

UPGROWTH FEATURES OF MODERN WEB INTERFACES ON THE EXAMPLE OF RESPONSIVE DESIGN

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Abstract. The article gives a definition of an adaptive design and reveals its basic principles. The importance and relevance of a responsive design at this stage are supported by the data from global statistical studies as well as visits statistics of Kryvyi Rih Economic Institute’s official Internet resource.

Keywords: adaptive design, layout, content, user experience (UX)

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Introduction

An Adaptive design was firstly spoken about in the U.S. at the end of 2010. For the first time the term was coined by Ethan Marcotte in the article “ Responsive Web Design “ (“Responsive Web Design”) in May 2010 and later, in 2011, he released an eponymous book (Ethan Marcotte, 2011; Ethan Marcotte, 2012). In our country this trend was responded in the same year. However, the term "responsive web design" did not survive and we use an inaccurate translation of the original term — responsive web design. This design is tied to the functionality of the website and is completely dependent on it. It doesn’t extend the functionality of the site, but it is only adapted for the mobile device.

The Responsive Design is Today's "Must Have" in the Web

The leading foreign media and news sources have already made the transition to the adaptive layout of the website: among them there are Forbes.com, The Boston Globe, The Time, Mashable, TechCrunch, The Next Web, Gizmodo. Common sites for all types of users and developers of corporate, educational and entertainment pages are also created. Nowadays, there are adaptive websites not only of Harvard, Starbucks, Sony, but many others, including Ukrainian ones.

It seems that several years have passed and this technology is easily monetized. So, in the documentation for users on the creative mobile versions of Google sites the developers are encouraged to use the cutting-edge technologies and to implement the responsive web design.

It’s also worth taking into account the promotion, because the sites are optimized for the mobile devices and they are ranked higher in the mobile search. This means that a website with this design will be placed higher in the mobile search results, as it is specially adapted for tablets and smartphones. When you navigate to any website from the search results page,

Google makes a note that this website may not be the best choice for that search. Thus, we can conclude that if your website is not responsive, the chance to find it is reduced.

Here are some examples of statistics usage on the mobile devices. In 2012, the tablet sales exceeded the total sales of computers and laptops. The number of smartphone users worldwide exceeded 1.5 billion by the end of 2013. It is projected that at least 83 million wearable gadgets for business usage will be spent in 2021 and the amount of revenue from the supplies will exceed 14 billion. (Computer Digest, 2016).

In October 2016, an event, being expected for a long time, occurred — the amount of users, having an access to a global network from mobile devices, for the first time exceeded the number of students, attending it from a desktop. This information is led by the independent statistics of the Agency StatCounter as by the end of September 2016 51.3% of Internet users came from mobiles and tablets and only 48.7 per cent have done this with the desktop computers or laptops (StatCounter Global Stats, 2016).

Despite the rapid growth in the number of mobile devices in the markets of the developed countries, the majority of people still prefer a traditional PC or laptops. In the U.S. there are 58% of those ones and in the UK there are 55.6 per cent of them. Greater availability of mobile devices for users plays a dominant role for markets in the developing countries. For example, in India there are 75% of users coming to the Internet, do it either from their smartphones or tablets. While in Europe mobile devices are preferable not everywhere, for example, in Poland (60,4%) and in Ukraine, the share of mobile users among the regular Internet users was 44%. (Business Censor, 2016).

In tables 1 and 2 the following data on Internet users in Poland and Ukraine is presented respectively (Internet Live Stats, 2016).

Table 1

Poland Internet Users

Year	Internet Users**	Penetration (% of Pop)	Total Population	Non-Users (Internetless)	1Y User Change	1Y User Change	Population Change
2016*	27,922,152	72.4 %	38,593,161	10,671,009	2.5 %	670,522	-0.05 %
2015*	27,251,630	70.6 %	38,611,794	11,360,164	6 %	1,530,727	-0.02 %
2014	25,720,903	66.6 %	38,619,974	12,899,071	6 %	1,449,360	0 %

(Internet Live Stats, 2016)

Total Internet Users in Poland (2016*) - 27,922,152

– Share of Poland Population: 72.4 % (penetration)

– Total Population: 38,593,161

– Share of the World Internet Users: 0.8 %

– Internet Users in the World: 3,424,971,237

Table 2

Ukraine Internet Users

Year	Internet Users**	Penetration (% of Pop)	Total Population	Non-Users (Internetless)	1Y User Change	1Y User Change	Population Change
2016*	19,678,089	44.1 %	44,624,373	24,946,284	0.4 %	68,947	-0.44 %
2015*	19,609,142	43.7 %	44,823,765	25,214,623	0.4 %	78,058	-0.4 %
2014	19,531,084	43.4 %	45,002,497	25,471,413	5.5 %	1,013,347	-0.36 %

(Internet Live Stats, 2016)

- Total Internet Users in Ukraine (2016*) - 19,678,089
- Share of Ukraine Population: 44.1 % (penetration)
 - Total Population: 44,624,373
 - Share of the World Internet Users: 0.6 %
 - Internet Users in the World: 3,424,971,237

*estimate for July 1, 2016

** Internet User -an individual who can have an access to the Internet at home, via any device type and connection.



Fig. 1. Global Mobile Data Traffic Drivers (Content-Review.com, 2015)

According to forecasts of Cisco, in the period from 2014 to 2019 the growth in the global mobile data traffic will be three times ahead of the growth rate of the fixed traffic. Among the trends, determining the growth of mobile data, the following ones are included:

- The growing number of mobile users. By 2019 their number will reach 5.2 billion (2014 — 4.3 billion). In 2014, nearly 59% of the world population, amounting to 7.2 billion people, used mobile phones. By 2019 there will be more than 69% of them (despite the fact that the global population will reach 7.6 billion people).
- Increase of the number of mobile connections. By 2019 the number of devices and connections, ready to establish mobile connections will reach 11.5 billion (8.3 billion of personal mobile devices and 3.2 billion of machine-to-machine connections), while in 2014 this figure was 7.4 billion.
- Increase of mobile speed. By 2019, the average transmission speed in mobile networks worldwide will grow by 2.4 times and reach to 4.0 Mbit/s (indicator 2014 — 1.7 Mbps).
- The growth of mobile video transmission. By 2019, mobile video will constitute 72% of the global mobile traffic (indicator 2014 — 55%).

However, in connection with the development of new, modern methods of data transmission for mobile networks, these indicators can be increased several times due to the commissioning of 4G LTE.

"Long-term evolution" redirects here. For the biological concept, see Evolution and E. coli long-term evolution. In telecommunication, Long-Term Evolution (LTE) is a standard for the high-speed wireless communication for mobile phones and data terminals, based on the GSM/EDGE and UMTS/HSPA technologies.

The LTE specification provides downlink peak rates of 300 Mbit/s, uplink peak rates of 75 Mbit/s and QoS provisions permitting a transfer latency of less than 5 ms in the radio access network. LTE has the ability to manage fast-moving mobiles and supports multi-cast and broadcast streams. LTE supports scalable carrier bandwidths, from 1.4 MHz to 20 MHz and supports both frequency division duplexing and time-division duplexing (Wikipedia, the Free Encyclopaedia, 2017).

In practice, web masters face a dilemma: what is more justified — mobile website or responsive design in time, as users do not distinguish between the mobile version and the responsive design, they are only interested in the consistency and simplicity of the site usage.

It is not safe to say what is better and more efficient: mobile version or adaptive design. The whole point is in the accessibility features and site content for mobile users.

When optimizing a website for the mobile devices, the experts recommend to treat mobile users as the brand to other potential customers. Mobile users behave differently and require a totally different approach (Shanelle Mullin, 2014). "Analyse the behaviour of mobile users in Google Analytics, what pages they visit, what devices come to the site and where from, the bounce rate, conversion, searches and other available metrics. Every detail matters, a meticulous analysis will show how and where to improve the user experience: to change the format of the text, add the call button, any other improvement can blow up the conversion". Although differences of mobile and desktop traffic are obvious, it can be distinguished by the following General trends:

1. Purposes. Mobile users have specific purposes. Desktop users mostly browse the web, sitting at home or in the office, having enough amount of time. They simultaneously listen to music, check social media feeds, and move from site to site, while a mobile user does not have any time. The user's decision depends largely on the format of information presentation, logic of the registration process, navigation, and simplicity of the goal achievement.

2. Distractions. When users browse the desktop sites, they sit at a working desk, they are in the office or at home, it is more comfortable and stable setting, without many factors of distraction inherent in mobile user experience.

When the user browses the website from mobile, the situation changes in seconds — street, shop, car, office, phone call, meeting a friend. These distractions entice a user to find the required information faster. The attention span of mobile user reduces. Therefore:

- it is important to reduce the number of distractions on the site;
- it is important to lead the user to the destination as quickly as possible, reducing the number of steps.

3. Behaviour. Desktop and mobile users behave on the site in different ways. As practice shows, the mobile versions have higher bounce rate, less time on the site, a smaller depth of view.

The question arises: if the mobile users behave differently, why do we try to attract them in the same ways that are working on the desktop version of the website?

Adaptive design is a compromise solution. It's still better than the standard version of the site you need to zoom and scroll. But it's irrelevant to optimize the user experience on mobile devices. In fact, the responsive design creates a beautiful picture of the site on mobile devices, but it does not solve specific problems of the user. By itself, the responsive design does not mean any high-quality user experience. It is not worth thinking that the site is optimized for mobile experience after making an adaptive layout.

Mobile versions of sites and mobile apps, specially designed for different mobile devices also solve the problem with the viewing of the website, but have the following drawbacks:

1. For each type of operating system, it is necessary to have its application (version) of the site. It requires the additional resources, both time and money.
2. Need to download the application. In order to use the application, users need to download it. It requires some additional effort from the users, and many of them won't do it unless they are not sure exactly what application they need and they plan to use it regularly.
3. The traffic division. From the point of view of the website promotion mobile application is not convenient because it separates the traffic into the website traffic and the application traffic that will look like less traffic to the site.
4. The need to integrate the website materials. In case of mobile application, you need to synchronize the website with the app (additional resources), or to do the double work to fill the website and application materials.

Unlike the mobile applications, the responsive design is one site address, one design, one management system and the content of the site.

Of course, the responsive design also has its disadvantages, the main of which is the relative novelty of the technology and, as a consequence, the lack of good professionals and knowledge on designing adaptive websites.

So, let's formulate the main principles of the adaptive design:

– Design for mobile devices from the earliest stages (mobile first). This is an approach, in which the design service begins with a mobile version and not the version for the large screens, as it was done everywhere previously. At this stage, designers strive to properly convey the meaning and the basic ideas of using a small screen and only one column. The contents if necessary are made short by removing the secondary information blocks and leaving the most important ones.

– Flexible layout based on a grid (flexible grid-based layout), in which the value of the width size of the parent element (elements) is set in percentage in relation to the resolution of the monitor. Modular grid page is an invisible "skeleton" of design, horizontal and vertical guides that help to direct and coordinate individual elements of the composition. To generate a modular grid they typically use so-called css-frameworks that are created to simplify the coder, page, speed of development and eliminating the highest possible number of errors for the layout.

– The use of flexible (rubber) images (flexible images). All images should be scaled, basing on the maximum allowable width. Optimum is displaying them in a full size. When the user changes the browser window size less than the image, it is automatically resized to fit the width of the browser window better.

– Work with media queries (media queries), CSS3 rules that are assigned as attributes when you call other rules from the style sheet, basing on the output device options, such as type, width and height of the browser window, resolution, orientation in space.

– To apply a gradual improvement (eng. progressive enhancement). The idea is that you firstly create a simple layout of a document, which is correctly displayed even in the simplest browsers. Then styles are added, interactivity, etc., using cascading style sheets, JavaScript, SVG, Flash, and everything else that you can insert into the page.

Most multi-device layout patterns for the Web are designed to rearrange page elements within a visible browser window. Off canvas multi-device layouts, on the other hand, use the space outside a browser's viewport to hide the secondary elements until people need them.

Next, we'll examine the basic types of adaptive page layouts, which have spread on the Internet over the past five years (Luke Wroblewski, 2012).

A tall scrolling list ("Rubber"). Easy to implement and obvious for the user type of content presentation. The main blocks are compressed to the width of the screen of the mobile device, if it is impossible, they are rearranged to form one long strip. This layout is very simple to implement with the adaptive CSS frameworks such as Twitter Bootstrap. (see Fig.2).

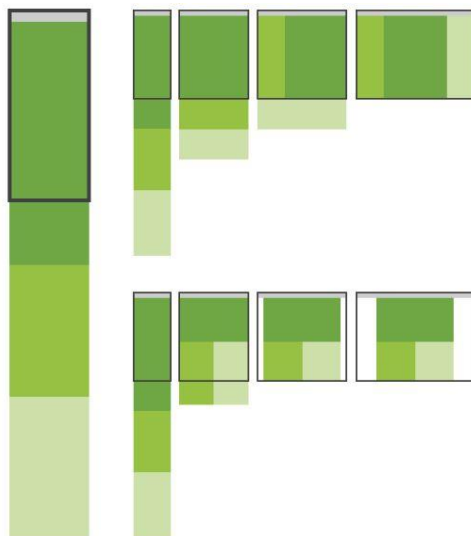


Fig. 2 "Rubber" Off Canvas (Wroblewski, 2012)

Footer Nav & Off Canvas Column ("Transfer of Units"). The obvious way for the multi-column website: when you reduce the width of the screen, additional units (sidebars) are transferred to the lower part of the layout. On the large screens, this pattern looks like a pretty typical Web page layout: primary navigation on the top, a left-hand column with some supporting information and a main content area in the middle. As you can see in the figure below, however, the layout is adapted to varying screen sizes in two important ways.



Fig. 3 Footer Nav & Off Canvas Column (Wroblewski, 2012)

Off Canvas Column & Nav ("Switching layouts"). This pattern also uses a top navigation and two-column layout on the large screens but, as the Fig.4 illustrates, it's adapted to the smaller device widths a little bit differently. This method is the most convenient while reading a website from different devices: for each screen resolution a separate layout is developed. The method is time-consuming, and therefore less popular than the previous two ones. As screen size decreases in this pattern, the navigation menu moves off canvas above the content of the page. Once again, a link appears that allows you to smoothly slide the navigation on the screen when needed. Though this time the menu appears from the top. While it still provides a quick access to navigation, the lack of options at the end of a content page can leave people hanging on mobile devices.

The supporting column of the content in this layout also moves off canvas but to the left instead of the top. So we have two off canvas elements when dealing with the smaller devices widths - both accessible through links.

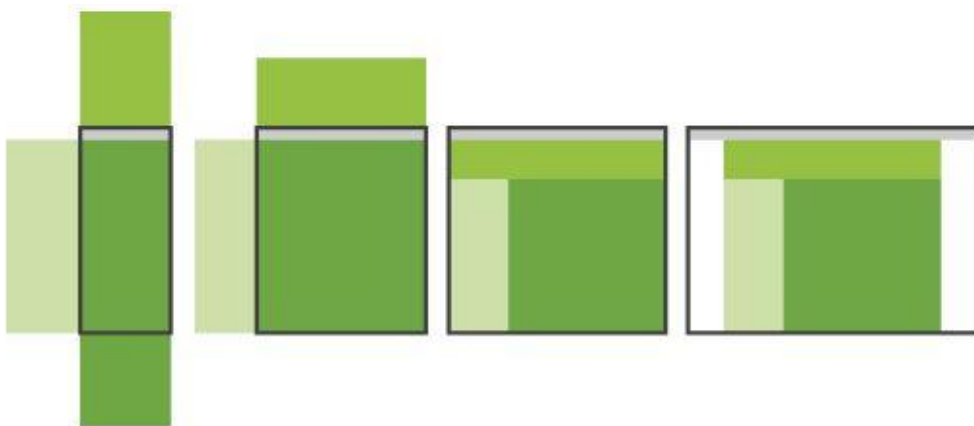


Fig. 4. Off Canvas Column & Nav (Wroblewski, 2012)

Two Columns Off Canvas. On wide screens this pattern is a standard three-column layout. As the screen size decreases, one by one the columns are moved off canvas as the illustration below shows. It's a very simple way which is suitable for simple sites. It is achieved by basic scaling of images and typography. It is not very flexible.

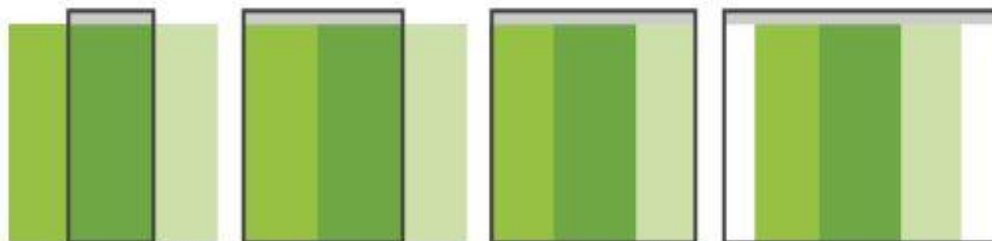


Fig. 5. Two Columns Off Canvas (Wroblewski, 2012)

Vertical/Horizontal Off Canvas. Clearly, this approach works best of all on the wide screens. But can we make it adapt elegantly to the narrowing screen sizes as well? Enter the vertical/horizontal off canvas pattern. On the wide screens, the content sections are stacked vertically and you can scroll down to make your way through them. On the narrow screens, the vertical layout is flipped by 90 degrees. All the content sections after the first one are moved off canvas to the right as the Fig.6 shows.

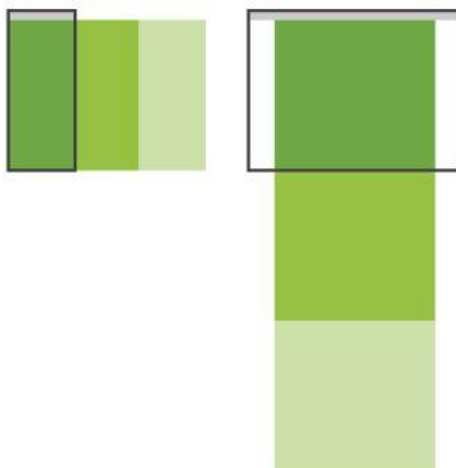


Fig. 6. “Panel” Off Canvas Layouts (Wroblewski, 2012)

It should be noted that the above models are not universal solutions for every project of the website development. It is necessary to choose the most suitable one, taking into account the needs and possibilities of the method. Even if the rearranging page elements are successful from the point of view of design, this may not be enough. The responsive design will be

useful for a project only if its pages retain the maximum function and the logical completeness in all screen resolutions.

When the page elements fall into new locations, the user's reaction may be very different from that for which this page was thought. That is why the joint work of the designer and developer is so important to make sure that, at all screen resolutions, after the transformation of the page it is preserved as the page functionality and ease of use.

Many developers, while creating websites, appeal to popular frameworks (e.g. Bootstrap). Of course, such tools can be very useful and significantly reduce the development of time. But at the same time, it's necessary to consider how the popular structure will work with the content and functionality of specific site, not how it works in general.

In such cases it is useful to conduct the usability testing for the website design. For the responsive design it is advisable to test it on different platforms. It is quite difficult to create a website that will be the most comfortable for the normal screens, but it's more difficult to develop a website that will be equally comfortable in the transformation of its elements in different sizes and screen orientations. The same design element that works like the clockwork in the ordinary resolution, may work horribly on a smartphone, and Vice versa.

The content is also one of the key aspects of the responsive design's successful use. On the same screen the text content of the page is usually entirely visible without using the scroll, in comparison with the small screen of a smartphone. And working on the big screen, users do not immediately see what they need, they can easily examine the whole page to find what they want. Smartphone users have to endlessly scroll the screen until they find what they are interested in. Well-structured, the information content of the page helps users to search more efficiently.

The performance issue can be a negative factor for a site with the responsive design. The fact is that the server gives out the same amount of code for all host devices, regardless of whether all the amount of code is used in the design of the layout or not. The selection of the desired layout is already on the client side. In other words, each device (phone, tablet or computer) gets the full page code intended for all devices at once and takes from it what it needs.

The 4-inch smartphone receives the same code and the 24-inch desktop monitor. It may reduce the performance of the smartphone if you use a slow Internet connection. That's why some sites with the responsive design use special requests of the hosting server to determine the device that made the request and send only the part of HTML code, which is designed exactly for this type of the device.

To truly test the usability of a responsive design of the website, it is not enough to test its design solution in a comfortable environment office only when it is having a high-speed connection. You need to go with a smartphone out in the street, test it between tall buildings, go on nature, and carry out tests in the interior conference rooms or basements, in the areas with the unstable connection to see how the website will be loaded in such circumstances. The purpose of a good responsive design is to give the equivalent access to information, regardless of any device. We should remember that the smartphone user won't have the same functionality as the desktop user, if the load time is unbearably long.

Conclusions and Suggestions

The conclusions are very simple. The number of people using mobile devices is more than ever, and it will only grow. More than half of the population subscribed to mobile

Internet services, and by the end of 2020 this figure will be increased by another billion people.

But, as it has been already mentioned, simple media queries, flexible grids and images are not enough to ensure the best user experience. An open mind and a flexible approach in tandem with the Internet development will be required from designers currently and later.

The responsive design is more than just a fine tuning of the layout. It is a complete rethinking of how to present the content. It is much more difficult to determine the correct feed of the desired content to the right user, right device and at the right time.

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