

# Impact of the Factors Influencing Website Usability on User Satisfaction

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*Though technological progress has allowed many improvements like new business opportunities, faster data transfers, etc., still, it is recommended that human computer interface design has a significant influence on the usability and user satisfaction level. The objective of this study is to understand the satisfaction level of users from an interface usability perspective. A pilot survey was conducted to fix the most popular website among the student community. An actual questionnaire survey was administered on 174 students pursuing MBA to elicit the required data. The study used two principal component analyses to extract the factors influencing usability and satisfaction separately. Later, satisfaction was regressed onto the factors influencing usability to determine the relative significance of each factor. Independent sample t-test was done to examine the impact of gender. The study found that information content, format, consistency and ease of navigation to be significant in explaining the satisfaction level of the users. No difference in gender was found with respect to the factors influencing usability of website. The findings of this study have implications for website designers, particularly in maintaining the consistency and accuracy of the information, while designing a website.*

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*The old computing was about what computers could do; the new computing is about what users can do. Successful technologies are those that are in harmony with users' needs. They must support relationships and activities that enrich users' experiences. Information and communication technologies are most appreciated when users experience a sense of security, mastery and accomplishment. Then these technologies enable users to relax, enjoy, and explore.*

**–Shneiderman (2002)**

Envisaging a new phase in the Information and Communication Technology (ICT) revolution, Shneiderman (2002) recommends that the concept of universal usability would promise successful deployment of technology by any user. Universal usability is a broader concept elaborated under an extensive research

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agenda based on three main issues or challenges such as technology diversity, user diversity and digital divide issues (Shneiderman, 2000; and Shneiderman and Hochheiser, 2001). Since the advent of the Internet in the 1970s, the technological advancements in the area have been gradual and for majority of the population it was inaccessible until the early 1990s. With the arrival of World Wide Web and browsers, the business activities were conducted electronically through the Internet, in other words, e-commerce (Schneider and Perry, 2000). Though technological advancements have allowed many improvements like new business opportunities and faster data transfers, still, it is recommended that Human Computer Interaction (HCI) design has a significant influence on the usability and user satisfaction level (Nielson and Norman, 2000). In general, technological innovations rely on user interface design to promote their technical complexity to a usable product. Technology alone may not win user acceptance and subsequent marketability. The key to acceptance is the user experience, or how the user experiences the end product. For greatest efficiency and cost effectiveness, relationship between technology and usability should be maintained at momentum. User interface design, also known as Human Computer Interaction (HCI) has great importance as a good user interface design that can impact the acceptance and rejection of a product in the marketplace. If end-users feel it is not easy to learn, not easy to use, or too cumbersome, there is a high chance for an excellent product to fail.

The objective of the study is to understand the satisfaction level of users from a usability perspective. A considerable amount of research has been done by various researchers (Abdinnour-Helm *et al.*, 2005; and Pearson *et al.*, 2007) to measure satisfaction with a website from a usability perspective with the intention of helping website designers to develop user-friendly sites and, in turn, facilitate e-commerce.

## **Usability and Satisfaction Concepts**

Usability belongs to a broader research field in HCI that surfaced after World War II and flourished in the 1980s (Head, 1999) as personal computers became ubiquitous in several areas of human activities. In this perspective, usability contributes to understanding which factors lead to successful interaction between users and computers (Hartson, 1998). The need for user-centric design of systems merged with the widening use of systems by users without specific education in computer science. Despite the increased focus on usability, there is no common consensus between HCI experts on a definition of what usability is.

Initially, usability referred to terms such as ease of use, user-friendliness, and ease of learning that implied providing users with systems requiring minimum cognitive and physical effort (Karat and Karat, 2003) to accomplish their tasks. Though this definition is widely accepted in the personal computing and consumer electronics industries, in most cases user interaction processes and outcomes are

affected by a broader context of user goals, tasks, and user environment aspects that are not focused in the impression of easy-to-use technology. Flaws of the ease-of-use approach encouraged the HCI community to search for a more comprehensive theory which could predict what makes individual use technology-based products and services. This question was answered by Davis (1989) in the Technology Acceptance Model (TAM) that relies on achievements of social psychology. Davis argued that the choice whether to use the system or not is affected by the subjective user judgment on two following factors: First, usefulness—ability of the system to improve user performance; and secondly, ease-of-use—minimal efforts required to operate the system (Dillon and Morris, 1999).

Web usability can be defined as making the design simple enough so that customers, who by nature tend to be goal-driven, can accomplish their task as quickly and painlessly as possible ([www.webcredible.com](http://www.webcredible.com)). The usability of websites belongs to much wider topic of HCI (Hartson, 1998; and Muller and Czerwinski, 1999). Nah and Davis (1989) define website usability in terms of several standard criteria: the ability to find one's way around the web, to locate desired information, to know what to do next, and to do so with minimal effort.

Nielsen (2000) describes how usability progressed to assume greater importance in the Internet economy. With products and software, customers generally experience the usability of the product after they buy it and pay for it. Software designers, however, paid more attention to usability to minimize the cost of running a support center. The web reversed this process, with users experiencing the usability of a website first before committing to using it or spending money on any potential purchases.

Shneiderman (2005) suggests that usability can be a balancing act—inadequate functionality will render the application useless while complexity and clutter make an interface difficult to use.

Nielsen (2003a and 2003b) states that it is more important for the design to meet the needs of the customer rather than be attractive and fun. If the customer finds the site too difficult to use, there will not be a purchase or return visit.

In their research on web customer satisfaction, McKinney *et al.* (2002) stated that a website will be abandoned if the consumer has difficulty in searching or retrieving his needed information, even if the website provides the information necessary to complete the intended task.

Researchers such as Nielsen (1994, 2003a and 2003b) and Krug (2000) provide detailed information on the definition, goals, rationale, and methodologies of usability assessment. Nielsen (1994) defines a usable interface as one which is: easy to learn, efficient to use, easy to remember, pleasant to use, and which causes few errors.

Palmer (2002) and Agarwal and Venkatesh (2002) inspected the underlying dimensions of website usability. Palmer defined usability based on five dimensions

derived from usability: Download delay, navigability, content, interactivity and responsiveness. Agarwal and Venkatesh (2002) exploited the Microsoft Usability Guidelines to define website usability through five different dimensions namely ease of use, made for the medium, emotion, content and promotion.

Zeithaml *et al.* (2002) identified five criteria that users look for while evaluating websites in general. They are: information content, ease of use, privacy/security, graphic style and fulfillment.

Pearson *et al.* (2007) found a modified instrument consisting of navigation, customization and personalization, download speed, accessibility, and ease-of-use, which provided a more valid and more robust measure of website usability.

Clearly, usability is important to the success of a website and tools such as the End-User Computing Satisfaction (EUCS) (Doll and Torkzadeh, 1988) can be used to measure user satisfaction in this domain (Abdinnour-Helm *et al.*, 2005). The EUCS represents five underlying dimensions of end-user satisfaction: content, accuracy, format, ease-of-use and timeliness.

The literature on end-user satisfaction with Information Technology (IT) is extensive. Mahmood *et al.* (2000) used a meta-analysis approach to synthesize and validate the construct of IT end-user satisfaction. Satisfaction with information technology has been widely accepted as an indicator of IT usage, which is considered as an important driver of IT success. In comparison, the literature on end-user satisfaction with the web is so far limited (Devaraj *et al.*, 2002; and McKinney *et al.*, 2002). Satisfaction is a set of biased reactions a user may have when using a website. The site should be pleasing to use and look at. Users' perception of 'pleasantness' influences their:

- Perceived ease-of-use;
- Motivation for learning how to use the site;
- Confidence in the reliability of the information content;
- Future intentions; and
- Recommendations.

## Research Model and Hypothesis

From the above literature survey, it is quite evident that there are several dimensions of various researches that explain the usability of a website and its user satisfaction level. Given the scenario, the study aims at answering the question: With all the available websites, diverse set of user skills and different levels of users (novice to expert), what motivates users to choose one site over another? The two Research Questions (RQ) examined through this study are:

**RQ1:** What are the factors that influence the satisfaction level of users with respect to the usability of a particular website?

**RQ2:** Does gender impact the relative importance of the underlying dimensions in assessing website usability?

The study carefully extracts the underlying dimensions to measure user satisfaction with a website's usability. Hypothesis is stated as follows:

*H<sub>0</sub>: Site usability has an impact on the perceived satisfaction of the user.*

According to Nielsen (1994), usability is defined by five quality components: Learnability, efficiency, memorability, errors and satisfaction. The dimensions proposed by Nielsen were latter incorporated by Lin *et al.* (1997). This study used the two of the concepts (consistency and user support) defined by Lin *et al.*, in their questionnaire that were most relevant to the users of a web environment. The study also took ease of navigation as one of the factors, as it was considered as an important determinant (Cheskin Research, 2000). Constructs such as information content, design, format and ease-of-use were taken from Doll and Torkzadeh (1988) and Davis (1989).

The set of factors assessed by the study are:

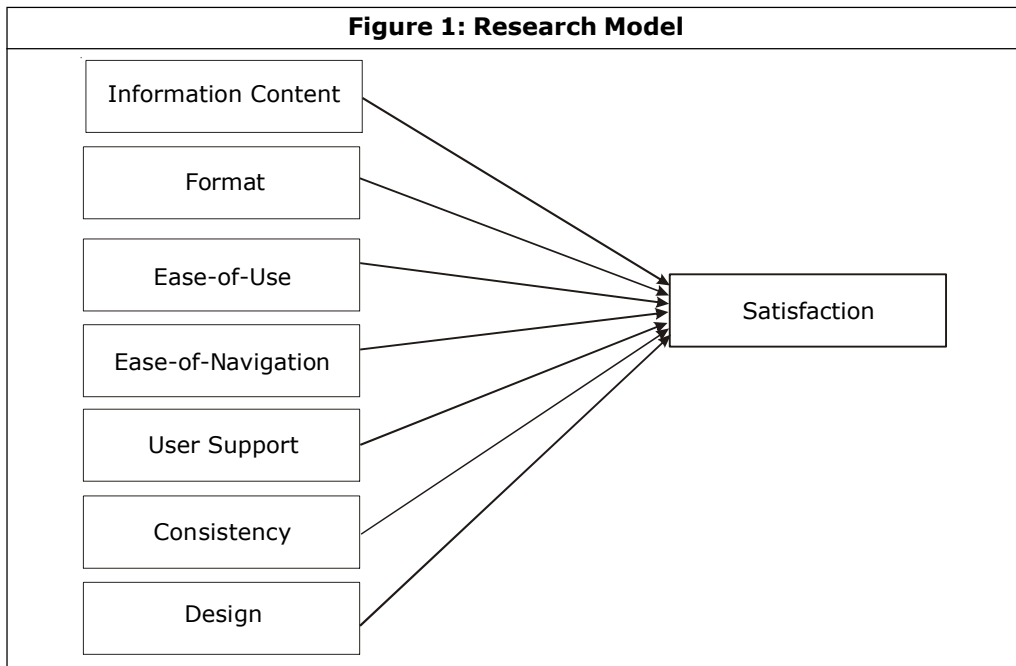
- Ease-of-Navigation: Ease of finding what one desires and knowing where one is in the website.
- Consistency: In HCI, consistency is considered to improve user performance and user satisfaction. It applies internally to the website and externally to other websites through standards and conventions (Roy *et al.*, 2001).
- User Support: To improve learnability and reduce the mental workload.
- Information Content: Quality and comprehensiveness of the information provided by the website (Zeithaml *et al.*, 2002)
- Ease-of-Use: Refers to design flexibility.
- Format: Refers to the logical structure.
- Design: Refers to aesthetics and language.

The study proposes a link between the above concepts and the user satisfaction (global measures) for a particular website, which can be generalized for other websites. The research model for this study is given in Figure 1.

## **Research Methodology**

### **Sample**

A sample of 174 students pursuing MBA were surveyed with the help of a questionnaire. The students had laptops and full-time access to the Internet and all websites. All of them belonged to the age group of 19 to 25 yrs. Among the respondents, 64.9% are males and the remaining are females. 90% of the respondents reported using web between 2 to 8 h per day inclusive of personal and study-related work, and have been using the Internet since two years. The usage of web by males and females is also in similar proportion, which is consistent with the earlier survey reports on web usage (UCLA, 2003).



## Measurement

A questionnaire was used to collect the data on website usability and user satisfaction. The particular website fixed for the user satisfaction survey was: [www.google.com](http://www.google.com), resulted from a pilot survey conducted prior to the actual questionnaire survey. This website is being used most frequently by the students in the campus. The pilot survey consisted of open-ended questions related to the respondents' interest towards a particular website. The sample size of the pilot study was 50, and 90% of them reported '[www.google.com](http://www.google.com)' as the most frequently used website for various purposes like information retrieval from huge repositories, e-mail, social networking, online games, and so on.

The final questionnaire was prepared taking into consideration the suggestions from the pilot study. The questionnaire consisted of 25 questions based on a 5-point Likert scale generated from the literature, 21 items dedicated to evaluating site usability, developed and validated by Lin *et al.* (1997) and 4 items to measure user satisfaction. The questionnaire also aided to collect the general demographic information like age, gender, years of internet usage, etc. Appendix 1 gives a detailed picture of the dimensions and scale items generated from various sources.

## Identifying Factor Structure and Reliability Analysis

Two factor analyses were performed separately to find out the usability and satisfaction dimensions. Factor loadings below 0.5 were eliminated in the current study. The iterative sequence of factor analysis and item deletion was repeated, resulting in a 15 item scale representing seven factors for usability dimension.

The seven usability factors such as Information Content, Format, Design, Ease-of-Use, Ease-of-Navigation, Consistency and User Support, are explaining 73.6% of the variance in the total dataset. For satisfaction, all the four items converged into a single factor explaining about 66.8% of the total variance in the entire dataset.

Reliability was evaluated by assessing the internal consistency of the items representing each factor using Cronbach's alpha. It evaluates the proportion of variance attributable to the true score of the variable the researcher intends to measure (Cronbach, 1951). It reflects the consistency of the measure and the homogeneity of the items in the scale. Factor loadings higher than 0.5 (ideally 0.7) was accepted to indicate the significant variance shared between each item and the construct (Rivard and Huff, 1988). This study did not consider the items below the 0.5 criterion.

Table 1 presents the Cronbach's alpha of all variables with the loadings of the various items on their corresponding constructs.

<b>Table 1: Reliability Analysis</b>					
<b>Variable</b>	<b>Item Code</b>	<b>Cronbach's Alpha</b>	<b>Factor Loadings</b>	<b>Mean</b>	<b>SD</b>
<b>Satisfaction (Dependent)</b>	SAT1	0.818	0.583	4.33	0.778
	SAT2		0.800	4.39	0.816
	SAT3		0.807	4.47	0.660
	SAT4		0.857	4.61	0.586
<b>Information Content</b>	IC1	0.738	0.708	4.25	0.731
	IC2		0.755	3.94	0.798
	IC3		0.765	4.04	0.849
<b>Format</b>	FT1	0.745	0.819	4.18	0.812
	FT2		0.850	4.25	0.715
<b>Design</b>	DS1	–	0.891	4.18	0.918
<b>Ease of Use</b>	EOU1	0.702	0.818	2.48	1.211
	EOU2		0.887	2.45	1.191
<b>Ease of Navigation</b>	EON1	0.520	0.642	3.81	0.889
	EON2		0.761	4.01	1.020
<b>User Support</b>	US1	0.634	0.747	3.64	1.128
	US2		0.859	3.61	1.078
<b>Consistency</b>	C1	0.620	0.596	4.16	0.822
	C2		0.772	3.89	0.618
	C3		0.592	4.41	0.878

The results show very good reliability for most of the measures. The dependent variable satisfaction has a very good alpha (0.818) and all the items show loadings

greater than 0.5 criterion. The independent variables also exhibit satisfactory reliability. Information content, format and ease-of-use have strong alphas (over 0.7) and all their corresponding items have loadings above 0.707 criterion. Consistency and user support also possess appreciable alphas and their items with high loadings. Ease-of-navigation is the only variable with less reliability; still it can be considered acceptable (Roy *et al.*, 2001). Though the Cronbach's alpha is 0.52, all the items load highly.

To evaluate the site usability factors on the satisfaction level of the users, a regression model was used. The required sample size for the regression analysis was 10 times the number of items in the largest construct (Gopal *et al.*, 1992). The largest construct is satisfaction, having 4 items. The sample size (174 cases) was therefore deemed adequate. It exceeds the 10 to 1 ratio for all the constructs.

## Results and Discussions

The model was tested with satisfaction as the dependent variable.

### RQ1: Identifying the Factors Impacting User Satisfaction

In order to examine RQ1, a linear regression was performed based on the factor scores extracted from the above factor analysis results. The following equation provides a representation of the regression model tested:

$$\text{Satisfaction} = \text{intercept} + \beta_1 (\text{Info Content}) + \beta_2 (\text{format}) + \beta_3 (\text{ease of use}) + \beta_4 (\text{design}) + \beta_5 (\text{user support}) + \beta_6 (\text{Ease of Navigation}) + \beta_7 (\text{Consistency})$$

The results of the linear regression produced the following results:

$$\text{Satisfaction} = 0.009 + 0.341 (\text{Info Content}) + 0.231 (\text{Format}) + -0.036 (\text{Ease-of-use}) + -0.001 (\text{Design}) + 0.322 (\text{Consistency}) + 0.120 (\text{User Support}) + 0.297 (\text{Ease-of-Navigation})$$

Information Content, Format, Consistency and Ease-of-Navigation have a significant impact on the satisfaction of the user as evident from the *t*-statistics of Table 2.

<b>Table 2: Beta-Coefficients and <i>t</i>-Statistics of the Variables</b>			
<b>Variable</b>	<b>Beta-Coefficients</b>	<b><i>t</i>-Statistics</b>	<b><i>p</i>-Value</b>
<b>Information Content</b>	0.341	<b>5.522*</b>	<b>0.000</b>
<b>Format</b>	0.231	<b>3.735*</b>	<b>0.000</b>
Ease of use	-0.036	-0.578	0.564
User support	0.120	<b>1.950**</b>	0.053
<b>Consistency</b>	0.322	<b>5.220*</b>	<b>0.000</b>
Design	0.001	0.022	0.983
<b>Ease of Navigation</b>	0.297	<b>4.816*</b>	<b>0.000</b>
Note: * Significant at 5% level; and ** Significant at 10% level.			



The independent variables explained 37% ( $R^2 = 0.376$ ) of the variance of satisfaction. Ease-of-navigation has come out to be significant and is in agreement with the previous studies (Roy *et al.*, 2001; Agarwal and Venkatesh, 2002; and Palmer, 2002). Also Information Content was found to be significant, which is again consistent with the earlier studies (Nielson, 1994; Agarwal and Venkatesh, 2002; and Palmer, 2002). Significance of Information Content in this study can be attributed to the website (Google) selected for the study, as it is repository of huge data. Consistency and Format were also found to be significant in the context in which the study was done, because internally, it applies to the consistency of displaying information and externally, when compared with other websites. Insignificance of Ease-of-Use in this study can be attributed to two reasons: First, the website selected for the study is 'www.google.com' and Ease-of-Use factor is implicit for that reason; Secondly, the demographics revealed that majority of the users are experienced users, acquainted with web for more than two years.

## RQ2: Impact of Gender

To see whether gender influenced the relative significance of the website usability criteria, an independent sample *t*-test was performed using gender as the blocking factor. None of them are found to have significant differences in the study, though some of the earlier studies pointed out significant differences in Ease-of-Use criteria in which females consider it to be important in their intentions to use the Internet. The *t*-test results of independent samples are provided in Table 3.

<b>Table 3: <i>t</i>-Tests Results of Independent Samples</b>		
<b>Variables</b>	<b>Levene's Test for Equality of Variances <i>p</i>-Value</b>	<b><i>t</i>-Test for Equality of Means <i>p</i>-Value</b>
Information Content	0.583	0.529
Format	0.890	0.629
Ease of use	0.633	0.936
User support	0.105	0.576
Consistency	0.766	0.556
Design	0.953	0.413
Ease of navigation	0.111	0.393

## Conclusion

Maintaining evenness with other studies (Abdinnour-Helm *et al.*, 2005; and Pearson *et al.*, 2007), this study also has come to the conclusion that website usability is also an important determinant of user satisfaction. Relatively, information content has more significance in the web context. This implies that the web designers should focus more on consistency and accuracy of the

information while designing a website. Besides content, other factors like learnability, navigability, and format also play a vital role in website design. Future research can be done to identify and test other factors that may impact satisfaction, such as timeliness, download delay, use of graphics, etc. With the outspread of information and communication technologies into all spheres of human life, services of modern libraries, museums and archives increasingly drift to the digital environment. Information and communication technologies are approved as one of the key factors, which contribute to the development of the most viable and vibrant knowledge-based society. ✕

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## Appendix 1

Items	Questions
IC1	The website provides information that exactly fit into my needs.
IC2	The website provides up-to-date information.
IC3	The website provides accurate information.
IC4	The website provides complete information.
DS1	I like the design of the website.
DS2	It has answers to most of my questions.
DS3	Site provides clarity and consistency of wording across web pages.
DS4	Color codes used in the websites are easily distinguishable.
DS5	Grouping and ordering of menu options are logical.
FT1	Considering the homepage of the website, I understand clearly how to proceed.
FT2	The flow of the site seems logical to me.
FT3	Considering the homepage of the website, I understand clearly what its goal is.
US1	Site keeps the user informed about what is going on, through appropriate feedback mechanism (e.g., download status).
US2	It always provides Cancel and Help options.
EON1	I can find easily what I'm looking for on this site.
EON2	I'm always able to go back easily to the previously visited Pages.
EOU1	The website is easy to use.
EOU2	The website is user friendly.
EOU3	The user of the website has to be skillful to use it.
EOU4	The user need not be knowledgeable to use the website.
EOU5	The user needs to be a frequent user.
SAT1	I am happy to use the website.
SAT2	I prefer these websites to other sites offering similar kind of services.
SAT3	I would recommend my friends to use this website.
SAT4	I would like to visit the site again.

*Reference # 02J-2009-12-04-01*

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