A web accessibility testing case study: QUT Library

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Abstract

In 2002 the QUT Library participated in the University’s WebAccess project. Client feedback, QUT’s web accessibility evaluation guidelines, and the Raward Library Usability Index (LUI) were applied to testing the Library’s high demand web based services as a case study. This paper reports on the methods, results and actions taken by the QUT Library to evaluate and improve accessibility to its core web services.

Introduction

The Queensland University of Technology (QUT) Library web services are an integral part of the university library. The QUT Library web site is the university’s information gateway and provides access to information resources and Library services supporting teaching, learning and research. About half of the collection development budget is allocated to electronic information resources such as databases and electronic journals. Usage statistics for the Library’s web services combined exceeds the total gate counts into library buildings, and total number of loans combined, proving clients are using QUT’s digital library services more than the traditional physical collection and services. Library web services need to cater for diverse client groups in terms of academic level and discipline, technical and other abilities, and economic and cultural background. This diversity necessitates that the Library ensures online services are accessible to the core client group of 40,000 QUT students and staff.

In 2002 the QUT Library participated in the University's WebAccess project, sponsored by the Division of Information and Academic Services. Each department in the division participated in the project which resulted in the first institution wide accessibility guidelines for QUT. The major outcome of the project was the development of the QUT Resources for an Accessible Web [HREF5] site which was designed as a resource and guideline for developing accessible web sites at QUT. These guidelines were applied to testing the Library’s high demand web based services as a case study. The timing of the QUT's WebAccess project particularly suited the Library as we could review the old site, learn from our mistakes, and apply what we learned to the new library web site which was also under redevelopment at that time.
This paper reports on the methods, results and actions taken by the QUT Library to evaluate and improve accessibility to its core web services.

**Background**

Web accessibility issues are applicable to both users with disabilities and other users. People with disabilities related to visual and colour blindness, motor skills, epilepsy, and hearing disabilities may experience difficulties accessing many web sites. The W3C (World Wide Web Consortium) Web Accessibility Initiative [HREF6] demonstrates case studies of how people with disabilities use the web, and provides an introduction to web accessibility evaluation and resources. As well as assisting disabled users, Arch [HREF7] points out that over half of web content accessibility guidelines are general usability requirements aimed at improving access for abled users. The design of accessible sites also assists people with respect to: English as a second language; education and literacy issues; computer skill and discipline specific knowledge; and those accessing the Internet using older technology, low bandwidth, from remote sites, or via PDAs and mobile telephones.

Service providers are operating within an environment governed by legislation and policy. The Commonwealth of Australia Disability Discrimination Act (DDA) [HREF8] prohibits discrimination on the basis of disability in a range of areas including employment, education, goods and services. The Human Rights and Equal Opportunity Commission (HREOC) [HREF9] has produced guidelines to assist in the development of web services in compliance with the DDA, and has produced a paper on the availability of materials to students with a print disability. The Queensland Government [HREF10] Information Standards No. 26 requires that Queensland Government Agency web sites meet the Priority 1 and Priority 2 W3C Web Content Accessibility Guidelines. Large institutions such as universities have developed internal policies to enforce compliance to the legislation and promote best practice.

The QUT accessibility guidelines draw heavily from the World Wide Web Consortium (W3C) [HREF11] Web Content Accessibility Guidelines (WCAG) 1.0, Priority 1. The W3C WCAG provide a comprehensive site including Web Accessibility Guidelines 1.0, Authoring Tool Accessibility Guidelines 1.0, checklists and techniques for testing, and accessibility features of languages and standards.

Whilst this study mainly focuses on web accessibility issues, some aspects of our testing applied to general usability concepts. A deeper investigation into usability would have been useful, but we lacked the resources to conduct full usability tests. As an alternative, we looked for an easy-to-implement and cost-effective usability test to apply to QUT Library’s web site. A recent study by Raward [HREF12] developed an appropriate usability analysis tool and Library Usability Index (LUI) specifically for the evaluation of library web sites. Nineteen university library web sites in Australia were tested, resulting in LUI results ranging from a low of 73% to 90%.
A great deal of literature is available supporting the creation of accessible web pages, covering aspects such as defining accessibility and the need for accessible web services (Jackson-Sanborn, Odess-Harnish & Warren, 2002; Lilly & Van Fleet, 2000; Lilly, 2001), legislation (Worthington, 2001), methodologies for accessibility testing, tools, measures and the impact of operating systems and browsers [HREF6], and the benefits of assistive technologies to users with disabilities [HREF13]. Relatively few papers demonstrate how sites were tested, and more importantly, fewer give an account of how the sites performed, and what was done to rectify the issues, which was the aim in writing this paper.

**Methodology**

The following describes the various methods of testing and user feedback used over the past three years to develop QUT Library's web services to meet accessibility standards and user needs.

The results of testing the public web site in 2001 and 2002 were incorporated into the design of the new public web site launched in late 2002. The new site was tested for accessibility attributes during the development phase, and this continued post-launch date in early 2003.

1. **Test methodology - Client Feedback**

   This has been an ongoing process. Although feedback processes encompassed wider issues than accessibility alone, a significant proportion of feedback related to accessibility issues proper.

   1. A brief client survey (straw poll), consisting of a small number of specific questions was conducted in 2001. Library clients were approached in Library buildings and asked to complete the questionnaire. Respondents were asked to deposit their responses into a sealed box. 119 undergraduate students responded. Several responses addressed accessibility issues. The straw poll instrument is provided as Appendix 1.

   2. Focus groups were conducted to obtain feedback on the use of the Library's web services. The Library conducted two undergraduate (11 attendees) and two researcher (10 attendees) focus groups and three Library staff focus groups (70 attendees) in 2001, and another three Library staff focus groups in 2002 (70 attendees) to obtain feedback on the public web site. The focus groups were relatively unstructured and informal and were facilitated by an independent non-Library employee of QUT, to elicit honest feedback. A number of prompts were developed to be used by the facilitator if required, several of which were related to accessibility. These are provided in Appendix 2.

   3. A student with a visual disability who uses the voice reader software 'Jaws' provided feedback on personal experiences using the Library web services in 2002. A QUT staff member
with a visual disability who also uses the 'Jaws' reader provided feedback in 2003.

The public web site offers feedback channels via the WebMaster and Suggestion Box services, and these responses tend to mirror those received by other methods.

2. **Test methodology - QUT Resources for an Accessible Web - Testing Your Site** [HREF14].

This document was used as the major guiding source. The QUT guidelines are largely based on the W3C Web Content Accessibility Guidelines (WCAG) 1.0, Priority 1.

From this the Library chose to perform evaluations combining elements from both preliminary and comprehensive evaluation:

1. **Automatic evaluation**
   - One validation tool:
     - W3C HTML validation service [HREF15]
   - Two accessibility evaluation tools:
     - WAVE, Institute on Disabilities, Temple University [HREF16]
     - LIFT online, UsableNet [HREF17]
     - Bobby [HREF18] was also used on a small sampling of pages, but returned similar results to WAVE and LIFT, and so was not continued
     - And Vischeck colour blind vision simulator [HREF19]

2. **Manual evaluation**: images, colour, font size, style sheets, multimedia, scripts, tables, and keyboard accessibility.

Using the following browsers:

- Internet Explorer 6, Netscape 4.01, Opera 6.04, HomePage Reader (IBM) [HREF20] on Windows 2000
- Internet Explorer 5.5, Netscape 5.5 on Macintosh OS9 (for old site); and Opera 6, Internet Explorer 5.2 on Macintosh OSX and Netscape 4.7 on Macintosh OS9 (for new site)
- Lynx simulator [HREF21]

3. **Test methodology - Raward Library Usability Index (LUI)**

This was used to provide benchmarking against selected Australian university library web sites as QUT Library was not evaluated in the test sample in the study. Two QUT Library employees completed the Raward test by answering yes or no to 104 questions. See *Appendix 3*. 
Due to the size of the QUT Library web site (2000+ pages), only a representative selection of pages were fully tested. However, most of the site uses templates and cascading style sheets that provide each page with the same structure and accessibility issues/features.

The above accessibility tests were applied to the following QUT Library web pages and services:

<table>
<thead>
<tr>
<th>Page Title</th>
<th>URL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Search page</td>
<td><a href="http://www.library.qut.edu.au/search.jsp">http://www.library.qut.edu.au/search.jsp</a></td>
</tr>
<tr>
<td>Site map (not tested on old site)</td>
<td><a href="http://www.library.qut.edu.au/sitemap.jsp">http://www.library.qut.edu.au/sitemap.jsp</a></td>
</tr>
<tr>
<td>eLibrary (not tested on new site)</td>
<td><a href="http://www.library.qut.edu.au/elibrary/">http://www.library.qut.edu.au/elibrary/</a></td>
</tr>
<tr>
<td>Databases</td>
<td><a href="http://www.library.qut.edu.au/databases/">http://www.library.qut.edu.au/databases/</a></td>
</tr>
<tr>
<td>New site: Databases beginning with Aa-At</td>
<td></td>
</tr>
<tr>
<td>New site: Programs and classes</td>
<td><a href="http://www.library.qut.edu.au/programs/">http://www.library.qut.edu.au/programs/</a> and results page</td>
</tr>
</tbody>
</table>
Summary of results

1. **Test methodology - client feedback results** (for full results see Appendix 4)

Client feedback presented a number of overall themes for improving the old web site in particular. These included the use of teal colour, the use of banners as major links, too many links, and overwhelming detail. The student with a visual disability pointed out missing ALT text on the Catalogue homepage and the difficulties experienced in locating the telnet catalogue option. The staff member with a visual disability pointed out that including bullets or arrows within linked items in a list is not desirable for voice reader use.
2. **Test methodology - QUT Web Accessibility Guidelines** (for full results see Appendix 5)

**Test results from the old site**

The issues apparent from the testing of the old site included:

- The division of the site into three major areas "eLibrary", "eLibrarian", "eLearn" was not translated by voice readers as they are not real words. This could cause some confusion to users of voice readers;
- The structure of the pages consisted of extensive headings and local navigation features before reaching the main content, which causes significant repetition when using a voice reader;
- Some ALT text missing for non-placeholder images, which meant that voice-browsers and text-browsers did not get the same information as a visually able user would;
- One section of the site used only colour in some tables to represent meaning, which could cause problems with colour-blind users and for users of text and voice browsers;
- Homepage banner text graphics did not perform well under magnification, which could cause problems with individuals who use screen magnification (such as available in the Opera browser).

The issues apparent from the Catalogue testing:

- Javascript for rollovers was not well designed as it forced reload of graphics when this should not have been required, and thus slowed down the page loading;
- ALT text missing, which meant that quite crucial information was missing for users of voice-browsers and text browsers;
- Link to the telnet connection was too deep into the page for easy access users of voice/text readers and keyboard accessibility. Our visually disabled users preferred using the Telnet version of the catalogue, so this was a significant issue.

The issues apparent from Pilot (QUT's undergraduate information literacy tutorial) testing:

- Use of Javascript to launch the glossary. This can be an accessibility problem as some older voice browsers do not support Javascript, so the information presented using Javascript should be available to the users in an alternate format;
- Some ALT text missing, including for ‘next page’ arrows;

The issues apparent from Course Materials Database (QUT's e-reserve system) testing:
Some resources in PDF were partially inaccessible using a text reader. Although all documents pass through an OCR process, due to the quality of the original documents, some words are unable to be recognised. If this is the case an image of the word is displayed and the most likely word also presented.

Publisher Databases

- No major accessibility issues were identified.

<table>
<thead>
<tr>
<th>Design principle or feature</th>
<th>Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hidden quick link to content and another to navigation provided at the top left hand side of the page.</td>
<td>Allows users with text-readers and voice browsers to quickly skip to main content and navigation features.</td>
</tr>
<tr>
<td>Provision of alternative to Javascript drop-down menus, with links to main directories. Both drop-downs and main index pages provide access to the same information.</td>
<td>Space creates easier initial navigation for first time users. Links to main index pages provide alternative access to content for users of text readers and non IE users.</td>
</tr>
<tr>
<td>Search box on homepage.</td>
<td>The search function is more obvious.</td>
</tr>
<tr>
<td>Addition of QUT standard metadata schema.</td>
<td>Generic metadata designed to work for external search engines, and Dublin Core metadata standard designed to work with AltaVista, including the QUT search engine.</td>
</tr>
<tr>
<td>Sitemap.</td>
<td>Easier visual navigation for first time and regular users.</td>
</tr>
<tr>
<td>A-Z index.</td>
<td>Alternative navigation for first time and regular users.</td>
</tr>
<tr>
<td>Flatter site structure. All main directories at top level eg. <a href="http://www.library.qut.edu.au/databases/">http://www.library.qut.edu.au/databases/</a></td>
<td>Shorter URLs more easily promoted over e-mail and print publications. URLs are therefore intuitive and</td>
</tr>
<tr>
<td>Feature</td>
<td>Benefit</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Homepage and page tables are designed for correct tabbing top-down and left-to-right.</td>
<td>Users of text-readers are presented content in the appropriate and meaningful order.</td>
</tr>
<tr>
<td>Graphics used minimally and kept bandwidth friendly. Homepage graphic is low resolution.</td>
<td>Faster download by users at home using modems.</td>
</tr>
<tr>
<td>Consistent use of text based navigation bar on all pages.</td>
<td>Provides familiarity to users and effective navigation throughout the site.</td>
</tr>
<tr>
<td>Use of inclusive language. Alternative wording provided for in explanations.</td>
<td>Libraries are complex and the use of some jargon is inevitable and part of the student users' education. Introductory paragraphs explain services offered.</td>
</tr>
<tr>
<td>'Ask a Librarian' link repeated throughout the site. Context-specific link to online help pages provided where appropriate. Eg. <a href="http://www.library.qut.edu.au/databases/">http://www.library.qut.edu.au/databases/</a></td>
<td>Every directory and page has links to appropriate sources of help or help information.</td>
</tr>
<tr>
<td>PDF documents created with accessibility features on.</td>
<td>PDF documents can be read by text readers.</td>
</tr>
<tr>
<td>Compliance with the QUT corporate style throughout the site.</td>
<td>Adoption of a format and style already familiar to QUT students and staff has aided usability.</td>
</tr>
<tr>
<td>Predominant use of background and table cell colour for style, instead of images for the homepage.</td>
<td>Faster downloading. Readability advantages.</td>
</tr>
<tr>
<td>Homepage design not too busy, incorporating significant white/blank space.</td>
<td>Easier initial navigation for first time users.</td>
</tr>
<tr>
<td>Use of Javascript drop-down menus to create space, repeated on all pages.</td>
<td>Navigation across all major directories available from all pages.</td>
</tr>
<tr>
<td>Grouping resources and services into clear and unambiguous groups: resources, information literacy, borrowing, about the library, branches and hours.</td>
<td>Creates more easily recognisable structure.</td>
</tr>
<tr>
<td>Quick links section on home page.</td>
<td>Easier initial navigation for first time and regular users.</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>-------------------------------------------------------------</td>
</tr>
<tr>
<td>Blue links that underline on rollover.</td>
<td>Obvious links.</td>
</tr>
<tr>
<td>Roll-over text used on important links on homepage.</td>
<td>Provides explanation to first time users without making the homepage too busy.</td>
</tr>
<tr>
<td>Use of Cascading Style Sheets with stipulated size 12 font. Pages format correctly if style sheets turned off.</td>
<td>Font large enough for most users. It was found that most visually able users were unaware of font resize options provided by common browsers, thus the set font size is appropriate for most users. Users with a visual disability can turn off style sheets and the site will format correctly, except the drop-down menus, but the alternative links to main index pages can be used.</td>
</tr>
<tr>
<td>All pages text-based and text-reader friendly. Graphical and text requirements are combined into a single version, providing content equally accessible by visual and text based browsers.</td>
<td>Easier maintenance than duplicating versions for different user groups. Same content available to all.</td>
</tr>
<tr>
<td>Standard footer with key links, Webmaster details, modification date.</td>
<td>Easier navigation, site accountability.</td>
</tr>
<tr>
<td>Lists commonly used.</td>
<td>Easier viewing of large amounts of information.</td>
</tr>
</tbody>
</table>

**Test results from the new site**

On the whole, the new library web site provides a marked improvement over the old site in terms of both accessibility and
usability. Users comments and feedback have been overwhelmingly positive.

Some minor accessibility problems were identified in the testing of the new site, including:

- The use of H3 before H2 in the content of the page, which can cause problems with voice readers that are set to "scan" a page. This practice is being phased out, and replaced with a style that reflects the same look without having the header structure associated with it.
- The majority of tables on the site are used for layout purposes, with a small number used for data purposes that are missing row and column headers. This is being rectified. The use of Cascading Style Sheets for layout purposes is not possible with the current design templates, but will be investigated with the next redesign.
- Archival PowerPoint presentations that were converted to HTML do not provide correct labelling of frames. The library has decided not to retrospectively correct these files.
- The use of an absolute size font (12 point) as the default font size was identified as an issue, as some browsers do not easily allow user overriding of defined font sizes. For example, increasing Text Size in Internet Explorer will not enlarge the text on the library web site, however changing the settings to "Ignore font sizes specified on web pages" (under Tools - Internet Options - Accessibility) does allow the sizes to be overridden. The library has chosen to keep the absolute font size to display pages correctly within the QUT template.
- Some instances of using <blockquote> incorrectly were identified and fixed.

3. **Test methodology - Raward Library Usability Index (LUI)**

(See Appendix 3 for full results)

The new library web site scored a high LUI from both testers, giving the site 94% and 95% respectively. The Library site performed well in all checklist categories, with no major problems identified. This compares favourably with results reported in the Raward (2002) paper, although no test control was possible because different testers were used. Testers were QUT Library staff with intimate knowledge of QUT Library web services, so could potentially give biased feedback.

**Discussion and conclusion**

**Improving the accessibility of library web services**

The QUT Library Systems team learned a great deal during this project. The project has been very successful in terms of testing and improving the Library’s core web services.
Significant improvements were made to the accessibility and more general usability of the old and new public web sites, and the catalogue. Minor improvements were made to the Pilot information literacy tutorial. No changes were made to the Course Materials Database. There is concern about PDF documents in the Course Materials Database because some documents are not wholly text readable due to the limitations of the Optical Character Recognition (OCR) process and the nature of the source documents. However, alternative arrangements for accessing these CMD documents have been made with QUT’s Equity section to support students with disabilities. The sample of publishers studied appear to be making great efforts to make their web based database services accessible and no problems were identified.

This project was most successful in influencing the design of the new QUT Library web site from initial concept through to implementation. Improved accessibility was a target of the web site redesign project. The incorporation of accessibility features into the design templates has produced a site which is greatly usable and accessible. Table 2 demonstrates the accessibility features of the new site, and Appendix 5 shows the improvements the new library web site has made as compared to W3C recommendations.

**Time and Resources**

The application of web accessibility principles into the design of a new web service is time consuming because it is integral to the overall site design process. The QUT Library web site redesign project involved five staff members (one working full-time on the project, two allocating 50% of their time, and two allocating 30% of their time) over a period of five months. A significant percentage of work over this time involved accessibility related tasks, which is estimated as equivalent to six weeks full time work by one staff member.

Researching and understanding the principles and techniques of accessibility testing is a hidden cost. Accessing and installing accessibility testing tools and running the tests requires significant time, but it is the analysis of test results, and the formation of technical solutions, specific to the needs of your own site and service goals that are the most time consuming tasks. A variety of testing tools were used, as described in the methodology. We had not purchased all the software used for the study, and used trial versions in some cases (eg. IBM HomePage Reader) which limits ongoing testing.

Client Feedback (Methodology 1) involving straw poll and focus groups required significant time input from four Library staff, estimated at six weeks full time work spread over a longer period of time.

QUT Web Accessibility Guidelines (Methodology 2) - from QUT Resources for an Accessible Web was conducted in a more intensive manner in 2002 and 2003. In 2002 a group of three Library staff were involved in the testing and addressing immediate concerns, and the design of the new
library web site. It is estimated this required four weeks full time work by one staff member. In 2003, two staff members were involved in additional testing of the new site, and it is estimated this required one week full time work by one staff member, although implementing recommended changes will be ongoing, requiring significantly more time. Library staff not involved in the web accessibility project will need to be trained in accessibility techniques before they can contribute and maintain content, also requiring major time input.

Methodology 3 - Raward’s Library Usability Index, is a straightforward test requiring one to two hours to complete.

To the future

The provision of web based services is ongoing. Adjustments and improvements are constantly required in response to client feedback and changing information needs and to the provision of new services. In hindsight aspects that QUT Library could improve upon include:

- Accessibility guideline compliance was systematically tested for W3C Priority 1 attributes only for the old site, while Priority 2 and 3 were tested on the new site, but these recommendations for improvement have not all been implemented;
- Better incorporation of student and academic focus groups at the design and mock-up stages of the new web site redesign project. Library staff were consulted (Liaison Librarians have an in-depth and personal understanding of client needs), but for student/academic feedback we relied on previous focus group results from the old site.

Other aspects for future attention include:

- Student and academic focus groups are held by QUT Library on an annual basis. This process will continue with the new web site;
- Evaluation of the accessibility of Portable Document Format (PDF) created from MS Word documents on the QUT Library site, and the establishment of processes to rectify any issues;
- The Library will need to maintain current awareness of Optical Character Recognition (OCR) technologies to further improve the accessibility of CMD documents;
- Broadening knowledge and skills of web authoring and accessibility issues across a wider and more diverse range of QUT Library staff who will be contributing to the maintenance of web services in the future.

Accessibility testing of QUT Library web services has resulted in significant improvements being made to these services. Accessibility testing can be a subjective process, and there are many guidelines and standards to choose from for testing and benchmarking purposes. The adoption of the QUT web accessibility guidelines has set standards and created an
opportunity for sharing, cooperation and the development of expertise at QUT.

**Appendices**

Appendix 1  
Client Survey (straw poll) instrument  

Appendix 2  
Focus groups – facilitator prompts  

Appendix 3  
Raward Library Usability Indicator device and results  

Appendix 4  
Test methodology 1 – client feedback results  

Appendix 5  
Test methodology 2 – QUT Web Accessibility Guidelines test results  

**References**


Hypertext References

HREF1  
http://www.library.qut.edu.au/contacts/staff/m_borchert.jsp

HREF2  
http://www.library.qut.edu.au/

HREF3  
http://www.qut.edu.au/

HREF4  
http://www.library.qut.edu.au/contacts/staff/m_conkas.jsp

HREF5  
http://www.webaccess.qut.edu.au/

HREF6  
http://www.w3.org/WAI/gettingstarted/

HREF7  

HREF8  

HREF9  

HREF10  

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HREF13  
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HREF18  
http://bobby.watchfire.com/

HREF19  
http://www.vischeck.com/

HREF20  

HREF21  
http://www.delorie.com/web/lynxview.html

HREF22  
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