

# Factoring in Users Oriented Aspects in Responsive Web Design Paradigm

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## ABSTRACT

The mushrooming of mobile devices, the expansion and profit needs of businesses and the desire to optimize time, cost and effort by developers or designers have been the main requirements driving the responsive web concept. The requirements of the end users is assumed in the course of the responsive web systems design. This study observed that this implicit end user needs assumptions is not sufficient and will not suffice to introduce the end user aspects into the evolving and maturing responsive web design concept. In response, the study then set out to investigate some basic user's preferences using the survey research design methodology. The study attempted to ascertain users preferred devices for accessing web contents and the reasons behind their choices, and also to ascertain the appropriateness of the display of some content types on all devices. The outcome showed that smartphones were the preferred devices of choice, but no credible reasons except ease of use could be adduces, and also, the study showed that some contents types were not appropriate for some designated screen sizes. Consequently, this ease of use reason which this study considers as convenience, and the clarity or vividness of content reflected by the user choice, were then suggested as possible user's explicit aspects to be taken into consideration in responsive web design.

**Keywords:** responsive Web design; mobile devices; clarity and vividness of display content; users preferred devices; Web content types; convenience or ease of use.

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## Aims Research Journal Reference Format:

Aweh, O. & Ohiagu, K. (2016): Factoring in Users Oriented Aspects in Responsive Web Design Paradigm. *Advances in Multidisciplinary Research Journal*. Vol 2, No. 2 Pp 25-32.

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## 1. INTRODUCTION

The World Wide Web (WWW) remains the leading information service on the Internet as individuals and organizations are increasingly leveraging this medium to reach out to their clients, customers, subscribers

and others. The motivation behind using the WWW information infrastructure to source and disseminate information is the capability to reach a wide range of audience at a negligible cost.

With the increasing proliferation of mobile devices and astronomically rising number of mobile devices users, the need to design and develop web contents that meets the peculiar requirements of the various device types, remains an active area of research. At the same time, the need to provide contents that meets the unique requirements of the different user types and categories, remains an ongoing research domain.

The idea to create applications that presents the same look and feel to users across sundry hardware and software platforms has been on for ages. This idea was the motivation behind the development of Java Swing components which gained high popularity at a time and has sustained that popularity till date. While Java swing applications still remains as relevant as ever, the need to retrieve and post Web contents across vast domains using mobile devices with multiplicity of software, hardware and network platforms gave birth to new requirements in Web design and content management. At the early stages, these requirements were met by the provision of different content types for different devices running on different platforms. With the continuing proliferation of platforms, and expanding Web contents needs of users and businesses, the need to design and develop contents that were amenable to these sundry platforms was conceptualized. And it was this conceptualization that gave birth to what is today referred to as responsive Web design.

### **1.1 Responsive Web Design**

Responsive Web Design is essentially a Web design paradigm that attempts to fits the retrieved content into the retrieving device for optimal viewing experience by the user. Responsive design enables the user to read and navigate a Web site with minimal resizing, panning, and scrolling irrespective of the device type and size. The growing popularity of responsive Web design is intricately linked with the proliferation of devices used to access Web contents, the growing information requirements of users and the need to save Web designers and Web content managers a lot of time and efforts in providing contents for various devices and users.

### **1.2 Benefits of Responsive Web Design**

Responsive Web design presents a couple of benefits to businesses and organizations that have invested in it. Some of these benefits are:

- (i) **Optimizing Online Contents:** Mobile devices constitutes the bulk of the devices currently being used to access online contents. It is therefore imperative for businesses and organizations to provide contents that meets this mobile devices need. A responsive Web paradigm meets this need of optimal content.
- (ii) **Increased Patronage:** Businesses and organizations whose sites allows for a reach set of customer experience across different devices will invariably enjoy greater patronage, and consequently make higher profits.
- (iii) **Optimizing Time and Cost:** Developing a responsive application or content that fits into any device type will surely save a great deal of time and cost, as oppose to developing separate contents for different device types. It also minimizes the costs incidental to developing and maintaining these various contents.
- (iv) **Search Engines Visibility:** By default, a responsive Web site will invariably enjoy higher presence in search engines as sundry devices will pick and render its contents at a time as opposed to a non-responsive site, that the accessing device will pick only one at a time.

From the foregoing, it is apparent that responsive Web design holds enough benefits and it is the choice for developers and content managers or providers now and in the future. Also, mobile devices holds enormous benefits and are the devices for now and the future. However, while developers and content managers or providers focuses on their designs and contents respectively, the aspects (desires or requirements) of the consumers (that is, the users) is seldom given due consideration. And it is apparent that the belief is: “we have devices of various sizes, so let the contents just fit properly into them”.

It is an established fact that some features in web contents do not show at all, or is not vivid on some devices screen size, even though the level of details depends on individual's sight strengths. Also, users have preferences for mobile device types, and the term mobile devices covers a very broad range, spanning laptop computers, palmtops, tablet pc (or just tablets), phablets (partly a phone and partly a tablet) and smartphones. And they all come in varying screen sizes. The concept of responsive Web design, this study believes, revolves around the efforts of designers/developers and content providers (businesses or organizations) and it is geared towards minimizing costs, time and other resources, while attempting to maximize returns or profits/benefits at the same time.

The end users (consumers) aspects of the responsive web equation does not enjoy any prominence in this contemporary dispensation. The common consumer aspects of this equation is statistics on the rising use of mobile devices in web access. Some important questions, such as: (1) what are the motivations for the rising use of mobile devices in web access? (2) What types of mobile device are mostly used by consumers for this web access? And (3) which devices are most appropriate under designated conditions?

To answer these questions, this study conducted an investigation, and the details of the procedures and methodologies adopted for the investigation is contained in the materials and methods section of this document. The outcome of the investigation is intended to show user's device preferences for accessing web contents, and the likely reasons for this preferences. The outcome is also expected to show if the devices of choice by these users is suitable or appropriate for every content type.

## **2. RELATED LITERATURE**

The need for detailed studies in the area of responsive Web design is underscored by the findings of [9], [16] and [13] who showed that a larger percentage of Web users access information with portable mobile devices, especially smart phones. This view strongly confirms every day observations of the use of a wide array of devices to access the internet. All these devices have different screen sizes and resolutions that must be supported.

### **2.1 The Concept Responsive Web Design**

The philosophy behind responsive Web design conforms to the classical engineering principles that underlie systems design in computer science. [14] highlighted this classical engineering principles imported into computer systems design when he asserted that responsive Web design stems from the notion of responsive architectural design. In responsive architectural design, rooms or spaces are conceptualized to automatically adjust to the number and flow of people within it. Importing this concept into Web design presented a novel idea. And this was the logic behind [14] argument that there was no need to create custom Web designs for each group of users since architects do not normally design buildings based on individual size and types. He believes that like responsive architectural designs, Web design should automatically adjust to fit into sundry types of devices rather than designing and developing countless custom-made solutions for each new category of devices or users.

In the words of [20], responsive Web design is the term given to the concept of designing and building websites so that the layout changes depending on the device/viewport on which the website is being viewed, by device that could be a mobile phone, tablet pc or laptop. [20] perspective accords with that of [11] who asserted that Responsive design is not a single technology, but a set of techniques that allow web pages to serve the needs of both mobile and desktop users [8] had a slightly different perspective. To them, responsive Web design is an approach that suggests design and development that responds to the user's behavior and environment based on screen size, platform and orientation. Their perspective was informed more from a practical and technical aspects of programming. To them, responsive Web design centers on a mix of flexible grids, layout, images and an intelligent use of css media queries, such that as the user switches from, say, a laptop to an ipad the website would automatically adjust itself to accommodate resolution, image size and scripting abilities. In other words, the website should have the technology to automatically respond to the users preferences.

## 2.2 Designing a Responsive Website

[6] still strongly believes in sticking to the traditional approach for designing for varying screen sizes such as small for mobile, medium for tablet portrait view and then large for tablet and desktop. The belief is premised on the notion that developing a website for any platform is an intractable challenge. Howard canvasses for the translation of these predefined widths into breakpoints that will act as dimensions for determining the points of changes for the various user interface for displaying contents.

[2] and [7] are of the view that a responsive Website can be designed using appropriate development tools and by first drawing out a suitable layout for that site. They illustrated this concept by using some of these development tools such as Hypertext Markup Language 5 (HTML5), Java Query (jquery) and Cascaded Style Sheet 3 (CSS3) media queries design a responsive website. Presenting a technical perspective, [5] mentioned the core concepts of a responsive Web design to compass media queries, media queries listeners and a flexible grid based layout that uses relative sizing or resizing. [3] concepts of a responsive Website design is consistent with those of [2] and [5] on the use of appropriate tools and resizable techniques. [3] however, emphasized the need for elaborate planning prior to embarking on a responsive Web design project.

## 2.3 Responsive Web Design Issues

Responsive Web design issues are intended to guide Web developers to accomplish good results in their Web projects or tasks. These issues are however not clear cut and sundry authors have attempted to articulate them. [18] is of the view that responsive Web design is accomplished if a process he described as device agnostic is adopted. Here, the developer aims at designs that have particular resolutions or sizes such as for iphone or ipad sizes only, instead of aiming at designs with contents that are expected to adapt to various environments where it will be seen or used. This [18] perception appears to have been drawn from the observations of sundry authors. In the "Desktop First and Graceful Degradation" concept popularized by [19], the traditional issues that informed the birth of responsive Web design were highlighted. [19] was of the view that designing for the desktop width of 870px by 980px first, before considering the mobile device versions of a website will help avoid the need to adjust the overall design of the "desktop" version of the website.

In another concept dubbed "Graceful Degradation Versus Progressive Enhancement", attention is placed on a Web design that is most suited for the device that was focused on first. With the progressive enhancement approach the limited size of the viewport means that only the most important contents can be displaced. All others that are deemed unnecessary are removed. This creates a very clean design and allows for only the key content to be displayed. If a larger viewport is selected, all that is needed is to selectively add extra content to fill the viewport or leave it as it is. Some authors seems to favor the establishment of standards to guide developers or designers target unique devices.

For example [4] believes that devices capabilities can be prefixed by “min” or “max” to create ranges for different type of devices. The logic behind this believe is to allow developers target particular devices or device types more specifically in their content layout design. [21] however counters this believe. He argues that when we code for specific devices, we are apparently ignoring the fact that infinite other shapes and sizes of devices exist now or will emerge in the future.

The progressive enhancement strategy used in conjunction with the mobile first approach, is seen by many Web designers and major and many technology companies that provide Web based services, such as Google as the best method for responsive Web design. And are therefore seen as the future of the Web [1]. Responsive Websites testing was the focus of [12] and [15]. While [12] focused on the factors to be used in testing such sites on mobile, [15] focused on testing with different browsers. They proposed an efficient way round the problems of testing responsive sites across a range of mobile devices and different browsers using a methodology described as synchronized testing. They also showed that tools for conducting these tests were available. [17] corroborates the existence of these testing tools, but argues that the needed platforms such as various devices hardware and operating systems required for full testing are never complete. [17] is also of the view that it is best to design a single responsive website instead of serving up multiple versions of “mobile optimized webpages. [10] is convinced that responsive Websites have made it to the mainstream, and that all modern websites will likely follow the responsive design paradigm. He acknowledges that while this idea will present users with a wonderful experience, it will present some challenges for the developer. On the question of responsive website testing, [10] is of the opinion that the real issue is on the cost of bugs and the investments the stakeholders are ready to make.

### **3. MATERIALS AND METHOD**

#### **3.1 Research Approach**

This study adopted a qualitative and quantitative survey approach. The choice of this approach was premised on its suitability in empirically eliciting and evaluating user's perception of web contents on different devices of varying sizes.

#### **3.2 Sample and Sampling Method**

The qualitative aspect of the study was conducted by asking some users (150 students) who had the three devices of interest (laptops, Pads and smartphones) the question of their favorable choice of devices for accessing the Internet, and their reasons for the preferred choice. The quantitative aspect of the study was conducted by presenting the same set of users with sample website outlay that was very rich in graphics using several devices spanning laptops with 17 inch screen size and 15 inch screen size. Tablets with 9 inch screen size and 7 inch screen size and then on smartphones with 4.5 inch screen size 5.5 inch screen size, successively. The selected devices all had high resolution display of the sample high graphic content website outlay. Each of the respondents, without paying attention to gender, were then asked to select their preferences for the display.

#### **3.3 Data Collection Method**

The study collected two sets of data, the first from the qualitative phase of the survey, and the second from the quantitative phase of the survey. Table 1 shows the distribution of the responses elicited from the qualitative phase, while Table 2 shows the respondents choices from the quantitative phase of the survey.

#### 4. DATA ANALYSIS

The collated data from the two surveys which were subjected to simple percentages computations are presented in the same Tables 1 and 2.

**Table 1: Users Preferred Devices for Accessing the Web**

S/N	DEVICE TYPES	USERS PREFERENCES	PERCENTAGE (%)
1	Laptops	22	14.7
2	Tablets	35	23.3
3	Smartphones	93	62.0
	<b>TOTAL</b>	<b>150</b>	<b>100</b>

Source: Field Survey from Respondents

Smartphones were the device of choice with a percentage score of 62. The respondent's reasons for their preferences were not consistent. For example, some who settled for the smartphones option gave different reasons such as availability of free data plans, ease of use, ability to perform other functions like play games, music or video (which the other devices do, if not better), portability (even though some of them carry their laptops and tablet along at the same time) and the argument that they have better network access capabilities for their inclinations. The reasons advanced by those who preferred tablets and laptops were incoherent or inconsistent as well. The only area that some respondents advanced the same reason for opting for laptop was attending to assignments.

**Table 2: Preferred Screen Size for Sample Web Content Display**

S/N	DEVICE TYPES	USERS PREFERENCES	PERCENTAGE (%)
1	17 Inch Screen Laptop Displayed Content	105	70.0
2	15 Inch Screen Laptop Displayed Content	31	20.7
3	9 Inch Screen Tablet Displayed Content	11	7.3
4	7 Inch Screen Tablet Displayed Content	3	2.0
5	5.5 Inch Screen Smartphone Displayed Content	-	0.0
6	4.5 Inch Screen Smartphone Displayed Contents	-	0.0
	<b>TOTAL</b>	<b>150</b>	<b>100</b>

Source: Field Survey from Respondents

The reversion to the 17 inch laptop option is overwhelming at 72 percent, and the respondent's reasons for this preference was definitive except for a few whose arguments or reasons were rather vague. While the majority who opted for the laptop display cited clarity and the ability to view minute details with ease, the few who opted for tablets could not advance any cogent reasons, other than excuses such as: I just like it, it is sharper, I can bring it closer to my eyes and I just prefer tablet. And from the table, no respondents picked any of the smartphones displayed contents.

#### 5. RESULTS INTERPRETATION AND DISCUSSION

It is imperative to note, before any interpretations or discussions of findings are done, that the population selected for this study, under every stretch of imagination fall into the same category (they are all students, fall within almost same age bracket, share common habits and fads and have similar idiosyncrasies, etc.) and this automatically constitutes a drawback to achieving a balanced spread. Also, the selected population all had the three set of devices, which they are free to use at will. This implies that some may have opted for their smartphones as their preferred option, when in reality, they may be making more use of the other devices, even though they indicated their preference for smartphones.

From Table 1, it is apparent that smartphones are the preferred device of choice for accessing web content. This finding is consistent with what obtains in the literatures [9; 16; 13]. However, the reasons advanced for this option by the various respondents was inconsistent, and if all is put together, they do not suggest any motivations as a factor, except for some responds who mentioned ease of use, which may be interpreted to mean convenience. The results of the second survey as contained in Table 2 was rather confounding even though it was expected that the larger the image the more likely it will be the preferred option. It was expected that a reasonable number of users who have settled for smartphones would stick with that option. But the overwhelming 72 percent switch to the larger screen laptop has introduced a different dimension of user's requirement, (vividness or clarity) to responsive web design concepts. And this is in addition to the concept of convenience which the ease of use suggests. One other important note in this study outcome is the second phase of the survey which was intended to be quantitative to validate or invalidate the first phase was also qualitative.

## 6. CONCLUSION

This study has highlighted two important user requirements of convenience and vividness or clarity as desirable attributes to be reckoned with in web access using mobile devices. And why it is clear that certain content types will not display appropriately in certain devices screen size, and hence the need to acknowledge this in responsive web design, the notion of ease factor (convenience) will require further investigation.

The subsisting factors driving businesses and organizations to invest in responsive web design technology have been articulated as increased patronage, optimization of online contents, optimization of development time and cost, search engine visibility and high web presence. All this factors are oriented towards owners and developers. It is imperative to consider some user's oriented factors as well. And to this end, this study canvasses for the inclusion of vividness or clarity and the taking into cognizance of convenience as germane attributes in the evolving and maturing responsive web design paradigm.

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