User Interface Design Practice for Web sites and Web-Based Applications in New Zealand

A thesis presented in partial fulfillment of the
requirements for the degree of

Masters

in Information Systems

at Massey University, Albany campus, New Zealand

Ramesh Lal

Monday, August 16, 2004

DECLARATION

This is to certify that the research carried out for the Masters thesis entitled "User Interface Design Practices for Web sites and Web-based Applications in New Zealand" was done by Ramesh Lal in the Information Systems, Massey University, (Albany), New Zealand. The thesis material has not been used in part or in whole for any other qualification, and I confirm that the candidate has pursued the course of study in accordance with the requirements of the Massey University regulations.

Supervisor's Name

SCOTT P. OVERMYER

Signature

Date

14-07-04

Candidates Name

RAMESH LAL

Signature

Date

14-07-04

Abstract

The research regarding user interface design practices for Web sites and Web-based applications revealed that there is very little awareness in the industry in New Zealand of usability issues. There is general lack of education, knowledge, and skills in usability methods, processes, and techniques amongst designers and developers. Generally speaking universities in New Zealand have not kept up with global changes in human – computer interaction (HCI) education. Most universities in New Zealand offer one or two HCI courses within their information technology undergraduate degree programmes, and those are not compulsory for students to study. Conversely, HCI has become a major area of study in universities from Australia, US, and the UK where usability is a major industrial concern. One possible reason for this is that New Zealand universities do not offer cognitive psychology and social science courses with information technology major to make HCI courses more relevant for students who study HCI.

Table of Content

Chapter 1

1.1 Introduction

The use of the Internet in scientific and research communities in New Zealand has grown swiftly from just a few users in the early 1990s to hundreds of thousands by 2004. Most of the growth of New Zealand Internet during this period has been the result of an increasing number of businesses providing information about their products and services via the Web on informational sites, and at the same time some going on-line to do business by electronic commerce (e-commerce).

Statistics provided by Statistics New Zealand in 2002 reveal that the number of New Zealanders with Internet access at any location has grown from 16 percent in 1996 to nearly 70 percent in 2001. These figures show that New Zealanders have adopted the Internet rapidly. They also show that there is a huge opportunity for businesses in New Zealand to use the Internet to make their services and products easily available to new customers outside their traditional marketplace.

The statistics on Information Technology provided by Statistics New Zealand in 1999 state that by March of the same year New Zealand had over 15,000 Web sites of which 13,000 were commercial Web sites. On the other hand Jakob Nielsen (2000), the guru of Web site design, had predicted that by 2003 there would be 200 million Web sites around the globe. This provides people who have access to the Internet with a vast range of alternatives and choices. So for New Zealand businesses, while the Internet provides a huge local and international marketplace, it also provides competition from many other business organizations that offer similar products and services.

According to Powell (2000) Web sites can be characterized in to various types such as: (a) commercial sites, (b) informational, (c) entertainment, (d) navigational, (e) community, (f) artistic, and (f) personal. Whilst the majority of Web sites in New Zealand are purely informational sites, there is a growing number of business Web sites that are engaging in e-commerce. One of the

main reasons why many business organizations have Web sites is that it gives them a competitive advantage, while others go online to match competitors who already have a presence on the web. As a result, in New Zealand and elsewhere, many Web sites have appeared overnight, which are not only poorly designed, lacking required functionality, but completely ignore the usability requirements.

In today's competitive marketplace many business organizations believe that their Web site is the gateway to the information, products and services it provides to the public, but many of these Web sites do not meet the needs of the customers and users they are trying to serve. Many of these Web sites are technology driven, reflecting the current state-of-the-art technology and it appears that Web site design and development is based entirely on the organization's business functionalities with no consideration given to usability factors. In the opinion of the researcher, it appears that the majority of New Zealand Web sites have been designed and developed with very little or none at all of the necessary ground work such as a user study to base their design decisions on. There also appears to be no formal processes, techniques or methodologies involved which enable businesses to design and develop usable Web sites.

The www.webdirectory.natlib.govt.nz/index.htm that belongs to The National Library of New Zealand, www.nzs.com, and www.piperpat.co.nz/nz/index.html are three New Zealand Web sites that provide a compressive Web directory that lists all the New Zealand companies and organizations that have Web presences.

In the opinion of the researcher, it appears that the majority of small to medium business organizations in New Zealand had their Web sites designed and developed by Web development companies, and the majority still have the content of their site updated and maintained by them. It is also worthwhile to note that some of the small business organisations had their Web sites designed and developed by students as part of their projects.

A count of Web development companies in the last two years of The Net Guide publications, a New Zealand computer magazine that provides a list of Web development companies in New Zealand, reveals that presently there are about 80 such companies. Large business organisations, government departments and tertiary institutes in New Zealand now have their own Web development team, but the majority of them had their initial Web sites designed and developed by Web development companies.

It appears that most Web development companies in New Zealand are small, with no more than 2 to 3 staff members, and only a few will have more than five members as part of their design and development team. Also at present, it appears that the majority of Web development companies in New Zealand do not have a team member who has education, qualification or skills in usability or HCI.

In the last five years Web site owners and developers, in particular from America and from European countries, have recognized and addressed the issue of usability. Due to stiff competition, many companies that have gone online are now paying serious attention to the user interface design of their Web sites in order to make their Web sites more accessible and usable for their users and other Web surfers.

The tertiary education providers in America, Australia and in European countries have gone a long way to provide the necessary qualifications and training in the area of HCI so that industry has access to graduates that will enable them to design and develop usable and user friendly Information Technology products. The HCI (Human-Computer Interaction) Webliography (www.hcibib.org/education) that provides resources on HCI lists 61 universities worldwide, including 34 universities from America and 4 from Australia, that provide IT courses and offers sufficient papers to enable students to do a major in HCI for undergraduate degree programmes. These universities also have the required resources and facilities for students to pursue postgraduate study leading into masters and doctoral programmes in HCI.

The need to develop knowledge and train students in this field has led to some of these universities having a separate HCI department from the computer science and information systems departments. These universities also have a usability lab that plays a huge part in teaching HCI papers, and also in research and development in this area.

While none of the major New Zealand universities are listed by HCI Webliography (www.hcibib.org/education) as a provider of courses that would enable students to do a major in HCI, it lists HITLABNZ (Human Interface Technology Laboratory New Zealand) as a research lab in HCI, which is hosted at the University of Canterbury in Christchurch in partnership with the HITLABUS that is based at the University of Washington.

HCI Webliography (www.hcibib.org/education) has listed only two consultancy firms in usability or user interface design in New Zealand. The very low number of consultancy firms is another reason that suggests that New Zealand businesses are still not aware of the importance of dealing with usability issues in business Web sites. The United States of America and European countries have seen the emergence of many consultancy companies in the user interface design area that produce effective and usable user interfaces for Web sites and Web-based applications, and also for other application software. HCI Webliography lists 295 usability consultancy companies worldwide which include: (a) 12 in Australia, (b) 125 in USA, and (c) 21 in UK. It also list usability consultancy companies from other European countries such as from Switzerland, Belgium, Sweden, Spain, Norway, Netherlands, Greece, Germany, Finland, France, Ireland, Denmark and from the rest of world such as Canada, India, Israel, Singapore, and South Africa.

The Nielsen Norman Group (www.nngroup.com/events), which is a US consultancy company led by Dr. Jacob Nielsen, who is one of the most influential usability professionals, has been regularly presenting seminars and tutorials in Australia that deal with usability issues of Web sites. These seminars and tutorials have created increased awareness in Australia about the importance of creating usable user interfaces of Web sites. It appears that

these kinds of seminars and tutorials for academics, developers and owners of Web sites have never happened in New Zealand.

The Engineering Group (www.uie.com), a usability consultancy company headed by Jarred Spool, has been regularly running conferences and tutorials on the usability of Web sites in the US and UK. Based on their research and experiences, Spool's group has been teaching Web developers new techniques, processes and methods to create usable Web sites. New Zealand also lags behind in these kinds of usability conferences and tutorials.

In New Zealand the traditional business sectors such as banking, airline travel, education, retail and groceries are increasing their presence on the Web, and some are going online to do business by adopting e-commerce. Various New Zealand local and central government departments now have an online presence that provides information and services to both local and international users. It is very important that these Web sites are easy to learn and use since usability is a prerequisite for survival on the Web.

New Zealand Web site owners have to quickly realise that Internet users, both locally and worldwide, are becoming more sophisticated and are demanding more personalized service to cater for their individual needs. On the other hand, the online marketplace, both locally and internationally, is full of choices and alternatives, and any failure to meet an individual customer's needs will likely mean a quick switch to a competitor.

A browse through the IT courses in the calendars of the six major universities in New Zealand reveals that even though all the major universities offer HCI papers, for majority of these universities these papers are not compulsory in computer science or information system degrees. It is becoming clear that New Zealand universities are falling behind in providing courses in HCI compared to universities from the US, Australia and European countries. While it is not known at this point of time if universities in New Zealand are aware of this, it is very important that universities in New Zealand thoroughly equip their IT graduates with knowledge and skills in HCI, and in particular

usability, so that we start to see Web sites, Web-based applications and other application software developed with an easy-to-use interface and a human element in it.

It is also important to create awareness in New Zealand among academics, who are responsible for designing and delivering Web and Web-related courses, of the current practices and guidelines for user interface design, and in particular the usability issues. These academics will play an important role in emphasizing the importance of user interface design through the classroom.

We were unable to identify any previous research that has been done to identify how much attention is paid to human factors when designing and developing Web sites or Web-based applications, or to measure awareness of usability issues amongst Web site owners, designers and developers in New Zealand. The purpose of this research was: (a) to identify the current practices for user interface design that are being advocated by researchers and practitioners in the user interface design field worldwide that enable the development of usable Web sites and Web-based applications, (b) to find out the extent to which these practices are being used to design and develop user interfaces in New Zealand Web sites and Web-based applications, and (c) to find out if the six major New Zealand universities are up-to-date in teaching HCI and usability courses when compared to overseas universities in other developed countries.

The findings from this research should:

a. Determine the level of awareness of usability issues among Web site developers and owners in New Zealand.

b. Help to determine the depth of coverage in HCI and usability by major universities in New Zealand.

c. Help to determine if universities in New Zealand have to make changes to their IT curriculum so that more appropriate papers or courses are offered to better equip graduates with knowledge and skill in HCI and usability.

d. Create awareness of the importance of producing usable user interfaces for Web sites and other Web-based applications.

1.2 Research questions

There are user interface design guidelines and rules for Web sites that have been suggested and published by academics and practitioners. If used sensibly, these enable the designers and developers of Web sites to develop sites that are usable, that cater to the needs of users, and meet usability requirements.

This research seeks to answer the following questions for user interface design practices for Web-based applications in New Zealand:

1. Do developers involve usability professionals to design and develop user interfaces? If not, why not?
2. Do developers have separate budget to deal with usability issues? If not, how is usability supported, if at all.
3. Do developers use prototyping to produce designs for interfaces? If so what prototype techniques are used?
4. Do developers conduct user research to gather data about users or do developers design and develop Web sites based on assumptions about the users?
5. Do developers provide personalized service, experience, information or content for individual users of Web sites? If not, why not?
6. Do developers use an iterative design and development methodology? Are there reasons that restrict them from using iterative methods?
7. Do developers use a participatory design methodology to involve users in designing Web sites? If they do, then at what stages do they involve the users? If they do not, what are the reasons?
8. Do developers consider the elderly users in the design and development of Web sites since this is one of the fastest growing user groups?
9. Do developers consider cultural issues in interface design and development?
10. Do developers use guidelines to design and develop user interfaces?
11. What evaluation technique(s) are used for evaluation?

12. Do tertiary education providers provide an adequate level of coverage of interface design in Information Technology courses in New Zealand?

The study was carried out in both the private and public sector, and included companies, organizations, and government departments from the Auckland and Wellington regions, as well as Web development companies. The first survey was sent to a total of 280 companies, organizations and various government departments which have Web presences, and to 80 Web development companies. The survey was based on the recent and current user interface design practices that were identified during a literature review of various journal publications and white papers of well-known practitioners of user interface design such as Aaron Marcus, Jacob Nielsen and Jarred Spool.

The second survey was to establish what is offered in human-computer interaction courses by the six major universities in New Zealand. This survey was sent to Auckland University, Waikato University, Massey University, Victoria University, University of Canterbury, and Otago University. The various human-computer interaction Web sites were identified and used to: (a) compile a list of universities worldwide that offer human-computer interaction education, (b) compile list of universities worldwide that have a reputable usability or HCI laboratory to support teaching and research work, (c) compile a list of private organization worldwide that have a reputable usability or HCI laboratory, (d) compile a list of well known human-computer interaction conferences, and (e) establish if there is a human-computer interaction curriculum proposed for tertiary education providers by any of the renowned worldwide HCI associations.

1.3 Background

1.3.1 HCI

For computer systems to be extensively acknowledged and accepted as a tool to help human beings to accurately, efficiently and effectively perform tasks, they need to be designed to accommodate the capabilities, skills, knowledge and needs of the users for who they are intended.

According to Norman (2000) the psychology of materials such as affordance should provide strong clues about the operation of things. Affordance refers to the seeming and actual properties of a thing – fundamentally those properties that determine how the thing could be used. It is common knowledge to human beings that turning the knob on the door will open it. The internal working that enables the door to open while the knob is turned is of no concern to the person who is trying to get access to the room. Similarly the internal functioning of any computer system is not a concern of any user who uses the system to accomplish a task.

The actual position of the knob on the door, the size of knob, the shape of the knob and other features of the knob will have a bearing on how easy or difficult it will be for someone to open the door to gain access to a room. The design of the knob is agreed upon after various rounds of design and testing with people of various age groups and physical capabilities, who should be able to easily open and close the door using the knob in all situations.

According to Norman the same principles also apply to computer systems – the users of the computer system should be able to easily use it in all situations without any problems that may result from its design. The physical features of the hardware and the features of software such as the appearance and familiarity of various menu items or icons on the screen will determine the attitude of users towards the acceptance of a computer system. The success of an interface depends upon: how quickly the interface responds when the user interacts with it to carry out a task, if the interface is easy to learn, and if the users find it easy to use. If the users find the interface attractive and fun to use, it will be accepted by them.

HCI (Human-Computer Interaction) is the study and practice of usability. It is about understanding and creating software and other technology that people will want to use, will be able to use and will find effective when used. Usability is the measure of the quality of a user's experience when interacting with a product or system, whether a Web site or a software application.

According to Rogers et al. (1994) human-computer interaction is the processes, dialogues, and actions that a user employs to interact with a computer in a given environment. They describe HCI as a discipline that concerns the design, evaluation, and implementation of interactive computing systems for human use, and the study of major phenomena surrounding them. Myers et al. (2000) describe human-computer interaction as the study of how people design, implement, and use interactive computer systems, and how computers affect individuals, organisations, and society.

Human-computer interaction requires an understanding of people who would use the computer program (the users), the domain and institutional structures that might affect how or when they would use the program, the tasks that are carried out, and the software and hardware solutions that could be offered (Johnson, 1992).

According to Rogers et al. (1994) the term human-computer interaction (HCI) was adopted in the mid-1980s as a means of describing this new field of study. Human-computer interaction has only become a hot topic of discussion in the Information Technology sector in the last two decades. Despite its importance, very little effort and resources are allocated to the design and development of the user interface of any information systems project. Research in human factors began in the Second World War so that more effective war hardware and weapon systems could be designed and developed. The Ergonomics Research Society was formed in 1949 due to substantial interest in this area among researchers.

Today the continuous development in the area of information science and technology is playing a major role in highlighting the need for incessant research and development in human-computer interaction. The research and development in human-computer interaction is viewed as very critical if computer technology is to be successfully used to make information available to the public.

The computer technologies that have enabled computer systems to become more user friendly and easy to use for the general public, especially for home and personal use, are the result of research that was done on human-computer interaction technologies by universities, government and corporate research labs such as Xerox PARC (Myers, 1998). The technologies that we currently use with our desktops and portable PCs, like: (a) fundamental interaction styles such as direct manipulation, the mouse point device and windows, and (b) applications such as drawing, text editing, and spreadsheets, are the product of research that started in the early 1960s. According to Myers the continuous research in human-computer interaction technologies such as gesture recognition, multimedia, and three-dimensionality will produces technologies that will have a significant impact on the interfaces of the future.

The endeavour of continuous research and development in human-computer interaction will ensure computer systems and related computer technologies are designed and developed to be usable and safe for the intended users. The goals of human-computer interaction can be summarized as developing or improving the safety, utility, effectiveness, efficiency, and usability of systems that include computers (Rogers et al., 1994).

The term "usability" is a major concept in human-computer interaction and it concerns producing systems that are user friendly – systems that do not leave users frustrated since they are not difficult to learn or use. According to Dix, Finlay, Abowd and Beale (2002), usability is a combination of factors that affect the user's experience with the product or system, including:

(a) Ease of learning – how fast can a user who has never seen the user interface before learn it sufficiently well to accomplish basic tasks?

(b) Efficiency of use – once an experienced user has learned to use the system, how fast can he or she accomplish the basic tasks?

(c) Memorability – if a user has used the system before, can he or she remember enough to use it effectively the next time, or does the user have to start over learning everything again? What are the frequency and severity of the errors that are made by users when using the system?

(d) Subjective satisfaction - how much does the user like using the system?

The studies that were done to determine the benefits of HCI have provided information that design and development teams that took care off of usability issues of their product improved productivity.

A study done by Eason et al. (1988) to examine the benefits that organizations were aiming to achieve by introducing word processing software, (arguably a product of research and development in HCI) , showed improved turnover, greater flexibility and better use of staff. Another similar study done by Wixon and Jones (1991) reported that DEC (Digital Equipment Cooperation) increased its sales in the second release of its applications generator software due to improved usability of its product. According to Rogers et al. (1994) the Three Mile Island nuclear power plant disaster, the Indian Airlines flight 605 airbus 320 that crashed which killed 98 people, China Airlines flight 006 that plunged thirty thousand feet in the Pacific Ocean, US shooting down the unarmed civilian jetliner (Iran Air 655) which killed two hundred and ninety people etc are some of the major tragedies that were reported as result of poor interface design of the computer systems that were used in various situations.

It is widely advocated by researchers in this field that to design a usable and effective user interface of any application multi-disciplinary skills are needed. HCI is classified as a multi-disciplinary field. According to Rogers et al. (1994) major disciplines that contribute to HCI are: (a) cognitive psychology, (b) social and organizational psychology, (c) ergonomics and human factors, (d) engineering, (e) design, (f) anthropology, (g) sociology, (h) philosophy, (i) linguistics, (j) artificial intelligence, and (k) computer science.

Knowledge in cognitive psychology might help to ensure that the system that is to be developed will only require information processing activities that are within the capabilities of the users' mental processing. According to Benyon et al. (1993), cognitive psychology can help to improve the design of computer system by: (a) providing knowledge about what users can and cannot be expected to do, (b) identify and explain the nature and causes of the problems users encounter, and (c) supply modelling tools to help build more compatible interface.

According to Rogers et al. knowledge in social and organizational psychology: (a) provides insight into the structure and working practices of businesses and institutions, (b) identifies and explains problems resulting from changes to work practices, (c) provides understanding of attitudes of computer use and implementation, and (d) suggests methods by which an organization can restructure to improve the quality of working life. They say that the discipline of ergonomics or human factors helps to define and design tools and various artefacts to suit the capacities and capabilities of users. It ensures safety, efficiency and reliability while making a task easier to perform and also ensuring comfort and satisfaction.

According to Rogers et al. the engineering discipline, which basically involves processes, model building and empirical design testing, and helps to build artefacts while the discipline of design contributes creative skills and knowledge to support the design of those artefacts. According to them linguistics helps to understand several issues in HCI by applying knowledge and theories from it. Knowledge from the field of artificial intelligence helps to understand the users' needs when interacting with an intelligent interface.

Rogers et al. say that the fields of philosophy, sociology and anthropology provide methods developed in these areas that can applied to the design and evaluation of systems. According to them it helps to provide more accurate descriptions of: (a) the interaction between users, (b) their work, (c) the technology that they use, and (d) the environment in which they are situated.

One of main contributions of computer science to HCI is to provide knowledge about the capability of technology and ideas about how this potential can be tied together with providing various kinds of methodologies for software design, development and maintenance.

Thus, effective interface development is a multidisciplinary process, which requires a holistic view applied to provide solutions to design problems. For user interface design and development more skills are required than any single individual is likely to possess.

HCI is very much concerned with design, by providing designed solutions to identified problems taking full account of all the constraints and requirements. The design aspect applies to entire systems, i.e. the software, hardware and the users. The purpose of the design is to enable work and other activities to be performed more effectively, efficiently, with more enjoyment, and satisfaction.

1.3.2 The User Interface

User interface is the tool that enables users to use computer systems to accomplish their tasks. According to Raskin (2000), the user interface is the way that you accomplish tasks with a product, i.e. what you do and how it responds. While there is an ever growing range of new technological products that are launched in today's marketplace, products like computers, watches etc. have greater functionality, but the interfaces of these products have become more complex.

Raskin says that an interface is humane if it is responsive to human needs and considerate of human frailties. If humane interfaces of software products are to be created, the developers, designers and the owners have to be aware of and understand the relevant information on how both humans and machines operate. These people must understand the likely difficulties or problems that users will face and experience when they use a computer system.

The notion "user interface" was adopted in the 1970s when there was a technology explosion. The developers of computer systems become aware that if their products were to be successful in the marketplace then these systems have to be easy for people to learn and use.

According to Rogers et al. (1994), this new dimension led to a greatly overused cliché – calling a system 'user friendly', which in practice simply meant tidying up the screen displays to make them more aesthetically pleasing and paying lip service to real issues surrounding HCI. But they say that academic researchers were concerned about how the use of computers might enrich the work and personal lives of people, in particular, they focused on the capabilities and limitations of human users. And as the HCI field began to develop it soon became clear that other aspects relating to users such as training issues, work practices, management and organizational issues and health hazards were all important factors contributing to the success or failure of using computer systems.

1.4 Outline of the study

The report of this research also includes chapters on a literature review, the methodology that was used to conduct the research, the results of the research, analysis and discussion of the results, conclusions, and recommendations.

Provided in the literature review chapter is a review of publications on issues, practices and guidelines to do with user interface design. The methodology chapter describes how the research was carried out using survey methods. The results chapter presents the findings of the research in table form so that the results can be easily interpreted. The discussion chapter provides descriptions of the interpretations of the results. Described in this chapter is how the results are related to the literature review. The conclusion chapter provides a summary of the main parts of the research and provides information on what results were achieved. The recommendation section

includes what needs to be undertaken to improve the usability of Web sites and Web-based applications in New Zealand.