

WEBSITE & MOBILE USABILITY

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ABSTRACT

Website Usability is often described as how easy a system is to learn, remember, and use. Making a website easy to use requires more than following a checklist of “best practices.” It is important that the purpose of the site be pre-determined prior to the start of the “design” process. In the past, users were tethered to a desk by power and communication cords in order to do their work. Advances in technology have enabled the development of “mobile computing.” Mobile devices no longer need to be chained to a desk. As a consequence, the constructs underpinning Usability have evolved. More emphasis is placed on the characteristics of hybrid devices such as: weight, size, battery life, reception (bars), number of buttons, and touch screen capability. Traditional themes to include load time, screen size, single hand operation, browser compatibility, color schemes, and contact links also need to be considered. For the most part, if all these elements are taken into account a website has a strong chance of being successful however, there is no guarantee.

Keywords: Usability, Websites, Web Usability, Web Design, Navigation

WHAT IS USABILITY

Strictly speaking, the term Usability has evolved from one of use to also include design and presentation aspects. A large amount of research has been conducted using this wider definition. These studies include everything from model development (Cunliffe, 2000), to the purpose of a website (Nielsen, 1999, 2000; Falk, 2000), and to website effectiveness (Fichter, 2005). Ultimately these topics are related to Usability and the success a website enjoys.

Usability is generally defined by five (5) quality components:

- *Learnability:* How easy is it for users to accomplish basic tasks the first time they encounter the design?
- *Efficiency:* Once users have learned the design, how quickly can they perform tasks?
- *Memorability:* When users return to the design after a period of not using it, how easily can they reestablish proficiency?

- *Errors*: How many errors do users make, how severe are these errors, and how easily can they recover from the errors?
- *Satisfaction*: How pleasant is it to use the design?

Nielson (2012) expands the Usability construct to include utility, which he designates as functionality. However, utility in and of itself is not enough, system features need to emphasize subjective satisfaction, low error rate, and high task performance (Calongne, 2001). Cheug and Lee (2005) add that Usability needs to support user satisfaction as well.

Usability is an important component of a variety of products and services from lawn mower instruction to website usage. In this vein, Usability is often measured by whether the product does what it claims to do, if the instructions are clear and if the instructions make sense. When it comes to software products (i.e. Healthcare.gov website) extra constraints are put in place to not only do what it is designed to do but also to be efficient and easy to use. Software products also need to be concerned with Human Machine Interfaces (graphical user interface).

The advent of online retail has forced organizations to consider consumers' in a new light. Organizations work hard to ensure a pleasant experience for the user. Shoppers want sites that have value and are easy to use. Slow loading web pages are consistently identified as one of the top annoying attributes of the Internet by online shoppers (eMarketer, 2006; Ewalt, 2002). Weinberg (2000) and Nah (2004) indicate that the perception of download delays is far more important to study than actual delays.

Features that aid the users can help retain visitors' interests (Sockel, Falk, Warren, & Chen, 2007). Sockel et.al warn organizations to exercise caution and not to rely on the graphical user interface (GUI) as the sole factor in boosting online sales. Since these interfaces can be imitated, and the long-term competitive edge is less salient compared to factors, such as customer confidence in the Web business and relationship services (Kotha, Rajgopal, & Venkatachalam, 2004)

Evolution

Originally, "online systems" were not developed for a "generic user" but for the specialist - someone who had an underlying understanding of the system being developed. They were expensive to build, and labor intensive to design, and implement. Initial development projects were created to replace existing "paper-based" manual systems. In the end these systems provided limited enhancements. The systems were often considered a success under the most dubious factors - frequently it boiled down to "we got some usable result" and "it did NOT outright fail." Early problems included limited "buy-in" by key sponsors, lack of understanding, fluctuating agreement in end goals, poor project management, turnover of key personnel, cost overruns and other issues. Additionally, the user community and technology development group utilized language and terms that were not well understood by others. This was a devastating process that created ill-will often enough to doom future projects.

The confusion was often the direct result of many things going askew. Developers overstating their capabilities, and users over demanding on what they would like, when they would like it, and what they were willing to pay. In the end, many projects failed because both sides did not communicate, were too ambitious, and neither wanted to compromise. Besides the normal typical people and political issues, technology was changing faster than the organizations could assimilate it.

Why It Matters

Errors seem to happen all by themselves, there is no need to compound them by confusing users on what is happening or what to do next. The Three Mile Island (TMI) incident is a prime example. According to the U.S. Nuclear Regulatory Commission (NRC) the most serious accident in U.S. commercial nuclear power plant operating history occurred at TMI, Dauphin County, Pennsylvania, on March 28, 1979. It was confusion over valve status that undermined TMI. Critical human factors and poor user interface engineering led operators to misinterpret the meaning of a “warning light.” The operators thought a critical valve was closed when it was actually open. It turned out the light they were concerned about did not indicate the position of the valve, only the status of the solenoid that controlled the valve. This confusion was a key contributor to the initial failure to recognize the accident as a loss-of-coolant accident, and led operators to turn off the emergency core cooling pumps due to fears the system was being overfilled (Walker, 2004).

While “the small radioactive releases had no detectable health effects on plant workers or the public. Its aftermath brought about sweeping changes involving emergency response planning, reactor operator training, human factors engineering, radiation protection, and many other areas of nuclear power plant operations” (see NRC Factsheets, 2013).

The TMI incident permanently changed the nuclear industry and the NRC itself. In addition to requiring upgrades, strengthening of the plant designs and equipment requirements they also addressed “the critical role of human performance in plant safety.” This led to revamping operator training and staffing requirements. “Followed by improved instrumentation and controls for operating the plant, and also an establishment of fitness-for-duty programs for plant workers to guard against alcohol or drug abuse” (see NRC Factsheets, 2013 para. 12). Further, TMI “inspired Charles Perrow’s (1982) Normal Accident Theory which suggests that accidents result from an unanticipated interaction of multiple failures in a complex system.

USABILITY GOALS

Pagani (2009) indicates that at one time, “Usability” was an afterthought and developers were rewarded for application features, and very little else. Nielsen (2000) indicates that Usability was a suppressed and barely tolerated oddity. Website Usability also includes a functionality component - how effective it is at permitting (and denying) access to information. In this expanded definition, website design needs to take into account the users characteristics, experience and context (Badre, 2002; Chen & Sockel, 2001, Rau, Liang, & Max, 2003).

People rely on their experience and use semantic models to make sense out of the

environment. What might seem an easy application for a design team member can be awkward and difficult for an end user (Marinilli, 2002). It is important that metrics and goals be set prior to design and production. If the aim is to produce high performance for data review, a sensible measure might refer to the speed in which the web pages load given a particular hardware and software combination (Calongne, 2001). On the other hand, if the aim is for data entry, then low error rate is the point of interest, click stream data and server logs might need to be analyzed to isolate patterns.

Usability Issues

Every web page has an address on the Internet. The more recognizable the address the easier it is for the user to become brand aware and the more often they might return to the site. Typically, the Web is used as a marketing tool that allows millions of potential customers to visit a site each day (Hart, Doherty, & Ellis-Chadwick, 2000). However, before that can happen, a person needs to be able to find the appropriate web page. In that regard, many individuals use and depend upon search engines to locate sites of interest. A serious problem is that a website's reference may be buried so deep in a search result, that it will likely go unnoticed and not visited. The consequence is not only a Usability issue, it is also a visibility/profitability problem. To circumvent this issue, an organization should consider using meaningful web addresses (uniform resource locators), and descriptive meta tags (tags hidden in the web page design code - DHTML, XML – used to describe content). Additionally, key words should be placed in titles and paragraphs. Backward links (link referrals) should also be used to enhance placement of a website in search results.

Domains - TLDs – Branding

The real name of a website is a number assigned by the Internet Corporation for Assigned Names and Numbers (ICANN). The problem is that humans have a hard time remembering large numbers, so to make it more convenient a unique mnemonic symbolic name is associated with this number. The symbolic name is typically composed of three parts: Top level Domain (TLD), the User Domain name, and a service/category/machine name. The group responsible, Internet Assigned Numbers Authority (IANA), for coordination of TLDs has defined over 300 TLDs which includes nearly 200 country codes. Examples from of these codes ICANN include: .com, .org, .gov, .uk, .ca, .jp, and others.

The actual domain name is chosen by the individual entity and is unique within a TLD. While search engines use web-bots to find the pages on their own, it is better to register the site with the various search engines - so that search criteria can be tailored to the website. Studies show that a majority of website's traffic is generated through search engines and directories. The website's domain name becomes more meaningful to the user if it contains cognitive cues.

Design Issues

Nielson (2003) lists the top ten violated web page design guidelines. However, even though this study is somewhat dated, the basic guidelines should still be taken into account.

1. Emphasize what your site offers that's of value to users and how your services differ from those of key competitors
2. Use a liquid layout that lets users adjust the homepage size
3. Use color to distinguish visited and unvisited links
4. Use graphics to show real content, not just to decorate your homepage
5. Include a tag line that explicitly summarizes what the site or company does
6. Make it easy to access anything recently featured on your homepage
7. Include a short site description in the window title
8. Don't use a heading to label the search area - instead use a "Search" button to the right of the box
9. With stock quotes, give the percentage of change, not just the points gained or lost
10. Don't include an active link to the homepage on the homepage

For the most part it seems that the focus of Usability has gravitated from traditional web page development to Mobile Computing. The ever growing popularity of computer cell phone hybrids is the reason. There is a difference between mobile or nomadic computing and the use of hybrid devices. Mobile computing is the use of portable devices to access the Internet and data from work or home from anywhere in the world (Rouse, 2007). Hybrid devices are primarily designed to be used for entertainment, communications, shopping, and incidental work utilizing a cellular and / or other wireless networks (Markoff, 2007).

Designing sites toward hybrid computing products such as cell phones and tablets brings up a host of new Usability issues. A lot of these devices are operated while multi-tasking. If a mobile device is to be truly usable, new elements need to be included. These elements/components have to be designed with the goal of minimizing attention so that other tasks such as driving, can be performed at the same time. As these hybrids try to incorporate the many functions that other devices are specifically designed for - such as, Talking (telephone), Texting, Global Positioning Satellite (GPS), and Internet browsing - Usability transitions from a secondary afterthought, to the major design concern.

Input and Queries

For products to work well in the hybrid environment certain design features need to be incorporated and enhanced. Traditionally a keyboard, mouse or touch pad were utilized to input data or conduct queries. In a truly mobile environment those input devices may not be effective. Within the ever growing evolution of the input and query function voice operation is at the top of the list. While the technology is not completely sound there are working elements that are in place. At this point GPS commands such as “find a location” and/or store are somewhat precise. Conducting voice searches and reading back messages (email or text) are also somewhat accurate. Sending text messages also works fairly well. Problems with this technology include user ascent, accurate data bases, and a user who still has to activate these features by touch. The fact that a user needs to touch a screen in a certain spot can also become an issue because the user has to look at the device. The next generation of Usability has to design systems to overcome these issues. A universal design needs to be created for web pages and apps.

Load Time

The overall goal of a web page should be to quickly deliver quality content in a fashion that does not cause the person to become hopelessly irritated. In this regard, time is a very big factor. Time becomes more of an issue when mobile computing on a hybrid device is considered. In the past a general rule of thumb is that a web page should load in less than eight seconds. More recent research suggests that business performance begins to decrease after a response time delay of 5.1 seconds. NetForecast's APDEX uses 4.0 seconds as the dividing line as to where users become frustrated (Godskind, 2009). Some users include too many images which can cause three problems: cognitive disorientation, slow downloads, and excessive bandwidth use. Graphics should be used sparingly – only when they add clarity and have a point (Nygaard, 2003).

The primary element in making a website usable is its design. Unfortunately, many people are anxious to skip steps and just go for a “product,” without considering the “basics.” As in the engineering field, the design has to be “defined” up front, along with the goals and objectives of the site. One cannot test quality into a product; it has to be designed in. However, designing interfaces is a complex problem quite different from typical engineering challenges because it deals with users' behavioral aspects. Inadequate forethought, tight schedules, misconceptions, inappropriate attitudes: such as "Usability is a plus that we cannot afford" (Marinilli, 2002, p. 1), and lack of professionalism are responsible for many of the poor sites.

Screen Size

Like in any other medium the design should be aesthetically pleasing and balanced. To avoid optical confusion, the background needs to be just that, background. The site should use ample white space so that the site does not appear cluttered. A problem that developers face is that they do not know the screen size of the user. This Usability issue includes the fact that each version of each browser may interpret/render web pages slightly different, with some browsers not supporting specific features (Apple and Flash). Over time the size and density of the viewing screen has changed. Initially the standard pixel screen size was 480 x 600, followed by 800 x 600 and then 1024 x 768 to larger. The standard screen sizes allowed web developers to pick smaller sizes and to be confident that most users would be happy. This is no longer true, devices that connect to the network can accept data faster – allowing for higher resolution images. They can process these images faster and crisper with lower energy costs. Additionally, the number of devices set to higher resolutions is on the rise. This is further complicated by the large mix of disparate technologies: distinct browsers, various versions of software, and many machine based applications. Further, there is a variety of devices that are web enabled besides the standard PC including, TV's, cell phones, watches, and tablets. Each technology is associated with a different set of characteristics that limit its ability to be usable. Most website systems were originally developed for viewing on “standard” monitors. This trend now skews toward mobile devices such as cell phones and tablets. A great deal of developmental effort is needed for the successful transition of traditional websites to smaller screen portable devices (Huang, 2003).

HARDWARE AND SOFTWARE ISSUES

Just as important as the change in the popularity of resolution size is the introduction of

new mobile devices. Newer equipment presents extra concerns for the website developers; different screen sizes and modes present information differently. The smaller the screen mode, the larger items appear on the screen, leaving less room (real estate) for information to be displayed. Differing mode sizes change the layout on the screen and can account for line shifts, sentences broken in midline, moved links, and many other irritating manifestations.

Another dilemma that can have an effect on the design is the browser selected by the consumer. A browser is an application that retrieves, interprets and displays an online (or offline) document in its final web page format. Some the more popular browsers are Internet Explorer, Firefox, and Safari. Various browsers and versions (even within the same vendor) may display items on a website differently. In some cases, certain elements and features such as videos, marquees, and colors can be viewed on some browsers and not on others. Some sites are designed to use the features of a specific browser, therefore the consumer may not be able view the site as the developer intended, especially if they are using an updated or older version of the browser. To ensure that a site works correctly developers need to assess it using multiple browsers and settings.

Disabled Users

A relative recent phenomenon in the realm of communication is the vast number of disabled related users and computer Usability functions that need to be tweaked to accommodate these individuals. The Federal Government has led the way with the Americans with Disabilities Act (ADA). Section 508 of the Rehabilitation Act now requires, among other things, that all websites used by federal employees and members of the public seeking information and services from the federal government be ADA compliant (Gerber, 2002). Entities under the ADA constrains are required to provide effective communication, regardless of whether they generally communicate through print media, audio media, or computerized media such as the Internet. While the ADA requirement does not apply to everyone, is it good practice to incorporate the necessary accommodations for those with disabilities. With the growth of computing technology many special needs groups are using the web to make things easier. Since approximately “57 million people are classified as having a disability” (United States Census, 2012, p. 1), it makes sense for an organization to incorporate ADA adjustments into website design.

Navigation

There are many issues that need to be addressed when creating an easy to use website. The layout of the screen is central to the user’s ability to recognize information. Information must be placed in a logical order and its physical location should be taken into account. Web page content can be longer and wider than the visible portion on a screen, causing the user to turn the device sideways - or scroll down or across to see the rest of the content. Generally speaking, scrolling should be minimized and avoided on navigation pages because hyperlinks below the fold (browser bottom border) are less likely to be seen and chosen (Nielsen, 1999). The screen is typically considered to be divided into nine asymmetrical regions (similar to a tic-tac-toe board) with each region associated with its own prominent use characteristics. Typical “European” style languages read from left to right. Consequently, it is generally considered appropriate to put the more important information on the left side of the screen so that the viewer reads it first before interest withers.

The three click rule should also be utilized. The rule indicates that users should be able to obtain data from all content on the website within three clicks from the home page. The content of the information should also be fresh and up to date (Langer, 2000). Hyperlinks need to be accurate and clearly marked. They should be placed at the bottom of long pages. Once accessed these links should change color. Each level in the site should allow the viewer to go back to the previous level and forward to the next. As a viewer gets deeper into the site, a link should be present that allows the user to return to the opening page so that the navigation can begin anew if so desired. Nothing is worse than having a user become frustrated because a means to either exit or restart is not present or apparent.

It is very important, in any discussion of hyperlinks, to note that there should be no dead links. It is annoying to go to a site and click on a link and have nothing happen, or to come back with a “404 error,” page not found. It is like reading a newspaper or magazine article and the continuation is not there. Some feel that a link that leads to a page that states “under construction” is equally annoying – if a page is not ready, do not post it.

The web page itself needs to cater to the needs of the user. Many developers feel that it is extremely important that each web page contain contact information or at least link to a page that has the contact information. From a user’s perspective, it is extremely infuriating to want to place an order and run into problems and not be able to contact anyone for assistance. Further, the responses generated by the site need to be monitored and responded to in a reasonable amount of time. The old “standard” was for organizations to respond within 48 hours. The new standard being adopted by many organizations is to respond within 24 hours. Failure to respond to contact inquiries can exacerbate the situation.

A “site map” can also be helpful in making a site more user friendly. In its simplest form a site map lists everything that is located on the website and provides navigational links to get to the information. This is important because it lets the viewer know what is and is not on the website (Krug, 2000).

Color

Color schemes play an important role in Usability, they help tie pages together and help with navigation. Color impacts the website in many ways, it can add to the value by helping to organize the site, or detract by making it harder to read the web pages. To help eliminate confusion, page colors and design should be consistent throughout the site. Radically changing a site’s “look and feel” may cause the user to question whether they continue to be on the same site. Within a web page, color can be used as an effective tool to help categorize products. In the past Amazon was a great example. The design was the same but by changing the color code of the web page depending on the product the viewer knew what category they are shopping in.

A website that would otherwise be “perfect” can be totally unusable if the colors are inappropriately chosen. Color contrast is also important. Some sites are not readable (usable) because the background color or the design is as dark as the font color. Contrasting colors need to be used so that the viewer can read the information on the site. Dark fonts with any light background works well. Another issue is the effect of color on viewers with visual disabilities.

Some of the more progressive site developers give users the ability to select a color theme (foreground and background) that is easier to view. This is important because not all colors are displayed the same across different browsers or machines. There are a few simple color rules that can aid in the construction of a successful site (Cannon, 2012).

Developers should be aware that The World Wide Web Consortium (W3C) has identified 216 browser safe colors. Developers should stay away from red and green backgrounds, ensure high contrast between background and foreground colors, and avoid busy background patterns that interfere with reading. To avoid confusion, the default hyperlink colors (such as blue for unvisited links and red for links already visited) should not be altered. Standard hyperlink colors should be avoided for text.

USABILITY MODELS

Many developers prescribe to the idea that the first step in making a site usable is to think about Usability and the information architecture of the site before it is actually developed. Because the success of a site is based on the metaphor of how a site will be used, by whom, and in what environment - it is essential to define the purpose of the website and the expected audience (Rosen, Purinton, & Lloyd, 2004). This is an important issue because it determines the type of information, the breadth, as well as depth. Three basic website models (Falk, 2000) are: the Presence Model (often referred to as the “me too model,” Informational Model, and the E-Commerce Model).

Presence Model

These websites are designed to establish a presence on the web but not really to accomplish anything more than “I am on the web too.” They do not usually contain a lot of information, but they often point to other sites that may and are used by individuals to share pictures and such with their friends. Organizations have used this model in the past as a promotional tool to show that their organization is progressive. This type of site is used mostly by smaller organizations that either do not have the expertise to design a more in-depth site or the manpower to maintain it.

Informational Model

The web pages in this model are usually heavy with information. These web pages are set up so the user can get to specific information. A lot of software or computer companies use this model to provide access to Frequently Asked Questions (FAQ), so that they can limit the amount of traditional support that they might otherwise have to provide. Organizations that use this model, often refer telephone callers to their website, and consequently miss the opportunity for one-to-one sales.

E-Commerce Model

This model typically employs dynamic web pages and is designed to: create, support, and establish sales. There usually is enough information on these sites so that the viewer feels sufficiently comfortable to make a purchase. These sites are run by companies with the expertise to quickly update and maintain online inventories.

FUTURE

The future of website Usability is changing, not just because of our understandings of how people actually use websites, but also because organizations and consumers are demanding more from the web presence. New Internet accessible devices are being introduced, so the earlier semantic metaphor of a “desktop” is no longer viable. Many users of a network do not use desks. Numerous inventory control agents remotely report sales activity and volume. Delivery personnel use Internet accessible clipboards to report distribution and location. Among the cutting edge Internet devices are a new breed of portable equipment that enhance the issues associated with mobile commerce. Presentation platforms have grown to include Smartphone’s, Televisions, Wrist Watches, and portable marquees. Software tool vendors are continuously introducing new features and techniques. Entertainment is also a factor in Usability. It is not uncommon to see personal Laptop Computers, Smartphones, iPods, and Tablets using WIFI and cell networks in almost every location. These mobile devices are a tremendous force for expanding the previous technology as well as advancing it.

CONCLUSION

Website Usability is defined as how effective the website is at permitting access to the site’s information. The evolving nature of this field is what makes it difficult to master. What once was considered standard, has been shaken up by the application of emerging technologies. As these new technologies emerge or develop, the rules change. Designing an interface that takes advantage of multiple mobile formats and other new parameters can be challenging to say the least. It is not just the new technologies that make designing interfaces difficult but also the re-imagining and addition of common tasks across various equipment that adds to the complexity i.e: GPS availability on mobile devices. Each and every one of these apparatuses has their own parameters.

Certain generic steps need to be followed to ensure all of these gadgets have an easy and effective interface. The first and probably the most important thing is the purpose. It should be determined before starting the design process. After the purpose is decided the following elements should be considered in the website’s blueprint so that it is easier to use: load time, aesthetically balanced, screen size, browser compatibility, contact information on each page, color schemes, and, clearly marked hyperlinks. The definition of the project is crucial to the effectiveness of the interface. Further, regardless of the amount of work that went into the process, all the operations must always be checked to make sure that everything works properly.

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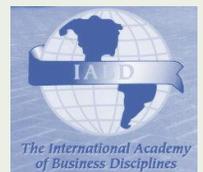
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