

The Visualized Design Dimensions on Commercial Website Usability: A Satisfaction Survey

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Abstract

A commercial website has grown tremendously every second. Millions of companies have established their web presence and started conducting business online. There are many books and research studies offer guidelines for designing usable websites. However, most researchers do not suggest how to design specifically in each category of website. Most such guidelines are based on informal observation rather than experimental data and most experiments investigated on artificially constructed websites rather than real world commercial website.

This paper empirically suggests how dimensions in real world commercial websites should be designed. We used 120 subjects, and surveyed user satisfaction for 30 different commercial websites.

1. Introduction

A commercial website has grown tremendously with a vast amount of information every second. A commercial website can become a storefront and needs to function efficiently, having the good design appeal to attract and retain customers. Millions of companies have established their web presence and started conducting business online. Estimated 85,000 websites created per month [1] especially the commercial website.

E-commerce or electronic commerce refers to the commercial transaction between and among organizations and individuals that is enabled by digital technologies [2,3,4]. Recently with the increasing use of the Internet, e-commerce mainly refers to the business transactions enabled via the Internet. The Internet based e-commerce first emerged in 1994. The Internet has become a major resource in modern business and many businesses are creating a web presence.

As the website drives the global economy, e-commerce has become one of the most important aspects of businesses [5]. Department for Trade and Industry [6] stated that "*E-commerce is likely to make a huge impact on the way we do business. It has the potential to lead to dramatic growth in trade, increase markets, improve efficiency and effectiveness and transform business processes*".

Users have been turned into consumers of services and products from various types of e-sites. However the designers of the e-sites do not make the users easy use due to bad design. Usability though necessary is often considered characteristically in the area of e-commerce sites [7].

E-commerce system consists of main three logical layers: presentation (user interface), processing (business logic), and data (database). The user-interface level contains all that is necessary to directly interface the user. Processing level contains the core functionality for establishing client-server communication, executing business procedure, and interacting with database for data management. Data level contains the actual data and programs that maintain the data [8].

In this paper, we emphasize to study the presentation (user interface) only. We specify the characteristics of websites in terms of dimensions. We would like to investigate how each dimension of commercial website should be designed. We empirically investigate the website characteristics on actual commercial website. We survey and measured our subjects' attitude from the satisfaction questionnaire.

2. Literature Review

This section consists of two parts. The first part considers definitions of usability. The second part surveys published guidelines for usable website design.

2.1 Definition of Usability

ISO 9241-11 [9] defines the term usability as "the extent to which a product can be used with effectiveness, efficiency and satisfaction in a specified context of use". Following the ISO definition the components of usability are both subjective and objective.

Effectiveness is the accuracy and completeness with which specified users can achieve specified goals in a particular environment. *Efficiency* is the amount of resources expended in relation to the accuracy and completeness of the goal achieved. *Satisfaction* is the comfort and acceptability of the work system for its users and other people affected by its use [10].

2.2 Guidelines for Usable Website Design

Website visualized design can be classified into three main components: information design, navigation design, and graphic design [11, 12]

Information design focuses on the structure for organizing information. A website should have identified grouped and labeled content items. Navigation design focuses on a mechanism for moving around in the website such as a navigation bar and links. Navigation relates to purposeful action for moving toward a final destination or goal. Graphic design focuses on visual presentation and layout.

There are many suggestions about the information design. Bevan and Spinhof [13] stated that ISO 9.6.5 recommends limiting the quantity of text per information unit/page, while HHS 6:10 recommends using an appropriate page length, and using longer scrolling pages when reading for comprehension. Nielsen suggested that website design should keep page text short; use 50% less text than in print publication [14]. Short pages download more quickly, require less scrolling, are easier to read, and are easier to navigate [15]. Flanders and Willis recommend that designers should break text up into small units on multiple pages, keep the pages short, and restrict the width of text on the page to forty-sixty characters [16]. On the other hand, Landesman and Schroeder [17] reported that users prefer pages with more content as opposed to breaking content.

The literature includes many guidelines concerning navigation design issues. ISO 9.4.15 warns against using redundant links, while HHS 10:5 recommends repeating important links [13]. Spool et al [18] suggest that a large number of links impedes navigation. Too many links only increase the opportunities for the site's visitors to get lost [19]. Redundant links may cause confusion [20].

The main site navigation "has to be on the left side of the page" [21]. At least a third of websites have a left-justified navigation menu [22]. However, recently a top navigation bar has become popular and commonly seen in about 30% of the most widely visited websites [22]. Weinreich et al. [23] found that in western language websites, navigation links are generally located near the top and left of pages. Spool reported that site with navigation menus at the top and bottom of the page are more successful than sites with navigation down the side of the page [18]. Rosenfeld and Morville [24] recommend that a website should be set up with a page that holds a hierarchical table of contents, to help web visitors quickly find what they need.

A website should be broad rather than deep [25, 26]. Sites should be designed with more links per page rather than many levels of pages; they should use moderate levels of breadth with minimal depth (e.g. two levels) in the information. However, other authors have recommended that an architectural balance of both site breadth and depth be maintained [27]. The designers

should offer only options on the main menu and no other information and they should minimize the number of options on the home page to ten and minimize depth to less than five levels [24].

There are many suggestions and guidelines about the graphic design. ISO 9.3.9 recommends using color, while HHS 11:1 recommends using black text on plain, high contrast background [13]. Coursaris et al [28] found that users had significantly more favorable perceptions of a website's aesthetics for cool color combinations (blue-light blue) than for warm color combinations (red-orange). Web designers should avoid using large graphics [16]. Web designers should avoid using animation unless it is appropriate [27]. Each page on website should have a consistent and predictable look and feel. This will let visitors know when they are at the website and when they have left it [29, 30].

Web designers should use fonts designed for computer screen (e.g., Verdana) rather than fonts for print (e.g. Times New Roman) [31]. Use serif fonts and fourteen points for older adults [32].

From the literature, we found that many books and research studies offer guidelines for designing usable websites. However, most researchers suggest how to design in general types of website, do not specify in a commercial website type. Furthermore, most such guidelines are based on informal observation rather than experimental data and most experiments investigated on artificially constructed websites rather than real world commercial website.

3. Method

This goal of this research is to determine how dimensions of commercial websites should be designed. Karahoca et al. refer that user satisfaction is the key parameter in software and website usage [33]. Hence in this study, we study how dimensions of commercial website should be designed by using the satisfaction questionnaire to measure the users' usability.

3.1. Population, Subjects, and Sample Size

Our subjects were students in the Department of Computer Engineering at King Mongkut's University of Technology Thonburi. We used 120 students from the International Program, in which all the lectures are delivered in English. Using students who are comfortable with English can reduce confounding factors from English language skill since all the sample websites in our experiments use the English language. The subjects were all experienced with computers and the Internet. They had all used the web for more than one year.

3.2 Location

This experiment was conducted in the human computer interaction laboratory at King Mongkut's University of Technology Thonburi. Our computers had

the same specifications and were connected to the Internet via the same gateway. The students were located at least one meter apart and were not allowed to talk to one another during the experiment.

3.3. Material and Equipment

We used the website satisfaction survey as a questionnaire. All websites were viewed using the Mozilla Firefox browser on the Windows XP operating system. We installed an automatic timer program to record time to use.

3.4. Procedure

Each subject surveyed four websites in order to compare the usability of commercial websites. We set one task per website and gave subject find the answer. We would like subjects to survey commercial website in the detail. The survey asks for subjects' opinions about the website that they just used. After subjects finish surveying the website, we gave them the questionnaire. Website dimensions investigated are shown in Table 1.

Table 1. Website Dimensions Investigated

Components	Dimensions
1. Information Component	1. Use of headings or subtitles 2. Amount of text on the page 3. Using lists and phrases 4. Partitioning the information
2. Navigation Component	1. Number of links on a page 2. Linked page presentation 3. Availability of sitemap 4. Number of navigation layouts 5. Availability of "home" link 6. Use of hierarchical architecture 7. Average Depth
3. Graphic Component	1. Number of pictures on a page 2. Number of regions 3. Consistency of page layout 4. Use of multimedia 5. Number of different type styles 6. Number of different text sizes

The details are shown in paragraphs below.

1. Information Design

1.1 Use of headings or subtitles

The website uses headings to provide names or titles for text paragraphs or entire pages. A heading is a paragraph style that is displayed in a typeface larger, bolder or darker than normal text. It is used to show hierarchical information about other information; it can emphasize or tell people what information is where, such as a title or subtitle or topic at the top or beginning of a paragraph.

1.2 Amount of text on the page

Text is the body matter of a page, as distinguished from the headings. The text is the main body of a written work; it contains words to express something. The amount of text on the page is number of words on a page that are not a heading or title.

1.3 Use of paragraphs of connected text versus lists and phrases only

Paragraphs consist of full sentences grouped together. Lists and phrases are not full grammatical sentences and are often organized with numbers or highlighted with bullets.

1.4 Partitioning the information space

A website that partitions its information space is one which organizes its content into a set of categories, usually represented by links. These categories, taken together, cover most or all of the content on the site. A website is considered to partition its information space if such a set of category-labeled links is shown at the top or second level of the site.

2. Navigation Design

2.1 Number of links on a page

A hyperlink, more commonly called a link, is an electronic connection among one web page to either (1) another part the same page (internal link), (2) other web pages on the same web site, or (3) web pages located on another web site. Number of links is the number of links that are displayed on a page. It roughly corresponds to the number of items at a given level of the hierarchy. Internal links, standard links, and unique links per page should all be considered in the number of links on a page in this experiment.

2.2 Linked page presentation (Separate window versus replace window)

Linked page presentation is how the link's information displayed. Generally, the information can be loaded to a new webpage in a new window or it can replace a content of an old window when we click the link. Some browsers allow the user to explicitly request a new window, but we are interested only in the default behavior, in the absence of such a request.

2.3 Availability of sitemap

A sitemap (or site map) is a web page that lists the pages on a web site, typically organized in hierarchical fashion. A sitemap provides an overview of website content in a manner similar to the contents page of a book. Sections and pages are listed according to narrative flow, if the author intends for pages to be read in a specific order; or alphabetically or in chronological order if content pages are essentially unrelated. Availability of sitemap means whether there is sitemap on a website.

2.4 Navigation Layout

The layout of a webpage is the location of the main navigation menu, which can be displayed as the set of links of a site usually appearing consistently on a page. It

is like an index of website that serves as the central information. Normally, there are four areas where a site navigation menu might contain links: one with the main site navigation menu on the left of the page, on the right, on the top, and on the bottom. If the navigation menu is the combination between top and left, top and right, or etc, we will count the navigation layout as two or multiple areas.

2.5 Availability of “home” link on each page

Home, home page or homepage is the entry page of a website, that is, the first page displayed when the user types the URL. Typically, it serves as an index or table of contents to other documents stored at the site. From the homepage users can get to all the other pages on the site. Availability of “home” link on each page means whether there is a link to return to the homepage on each page on a website.

2.6 Average depth

Depth is visualized as a complete path from the home page down through all levels of the information architecture. Depth is only relevant if a website is organized hierarchically, that is as a top-down tree of topics and subtopics.

3. Graphic Design

3.1 Number of pictures on a page

Number of pictures on a page means number of separate pictures, photos, drawings, images, etc that are displayed on a page. Sometimes multiple images are used to compose one picture. This still counts as one picture.

3.2 Number of regions

A region is a rectangular area of the screen. The content in each region is interrelated more closely than to other regions on a page. Most newspaper websites, for example, contain many regions per page. However, some websites use frames. A frame is used when designers want the contents of one part of the page to remain unchanged while the contents of other parts of the page change. Headers and sidebar menus do not move when the content frame is scrolled up and down. A frame will usually be a region, but not every region is a frame.

3.3 Consistency of page layout

Consistency of page layout means the degree to which various properties of the page are similar across all pages. Properties to be considered include: shape, style, font, colors, etc, and where on the page different types of information generally occur.

3.4 Use of multimedia

Multimedia refers to more than one presentation of information or entertainment medium. It is typically used to mean the combination of text, sound, graphics and/or video. Using multimedia means whether there is multimedia in this page playing by default. User does not initiate. For our purposes; we consider multimedia to be moving graphics (video, animation, animated gif) or

sound.

3.5 Number of different type styles

The type style is the design or style characteristics of a complete font of type. The various type styles are designated by the names: serif, san serif, or ornamental.

The important characteristic of a serif font has serifs, small lines at the ends of characters projecting from the top or bottom of a main stroke of a letter. Popular serif fonts include Times Roman, Courier, New Century Schoolbook, and Palatino. For example:

A, M, T, a, m, t

The san serif font does not use serifs. Popular sans serif fonts include Helvetica, Avant Garde, Arial, and Geneva. For example:

A, M, T, a, m, t

The ornamental is a decorative style to embellish characters. For example:

A, M, T, a, m, t

In this experiment, number of different type styles means that to count how many types of type styles are there on a web page. The heading, or title type style are counted in a number of type style as well, but not including text that is part of images such as advertisement or logos.

3.6 Number of different text sizes

The size of text is measured in points between the bottom and the top of a font (the vertical point size of a font). Sometimes it is referred to as the type or point size. In this experiment, we will count how many different sizes are used on a page.

4. Results

After subjects finished the task, we gave subjects score the questionnaire. Most subjects took times around 8 minutes to survey per a website, but we did not limit the time to score the questionnaire. Table 2 shows the characteristics of each dimension that made users most satisfied a commercial website from the satisfaction questionnaire.

The results suggested that users like to use of headings or subtitles about 20% on a page. Users do not want to scroll to see the text. Users like to use of paragraph connected text about 10%. The partitioning content into logical categories is the important key to find the information correctly. Users preferred 11-20 links on a page. Users do not like to create a new window. There should be a site map in the website. Number of navigation layouts should be only one navigation areas (area with links). Availability of home link on each page should be about 70% “home” on a page. Website should be organized hierarchically. A suitable number of graphics is one or two graphics on a page and 4 regions on a page. Page layout should be always consistent across pages. There should be no more than one multimedia element. An optimum number of text sizes should be two text styles and two sizes on a page. Two text sizes may help to

distinguish between body content and headers or categories.

Table 2. The Characteristics of Each Dimension that Made Users Most Satisfied a Commercial Website

Dimension	Preferred Level
Use of headings or subtitles	About 20% on a page
Amount of text on the page	Never had to scroll to see the text
Use of paragraphs of connected text	About 10%
Partitioning the information space	Partitioned its content into logical categories
Number of links on a page	Between 11 and 20 links
Linked page presentation	Did not create a new window
Availability of sitemap	There should be a site map in the website.
Number of navigation layouts	Only one navigation areas (area with links)
Availability of home link on each page	About 70% "home" on a page
Hierarchical organization	Website should organized hierarchically
Average depth	Typical depth of hierarchy of 2-3 levels
Number of pictures on a page	1-2 pictures on each page
Number of regions	4 regions on each page
Consistency of page layout	Always consistent across pages
Use of multimedia	No more than one multimedia element
Number of different type styles	2 types on a page
Number of different text sizes	2 sizes on a page.

5. Conclusions

This study experimented and analyzed a collection of real commercial websites in order to get the empirical suggestions for how usable commercial websites should be designed. We had 120 subjects and 30 websites to investigate. We believe that this paper contributes to design a usable commercial website. For our future work we will investigate how additional dimensions should be designed such as e-commerce functions (purchase, delivery, or payment option), the aesthetic designs that attract and retain customers, and e-security dimensions.

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