USABILITY AND HUMAN COMPUTER INTERACTION IN DEVELOPING WEBSITES: AN AUSTRALIAN PERSPECTIVE

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ABSTRACT

This paper discusses the barriers to, and potential impacts of, adopting usability and Human Computer Interaction (HCI) principles in developing websites for marketing purposes. The poor usability of many websites wastes users' time, and increases their frustration. This paper will discuss how usability and HCI aspects were included in a new methodology for developing websites for marketing, to reduce user frustration and to improve the website capabilities. This new methodology was developed after intensive study of methodologies from different disciplines, parts of which were combined in an integrated approach. The new methodology was assessed by two research phases: interview and questionnaire. This paper includes only two aspects of the full research process: an overview of the research methodology; and discussion the results from the interviews and questionnaire, focusing on usability and HCI aspects.

KEYWORDS

Developing Websites, Usability, Human Computer Interaction and Integrated Methodology.

1. INTRODUCTION

The Internet is an important communication tool linking massive numbers of users. This technology provides numerous benefits to users in relation to access to information, business transactions and entertainment. In addition, the Internet allows *"consumers to educate themselves about the information or products at their own pace. Furthermore, the consumers can instantly access only that information which is pertinent to their needs"* (Issa 1999). The key principles behind designing a website are *"to help people find the content they need quickly and to present content in the most readable format"* (McCracken & Wolfe 2004, p.27). However, some people try to mimic successful sites by copying attractive images off the internet and they create their home page without the basic knowledge of design principles. Hence, the website will never have a kind of unity, since the graphics and the texts were written and created by different writers and designers, and it will *"stay a jumble of loose parts, lacking coherence"*. However, *"If you make your own site, it is your work. It will radiate something of your personality, your preferences and your taste"* (Hoekstra 2000).

To create an effective website, designers and users need to work together with a specific methodology to create a website that meets the requirements of the users and encourages them to revisit the website. This requires that these users feel comfortable, confident and satisfied working with the site. To ensure that a website interface is easy to use, usability and HCI principles should be applied in the website design to ensure: *"Learnability (how easy is it for users to accomplish basic tasks the first time they encounter the design), efficiency (how quickly can users perform tasks?) and user satisfaction (how pleasant is it to use the design?)"* (Cappel & Huang 2007, p.117). By adopting these principles, the users will be less frustrated and make fewer mistakes.

The usability of a system is *"the capability in human functional terms to be used easily and effectively by the specified range of users, given specified training and user support, to fulfill the specified range of tasks,*

within the specified range of environmental scenarios" (Shackel 2009, p.340). Usability is especially important for marketing websites. For example, user satisfaction and sales in e-commerce shopping sites will increase due to high usability of websites. Usability *"has been shown to be a key factor when the services of an organization use the Internet"* (Flavian, Guinaliu & Gurrea 2006, p.2). Trent Mankelow (2006, p.53) corroborates that with good usability several advantages will be bestowed on the business by *"increasing sales, reducing costs and boosting labor productivity, staff take less time to train, are more productive and make fewer mistakes"*. In addition, *"the costs of development, maintenance and support decreases and clients have a better experience of dealing with your business"*. Furthermore, Flavian, Guinaliu & Gurrea (2006, p.2) declared *"website usability is a very important part of the store's image and (that) it can influence shopping behavior in a similar way to those aspects of traditional establishments"*. However, poor usability in website design can cause various negative consequences: *"user frustration, discourage exploration; waste of time and increase Internet traffic"*(Borges, Morales & Rodriguez n.d.).

The purpose of this paper is to briefly describe some of the research processes that sought to construct and evaluate a more effective, participative methodology for developing websites with high usability. There is only space in this paper to cover some aspects of this research. Other summaries of the research are provided in Issa and Turk (2009) and Issa, Turk and West (2010).

2. BACKGROUND

In the past Human Computer Interaction (HCI) has often *"concerned itself almost exclusively with effectiveness and efficiency with satisfaction being regarded mainly a by-product of great usability"* (Lindgaard & Dudek 2003, p.430). However, HCI should seek *"to understand and support human beings interacting with and through technology"* (Carroll 1997, p.62). Usability is the *"extent to which a system with [a] given functionality can be used efficiently, effectively, and satisfactorily by specified users to achieve specified goals in a specified context of use"* (Te'eni, Carey & Zhang 2007, p. 2-3).

Frustration is a major potential problem for users dealing with websites, email facilities or using other software applications. This frustration can often result from errors in computer hardware, software or networking design or poor integration of system components (Ceaparu et al. 2004). Furthermore, if the user's goal(s) are unsatisfied, frustration will occur, since *"satisfaction was not achieved and hopes were suddenly thwarted. The thwarting or hindrance – terms often used synonymously with frustration – is not limited to the actual activity in progress, but relates to what the individual is expecting"* (Lazar, Jones & Shneiderman 2006, p.240).

Frustration in website use often occurs in response to navigation problems, resulting in users being misplaced in the web. Usability is related to *"consumer ability to know where s/he is at any time and what can be done"* (Flavian, Guinaliu & Gurrea 2006, p.3). Designers and users should take into consideration this aspect in their website design, by having text-based navigation instead of graphic navigation as it *"loads faster and graphical navigation can provide problems for users with disabilities"* (Lazar et al. 2003, p.20). In addition to this, testing should be performed with users *"to ensure that the descriptions of navigational links are clear and that the content is organized into topics that generally match the user's model of how the content should be organized"* (Lazar et al. 2003, p.20).

Frustration can also result from long website loading times: *"the longer the wait for pages to load, the greater the frustration, which could lead users to quit the task or try another site to find information"*(Selvidge 1999). To prevent this problem, designers and users should work jointly in designing websites that *"decrease download time, such as limiting unnecessary graphics"* (Selvidge 1999). Kelly (2007, p.49) stated: *"A good professional website designer should be able to create your website so that it loads quickly"* and *"If your website takes a long time to load, it affects the trust and credibility your visitor has with you"*.

Therefore, it is important that a website development methodology take into consideration the principles of usability and HCI to avoid user errors and reduce user frustration. Involving users in the design from the beginning will assist the website to be more approachable, friendly and interesting and winning the trust of the site visitors by meeting users' requirements.

3. RESEARCH METHODOLOGY

The main objective of this research was to develop an integrated website design methodology and to confirm whether or not it will help the designers to meet users' requirements. There were also several minor research objectives, as follows:

- To investigate whether the website development process will benefit from participation by both end-users[1] and client-customers;
- To consider how designers can address the issues of usability, HCI, iteration and real interaction;
- To evaluate whether or not this new methodology will satisfy the needs of the website industry in Western Australia;

An interpretive (qualitative) approach was used in this research, as such approaches "*attempt to understand phenomena through the meanings that people assign to them*" (Myers & Avison 2002, p.6). Interviews and questionnaires were used to allow the researcher to collect an extensive variety of information from participants in the Western Australian website development industry and from information systems (IS) professionals[2].

The research commenced with a study of various methodologies from computer-based systems development, information systems, web sites and marketing. This analysis provided a "*model which aims at describing information systems methodologies, their structure, scopes, paradigms, approaches, principles, emphases, usability, coverage, flexibility and general applicability*" (Kangassalo et al. 1993, p.218). From the information obtained a New Participative Methodology for Developing Websites from the Marketing Perspective was developed. This methodology will help the designers and users to fill the gaps in the current methodologies and to avoid the frustration, which is currently experienced, by website users.

Interviews were utilized in this research to explore the type of methodology, tools and techniques that are adopted by the website development industry in Western Australia and to learn more about their technical expertise and knowledge of how to develop a website. The interviews were also used to obtain expert feedback on the prototype new methodology; and to generate the questionnaire for the second phase of this research. The online questionnaire was developed from the interviews after analyzing them "*to derive categories for questions that focused on the primary expectations expressed by interviewees*"(Kaplan & Duchon 1988, p.578).

The main purpose behind using the questionnaire approach was: 1) to evaluate the "practicality" and "benefits" of adopting the proposed new methodology in the website industry in Western Australia. 2) To consider the various requirements for promotion and adoption of the methodology, and 3) to evaluate whether it is possible to achieve effective user participation in website design, via the new methodology. The aim was to find out how practical the new methodology is likely to be in the real world industry environment.

4. NEW PARTICIPATIVE METHODOLOGY FOR DEVELOPING WEBSITES

To create any interface (or website) successfully designers and users should utilize a specific methodology, which allows them to generate a system, which matches the user's needs. A methodology should have stages and steps that need to be followed to complete the job productively. A 'stage' is a "*convenient breakdown of the totality of the information systems life cycle activity*", while a 'step' is "*the smallest part of a design process*" (Olle et al. 1988, p.21). The sequence of the stages and steps may not always be fixed. In some projects, iteration between stages will occur, which may "*take different forms and thus impact differently on what one can do with a methodology*"(Olle et al. 1988, p.30). The adopted methodology in any interface development should aim to achieve "*better end products (meeting user demands); a better development process (improving developer control and productivity); and a standardized process (enabling better systems*

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[1] This research distinguishes between two types of users: end-users (internal to the client organization) and client-customer users (external). End-users (Internal) are the real users in the client organization, who test and evaluate the website and use it to respond to the client-customer's queries. The client-customer users (external) are those who interact with the website to accomplish their goals such as purchasing goods or services from the client organization

[2] The companies and IS professionals in Western Australia is considered broadly representative of the industry throughout Australia.

integration and the benefits of a common approach in an organization) "(Avison & Fitzgerald 2003, p.80). For these reasons, a designer needs to understand users' requirements for the project before choosing the most appropriate methodology, in turn to successfully complete the work and to accomplish profitable results; this is a 'contingency-based' approach (Turk 2001).

The new participative methodology for development websites was developed after studying methodologies including lifecycle models; IS development methodologies; methodologies with explicit human factors aspects; websites methodologies; marketing methodologies; and additional detailed techniques such as task analysis and detailed website design and implementation. Firstly, the researcher reviewed the methodologies in this sequence to identify two aspects: 1) the stages needed for the system development process; and 2) the facilitation of the four key principles (user participation, usability, iteration, real interaction). Secondly, the information systems development methodologies were checked to assess how effectively they implement the four key principles at each stage and to identify the strongest stage in each methodology. In addition, the research identified extra stages, to be added to the new methodology; navigation, promotion and staff training. Finally, additional techniques (i.e. task analysis and detailed website design and implementation) were added to appropriate stages.

The overall structure of the new participative methodology for developing websites (see Figure 1) was adapted from the Star Lifecycle model (Hix & Hartson 1993), with the evaluation and testing stages at the center of the methodology. This indicates that the designers and users will evaluate and test each stage before moving to another stage. In this new methodology, there are processes, tools and techniques for each stage and step, which need to be carried out by the designer in order to achieve a user-friendly website (see Figure 1).

The usability and HCI goals are part of the design stage. This stage will utilize the requirements specification from the analysis stage to define: 1) what the website is; 2) how the website will work; 3) user involvement in decision-making; 4) future users; 5) usability requirements. The HCI and Usability Goals step will allow users (end-user (internal to the client organization) and client-customer (external)), analysts, and designers (internal and external) to confirm that the website design is efficient, effective, safe, has utility, is easy to learn, easy to remember, practical and provides satisfaction. There are many specific issues that need to be taken into consideration when designing website pages, such as text style, fonts, layout, graphics and color.

In addition, it is important to define the specific navigation paths through the website between the entities and to establish effective communication between the interface and the hypermedia application. The prototyping step is essential in the website design process to allow users and management to interact with a prototype of the new website to evaluate its effectiveness. This step will allow the management to reduce costs and increase quality through early testing.

5. EVALUATION OF THE NEW METHODOLOGY

To evaluate the new methodology the researcher collected information from IS professionals and designers involved in the website development industry in Western Australia[3]. This research was divided into two phases; interview and questionnaire.

The researcher provided details of her prototype new methodology and discussed it in detail with the interviewees. The interviewees raised questions concerning the prototyping, testing, evaluation, implementation and maintenance stages, and about tools to encourage user feedback. From the interviews, the researcher derived several conclusions concerning the four key principles for this research and the various stages of the proposed new methodology. There is not sufficient space in this paper to discuss all aspects of the interviews; hence, the remainder of this section concentrates on discussion of the HCI and usability topics.

Usability and design for effective HCI are important elements in the New Participative Methodology for Developing Websites from the Marketing Perspective. These aspects are considered indispensable in order

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[3] On the Australian Web Industry Association website, there were 35 web industry companies listed in Western Australia. The researcher sent a collaboration invitation letter to 29 of these 35 companies. Interviews were held with representatives of nine companies (about 25% of WA companies) and sixteen company representatives and Information Systems professionals completed the questionnaire.

to produce a usable, effective, efficient, successful, trustworthy, user controlled, navigationally sound, speedy and secure website for the end-users and client-customer users.
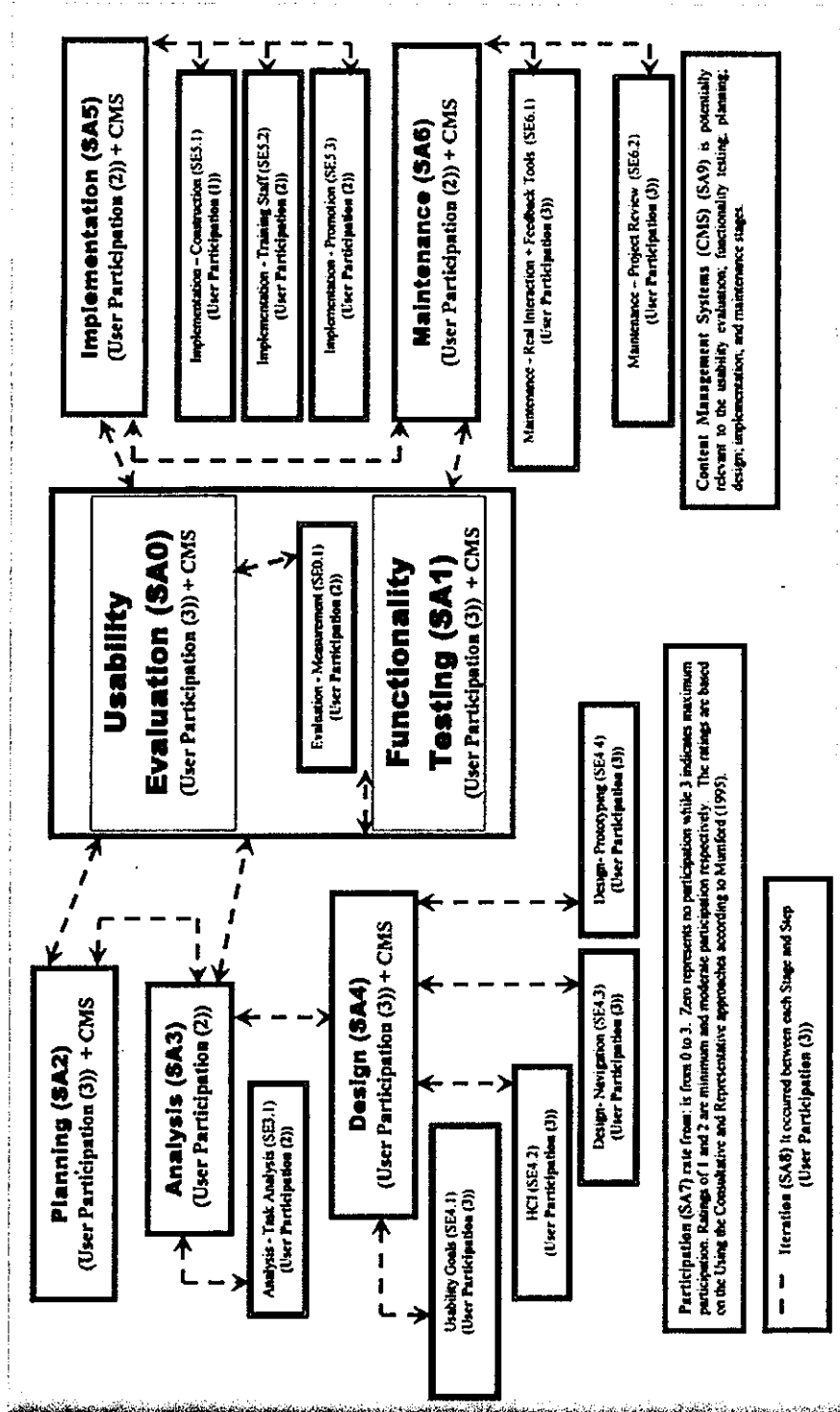

Figure 1. New Participative Methodology for Developing Websites

The five goals of the discipline of HCI are *"to develop or improve the safety, utility, effectiveness, efficiency and usability of systems that include computers"*(Diaper & Sanger 2006, p.119). According to Te'eni et al.(2007, p.22-23), the study of HCI is *"not confined merely to the interface between the computer and user"* but should be used to: *"develop more usable and successful systems; provide researchers with cohesive and cumulative knowledge for theory building, and; apply this theoretical knowledge to enhance real information systems"*.

During the interviews, most of the interviewees agreed that usability is critical to the development process to produce websites where users can *"find information quickly and easily"* (Company A). It will help the website to be *"free from bugs, with good navigation,"* (Company D), and *"to avoid frustration"* (Company B). According to Company C, *"Usability is very important from the marketing perspective to ensure that the application achieves the goals of the application"*. However, after reviewing the industry methodologies, it became obvious that usability techniques were often not clearly defined. In other words, this technique is not considered as an explicit step in any stage but is an implicit part of some stages. For example, Company F stated, *"Usability is available in the first two stages in our methodology"*; these stages identify the business requirements and define what the client wants. Company A declared that usability techniques are *"available from the beginning of the design until to the end"*.

The term 'Human Computer Interaction' was new to most of the companies, with most participating web designers not recognizing the term, and therefore it has not been adopted in the terminology of their methodologies. The research concluded that more techniques for implementing HCI principles are needed in website development methodologies used by industry.

After examining the data gained concerning all the topics from all the interviews, the researcher identified the new information about methodologies provided by the industry. This was very useful for revising the New Participative Methodology for Developing Websites from the Marketing perspective, as it assisted the new methodology to become more practical. Designing the questionnaire involved interpretation of the interview data and analysis in the context of the research questions. The questionnaire was divided into seven parts, with each part addressing one key aspect of the research: User Participation; Real Interaction; Usability and HCI; Iteration; New Methodology for Developing Websites; General Questions; and Background Information.

A Likert five-point scale was used in each part of the on-line questionnaire to *"examine how strongly subjects agree or disagree with statements"* (Sekaran 2003, p.197). The researcher also provided a section for participants to write down other comments regarding each set of questions. The 16 participants who completed the questionnaire were drawn (in equal numbers) from the website companies who participated in the interview phase and IS professionals (to obtain the IS perspective regarding the new methodology, since most of the industry participants had degrees in multimedia and communication technology, but few had an academic background in Information Systems).

All of the participants strongly agreed that usability is a very important aspect of the website development process. However, about half thought that usability issues are hard to work with, especially with immature clients, since it takes time and money to learn the concepts behind it. This has led some members of the industry in Western Australia to start teaching their clients (old and new) about the benefits of adopting usability principles and techniques in the website development process.

From the participants' responses, 75% agreed that adopting usability principles in the website development process will increase the clients' profit, and 94% agreed that adopting usability principles in the website development process would encourage client-customer users (external) to revisit the website. Significantly, 94% of responses from the industry and IS Professionals agreed that HCI techniques should be part of the website development process since it is concerned with design, evaluation and implementation of interactive computer-based systems. This statement is considered very important to this research since current industry's methodologies were missing key HCI aspects. Similarly, 53% of the industry participants and IS Professionals agree that by adopting HCI techniques in the website development process, the client' profit will be increased, and 87.5% agree that usability and human computer interaction techniques should be part of the website development process to improve the structure and functionality of a website.

Participants' comments also supported the significance of Usability and HCI: *"Usability is a very important aspect of the website development process .... and usability is a measure of a certain quality of a website. The quality of usability is created during the process..."* (Company I). Furthermore, a participant from Company H stated *"Good HCI practices need to be put into practice, rather than just HCI fads. Solid understandings of HCI are often overlooked when new technologies or revisited technologies are distributed*

(eg AJAX), which break many user learned conventions". However, IS Professional 5 stated, *"While usability is very important, many other factors influence visits to the site and profitability".*

After reviewing the entire questionnaire responses from the Industry Participants and IS Professionals, it was clear that there was strong support for the proposed new methodology. The only key additional insight gained from the questionnaire regarding the structure of the new methodology was identifying use of HCI design principles as a separate step under the design stage. The rest of the stages and steps remained the same.

6. CONCLUSION

This paper discussed the development of a new participative methodology for development websites. Usability and HCI aspects were identified as very important, especially for marketing websites. Most of the industry participants agreed that these aspects would enhance the business by increasing sales, reducing costs of website development and maintenance, and that the clients will be pleased with the outcomes of the website. The researcher is currently running a postgraduate course to introduce the benefits of adopting usability and HCI aspects in website development process as from the interviews and questionnaire it was noticed that most of participants have limited knowledge with respect to the Usability and Human Computer Interaction (HCI) aspects. In the future, a similar course will be run for the industry to encourage the adoption of usability and HCI techniques in their website development methodologies. In addition, the new participative methodology for developing website will be introduced as a part of these courses, by providing detailed information about how this methodology was created and discussing the stages, steps, tools and techniques, which are part of this methodology. The courses will also discuss how the new integrated methodology needs to be "contingent" and how to implement this approach.

The researcher also plans to develop a website about the new methodology (in a similar style to the UsabilityNet (www.usabilitynet.org) website). This website will incorporate a software tool to facilitate selection of particular stages, steps and techniques from the contingent methodology to produce a tailored methodology for any specific project (including to project objectives, budget, time available, etc.). This means that the researcher will assist the designers to select the most appropriate stages depending on the situation.

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