made by style sheet too. In case of black and white website – black letters on white background – we have an easy work; we replace the color of the "left" content's text to cyan, and the "right" content's text is replaced by the color red. In order to both colors appear visible simultaneously, opacity of the top layer's (the "right") content is reduced by half.

The websites are usually not black and white. In this case we split the letter color into red and cyan channels and use the received colors.

Usually the background has some color too, in this case, we also split the background's color into color channels. If the background of the text is a picture, we take a sample from the direct environment of the letters and continue to work with it like a background color.

The three-dimensional representation of the pictures is especially spectacular.

The images are like matrixes. In all cells a pixel can be found, to which you can refer to by row number and column number. Each pixel includes four pieces of information, the three color channels and the alpha channel (RGBA).

In case of the pictures we do color channel exchange, this is how we create cyan and red pictures, then by offsetting the red pictures we receive the anaglyph three-dimensional picture, that can be seen three-dimensional by red-cyan color-filtering glasses.

If two images are available – photographed from different angles, for the left and right eye separately – then we use the cyan version for the left-eye image and red version for the right-eye image.

#### 4.1.2 Side by Side transformation

Considerable part of this 3D conversion is identical to the anaglyph transformation, thus we describe only the differences.

We do not place the "left" and "right" contents on each other, rather next to each other. Since the left and right do not overlap, there is no need to delete the background of the "right" part.

This website is designed for 3D TV, which automatically detect the two similar parts then combine them into three-dimensional. A special property of 3D television that during unification it pulls the screen apart to full width. For the sufficient scale, we double the website's altitude.

The offset, reviewed at the anaglyph conversion, is valid here too. There is no need to replace the color channels, the site keeps its original colors, because of this three-dimensional solution is the most realistic because.

## 5. PERFORMING CONVERSION AUTOMATICALLY

The manual 3D conversion of a site takes long time, therefore we automated a significant proportion of steps in case of anaglyph technology. The number of errors was minimized and the process is time-effective. In the course of the automation JavaScript was applied.

The original HTML code, with attributes (class="z-2" etc.) defining the depth is the only thing we supplement manually. The rest of the process is made by jQuery functions.

We have duplicated the body using "left" and "right" ids, and the we have extended the original ids in the right section with the prefix "right\_", since on id can occur only once in an HTML document.

The offset is solved by jQuery too, compared to the original value, in order to achieve the desired depth, we increase or decrease the value of the margin.

In the automation of pulling out or pushing in the images three different cases can be distinguished, the automatic positioning of the pictures every possibility were taken into account.

The first, and most probable case is, when only one image is available, and we have to add some 3D effect to the image. In this case there won't be depths in the pictures, the z-axis position of the picture can be changed, only.

When two images are available – as in real life we can see two images simultaneously – then the three-dimensional picture is spatial.

Using jQuery functions we filter cyan and red color channels of the images. If only one picture is available, then one picture will be used twice.

The third case, if conversion is not necessary because we have an anaglyph image already.

## 6. EXPERIMENTS

### 6.1 First real three dimensional webpage

In the course of three-dimensional web page development, we created a website, in which we melded all three-dimensional techniques used by us. We reviewed the methods in the former sections. The user can meet the application of these methods on this web page.

With the help of view changer buttons you can choose from a variety of three-dimensional representations. For example, if we select the anaglyph 3D view of the entire site, the site with all of its sub-sites changes into anaglyph. The website can be viewed at <http://3dweb.hu/> (see Fig. 1).



Figure 1.  
Anaglyph view of 3dweb.hu

### 6.2 3D webpage of MTA SZTAKI

In collaboration with the developers of the website of the Institute for Computer Science and Control (MTA SZTAKI, <http://sztaki.hu>), we created the anaglyph version of the MTA SZTAKI website. We introduced the automation of 2D to 3D conversion on this website for the first time. The results can be seen at

<http://web2.dsd.sztaki.hu/3d>

## 7. FUTURE PLANS

Our further plans include creating several 3D websites. We've prepared the anaglyph view of the webpage of the Hungarian Academy of Sciences (<http://www.mta.hu>, see Fig. 2), of a well-known Hungarian news portal (<http://origo.hu>, see Fig. 3), and of a very popular dictionary, developed in MTA SZTAKI (<http://szotar.sztaki.hu>).

The visualizations are constructed as a three-dimensional image. First, we captured a picture of the site, and then we divided it into colour channels and finally we made the highlights.

In addition, we are searching hidden possibilities of 3D visualization compared to 2D websites.

We are looking for methods, with which we can directly display 3D side-by-side webpages on 3D devices.



Figure 2. Visualization of mta.hu



Figure 3. Visualization of origo.hu

## 8. CONCLUSION

We have examined several 3D visualization methods that we have tested on our 3D websites. Among the tested methods the anaglyph technology seems to be the most promising one. Our main results are well-functioning 3D websites, which are cost effective, we need just a traditional 2D monitor and red-cyan glasses. Therefore, we expect that our 3D webpages will widespread. With this method, we have created the website of MTA SZTAKI in 3D. In the near future our goal is to improve the automation and undertake the transformation of traditional 2D websites to 3D.

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