

Designing Usable Websites with the Usability Engineering Approach

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Abstract

Successful web development requires knowledge and skills in many areas, in particular in an aspect of computing called HCI (Human Computer Interaction) and Usability Engineering.

This paper will combine both approaches and also, how to apply usability methods to website design and how usability methods can be integrated efficiently and effectively into each stage of the website design process. Also it will focus on the user-centered approach utilized in the design process. By combining the knowledge gained from a variety of data collection, to obtaining web site user requirements from the data collected and application of usability engineering development process. This will to developing a highly-usable website.

Keywords: Web usability, User centered design, Usability engineering.

Introduction

Nowadays, the ease of use is now becoming more important than in software development. Usability engineering techniques and the application of usability principles will let developers create more usable products by helping them know their audience, evaluating their user interfaces, and redesigning their software based on user feedback. How usable or user-friendly is this product, service or system?. Is it important to know how usable a product is? How can a product be made more user-friendly? That's the primary question most usability research attempts to answer. Usability or the ease of use has become the most important requirement of designing software and other computer applications. To meet this necessity, usability engineering approach has emerged as a serious field of research. Presently, only a few information systems satisfy usability criteria, resulting in a lot of frustration among users, the reason for this is that the design of these information systems are technology-centered, in which the requirements and needs of the users have not been taken into consideration during the development process. Ceaparu, Lazar (2004) posited that for even experienced users of common personal computers, approximately 45% of their time is wasted with frustrating experiences tied to confusing menus, indecipherable dialog boxes and hard to find functions. These add to the miseries brought by application crashes, network disruptions, and email

spam/viruses. While techno-utopians believe that computing technology has steadily improved over four decades, the fact still remains that it is too unreliable, too difficult to use, and too error prone, also the demands and expectations of diverse users have grown faster than the quality of products.

Another problem with most development methodologies is that they start by identifying what functions a system should support (functional requirements) and designers then go on to design and implement the system to satisfy these requirements, Prior to the release of the system, test engineer evaluate whether the system does what it is supposed to do, Unfortunately, this approach omits the human as a part of the system. Real user are never actually observed using the system, also software developers often pay attention to important product attributes such as functionality, reliability, compatibility with existing systems, manufacturability and reusability. Usability, however, which is the key attribute that can determine a system's success, is often overlooked.

There are also many reasons why many products are difficult and frustrating to use. Rubin (1994) identifies the most common reasons as follows:

1. A broader user base with greater discrepancy between user and designer in terms of skills and expectation
2. System components relating to usability are developed independently by specialised teams.
3. During product development, emphasis is on machine or system, not on the person who is the ultimate end user.
4. Design of a usable system is a difficult endeavour, yet many organisations treat it as if it were just common sense.

Banati et al (2006) identified that with many websites offering similar facilities, the user today has become more demanding in respect of the web access. Users prefer visiting those sites, which are easy to learn and operate and are aesthetically appealing. They concluded that the usability of a website plays a significant role in determining the number of hits to a website. That is why the usability

engineering approach to the design of an information system begins by analyzing the user's needs and setting usability goals for the intended system. Nielsen (1993) developed an approach to software design methodology known as the usability engineering lifecycle. This software design methodology has a heavy focus on the user of the software and it also has many forms of usability testing. This methodology begins by analyzing the user's needs and setting usability goals for the intended system. The usability engineering lifecycle as proposed by Nielsen consist of the following eleven stages:

1. Know the user
2. Competitive analysis
3. Setting usability goals
4. Parallel design
5. Participatory design
6. Coordinated design of the total interface
7. Apply guidelines and heuristic analysis
8. Prototyping
9. Empirical testing
10. Iterative design
11. Collect feedback from field use.

The importance of this approach is that one should not rush straight into design and a lot of work should be done at the beginning on getting to know the user, gathering requirements and setting usability goals. Usability engineering involves several methods, each applied at appropriate times, which includes gathering requirements, developing and testing prototypes, evaluating design alternatives, testing with users to establish usability problems in the design, redesigning and addressing problems uncover from usability evaluation. It is an iterative design process.

Objectives of This Study

1. It is the goal of this study to help developers realize that developing a computer application or a web site is not something to be done at the last minute.
2. To teach programmers on how to apply human factors principles and guidelines in the design and critical evaluation of interactive designs
3. To show the importance of an iterative and evaluation-centered life cycle for website or information system development.

What is Usability?

Usability in ISO/IEC 9126 is defined as "The capability of the software product to be understood, learned, used and attractive to the user, when used under specified conditions". Usability can further be defined as a quality attribute that assesses how easy user interfaces are to use. The word "usability" also refers to methods for improving ease-of-use during the design process.

Usability Metrics

Different scientists have proposed different criteria to measure usability, but it can generally be measured by the following metrics:

- i. **Learnability:** How easy is it for users to accomplish basic tasks the first time they encounter the design?
- ii. **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.
- iii. **Errors:** How many errors do users make, how severe are these errors, and how easily can they recover from the errors?
- iv. **Satisfaction:** How pleasant is it to use the design?

Factors Influencing Web Usability

Banati et al (2006) in their work on evaluating web usability from the user's perspective stated the factors which can influence the usability of a website as follows:

- a) **Stakeholders of the Website:** A stakeholder is an individual or an organization who is affected by the performance of the website. There are three main categories of the stakeholders, " the actual users", " the designers" and " the organization hosting the website". All these perceive usability of a website in a different light.
- b) **User Profile:** The age and the cultural upbringing of the user influences the way a user uses a website.
- c) **User Experience:** The experience of user includes different parameters such as the computer knowledge, the amount and the frequency of usage of Internet by the user and the kind of work the user uses the Internet for. On the basis of experience the users can primarily be classified into novice, expert and professional users.
- d) **Type of website:** Websites can primarily be classified into 3 main categories, the information-oriented websites, the service-rendering websites and the business-oriented websites. This classification is based on the prime purpose the website is intended.

What is Usability Engineering Approach?

“Usability Engineering is an approach to the development of software and systems which involves user’s participation from the outset and guarantees the usefulness of the product through the use of a usability specification and metrics” (Faulkner, 2000). It is an approach to the development of information system, with a greater user involvement in the design process and with a greater concern for the usability of the system.

Faulkner (2000) also presented the various stages of the usability engineering lifecycle task and the information produced that could be used in designing usable websites in a table as shown in figure 1 below.

Task	Information Produced
Know the user	
User characteristics	
User background	
Know the task	
User’s current task	
Task analysis	
User requirements capture	
User requirements	
Setting usability goals	
Usability specification	
Design process	
Design	
Apply guidelines, heuristics	
Feedback for design	
Prototyping	
Prototype for user testing	
Evaluation with users	
Feedback for redesign	
Redesign and evaluate with user	
Finished product	
Evaluate with users and report	
Feedback on product for future system	

Figure 1: table showing Faulkner’s various stages of the usability engineering lifecycle.

Usability Engineering Approach is a new and promising method of designing software/systems that are easy to use based on customer data and feedback.

Jean E Fox, (2000) talked about the use of usability principles in designing a user interface in his paper on Usability methods for designing a computer-assisted data collection instrument, he concluded that from the start, the development process should employ a “User-centered design approach, meaning that strong emphasis should be placed on meeting the needs of the

users and involving them throughout the design and development. This will lead to producing a highly usable product. Battilana (2008) in his paper on “User centre design and Usability: its role in a project” postulated that user centred design is a process focussed on the design of information systems that cater for the end user for the purposes of most effective and efficient way of maximising usage. According to Deborah J Mayhew, Usability Engineering approach to software design is necessary to avoid the following problems: Low productivity, Costly User errors, High training cost, High customer support cost. Dedorah J Mayhew also in her work about usability approach to software development came out with a methodology for producing a highly usable system also called “The Usability Engineering Life Cycle”, it is made of the following steps:

- 1 Obtaining Usability goals from requirements analysis and using it to drive the design.
- 2 Applying a structured approach to User Interface design.
- 3 Applying iterative evaluation techniques towards usability goals.

The usability engineering process for developing an information system is presented as shown in figure 2.

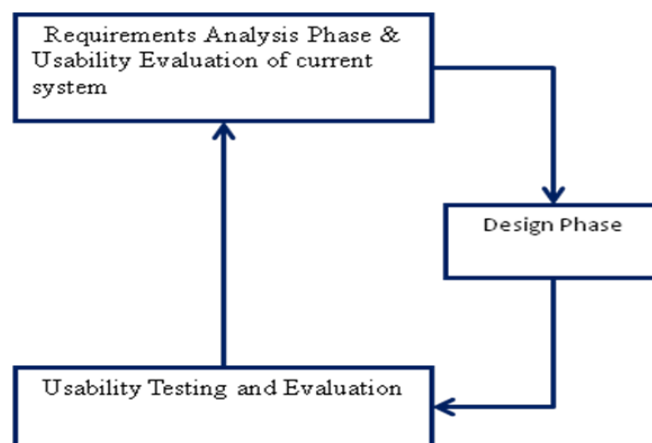


Figure 2: Usability Engineering process (Self Adapted)

The process shown above is an iterative design process which will analyse/design, evaluate/decide, and redesign to ensure that most usability problems are covered in the software development process.

This model also shows most of the factors that should be considered before designing an information system, these are results of evaluating previous version, guidelines and

standards based on human factor research, requirements derived from task analysis, experience with other systems.

In other words, it is now possible to design very good information systems whereby the ease of use of these information systems can only be guaranteed if it is design and developed with a thorough knowledge of who the users are, what task they want to achieve, that is using the usability engineering approach.

Benefits of Usability Engineering

The benefits derived from using the usability engineering approach are:

- It saves cost
- It minimizes application maintenance
- It improves quality
- It increases productivity
- It minimizes training time
- It increases customer satisfaction

Interfacing Usability Engineering in Web Development Process

The stages involved in the design of a website design are Planning, Analysis, Mockups and Prototypes, Production, Testing, Launch, and Maintenance. Some of these stages involve usability evaluation and redesign. Following is a summary of these stages and some of the techniques that can be use to integrate usability into the development process.

Planning

During the planning phase, a project plan is formulated with information about budget, necessary resources (e.g. software), and personnel who need to be involved. At this point, a usability plan is created to clearly specify the target user population, their expected use of the website, and the type and depth of usability evaluation to be performed.

Analysis

In an initial design session with the client, requirements are determined with help from an interview form which identifies the main user requirements. When users are accessible, straightforward interviewing and questionnaire approaches can be used to gather further user requirements. Technical requirements must also be determined early, such as the need for special database, multimedia or security elements. Although somewhat orthogonal to usability, the available technologies can impose severe restrictions on interface design. With requirements in hand, usage scenarios, user-modelling, and other forms of analysis can be conducted as needed.

Mock-ups and Prototypes

Simple sketching and Paper prototyping involves creating mock-ups of the system screens with enough detail to demonstrate the system. Users work through scenarios on the system while a facilitator shuffles screens. These drafts and prototypes can then be evaluated using functional checklists, usability inspection checklists, task analysis, and with user testing and user feedback and redesigning. Effort should be made to arrive at a final design by the end of this stage.

Production

As design documents and mock-ups are finalized, the designer of a website refer to sets of rules (for content such as text, graphics etc) to develop the details of the design and transform that design into a final system.

Testing and Launch

Usability testing should be done throughout the production process, and meeting usability specification determines when a website can finally be launched. Iterative Usability testing and client feedback are also crucial to identifying final problems.

Maintenance

Website maintenance should be accounted for during the initial planning stage, but this can change during the course of product development. Documentations and design guidelines developed during the production process can be used for maintenance purposes.

Twelve Guidelines for Developing a Usable Web Site

1. Involve users from the beginning by:

1. Discovering their mental models and expectations
2. Including them as an integral part of the design/development team
3. Observing them at their workplace, analyzing their tasks and goals
4. Collect feedback via walk-through, paper prototypes, think-aloud sessions, and other methods

2. Know your users profile

Ask questions such as the following and use the answers to guide development and design decisions:

- How much experience do the users have with: Computers and The Web
- What are the users' working/web-surfing environments?
- What hardware, software, and browsers do the users have?
- What are the users' preferred learning styles?

- What language(s) do the users speak? How fluent are they?
- What cultural issues might there be?
- What relevant knowledge/skills do the users already possess?
- What do the users need and expect from this web site?

3. Analyze user tasks and goals

Observe and interact with users (preferably at their workspace) as you attempt to answer questions such as:

- What are the tasks users need to perform; how do they currently perform these tasks?
- Why do the users currently perform their tasks the way they do?
- How do users discover and correct errors?
- What are the users' ultimate goals?

4. Test for usability—repeatedly!

It is important to conduct usability testing throughout the development cycle. Usability testing is the only way you can know if a particular site meets users' needs.

5. Visibility

Make important elements such as navigational aids highly visible so users can determine at a glance what they can and cannot do.

6. Memory Load

Make screen elements meaningful and consistent across the site to reduce memory load. In this way, users do not have to remember what the elements mean from one page to another. Relate new items and functions to ones the user already knows by maintaining a consistent page look and layout.

7. Feedback

Provide immediate feedback when a user performs an action. For example, when the user clicks a button, something on the screen should change so the user knows the system has registered the action.

8. Orientation/Navigation

Help users orient themselves by providing the following navigational clues:

- Descriptive links
- A site map
- Obvious ways to exit every page

- Clearly visible elements on each page that inform users where they are in relation to other pages and how to navigate to other pages

9. Errors

Minimize user errors by avoiding situations in which users are likely to make mistakes. Also try to accommodate incorrect actions by users so they can recover quickly.

10. Satisfaction

Make your site pleasant to use and view. Users' satisfaction with the interface influences their

- Perception of ease-of-use.
- Motivation for learning how to use the site.

11. Language

You can improve usability by incorporating the following stylistic elements:

- Concise language
- Everyday words instead of jargon or technical terms

Because the Internet crosses cultural and national boundaries, be careful with ambiguity. The following stylistic elements can be misinterpreted easily:

- Humour (Humour have different meanings across cultures).
- Metaphors
- Icons
- Idioms

12. Visual Design

The aesthetics of a website interface play an important role in communicating information and tone to your users effectively. As you develop your site, some visual design strategies should be taken into consideration

Conclusions and Recommendations

The significance of this study is most appropriate to product developmental processes. Application of the twelve guidelines stated in the study will lead to developing highly usable websites. The use of the usability engineering approach to web development offers many benefits, among them are: reduction of failed products, reduction in development time and costs, reduction in training and support costs for end users, increased sales and revenues for website owners and increased productivity.

The usability engineering approach is highly recommended when designing not only websites but also other types of information systems because users are actively involved in the design and development of the product, this will lead to developing a highly usable product compared to most other design methodologies where designer often assume a lot about the users and then designing a product which users will not find easy to use.

This study recommends that users need be taken into consideration and also identify what characterizes usable websites, problems of usability, qualities and all that is involved in the developing a highly usable website.

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