

# WebGL on Mobile Devices

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**Abstract**—The abstract goes here, e.g. <http://www.phdcomics.com/comics/archive.php?comid=1121>.

**Index Terms**—WebGL, mobile computing, teleseminar.



## 1 INTRODUCTION

The technologies which allow people to interact with the world around them evolve constantly. Whereas it was common to simply display information in a static form in the early days of the web, at present an ever increasing amount of content is presented in dynamic and interactive ways.

In the effort to expand internet browser functionality to natively support three-dimensional graphics, HTML5, WebGL have been developed. Many web sites already offer functionalities which were previously only found in native applications, e.g. word processing using Google Docs [1] or creating presentations using 280 Slides [2], thus narrowing “the gap between them” [3]. A native usage of 3d-functionality enhances these “web applications” even further.

“Augmented Reality (AR) has been defined broadly as combining real and computer-generated digital information into the users view of the physical and interactive real world in such a way that they appear as one environ-

ment, thus providing a bridge between digital information and the physical world” ([4], [5], [6], [7] via [8]). Application areas of AR can be as broad as ranging from health care [9] to education [10] to tourism [11]. The topic has gained momentum thanks to the rise in smartphone usage. “To make the world itself the user interface [...] may revolutionize the way information is accessed and presented to people in the future [4], [7].

The rise of smartphones is growing with a fast and still accelerating pace, enabled ways of displaying information in a new way in a truly mobile context to many people [12], [13]. They offer a much higher power than feature phones and even claim to offer the “real web” experience with “real browsers” [14]. There are differences, however, between the way information can be accessed from a desktop system and a mobile device, influenced by factors like screen size, processing power, and input methods.

3d-support on mobile devices is still in an early phase. Adobe abandoned Flash in late 2011 [15], leaving WebGL as the main (method) of providing interactive 3d content on the mobile web, even if it is still in an initial phase.

This paper analyzes the status quo and potentials of WebGL on mobile devices (regarding performance and human-computer-interaction.)

The paper is structured as follows: Chapter 2 gives background information on relevant topics, i.e. augmented reality, WebGL, and

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human-computer-interaction (HCI) with mobile devices and their evaluation criteria; Chapter 3 gives implementation details of the the WebGL environment used to capture the status quo; Chapter 4 presents the evaluation as well as limitations to this study; and Chapter 5 gives a summary of the results and presents future research opportunities.

## 2 BACKGROUND

### 2.1 WebGL

#### 2.1.1 Design

#### 2.1.2 Mobile WebGL

Although support for WebGL is available on the desktop computers within all major browsers WebGL (Firefox 4+, Safari 5.1+, Chrome 10+, Opera 12+), except of Microsoft's Internet Explorer [3], browsers on mobile devices supporting WebGL are still very rare.

Apple has added WebGL capabilities to iOS with iOS 4.2 [16], [17]. However officially WebGL is only available to be used on Apples iAd platform [16], [18]. With an hack discovered by Nathan de Vries [16] WebGL can also be enabled in a UIWebView. Using this way it is possible to build a custom WebGL viewer for iOS. However since this method of enabling WebGL on iOS requires the use of non-public APIs it cant be made available to end users due to Apple's App Store Review Guidelines (Section 2.5) [19]. The built-in Safari browser on iOS does not support WebGL and due to Apples App Store Review Guidelines (Section 2.7 and 2.8) [19] third party browsers are required to use the WebKit rendering engine provided by Apple.

Opera Mini is the only browser on iOS, which does not use the WebKit provided by iOS. Opera Mini circumvents Apples restriction by rendering the web content on Operas servers. Opera Mini does not support WebGL. So until Apple officially supports WebGL in Safari on iOS there is no way available for the end user to run WebGL content on iOS.

On Android WebGL compatible browsers are available (Firefox for Android 4+).

As the desktop version of InternetExplorer does not support WebGL [3] and Microsoft

is considering WebGL "harmful" [TODO] we probably wont see WebGL support on Windows Phone 7 in the near future.

#### 2.1.3 Concerns

#### 2.1.4 Status Quo

#### 2.1.5 Evaluation criteria

### 2.2 Augmented Reality

#### 2.2.1 History

#### 2.2.2 Categories

#### 2.2.3 Native apps and web applications

#### 2.2.4 WebGL usage

#### 2.2.5 Evaluation criteria

### 2.3 UI and UX Research

## 3 IMPLEMENTATION

<http://www.phdcomics.com/comics/archive.php?comid=1476>.

## 4 EVALUATION

## 5 CONCLUSION

The conclusion goes here.

## APPENDIX A

Appendix one text goes here.

## APPENDIX B

Appendix two text goes here.

### Listing 1: Hello World Code Snippet

```
System.out.println("Hello World!");
```

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