

# A Responsive Web Design Testing Tool Using a Simulator of Different Screen Shapes Built in JavaScript

Tanja Krunic

The Higher Education Technical School of Professional Studies in Novi Sad  
Novi Sad, Serbia  
krunic@vtsns.edu.rs

**Abstract** — The market of LED displays is growing worldwide. They appear in more and more different shapes and can be connected to computers. This means that they can be used for displaying web pages. Adapting web content for various screen shapes is going to be an upcoming issue in the field of responsive web design. Herein a responsive web design testing tool using a screen shape simulator is presented. The tool is built in JavaScript and is available on GitHub.

**Keywords**-screen shape; simulator, responsive web design; testing tool; JavaScript

## I. INTRODUCTION

There is an increasing number of people using the internet from year to year. According to [1], in January 2019, 57% of the world's population are internet users. The same source claims that the average internet user spends almost seven hours a day surfing the web. On the other hand, there is an increasing number of smart devices developed for various purposes (tablets, smartphones, smart watches, smart glasses, TV sets, wearables for monitoring health, refrigerators and other smart home components that gather physical data like light, temperature, smart displays - voice assistants usually connected with smart devices, etc.), [2], [3], [4]. But in most cases they can also be used for surfing the web, since smart device manufacturers want to attract customers by enabling their favorite activity - web browsing on their products. This caused a rapid development of LED displays for various devices. Besides this, indoor and outdoor displays are also produced in various shapes and dimensions. Mainly they are touchscreens and can be connected to computers, so they can be used for displaying web presentations of companies and their products. Displaying web content is maybe not their main purpose for now, but the existence of such a possibility is worth of attention. Their popularity is raising globally since they can heavily be used in marketing campaigns. They are claimed to be 'the heart of any business campaign', [5], [6].

As one can conclude, LED displays are nowadays produced in various shapes and dimensions, so it is obviously that the future of web design will go into the direction of adapting web content for various screen shapes. This was a motivation to create an online responsive testing tool which enables the user to choose the desired screen shapes, and to test the layout of their webpage subsequently.

This paper is organized as follows. The second section is devoted to different screen shapes. Section three gives some notes on adapting web content to be displayed on different screen shapes. The online responsive testing tool is presented in section four.

## II. DISPLAYS AND THEIR SHAPES

The rapid evolution of computer monitors started in 2000., since the invention of LCD monitors, [7]. The same year, this was followed by the invention of smaller devices like tablets, [8], the iPhone in 2007, [9] and the smart watch in 2012. But the appearance of devices with screens of different dimensions was just the start of the revolution of displays. Nowadays, there are a lot of smart devices and displays with different screen shapes. Let us mention some of them: Smart watches with round (Fig. 1 (a), [10]) and hexagonal (Fig. 1 (b), [11])

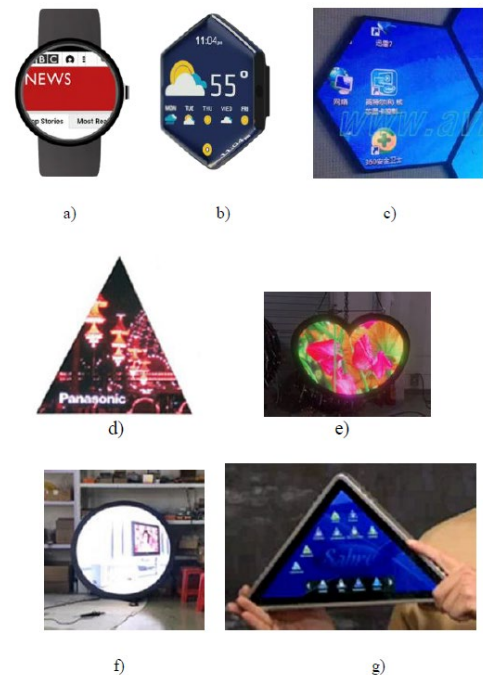


Figure 1. Various shapes of displays.

displays, hexagonal (Fig. 1 (c), [12] ), triangular (Fig. 1 (d), [13]), heart (Fig. 1 (e) [14]) and round (Fig. 1 (f) [15]) shaped indoor LED displays, and a triangular lap top (Fig. 1 (g), [16]).

The idea to build a triangular laptop shown in Fig. 1 (g), came from by Eric Calisto in 2011 and he launched a Kickstarter project to found the development. There is no information if the project is released by now or not, but this is certainly the evidence that lap top constructors definitely started to think ‘out of the box’, or better said ‘out of the square shape’.

### III. ADAPTING THE CONTENT TO DIFFERENT SCREEN SHAPES

As mentioned in the previous section, the development of smart devices started with the appearance of smartphones. According to [9], the true revolution of development of smartphones started in 2007, when the first iPhone was created. From that moment, people started surfing the web with smartphones. But this was quite uncomfortable, since at that time, web pages were designed for viewing on desktop computers only. Web designers responded with responsive web design. Responsive web design is a relatively novel discipline which is developed in 2010, [17]. Its main idea relies on web design that responds to the user’s device screen size and orientation. It can be achieved by the use of CSS media queries and flexible grids, [18]. For example, a web page can show content in three columns on a wide screen, but the same content can be presented in two columns on a tablet, or even in only one column when viewed on a smartphone, [19]. This can be achieved by using CSS media queries. A media query allows using different styles for different screen widths and page orientations, [20]. Below are two examples of media queries. The appropriate style should be defined in the curly brackets.

```
@media (max-width: 768px) { }
@media (min-width: 600px) and (orientation: landscape) { }
```

Flexible grids are used in several CSS frameworks like Bootstrap, Foundation, Skeleton, W3CSS, etc. Roughly speaking, a grid system uses containers, rows and columns to layout and align content, [21]. Containers are used to center the content horizontally. Rows are wrappers for columns, which are the only immediate children of rows. Content is supposed to be placed within columns. There exist predefined column classes which indicate the number of columns out of possible 12, which are intended to be used for the placement of any HTML element. Column widths are set in percentages, which makes the layout responsive. Typically, there are the following grid breakpoints based on minimum width media queries: extra small, small, medium, large and extreme large. There are predefined column classes for them, too.

Also, the width of HTML elements is defined in units relative to the device screen width. Using such an approach, one avoids horizontal scrolling, which is not desired for at least two reasons. First of all, reading web content using the horizontal scroll requires constant attention of the user and physical effort. Also, since users don’t expect content to be accessible by using the horizontal scroll, such content may be

ignored, [22]. Nowadays, web designers worldwide can use many responsive web design testing tools which are available for free (See you web site responsive, [23], Responsive test tool, [24], How responsive is your web design?, [25], etc.). Those tools give the preview of their web pages on a wide set of screen dimensions. But all these testing tools are created for square screens.

A new issue in responsive web design appeared 2014 with the development of smart watches with round screens, [26]. This time web designers responded with a proposal of new media queries which would distinct devices with square and round screens and load the appropriate CSS styles for each of these screen shapes. Below are the suggested media queries for rectangular and round screens.

```
<link media="screen and (shape: rect)" rel="stylesheet"
href="rectangle.css" />
```

```
<link media="screen and (shape: round)" rel="stylesheet"
href="round.css" />
```

But by now, this is in the CSS working draft, and is still not supported by web browsers, [27]. In the meantime, the only way to adapt content for round screen smart watches is to find a style that is suitable for smart watches with both round and rectangle screens. This was the motivation of the author of this paper to construct a responsive testing tool which enables previewing web pages on screens with square and round shapes at the same time, [28].

In the meantime, while we are awaiting the media queries for round screens to be adopted and supported by web browsers, smart devices appear with a wider class of screen shapes, as seen in the previous section. It is clear that it will take time since media queries for different shapes, or even a complete different approach for this problem appears. However, it is obviously that the future of responsive web design is to adapt content to any screen shape and all dimensions, as presented in Fig. 2, [29]. This illustration is created according to Steve Perry’s modification of Bruce Lee’s speech [30]. While Bruce Lee explains that a Karate master has to be shapeless and his body adaptive to all situations, Steve Perry claims that the same holds for web content: It must be shapeless like water! Adapting web content to smart watch

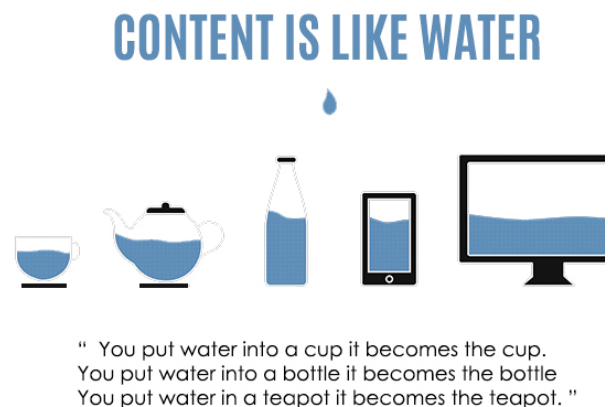


Figure 2. Responsive web design illustration, [29].

screens and other novel smart devices is listed in [31] as one of several future directions of web design which also include: adapting content to foldable screens (tablets which can be folded to smartphones), dealing with stretchable, bendable, and rollable screens, dual displays, touch screens for laptops and desktops, etc.

To make a small effort in the direction of the future of responsive web design, the author of this paper created a responsive web design testing tool for checking the layout of web pages on different screen shapes. It is briefly described in the next section.

#### IV. THE RESPONSIVE WEB DESIGN TESTING TOOL

As already mentioned in the introduction, the responsive testing tool is intended to be used for the simulation of various screen shapes. The tool is created using HTML, CSS and JavaScript. It is available online at GitHub on the following URL:

<https://htmlpreview.github.io/?https://github.com/screenShapeSimulator/responsiveTester/blob/master/simulator.html>.

For now, there are six screen shapes available: square, round, triangle, octagon, hexagon and rhombus, Fig. 3. But note that any other geometrical shape can easily be added to the list.

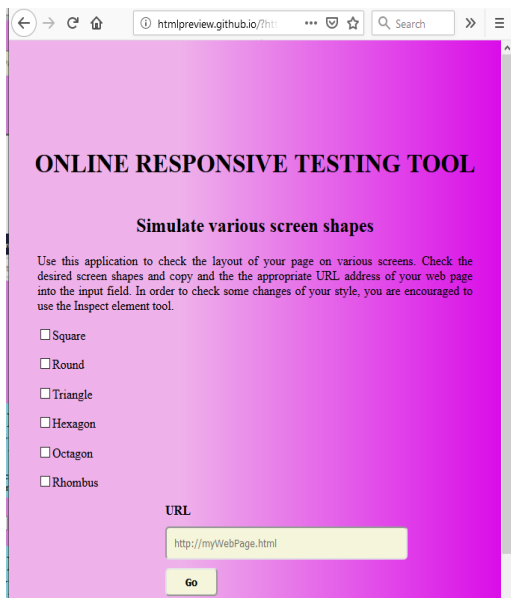


Figure 3. Online testing tool.

Let us describe the use of the responsive testing tool in the sequel. The user can select the desired screen shapes from a list of checkboxes, and they will appear on the page in the form of iframes of dimensions 300 x 300px afterwards. The checking event of every checkbox creates a new iframe using *document.createElement("iframe")* method. Different shapes are obtained using the JavaScript Style object *clipPath*.

Fig. 4 shows two iframes simulating a round shaped and an

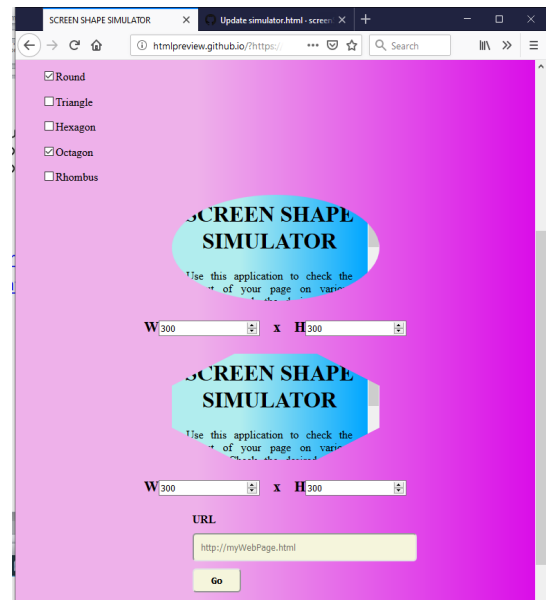


Figure 4. Round and Octagon shaped screens.

octagon shaped screen which appeared at the page after checking the appropriate checkboxes. All added iframes load a test page.

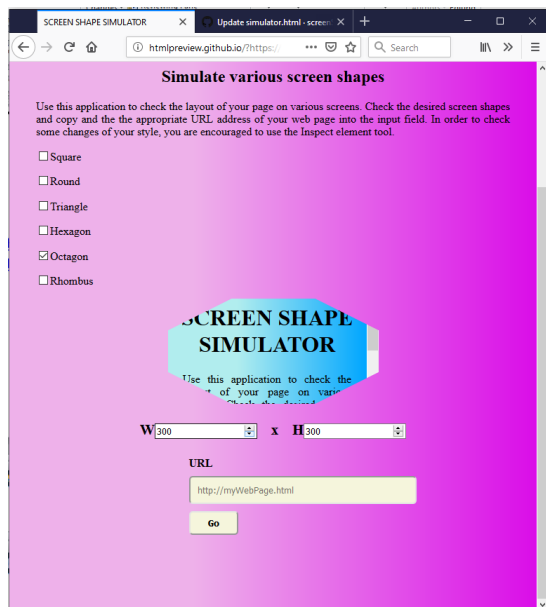


Figure 5. The round shape is unchecked now.

As one can see at Fig. 5, if we uncheck the round shaped checkbox, the appropriate iframe will disappear from the page. This is obtained using the JavaScript *remove()* function when the checkbox is unchecked.

In order to allow testing the entire web page, all iframes are scrolling enabled, Fig. 6. Thus, the user can turn on and off the visibility of each frame as needed, in order to have better overview.

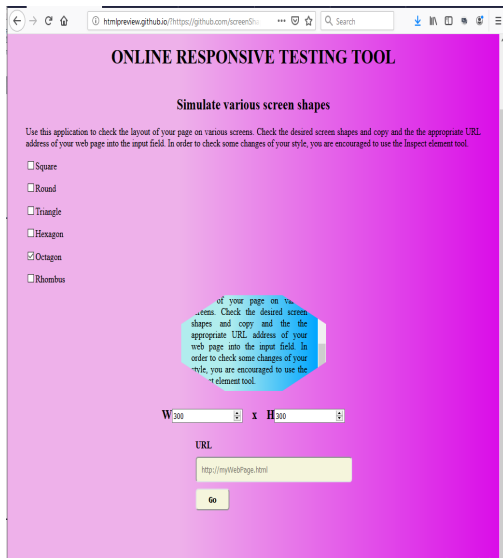


Figure 6. The iframe has scrolling enabled.

Below each iframe, there also appear two menus for selecting the width and height of the iframe. Fig. 7 shows the enlarged iframe (480 x 320px).

On the bottom of the page there is an input field where one can input the URL address of the web page to be tested. For example, let us check the Infotech conference website, Fig. 8. As one can see, the conference logo is not correctly displayed, i.e. it is cropped. So the next step is to find out which corrections in the style one should make in order to display the logo correctly. The easiest way to check this is to right click at the logo and to start the Inspect Element tool (see [32] for a detailed description of the usage of this tool).

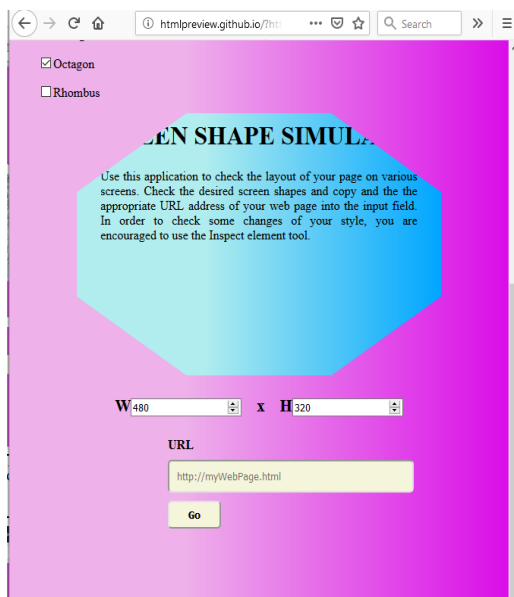


Figure 7. The dimensions of the screen are changed.

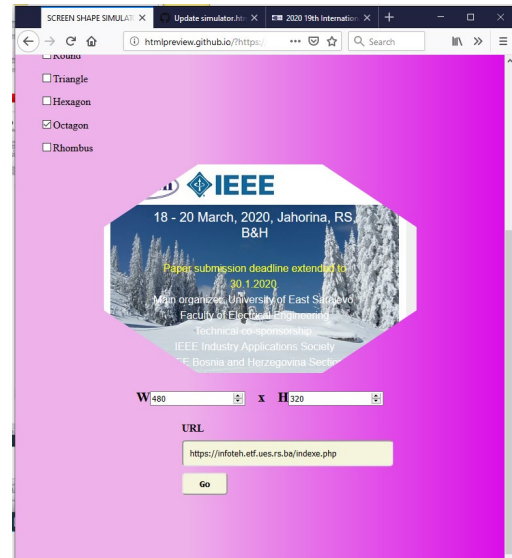


Figure 8. A web page is loaded in the iframe.

By using the Inspect Element tool one can see the source code of the web page, and the appropriate CSS style. The user can change the style in order to have a preview on the intended changes. In our case, first the IEEE logo is pushed to right specifying the float feature to be right, and adding 50px right margins, in order to make place for the Infotech conference logo, Fig. 9. Subsequently, the Infotech conference logo is pushed to right by adding 95px left margins, Fig. 10. Now it remains to copy the changes in the style that have been tried out in the Inspect element tool and to paste it in the source code of our web site. Then the layout of the conference page is suitable to be displayed on an octagon shaped display of dimensions 480 x 320px.

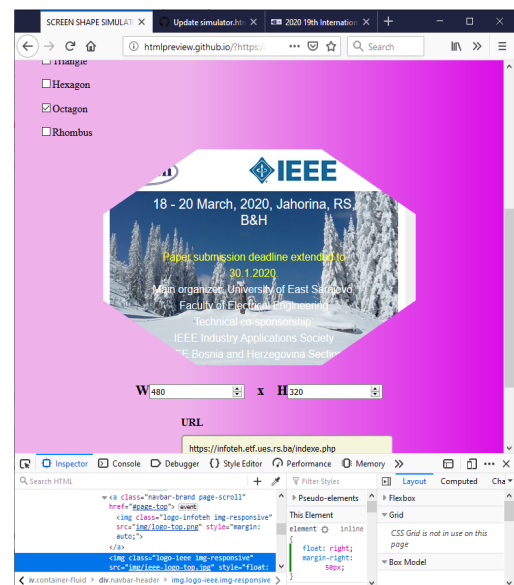


Figure 9. Changing the position of the IEEE logo.



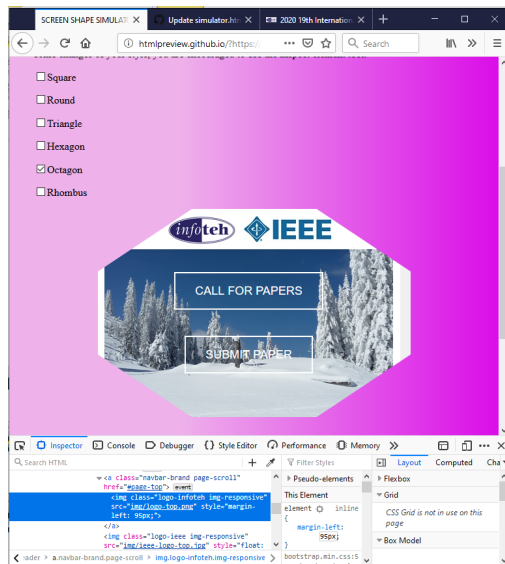


Figure 10. Changing the position of the conference logo.

## V. CONCLUSIONS

Herein a responsive web design testing tool for different screen shapes is presented. This tool presents a small step in dealing with an upcoming big issue in the field of responsive web design: Adapting web content to different screen shapes. The screen simulator is limited for now, since it offers only a few different screen shapes. But the list of shapes can be easily extended. Another limitation is that the screen shapes which are available for testing are regular geometric shapes. On the other hand, there are no limitations for LED displays to be produced in irregular geometric shapes. Creating a modification of this testing tool which allows defining irregular geometric screen shapes could be created in JavaScript as well. It could be based on transforming the regular geometric shape by dragging its nodes and obtaining the parameters of the clip-path accordingly. This will remain for the author's further investigations.

## REFERENCES

- [1] S. Kemp, Digital 2019: Global internet use accelerates, 2019, <https://wearesocial.com/blog/2019/01/digital-2019-global-internet-use-accelerates>
- [2] Smart device, Technopedia, 2020, <https://www.technopedia.com/definition/31463/smart-device>
- [3] Smart devices, Arm glossary, 2020, <https://www.arm.com/glossary/smart-devices>
- [4] T. Lacom, What is a smart display?, Smart home, 2018, <https://www.digitaltrends.com/home/what-is-a-smart-display/>
- [5] Popularity of outdoor LED displays in different countries, DAKCO, 2019, <https://www.dakcoled.com/blog/popularity-of-outdoor-led-displays.html>
- [6] M. Federed, Why LED display solution are must have for business, 2109, <https://www.digitalsignageconnection.com/why-led-display-solutions-are-a-must-have-for-your-business>
- [7] History of monitors, 2020, <https://www.absolutelegends.net/history-of-monitors/>

- [8] J. Bort, The history of the tablet, an idea Steve Jobs stole and turned into a game-changer, 2013, <https://www.businessinsider.com/history-of-the-tablet-2013-5>
- [9] K. Jackson, A brief history of the smartphone, Science node, 2018, <https://sciencenode.org/feature/How%20did%20smartphones%20evolve.php>
- [10] Web browser for wear OS (android wear), Google play, 2020, <https://play.google.com/store/apps/details?id=com.appfour.wearbrowser&hl=fr>
- [11] J. Edelblut, Hexagon wearable, 2020, <https://www.behance.net/gallery/30412423/Hexagon-Wearable>,
- [12] Visual Power, Creative LED Display, P3 Hexagon shape led display, <http://www.avledscreen.com/productn.asp?ArticleID=2004>
- [13] Creative led display, Apexls, <https://www.kszled.com/creative-led-display/triangular-led-display.html>
- [14] Heart shape flex LED panel, 2020, <http://www.ledadvertising-display.com/sale-11770649-heart-shape-flex-led-panel-ultra-thin-flexible-display-screen-1000nits.html>
- [15] Round flexible LED display for shopping center, 2020, <http://www.ledadvertising-display.com/sale-11770642-1500-nits-round-flexible-led-display-for-shopping-center-concert-room.html>
- [16] I. Fried, That Triangle-Shaped Tablet From "The Office" — One Guy Wants to Build It, 2011, <http://allthingsd.com/20111222/that-triangle-shaped-tablet-from-the-office-one-guy-wants-to-build-it/>
- [17] The evolution of responsive web design: A very brief history, 2020, <https://www.digitalagency.com/the-evolution-of-responsive-web-design-a-very-brief-history/>
- [18] Responsive web design – what it is and how to use it, 2011, Smashing magazine, <https://www.smashingmagazine.com/2011/01/guidelines-for-responsive-web-design/>
- [19] A. Pillon, What is responsive web design, Small business trends, 2018, <https://smallbiztrends.com/2013/05/what-is-responsive-web-design.html>
- [20] Using media queries, MDN web docs, 2020, [https://developer.mozilla.org/en-US/docs/Web/CSS/Media\\_Queries/Using\\_media\\_queries](https://developer.mozilla.org/en-US/docs/Web/CSS/Media_Queries/Using_media_queries)
- [21] Grid system, Bootstrap, 2020, <https://getbootstrap.com/docs/4.0/layout/grid/>
- [22] K. Sherwin, 2014, Beware horizontal scrolling and mimicking swipe on desktop, 2014, <https://www.nngroup.com/articles/horizontal-scrolling/>
- [23] See your site responsive, 2020, <http://ami.responsivedesign.is/>
- [24] Responsive test tool, 2020, <http://responsivetesttool.com/>
- [25] How responsive is your web design?, Responsive web design checker, 2020, <https://responsivedesignchecker.com/>
- [26] P. Lamkin, Smartwatch timeline, The devices that paved the way for the Apple watch, 2015, <https://www.wearable.com/smartwatches/smartwatch-timeline-history-watches>
- [27] CSS round display level 1, CSS working draft, 2016, <https://www.w3.org/TR/css-round-display-1/>
- [28] T. Krunić, D. Krstić, A simple responsive web design simulator for round screen devices built in JavaScript, XVLI International symposium on operational research, Kladovo, Serbia, 2019, ISBN: 978-86-768-363-7, pp. 209 – 214, <http://symopis2019.fon.bg.ac.rs/download/SYM-OP-IS%202019%20Proceedings.pdf>
- [29] Responsive web design, AIDAH creative enterprise, 2019, <https://www.aidah.co.za/responsive-design.html>
- [30] S. Perry, Bruce Lee may have invented responsive web design, Posts – Steve Perry Creative, <https://steveperrycreative.com/post/bruce-lee-may-have-invented-responsive-web-design>, 2019
- [31] A. McPeack, How responsive web design will change in 2019 and beyond, 2019, <https://crossbrowsertesting.com/blog/development/future-responsive-design-2019/>
- [32] A. Pope, Inspect Element: How to temporarily edit any web page, 2018, <https://zapier.com/blog/inspect-element-tutorial>