Draft

Redesign the Library Website for Enhancing Usability and Accessibility

Abstract
This paper describes the key tools and techniques that are widely used for usability testing of Websites together with authors' experience in using them for the on going Website redesign project at the Open University of Sri Lanka library. Besides, the current status of Sri Lanka, in terms of distribution of disability among the citizens and level of accessibility of university library websites, have been outlined to show how fast we should act to correct our careless mistakes to ensure the free and open access to information, we promised as the leading information service provider of the nation. Authors hope that the contents of this article will empower readers with tools and knowledge that can be used to perform successful Website redesign projects in their library environments.

Keywords: *Web accessibility tools, academic library Website, Website redesigning*

Introduction

Library is one of the key social institutions that have been vastly influenced by the development of the Internet and expansion of the information based society. At first, librarians started building up the Web counterparts for their physical libraries often as supplements but later these virtual libraries became the "LIBRARY" for learners who are, time or place separated, or prefer working in virtual environments. Today, virtual library has become a compulsory feature in higher education due to the abundance of electronic information resources and social demand for "any time, any place" library services. Hence, the library Website as the interface between the librarian and the patrons, has gained an innovative role.

A new passion for designing user-centred virtual library interfaces with enhanced accessibility and usability has emerged in the international library and information field to go on par with the global trend in establishing accessible Web design. Design of the Website is usually described in two key terms, usablity and accessibility. "Usability" is making a Website as simple and fast to navigate as possible, and presenting the content in an easily readable format while "Accessibility" is making the content of a Website available to everyone. Cheryl Kirkpatrick's description on accessible Web designing - "Designing the Websites in a manner such that the information they contain is accessible regardless of a person's abilities or disabilities, software, or equipment" (Kirkpatrick, 2003) - provides simple but comprehensive view as it summarizes all different situations when and where Web accessibility comes to play.

Simultaneously, various standards and guidelines have been put forward in national and international levels to facilitate barrier-free Web designing throughout the world. Web Content Accessibility Guidelines (WCAG) developed by World Wide Web Consortium (W3C) is a widely used and the most popular tool, which explains how to make Web-content, accessible to people with disabilities and defines target levels of accessibility. Another major step towards barrier-free Web design is adding the Section 508 to the Rehabilitation Act of 1973 of United State of America. Besides, countries such as Canada, Australia and Japan have initiated successful projects to formulate national guidelines to make sure that their countries' Websites are accessible to all. In addition, library professionals also had made several contributions in this aspect. International Federation of Library Associations' (IFLA) checklist - "Access to libraries for persons with disabilities" - authored by Irvall & Nielsen

(2005), describes Website accessibility in a separate section. Jasek's (2007) Elsevier User Centered Design Group has put forwards a set of very valuable factors that are very helpful in designing an engaging and interesting library Website. Bibliographies published by University of Wisconsin library & NCSU libraries, which list various studies and publications of "library Website usability", are also very good sources to learn the accessible Web designing in library's perspective.

It is true that professional library literature is rich with scholarly publications that describe the library Website accessibility in various aspects. On the other hand, numerous library professionals such as Craven (2002), Kelly (2002), Schmetzke (2001), have declared that a large proportion of library Web pages are not accessible. As Providenti (2004) accurately points out, in spite of Web accessibility being a well-established topic in library literature, reaching back to at least 1996, there seem to be a disconnect between recommendations for and implementation of an accessible design.

Distribution of Disability in Sri Lanka

Protection of the Rights of Persons with Disabilities Act No.28 of 1996 (Sri Lanka) has defined the disabled person as "any person who, as a result of any deficiency in his physical or mental capabilities, whether congenital or not, is unable by himself to ensure for himself, wholly or partly, the necessities of life".

According to data collected by the Department of Census and Statistics, Sri Lanka there were 274,711 people having disabilities in 2001. Males had a predominately higher rate of disability at approximately 58% versus 42% female.

Table 1 presents statistics on the three major types of disabilities that limit one's ability of accessing the Web.

Table 1 - Distribution of types of disability in Sri Lanka in 2001

Type pf disability	Male	Female	Total	Percentage
Disability in seeing	35,419	33,677	69,096	19.0%
Disability in hearing	40,584	32,759	73,343	20.2%
Disability in hands	31,070	17,061	48,131	13.2%

Undoubtedly, the situation might be far more critical by now due to the increasing road accidents and war activities happening during the last eight years. Sri Lankan government also has realized this growing social issue in recent years. National Disability Policy 2003 is a good example for government's interest in ensuring equal rights for people with special needs. Unfortunately, despite its wide coverage of topics that address the accessibility of physical world, National Disability Policy 2003 has failed to discuss the issues regarding accessibility to cyberspace.

Hence, it is obvious that Web accessibility from the perspective of disability is yet to be received the attention at national level in Sri Lanka. Besides, there is hardly any evidence in the literature to indicate the individual or institutional interest towards accessible Web designing among Sri Lankan professional communities who are exclusively using the Web channel to communicate with their clientele or for delivering information.

Level of Accessibility of University Library Websites of Sri Lanka

As the leading information provider of the nation, academic library community of Sri Lanka has a bigger responsibility than any other sector, in exploring tools for dynamic information delivery. However, Web accessibility is a least discussed topic among the academic library

community of Sri Lanka. Therefore, authors of this article decided to assess the accessibility of university library Websites to inform librarians of the current status.

Fifteen government universities registered under the University Grant Commission (UGC) of Sri Lanka were taken as the sample.

A list of Web addresses of the library Websites (see Appendix 1) affiliated to the Universities was developed during the initial phase of the study. Authors first visited each University homepage following the link provided by the UGC Website at www.ugc.ac.lk and checked whether it was providing a link to the library homepage of that particular University. If the institutional homepage did not list a link to the library homepage, then Web searches using "AltaVista" and "Google" search engines were carried out to locate the library site. The two different search engines were used to reduce the effect of routine weaknesses of search engines and to enhance the possibility of tracking the Web address if the relevant University is hosting a library site. The process was repeated a week later to minimize the possibility of temporary technical problems of the host server on non- availability of the Website at the time of first searching.

Please note that the link of the library site listed in the Sri Jayewardenepura University homepage was inactive during the period of the survey and authors could not locate active links either for Sri Jayewardenepura University library or Uva Wellassa University Library via Web searches conducted during the first two weeks of March 2009.

WAVE version 4.0 (http://wave.webaim.org) was selected for this study, as it is capable of checking the Web pages for conformity issues with several established Web accessibility standards such as WCAG guidelines and Section 508. Besides, it is inexpensive, efficient and easy to use tool. Although, WAVE cannot check all of the issues in the guidelines, it can identify errors and highlights the points that need human inspection.

Accessibility evaluation test was conducted during the third week of March 2009 for the 13 library sites located. Table 2 illustrates the results of the usability test.

Table 2 – WAVE results of University library homepages of Sri Lanka

No. of library sites	No. of instances zero errors	No. of instances 1 - 5 errors	No. of instances more than 10 errors
13	0	7 (54%)	4 (31%)

It is true that results were very discouraging as there was not a single site with zero critical accessibility errors. However, as shown in the table 2 the number of instances of accessibility errors existed on individual pages, showed that the situation is not that serious as it first appeared to be. Only around 31% of library sites had more than 10 errors while around 54% of the library homepages had less than 5 errors. Spindler (2002) declares that a site with 5 or less number of errors is quite simple to fix. Another positive factor is that majority of the tested homepages had just one or two types of errors, predominant by the absence of alternative text for auditory and visual content, which can be easily eliminated by adding alternative texts using <alt> tags. Adding meaningful and descriptive alternative texts for auditory and visual content not only makes the Website deaf and blind friendly but it also helps the indexing process of search engines thus Website could be more easily found by users since "spiders" that harvest words and terms from Websites can read <alt> tags though they cannot read information contained in images.

However, this kind of an accessibility assessment of the homepage can produce only a vague picture of the level of the accessibility of a Website. Further, WAVE is not a perfect tool as mentioned above it may produce falsely negative and falsely positive results. That is why WAVE developers persuade the users to perform thorough manual inspection. Hence, it is essential to run parallel assessments using different tools and manual checking of the homepage and at least second and third level pages to obtain precise and comprehensive results. In brief, proper evaluation of accessibility is a multi-stepped process that needs the application of various accessibility evaluation tools and techniques as well as the manual inspections.

Website Usability Testing at OUSL Library

Among the numerous methods and tools, OUSL library selected "think aloud protocol", "card sort protocol", "focus group discussion", "paper prototyping", "cognitive walkthrough" and "automatic evaluation tools" during the different stages of the redesign process, which included the following steps;

Step 1: measure the usability and accessibility of the existing library Website
Step 2: explore the user needs of the OUSL user population (student and staff)
Step 3: identify the terminology that can be understood by the users
Step 4: measure the usability and accessibility of the proposed Website (paper prototype)
Step 5: measure the usability and accessibility of the built up Website

Several of the above tools may be somewhat unfamiliar to the Sri Lankan library community although they have been widely used by the international community for Website redesigning projects over the years. The specific aim of writing this section is to introduce the tools that we used at OUSL library.

Think aloud protocol

Think-aloud protocol (TAP) is a very popular usability interface study technique that helps to evaluate the functionality, usability, strengths, and weaknesses of the site and to make recommendations for revisions. This tool is called "think aloud protocol" as it is expected from the participants to verbalize their thoughts as they complete a series of tasks.
OUSL library used this tool in three times during step 1, step 4 & step 5 of the redesign process.
Small numbers of participants were used for each step as recommended by usability Gurus like Jakob Nielsen and Thomas Landauer. They agreed that the use of 3 to 5 subjects produces maximum cost-benefit ratio (Nielsen, 2000). Further, King (2003) points out that three tests with a smaller number of volunteers allow a faster turnaround and deeper probing into the usability of the site, than if all 15 users are tested at once.

Participants

Six participants representing the cross section of the user population of OUSL attended the test sessions.

Procedure

First set of TAP sessions, based on the existing OUSL library site, were conducted during the month of March 2008. A pre-tested 12-task research instrument was created for the first step and then it was modified for the 4th and 5th steps according to the changing needs and nature of the Website/ paper prototype that is under evaluation.

Each session was monitored by a facilitator and an observer. Observer's worksheet, which included the set tasks together with the expected path/s to perform each task, was introduced to the selected observers, during an instruction session conducted to make them aware of the role of the observer.

At the commencement of all sessions, same introductory script was used to introduce the test to participants in order to make sure all of them got the same instructions. The tasks were written on 3"x5" cards and given to the participant one at a time in random order. As part of the instructions, all participants were encouraged to speak aloud throughout the test, verbalizing their thought processes and rationale behind their decisions.

The facilitator read the questions and interacted with the participant while the observer recorded the participant's actions, including:

- the path taken to find the answer;
- anything said while navigating the site; and
- any observations of the participant's behaviour

Average time allocated per a task was five minutes. If the participant was unable to complete within five minutes, then the participant was asked to move to the next question.

The level of success in completing the tasks were measured using the scale:

- Very successful = found the information quickly in the shortest possible path
- Successful = found the information fairly quickly, after 1-2 false starts
- Moderately successful = found the information after several false starts
- Not successful = did not find the desired information

The consent was taken from the participants to tape-record the session and use the "ScreenHunter" (www.screenhunter.org) software to track the path of the mouse clicks.

Focus group discussion

The focus group (FGD) has been widely used to explore user needs during Websites redesign projects by professionals such as Tolliver, et al (2005), VandeCreek (2005) and Ward (2006).

Participants

Eight participants from the library staff participated for the first FGD session conducted on3rd June 2008 and 11 members of the academic staff attended the second FGD session held on 11th June 2008.

Procedure

Pre-tested discussion Guides were e-mailed to the participants in advance. Another e-mail was sent on the day before the FGD session, asking them to go through the library Website before attending the session and reminding them the date, time and venue.

Both FGD sessions commenced with introductory speeches and refreshments. The facilitator conducted the sessions in a way to encourage participants to voice their ideas freely. The facilitator interfered only when it was necessary to remind the time, put the participants back on track or to encourage a participant to talk if he/she seemed to be just listening without contributing to the discussion actively. The sessions were tape-recorded and videoed with the consent of the participants.

Mailed Questionnaire

Williamson (2000, p.217) declares that questionnaires have been used frequently in the information management/ librarianship field, especially to understand the needs of library users and to evaluate library services. He, further, states that they are particularly helpful in identifying user needs and satisfaction; attitudes and perceptions towards the existing system or newly developed system, in situations where there are large numbers of users at different sites.

OUSL is heavily using the postal medium to communicate with the students for academic and administrative purposes. Hence, redesign team decided that mailed questionnaire was the

cheapest as well as the most reliable means to reach the widely scattered distance learner community of the University.

Participants
524 students representing four faculties of OUSL (10% of the students registered during the academic year 2006/2007) were selected for this questionnaire based user survey. The students of the 2006/2007 batch was selected because they had spent more than one year in the University by the time of the survey and expected to have sufficient experience to make useful contributions for this study.

Procedure
A questionnaire was designed incorporating some questions previously used by Blackman (2003) for his library user survey. Several new questions were also designed and added to cover the specific aims of this survey. A pilot study was undertaken before posting the questionnaire. Non-respondents were contacted over the phone and politely asked them to post the completed questionnaires if they were willing to participate in the survey. Questionnaires were posted during first two weeks of May 2008 and concluded the survey at the end of June 2008.

Card sort protocol
Card sort protocol is a widely used technique by Web-developers to identify user-preferred terms and to find out how they wish to group the items in the homepage of the Website in a manner that is easy and fast for a user to locate.

Use of library-jargon is one of the frequent negative feedbacks received during the think aloud session for the existing OUSL library site. Hence, the OUSL library decided to identify more appropriate terms to replace the terms that were found difficult to be understood by the users, and to find out suitable terms to indicate services and resources that are going to be introduced in the new site.

Participants
Ten participants were selected to represent the students of 4 the faculties and teaching staff of the OUSL.

Procedure
A 40-items card sort protocol tool was developed. Terms were written on the 5”x3” cards. A description (what is meant by the particular term) was given on the reverse side of the card.

Volunteered participants were contacted over the phone and decided a time that is convenient for them. Test was commenced on the 5th September and concluded on the 28th September 2008. The participants were provided with a large table where he/she can spread the cards for easy pick-up. Each of the participants was given a brief introduction on the nature of the test and explained what was expected from them. Participants were asked to set a side the cards that contain the terms, which are not clear to them.

While participant was grouping the cards and writing down the preferred terms on the participant’s worksheet, the facilitator stayed in the vicinity of the participant in order to offer help when requested by the participant or if he/she seemed to be in trouble.

After the participant announced that he/she has completed the task the facilitator checked whether there were any left over cards and if so explained the particular term/s and asked the participant whether the card/s can be fixed with any of the groups he/she has created. Then the facilitator went through the worksheet, which was given to provide alternative or preferred terms according to their choice. Each session was concluded with a brief, friendly discussion.

Paper prototyping
Dr. Jakob Nielsen is a strong proponent of paper prototypes being an extremely effective and an efficient testing practice before resources are committed to building a full Web-based interface. Prototypes allow designers the chance to quickly create early versions of a product that can be tested with users. It allows exploring different design templates beforehand. Another advantage is that constructing paper prototype needs just pen and paper and more importantly no technical skills are required. Hence, paper prototypes are easy for anyone to create (Ward, 2006).

First step of paper prototyping is to create a rough outline of the site based on the data collected during the preliminary studies. At OUSL library a brainstorming session was conducted with the participation of three members of the library staff and each member was asked to draw the homepage on a white paper to explore various design options before settling on a single approach. Incorporating all the ideas, the structure of the site was created using different coloured papers for different layers of the site. Coloured pens, sticking papers, screen prints etc have been used for highlighting or representing forms and navigation paths in the paper prototype. The book titled 'Paper prototyping: the past and easy way to design and refine user interfaces" was very helpful in accomplishing this unfamiliar task of creating a workable paper prototype.

Then a set of "cognitive walkthrough" sessions and "think aloud protocol" sessions were conducted using the paper prototype of the proposed site to identify the accessibility and usability barriers of the design.

Cognitive walkthrough
Cognitive walkthrough is a review technique in which evaluators role play the part of the user and "walkthrough" the interface in an attempt to complete certain information seeking tasks Walkthrough method proved to be very valuable for identifying ways to reduce clutter, reduce the number of links and make links more visible, and reduce the amount of text (McMullen, 2001).

The OUSL library conducted the 4 cognitive walkthrough sessions to refine the paper prototype design of the Website from 9th August to 12th August 2008.Two from the library staff and two from the academic staff were picked up for the test. Participants were asked to go through paper prototype and evaluate it according to Jakob Nielsen's "10 heuristics". The list of heuristics is available at www.useit.com/papers/heuristic/severityrating.html.

Cognitive walkthrough sessions were conducted mostly as discussion sessions between the facilitator and the participant. Suggestions were recorded and necessary modifications were made simultaneously if possible, or else, soon after the session. Therefore, at least a 3 hours gap between each session was maintained in order to ensure sufficient time to do the necessary modifications before commencing the next session.

Think aloud protocol
Four participants who had participated in the first set of TAP sessions conducted during the step 1 and two new participants took part in this second set of TAP sessions. When performing TAP test using paper prototype, the facilitator played the role of the computer while participant's index finger played the role of the computer-mouse. For example, participants were asked to point out the keyword/s that they think as the accurate link to find the information requested by the task in hand and the facilitator produced the relevant page.

Automatic evaluation tools
Another important usability testing technique is the use of automatic evaluation tools. Fortunately, there is large number of free and open source products available in the Web.

OUSL Library used 7 types of such tools to measure the usability and accessibility of the existing site and the new site that is under construction right now.

They are:

- WAVE automatic Web accessibility evaluation tool (http://wave.webaim.org/) tests web pages for conformance to various accessibility guidelines including WCAG.

- "W3C Markup Validation Service" (http://validator.w3.org) – checks the markup (HTML, XHTML) of Web documents

- W3C CSS Validation Service – http://jigsaw.w3.org/css-validator - checks Cascading Style Sheets (CSS) and (X)HTML documents with style sheets

- Contrast Checker (http://q42.nl/demos/contrastcheck), checks the suitability of background and foreground colours for colour-blind people and low vision people

- Image Analyser http://juicystudio.com/services/image.php tests width, height, alt, and longdesc attributes of images for appropriate values and accessibility issues.

- Juicy Studio readability test (http://juicystudio.com/services/readability.php) calculates readability index score for a text and helps to find out if a draft manuscript is at the right Grade Reading Level for the intended audience.

- AnyBrowser.com http://www.anybrowser.com/ checks for different browser compatibility by viewing in various screen sizes and viewing with images are replaced by ALT text. Also available are HTML validation, link checking, search engine tools etc.

The OUSL library redesign team selected these tools because they are available freely online, easy to use and produces results in very simple and easy to understand formats.

However, there are many more popular as well as effective tools that you can select according to your specific needs and preferences. A comprehensive list of different types of accessibility tools is available at http://www.w3.org/WAI/ER/tools/complete.

Results in brief

The data collected through all these tools and techniques were analysed to measure the level of library Website in 4 dimensions accessibility, usability, content richness and terminology. In a nutshell, it could be said that current status of the site is not satisfactorily high since percentage of success is below 60% in all 4 dimensions. However, more importantly, the testing process brought a lot of insights, suggestions and comments towards designing a user centred library site.

Concluding Remarks

OUSL library learnt a lot from its usability testing process and collected invaluable information. Observing real users performing real tasks and short interviews afterwards during TAP sessions gave us a rare opportunity to closely interact with our students. It generated new insights such as the relationship between poor Web designing versus lack of information and computer literacy skills of users. Further, the capacity of usability testing on creating awareness among users, which was realized during the process, has brought new ideas for user-orientation programs. Focus group discussion sessions and user survey brought exciting suggestions to widen the resource-base and improve the visual appearance of the proposed site while card sort protocol generated a list of user-preferred terms.

Creating a Website, incorporating all these exciting suggestions and eliminating all the deficiencies is not an easy task. However, we as librarians of a nation that already consists of fairly large number of disable people; besides, at a risk of increasing the numbers significantly in the near future; cannot postpone making our Websites accessible in order to open the doors of cyberspace for disabled. Particularly, as we know that despite the recommendations of "Disability Policy 2003", that there are hardly any facilities for disabled to move freely in the physical environment.
Fortunately, there are numerous low-cost tools and simple approaches to lift the barriers in the cyberspace. Hence, no need to wait for government funds; we can start fixing accessible problems of our Websites today itself.

Related links

Census Department of Statistics Sri Lanka
http://www.statistics.gov.lk/

University of Grants Commission
http://www.ugc.ac.lk/index.php

References

Blackman, R.F. (2003). A study of the perceptions and attitudes regarding library services available to students enrolled in online degree programs, PhD Thesis, University of Tennessee.

Craven, J (2002). Electronic access for all: awareness in creating accessible web sites for the university library. Retrieved August 5, 2007 from
http://www.dmag.org.uk/resources/casestudies/cravenfull.asp#1
http://news.ala.org/ala/rusa/rusapubs/rusq/specialfeatures/rspawardwinning/2004abc/2004rspa.htm

Irvall, B. and Nielsen, G.S. (2005) Access to libraries for persons with disabilities: checklist (IFLA professional report 89) International Federation of Library Associations and Institutions. Retrieved February 15, 2009 from http://www.ifla.org/VII/s9/nd1/iflapr-89e.pdf

Jasek, C. (2007). How to design library Websites to maximize usability. Library Connect; Elsevier User Centered Design Group, Retrieved February 15, 2008 from
http://libraryconnect.elsevier.com/lcp/0502/lcp0502.pdf

Kelly, B. (2002). Web watch: an accessibility analysis of UK university entry points. Ariadne. no. 33, Retrieved July 23, 2007 from <http://www.ariadne.ac.uk/issue33/web-watch/>

King, D. (2003). The mom-and-pop-shop approach to usability studies. Computers in Libraries, 23 (1), 12-15.

Kirkpatrick, C.H. (2003). Getting two for the price of one: accessibility and usability. Computers in Libraries. 23 (1), 26-37.

McCarthy, J. (2003). Integrating library services into the e-learning environment at Queensland University of Technology. Retrieved September 26, 2007 from
http://alianet.alia.org.au/publishing/aarl/32.3/full.text/mccarthy.html

McMullen, S. (2001). Usability testing in a library web site redesign project. Reference Services Review, 29 (1), 7-22.

Nielsen, J. (2000). Why you only need to test with 5 users. Retrieved September 14, 2007 from <www.useit.com/alertbox/20000319.html>

Providenti, M. (2004). Library Web accessibility at Kentucky's 4-year degree granting colleges and universities. D-Lib Magazine. 10(9), Retrieved July 23, 2007 from http://www.dlib.org/dlib/september04/providenti/09providenti.html

Schmetzke, A. (2001). Web accessibility at university libraries and library schools. Library Hi Tech. 19 (1), 35-49.

Spindler, T. (2002). The accessibility of Web Pages for mid-sized college and university libraries. Reference & User Services Quarterly. 42 (2), 149-154.

Tolliver, R.L., Carter, D.S., Chapman, S.E., Edwards, P.M., Haines, A.L., Krolikowski, L.E. & Price, R.M. (2005). Website redesign and testing with a usability consultant: lessons learned. OCLC Systems & Services. 21 (3), 156-166.

VandeCreek, L.M. (2005). Usability analysis of Northern Illinois University Libraries' website: a case study. OCLC Systems & Services. 21 (3), 181-192.

Ward, J.F. (2006). Web site redesign: the University of Washington Libraries' experience. OCLC Systems & Services: International digital library perspectives. 22 (3), 207-216.

Williamson, K. (2000). Research methods for students and professionals: Information management and systems. Wagga Wagga: Centre for Information Studies Charles Stuart University.

Appendix 1

List of Website addresses of University libraries of Sri Lanka

University of Colombo Library
http://www.lib.cmb.ac.lk/

University of Peradeniya Library
http://www.lib.pdn.ac.lk/

University of Kelaniya Library
http://www.kln.ac.lk/library/index.htm

University of Moratuwa Library
http://www.lib.mrt.ac.lk/

University of Jaffna Library
http://www.jfn.ac.lk/library.htm

University of Ruhuna Library
http://www.lib.ruh.ac.lk/

Eastern University of Sri Lanka Library
http://www.esn.ac.lk/Library/Index.htm

South Eastern University of Sri Lanka Library

http://www.seu.ac.lk/mission.htm

Rajarata University Library
http://www.rjt.ac.lk/maiin_library/main_Lib.html

Sabaragamuwa University Library
http://www.sab.ac.lk/library/Library.htm

Wayaba University Library
http://www.wyb.ac.lk/mkdr/lib/index.htm

Open University Library
http://www.lib.ou.ac.lk/

University of the Visual & Performing Arts Library
http://www.vpa.ac.lk/Library/lib_main.htm