Bringing the Web Closer: Stereoscopic 3D Web Conversion

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Abstract. In this paper we present 3DSjQ, a tool used to implement stereoscopic 3D in web pages. It provides HTML developers the possibility to create static and dynamic content that interacts with depth. We uncover the algorithm used for the tool, describe the method of operation and discuss future work including further development and implementations.

Keywords: stereoscopic, 3D, web, depth, HTML, framework, interface, interaction, javascript.

1 Introduction

Stereoscopy can be used as a narrative technique to try to provoke immersion and arousal in a movie [1]. Despite this, according to the Motion Picture Association of America, only 159 films (2.7% of all released since 2003) have been released in 3D [2]. This aligns with complaints from users regarding available content [3]. But new uses of 3D in education where "marked positive effect of the use of 3D animations on learning" is indicated [4], shed light on the importance of expanding beyond films and allowing the creation of 3D assets and apps. When coupled with forecasts of the rising trend of stereoscopic 3D (S3D) devices [5], a niche for more interactive S3D apps can be noted.

Analysing how much content is on the web, over 672M websites were estimated by Netcraft's June 2013 Web Server survey [6]. If we take the previously exposed situation with S3D movies as a metaphor, we can state that the amount of existing S3D content in relation to the total number of web pages is 0 percent. In order to alleviate this problematic, the idea of converting existing pages into a valid stereoscopic format to be used in stereo displays is of great interest for us. Additionally, future tools or frameworks that allow the introduction of depth in web applications can be valuable when coupled with semantic information. In this article, we present a proposal to do exactly this, convert an existing webpage into a side by side valid stereoscopic format.

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2 State of the Technology

Stereoscopy is used mostly in cinematography for entertainment purposes, but three developments are allowing a more interactive approach with 3D: (i) The number of devices equipped with 3D displays is growing [7]. (ii) 3DTVs are becoming more affordable for consumers, and (iii) the development of head mounted displays and the interaction they portray with virtual 3D environments is in expansion.

Related to this, the usage of stereoscopy on the web can be seen in several examples listed here [8]. All of these websites use passive anaglyph images as a background and most of them serve promotional and entertainment purposes, leaving productivity, accessibility and other possible enhancements on a second place, or even unconsidered.

Despite the poor appearance of stereoscopy on the Internet, the World Wide Web Consortium, which is responsible for developing modern web standards, has a proposal called “Extensions for S3D support” [9]. This proposal introduces the extension for CSS (Cascading Style Sheet) properties specific for S3D content.

3 The Tool: 3DSjQ

As a way to approach the problem related to the lack of existing S3D content, we present a tool that adds S3D depth to a web page. In order to achieve this we developed a 2D-to-3D conversion algorithm (referred from now on as ‘algorithm’). Following is a description of the process that clones, adapts, mirrors and shifts markup elements on an HTML page in correspondence with the technical guidelines defined by Sky3D [10] using HTML5, CSS3 and jQuery.

3.1 Content Cloning

According to the theory of stereoscopy [1] to achieve the stereoscopic depth illusion, we must create an exact copy of the ``body" part of the existing HTML and paste the cloned markup side by side along the original. Thus the first step of the algorithm is to clone the content. At this stage the script creates two containers for each the original and the clone. Then, it cuts the existing HTML and pastes it into the corresponding containers. After, the output HTML becomes invalid according to the recommendations of W3C which restrict the appearance of elements with the same “id” attribute [11]. In order to revalidate the output markup with the recommendations provided by the W3C, additional processing is executed. The script detects elements with the “id” attributes within the clone container, and adds a prefix which makes their “id” unique.

3.2 Styles Adaptation

Style adaptation is intended to solve two main problems: (i) apply styles for the cloned elements that lost their style rules after their “id” attributes were renamed and (ii) handle the mirroring of interactions defined by dynamic pseudo classes.In order to

apply the initial styles to the cloned elements with updated “id” attributes, 3DSjQ uses AJAX (Asynchronous Javascript and XML) to get the stylesheets referenced in the input HTML, parses it with regular expressions, and replaces detected “id” selectors with the prefixed “id” value. It then stores the rule associated with this selector. At the same time the script does the same search for elements with dynamic pseudo classes such as “:hover”, “:active”, and “:focus”. At the end of this part of the conversion process, 3DSjQ collects updated rules and injects them under the “style” tag in the output HTML.

3.3 Interaction Mirroring

During this phase, the main purpose of this script is to apply all the basic interactions from the original part of the content to the clone. It includes the mirroring of the mouse cursor position, basic interactions defined by dynamic pseudo classes and the mirroring of content scrolling.

3.4 zPlane Builder

To create the stereoscopic effect, elements in each container should be shifted to the left or to the right from its original position depending on desirable depth level [1]. Here, 3DSjQ creates an array of data associated with each element specified during the setup. Taking into account all this parameters 3DSjQ shifts and (if visual cues are allowed) scales the elements and its clones from their original positions according to the settings specified along with the initiation function. This way 3D depth illusion is achieved.

4 Conclusion

The tool that converts HTML pages to stereoscopic 3D (S3D) was presented. The processes that compose it have been explained. We developed this tool as a partial solution for the lack of S3D content available on the Internet. We also present this tool as an innovative way to build HTML-based S3D user interfaces for displays and mobile devices that work with this format.The tool is easy to use. It leverages features of open technologies HTML5, CSS3, and jQuery, which are supported and used by the web developer community. The tool was tested to create an HTML page from zero and to convert the Mozilla Foundation homepage and a Google search engine results page. Both cases finished with positive results in all modern browsers and required less than five minutes spent on coding. Nonetheless there are several limitations when interacting with pages that are not valid according to W3C standards.

5 Future Work and Discussion

As of date of writing, the tool is in stable alpha release and can be used as a jQuery plugin on any HTML page. Nevertheless in order to make the tool reliable additional testing, debugging, and code optimization is required.

The tool can also be used to develop static 3D compositions and conduct research on 3D stereoscopic depth perception. 3DSjQ can be used to study user interactions in stereoscopic spatial graphical user interfaces [12], and the influence of stereoscopy on productivity of diverse tasks in education processes [4] and cognitivity.

We also intend to promote 3DSjQ within the developer community. For this, we plan to release a beta version of the script on GitHub and attract more people to participate in further code development in order to improve the quality of the project. At the same time, this will aid the growth of S3D websites on the Internet.

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