

WHY ONCE IS NEVER ENOUGH: A CASE STUDY OF ITERATIVE USABILITY TESTING OF A LIBRARY'S ONLINE SERVICES

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To help enable user-centred design of online library services, usability testing should not be thought of as a 'nice to do' project that is run during a large review or with the implementation of a new service. Rather, it should be integrated into the design process, with tests performed regularly during development and after implementation.

Performing large-scale, one-time usability testing on a library's online services and producing a list of recommended changes is a suboptimal approach to user-centred design. It is important to recognise that recommendations do not automatically equate to improved design; rather they merely reinforce what the designer believes will be an improvement. Ultimately, it is the library end-users that determine if a design is usable. Iterative testing will verify whether problems identified early in the process have been resolved or if in fact a new set of problems have emerged.

This paper outlines how the Queensland University of Technology Library has commenced embedding iterative design and evaluation into the ongoing development and maintenance of the Library's online services. It also discusses the outcomes of recent usability testing of online services, such as the web site, catalogue and link resolver.

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1. Introduction

The Library web site is the main point of access to the resources and services offered by the Library. At Queensland University of Technology (QUT), students and staff spend tens of thousands of hours using the library web site each month. However feedback indicates that the Library's online services are difficult to use and people often have problems finding the information they seek. To date, the Library has conducted very little research as to how people actually use the web site. As a result, the Library has started implementing user-centred design principles and methodologies, in particular usability testing, in order to improve web usability.

At the beginning of 2006, initial project funding was sought to employ a project officer with specialist user-centred design skills who could teach relevant library staff how to plan and conduct usability testing sessions. During the initial phase of the project extensive procedural documentation was developed to help embed usability testing into ongoing web site development and maintenance. Usability testing sessions were conducted during April to August 2006.

This paper outlines the procedures followed for planning and conducting usability sessions, provides an overview of problems identified and shows examples that demonstrate why follow-up (iterative) testing is necessary to ensure that subsequent changes made to the web site improve usability.

2. Usability testing methodology

Four iterations of usability testing were conducted as part of the initial project. Outlined below are the steps that were followed to set up and conduct the usability testing sessions.

2.1 Ethical clearance

The first step was to obtain ethical clearance from the University's Research Ethics Office. Although the identity of the participants would be protected, clearance was required because participants were being recording and the data would potentially be shown at professional conferences.

2.2 Recruitment

2.2.1 Advertising and incentives

The main avenue for recruiting participants was a graphical web advertisement placed on the library homepage for two weeks (*see Figure 1*). This asked for student volunteers to participate in web site testing. The advertisement was linked to an online form where students could register their interest. The form also required students to indicate their enrolment level e.g. first year undergraduate, what course they were enrolled in and how often they visited the library's web site. An email was also sent to all first year undergraduate students requesting volunteers.

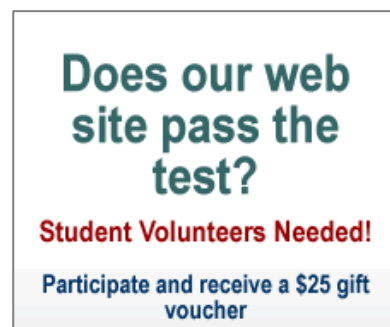


Figure 1: web advertisement for recruiting

Gift vouchers to the value of \$25 were given to each participant as an incentive to participate.

2.2.2 Profile of participants recruited

The desired participant profile was a first or second year undergraduate student with limited (or no) library web site experience. This was because the initial project was primarily concerned with the problems faced by inexperienced users. Testing of further user groups such as staff and researchers will be conducted in the future.

It was not always possible to find participants that matched our desired profile so in some cases volunteers that indicated they were regular users of the library web site were recruited. Participants ranged from first year to third year students and were from a variety of faculties. The majority of participants indicated that librarians had attended at least one of their lectures or tutorials but reported they mainly learnt to use the library's online resources through trial and error. Most participants were reasonably web savvy but not library savvy.

2.2.3 Participant screening and scheduling

Potential participants were contacted by telephone and provided with information about the usability testing session. They were also advised that they would be recorded during the session. Care was taken not to provide information about the type of tasks they would be required to perform in case this biased results.

In addition to informing students about the session, questions were asked to determine if the student would be a suitable participant. This included asking about their general Internet usage and library web site usage as well as asking if they had any special needs or disabilities. During the conversation students were also assessed to see if they were easily able to articulate their answers, as they would be required to think out loud during the session. If the student was considered a suitable candidate and was willing to participate they were scheduled for a session within a week. It was found that if there was a large amount of time between scheduling and the actual session then there was a higher rate of no-shows.

After a session was booked, the participant was emailed an information sheet that included a copy of the consent form they would be required to sign. The day prior to each session the participant was contacted to confirm the session.

2.2.4 Number of participants required

For each iteration, five to six participants were recruited, with different participants recruited for each round of testing. Nielsen (2000) states that it is not necessary to use large numbers of participants initially as most usability problems can be identified with five participants and that the value is in performing multiple rounds to test design changes as well as identify new and existing problems.

2.3 Setting up the usability studio

A spare office with a desk and computer was turned into a 'usability studio'.

2.3.1 Hardware requirements:

- A computer
- A webcam was used to record participant's facial expressions. The webcam also had a built-in microphone to record the participant's voice.

2.3.2 Software requirements:

- Camtasia Studio was used to capture screens and mouse movement as participants completed their tasks. This was integrated with the webcam recordings in order to obtain a complete picture of what happened during the session.

2.4 Tasks to be tested

The following key library tasks were identified for initial testing:

1. Finding borrowing limits
2. Finding opening hours
3. Finding information on a topic
4. Finding information about how to reference
5. Finding how many copies of a book are available in the library
6. How to obtain a book held in the library at another campus
7. Finding a specific journal article
8. Finding a peer-reviewed article
9. Using a link resolver to find the fulltext of an article
10. Finding and registering for a library class

Each task was developed into a scenario representative of a typical undergraduate experience.

2.5 Conducting the usability testing sessions

Each session had a facilitator, a note taker and one participant. The facilitator ran the session while the note taker observed the test in the background and made notes about what the participant was doing. The note taker also ensured the facilitator did not overlook any aspect of running the session. At times, additional library staff observed if they were learning to facilitate tests. For each session a standard procedure was followed:

1. The facilitator introduced the participant and explained what was going to happen during the session. The participant was then given their gift voucher.
2. The facilitator asked the participant to read and sign the consent form
3. The facilitator briefed the participant about talking out loud during the tasks (called the "think aloud" protocol). This provided greater insight into what the participant was thinking as they did the tasks.
4. The facilitator presented each scenario to the participant, starting with the easier tasks, such as finding borrowing limits and opening hours, in order to put the participant at ease.
5. After the tasks were completed the facilitator conducted a debriefing interview to understand more about what the participant did and why. The facilitator then invited additional questions from the note taker and observer.
6. The facilitator asked the participant to sign a video release form which gave them several options as to who could view the video recording.

Generally each session, including the introduction and debriefing, took approximately one hour.

3. Data analysis

For the initial round of testing, task completion, difficulty rating and a transcription of what participants did for each task was recorded. However this level of analysis was very time intensive and was not sustainable with the available resources. The primary purpose of this project was to identify problems that negatively affected the

usability of the Library's online services and as a result the decision was made to only maintain a 'problem log' for data analysis purposes. This entailed watching the recording of each session and noting the problems, the changes that were made and the outcome of follow-up usability testing.

4. Results and discussion

A large number of problems that negatively impacted on usability were identified during the initial round of usability testing. Many of these were relatively minor usability issues, however a number of significant usability issues were uncovered, particularly with the library catalogue and link resolver interfaces.

4.1 Problems identified

4.1.1 Minor usability problems

Participants had little or no trouble finding information about borrowing limits, opening hours, referencing and classes and programs on the library web site. The main problems identified related to the wording of links, page layout and site structure.

4.1.2 Significant usability problems

Catalogue and link resolver

Participants frequently failed at tasks because the relationship between the catalogue and fulltext databases was unclear. Specific usability issues identified include:

- It was not clear from the library or catalogue homepage what path to follow to find the fulltext of a known article.
- When a fulltext link wasn't provided by the link resolver, participants did not understand the additional options for finding fulltext, especially the catalogue options.
- Participants tended not to see links to online journal holdings in the journal catalogue record, or did not recognise what the links were. For print holdings, many participants thought the description field was the holdings.

Further significant catalogue problems included:

- The difference between the keyword and subject heading catalogue searches was not clear. Participants did not understand that the subject heading search in the catalogue was a controlled vocabulary (LCSH) browse.
- The default result ranking caused confusion for participants as they regularly indicated that their searches didn't find any relevant items.
- Participants did not know how to request intercampus loans.

Database pages

Participants had significant problems choosing an *appropriate* database to search for peer reviewed articles. Initial testing showed that participants had little trouble finding databases however problems were identified with selecting a database from a database subject guide. The database names were not meaningful to participants and they did not read database descriptions. The majority of participants simply chose the first database listed or selected a database they were familiar with.

Help pages

It should be noted that participants rarely looked for help options and did not read information on the screen. This was especially apparent if there was a search box on the page.

4.2 Interface changes and iterative testing

Initial changes were made to the web site, catalogue and link resolver interfaces in an attempt to resolve the usability problems identified in the first round of usability testing. For most minor problems follow-up testing showed that the initial changes improved usability. For the more significant problems involving the catalogue and link resolver interfaces, a series of changes were made in an attempt to create a usable design. In some cases, the changes tested did not adequately resolve problems and consequently further targeted testing would be required to make significant improvements to usability.

For the purposes of this paper a selection of examples are outlined which illustrate the importance of iterative testing in ensuring changes made to the interface result in improved usability.

4.2.1 Examples where initial changes successfully improved usability

Task: finding borrowing limits

When participants looked for how many items they could borrow, it wasn't clear they needed to select the "Students & Staff" link in the Borrowing menu to find this information. Several participants initially selected "Borrowing services" and became confused. Renaming the link "Students & Staff" to "Borrowing conditions" appeared to resolve the issue as participants were able to complete the task without difficulty (see figures 2 and 3).



Figure 2: Original borrowing links

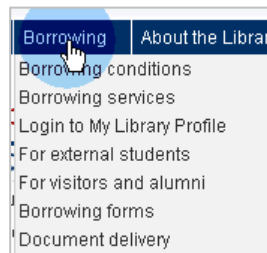


Figure 3: Revised borrowing links

Task: finding opening hours

When participants were asked what time they needed to get to the library to borrow a book, they went to the Opening hours page and jumped straight to the table to look for the library closing time. They did not notice the message at the top of the page that stated loans closed early. An extra column was added to the Opening hours table to include loans closing time. All participants noticed this information during follow-up testing (see figures 4 and 5).



Figure 4: Original Opening hours page

Semester Two 2006			
Period	Day	Opening Hours	Loans close
17th July to 19th November 2006	Monday to Friday	7.00am - 10.00pm	Loans close 9.45pm

Figure 5: Revised Opening hours page

Task: placing an intercampus request

Participants could not find how to request an intercampus loan from the catalogue item screen. The link “Place a hold on this item” was changed to a button with the text “Place a hold or intercampus request”. Follow-up testing indicated that participants could now easily find this option (see figures 6 and 7).

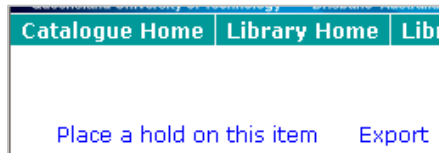


Figure 6: Original intercampus request link

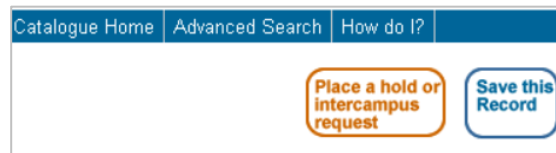


Figure 7: Revised intercampus request link

4.2.2 Examples where multiple iterations were required to improve usability

Task: using a link resolver to find fulltext

Participants were confused and frustrated by the options available when a fulltext link wasn't provided by the link resolver (see figure 8). It was not apparent that a link to the article was not available and participants tended to click on the first link provided to 'see what happens'. Often participants found themselves going in circles trying to locate the fulltext.

The catalogue search links also caused problems for participants as they did not understand what search was being performed and were often confused by the search results retrieved. Many thought they would find the article listed in the catalogue. In some cases, participants did not realise the links would perform a catalogue search and interpreted the text as a search suggestion. Subsequently they would go directly to the catalogue and search again.

It was also not clear to participants that the library may not have the fulltext and they mostly ignored the options for obtaining the article from another library.

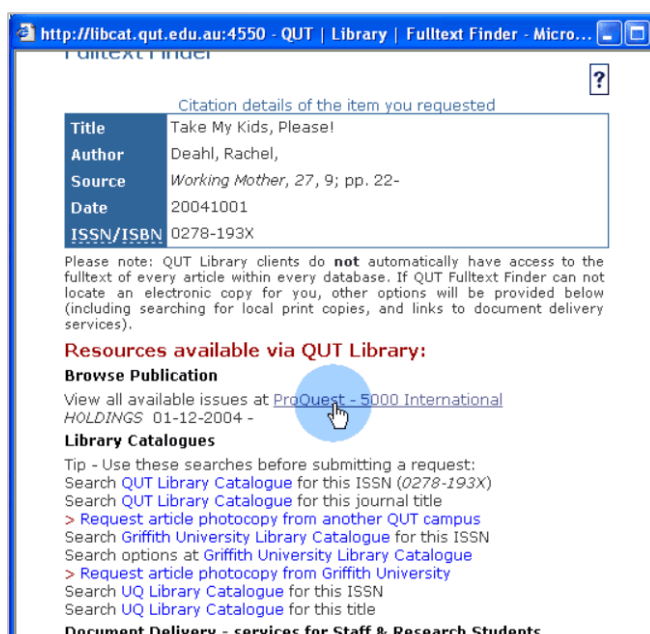


Figure 8: Original link resolver interface when no fulltext link

To address these problems the following initial changes were made using mock-up web pages (see figure 9):

- The link resolver interface was completely redesigned to make it clearer when fulltext was available online and when participants would have to check if the library held the publication in print or online in another database.
- An attempt was made to reword the catalogue search links to make it clearer that this would search the catalogue for the publication and that they would need to note the volume and issue details to determine if the library had the relevant holdings.



Figure 9: First attempt to revise link resolver interface

The results of follow-up testing indicated that these changes made reasonable improvement in usability with participants easily able to recognise when fulltext was not found, however it was still not clear that the library might not hold the fulltext. Participants remained confused when they clicked on the catalogue links. They did not always realise this link would perform a catalogue search (e.g. one thought it would go to the journal web page) while some still expected to find the article listed in the catalogue.

As a result more modifications were made to the mock-up link resolver pages (see figures 10, 11 and 12):

- The headings and catalogue search links were modified several times in an attempt to make it clearer that the links were searching the catalogue and that participants needed to find the publication first, then check the library's holdings to see if the article would be available. These changes showed some further improvement but usability problems with the display of the catalogue search results (added entries were especially confusing for participants) and journal records continued to affect the success rates of these tasks.
- The ISSN search option was removed as participants did understand what this meant. This did not create problems for participants.
- An online journal search option was added so participants could check if the fulltext was available online in a database that hadn't yet been added to the link resolver knowledgebase. Testing proved this was not very useful for participants. The search would either find no matches or it would provide links to fulltext databases that held the journal but did not have the volume or issue required, resulting in participants going in circles again. This option was removed.
- The headings and links were reworded several times to make it clearer to participants that the fulltext is not always available in the library and that obtaining the article from another library could be a possible option. During testing of the fourth design showing increased understanding of this concept.

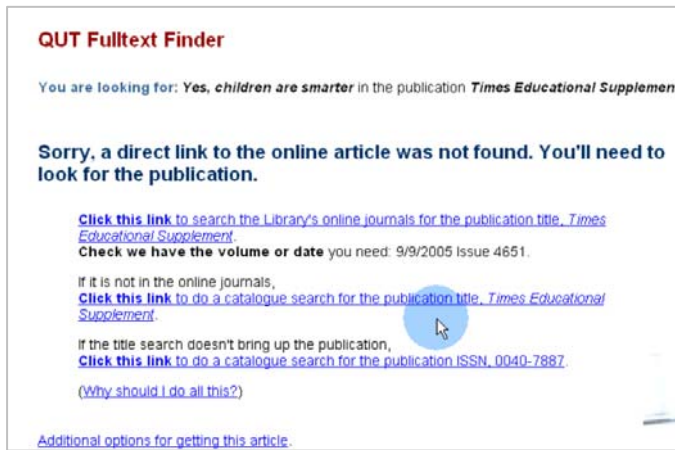


Figure 10: Second attempt to revise link resolver interface



Figure 11: Third attempt to revise link resolver interface

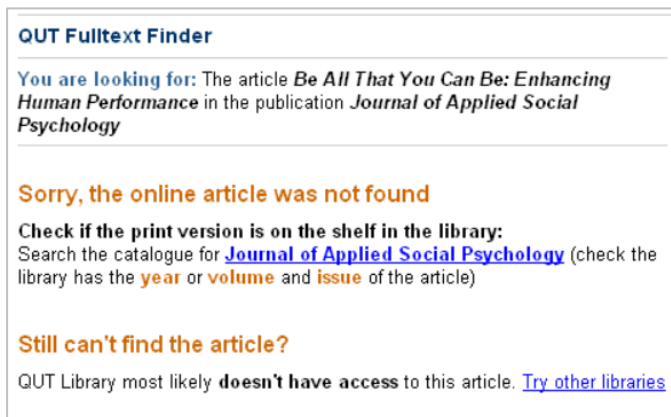


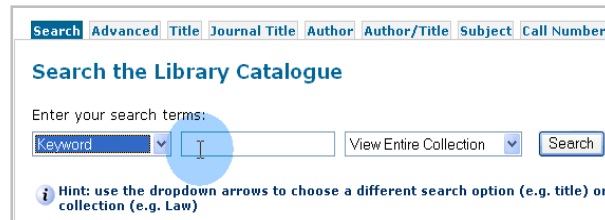
Figure 12: Fourth attempt to revise link resolver interface

After four iterations a more usable link resolver interface was reached. This was achieved by creating a design that was optimised for the majority of situations as opposed to the original design that tried to accommodate for all possible scenarios. Additional changes to the catalogue would be required to make further significant improvements in success rates.

As mock-up web pages were used during the testing, the recommended design will be implemented (where possible) in the current link resolver. Further testing using a diverse range of examples will be conducted in the live environment to identify additional issues.

Task: finding a known journal article

It was not clear from the library homepage how to locate a known journal article. Participants frequently entered article details into the search box on the catalogue homepage (see figure 13) or into the catalogue's journal title search box (see figure 14). Alternatively participants would go directly to a database they think would be relevant and start searching for the article.



The screenshot shows the 'Search the Library Catalogue' interface. At the top, there are tabs for 'Search', 'Advanced', 'Title', 'Journal Title', 'Author', 'Author/Title', 'Subject', and 'Call Number'. Below the tabs, the main heading is 'Search the Library Catalogue'. Underneath, it says 'Enter your search terms:'. There is a dropdown menu currently set to 'Keyword' and a search input field. To the right of the input field is a 'View Entire Collection' dropdown and a 'Search' button. A hint at the bottom reads: 'Hint: use the dropdown arrows to choose a different search option (e.g. title) or collection (e.g. Law)'. A blue circle highlights the 'Keyword' dropdown menu.

Figure 13: Original catalogue homepage interface



The screenshot shows the 'Journal Title Search' interface. At the top, it says 'Looking for articles on a topic? Search Library Databases'. Below that, it says 'Enter the journal title (not the article title):'. There is a dropdown menu currently set to 'Title begins with' and a search input field. To the right of the input field is a 'Search' button. Below the input field, there is a note: 'Keyword search will also find newspapers, magazines and other periodicals'. A blue circle highlights the 'Title begins with' dropdown menu.

Figure 14: Original wording for journal search fields


To address this problem the following initial changes were made (see figures 15 and 16):

- The journal search option was made more prominent on the catalogue homepage.
- The text of the journal search fields was renamed to make it clearer this was a journal search, not an article search.
- Help links explaining why articles aren't in the catalogue were added to the screen.
- A link to a separate A to Z online journal portal was added to the Library homepage (the link was called "Find online journals").



The screenshot shows the redesigned catalogue homepage. It has three main search sections. The first section is 'Search the Library for information on:' with a dropdown menu set to 'Words in the author's name' and an input field containing 'Perrin, Rob'. The second section is 'Find a specific item:' with a dropdown menu set to 'Title starts with' and an empty input field. The third section is 'Search for this journal, magazine, newspaper:' with a dropdown menu set to 'Journal title starts with' and an empty input field. Below the third section, there are two links: 'Why aren't articles in the catalogue?' and 'How do I find my article?'. A blue circle highlights the 'Journal title starts with' dropdown menu.

Figure 15: First attempt at redesigning the catalogue homepage



The screenshot shows a close-up of the 'Search for this journal, magazine, newspaper:' section. The dropdown menu is open, showing three options: 'Journal title starts with', 'Journal title starts with', and 'Words anywhere in record'. A blue circle highlights the 'Journal title starts with' option.

Figure 16: First attempt at renaming the journal search field options

The results of following-up testing indicated that the link to the A to Z online journal portal significantly improved success rates as it appeared to put participants in the frame of mind of searching for the journal not article.

However changes made to the catalogue did not significantly improve success rates:

- More participants chose the journal search option but they continued to enter article details. The catalogue homepage was again revised (partly in response to other catalogue issues) and the wording of the journal search field was modified

to add the text “*Journal title (not article title) starts with*” in an attempt to make it clearer not to enter article details (see figures 17 and 18). Further testing showed participants did not read or disregarded this information and they continued to enter article details

- Participants did not notice the help information about article details not listed in the catalogue.

To significantly improve the use of the library catalogue requires the library to address why students expect to find articles listed.

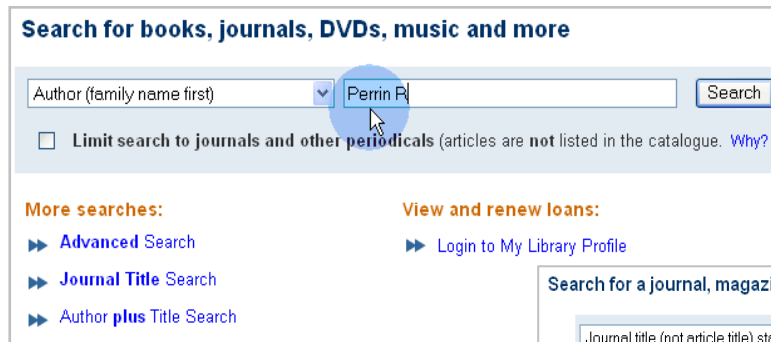


Figure 17: Second attempt at redesigning the catalogue homepage

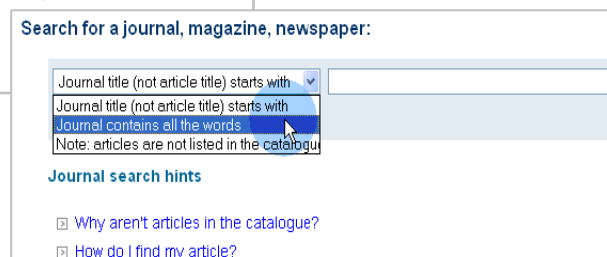


Figure 18: Second attempt at renaming the journal search field options

This project had a significant impact on QUT Library’s understanding of how undergraduate students use the Library’s online resources. During the initial round of testing, library staff were frequently surprised by what participants did on the web site and in some instances staff were quite shocked by the poor rate of success for what were considered key library tasks (such as finding a known journal article).

The iterative testing cycle also proved equally surprising. It was thought that many of the changes would certainly improve usability however follow-up testing proved this was not always the case. As a result it became increasingly important to encourage participants to think aloud as they completed tasks in order to gain a greater insight into their behaviour. The debriefing interview also became a valuable tool for finding out why participants did certain things. It was only when library staff started to understand participant behaviour that some usability improvement was attained.

5. Conclusion

Usability testing should be used to identify problems with a web interface and to confirm that subsequent changes made will in fact improve usability. This paper has shown that multiple interface changes are often required to reach a usable design, especially for complex interfaces such as the library catalogue and link resolver. In some cases where numerous problems were identified, such as the library catalogue, no satisfactory design was reached and further in-depth testing and changes are required.

Usability testing is now being incorporated into standard web site development and maintenance practices at the QUT Library. In the future, the Library plans to conduct usability testing on a range of client groups including new students, external students, staff and researchers.

6. References

Nielsen, J. (2000) "Why You Only Need to Test With 5 Users", *Alertbox*, <http://www.useit.com/alertbox/20000319.html> [accessed 10 November 2006]