Purpose and usability of digital libraries

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ABSTRACT
A preliminary study was conducted to help understand the purpose of digital libraries (DLs) and to investigate whether meaningful results could be obtained from small user studies of digital libraries. Results stress the importance of mental models, and of "traditional" library support.

KEYWORDS: Usability, user models, "lost in hyperspace."

INTRODUCTION
Compared to other areas in DL research on structuring and management of collections, on technical concerns and on issues raised by internationalisation, little work is being done to understand the purpose and usability of DLs. This paper describes a preliminary study conducted with 45 subjects to: (*i*) understand the purpose of DLs and (*ii*) investigate whether useful results can be obtained from 'small' user studies using a prototype usability tool.

Three DLs were chosen for this study because they are representative of mature topic-based DLs, and all are similar in that they are technical computing collections.

- ACMDL, the ACM Digital Library, http://www.acm.org/
- NCSTRL, the Networked Computer Science Technical Reference Library, http://www.ncstrl.org/
- NZDL, the New Zealand Digital Library, http://www.nzdl.org/

For the experiments, the 45 subjects were split randomly into 3 groups of fifteen subjects that evaluated one DL each. Subjects were asked to complete an extensive questionnaire (see http://www.cs.mdx.ac.uk/dl for details) evaluating how satisfied they were with the design and structure of the DLs. They were also asked to comment on the purpose of DLs, and to suggest design features for DLs.

The 45 subjects were third-year undergraduate students doing a module, "HCI Interface Building." As a result, all of them have experience in using DLs. As part of their course assessment, the subjects were asked to design and develop the user interface of a DL collection on stories and poems. Therefore, they should also have acquired a thorough understanding of the design and evaluation issues involved when building interactive systems, of which DLs are an example. To some extent, then, the subjects were "expert users" and one would expect — but this has not been tested here — that their comments would be more useful than naïve users'.

UNDERSTANDING THE PURPOSE OF DLS
Although DLs *address* traditional problems of finding information, of delivering it to users, of preserving it for the future — they are also *creating* problems for traditional libraries, creating tension between the architects (designers, computer programmers) of DLs, and the information suppliers (authors, librarians) of DLs.

In this short paper, we can report two design insights gathered from analysing responses from the 45 subjects:

Insight 1: Prefer tradition
26% of the subjects, who would not like to see traditional libraries being replaced by DLs, highlighted the fact that librarians play an important role in assisting the library users in the traditional library. 68% of subjects prefer human-like librarian help, for example, guided tours, and 53% prefer this "librarian-like" help, for example, recommendations when they browse. 50% of subjects, who agreed that DLs should replace traditional libraries, found that the search facility in the DLs helped them to achieve their goals better and quicker when compared to searching and browsing in traditional libraries. 55% of subjects thought that DLs should incorporate more powerful search facilities that could help them find accurate solution and complete their tasks quicker. 46% subjects felt that providing better and clearer display of results would make DLs more efficient.

Although subjects' expectations on the purpose of DLs showed that subjects preferred the traditional library environment where the library users can learn and exchange ideas with other users, only 27% of subjects suggested that, this kind of environment should be included in DLs. The subjects were not in favour of having a personal workspace to manipulate their search results, for example, "My bookshelf" feature provided by the ACMDL. Only 23% of the subjects thought that a "personal workspace" feature ought to be included in the DLs.

Insight 2: Use appropriate models

The study indicated that users are "lost" when using the three sample DLs (73% of subjects, over all three DLs). They experienced different degrees of *lostness*. Subjects' feedback also highlighted that the sample DLs did not provide sufficient information to help them understand the structure of the DLs: 67% for NCSTRL, 53% for NZDL and 47% for ACMDL.

"Lostness" is a central issue. Users build mental models of what is happening in their minds, and they use these models in their interactions. To proceed with interactions with DLs, users expect the DLs to give them cues, otherwise they will rely on their prior experiences with DLs and traditional libraries. This in itself is not bad, however there are occasions when users' prior experiences, their understanding and interactions with the current DLs interfere with their work. If users have preconceived notions of what the structure of a system is supposed to be (though it may not be necessarily right), and if that structure does not match the actual structure of the system they are using, they experience the "lost in hyperspace" problem regardless of whether they are novice or experienced users [4].

SMALL STUDIES ON USABILITY

We implemented a prototype usability tool (see http://www.cs.mdx.ac.uk/tool/) to investigate whether meaningful results could be obtained from small user studies of digital libraries. In contrast to some other approaches [e.g., 3], our tool incorporates questionnaires and heuristic evaluation, and employs real users. It does both quantitative and qualitative evaluations. Insights from qualitative evaluations are beneficial in helping one understand reasons why problems occur; insights from quantitative evaluations help designers to compare and evaluate the effectiveness of systems using metrics [1]. A detailed description of the tool can be found in [5]. The inputs of the tool capture users' responses to questionnaire and usability heuristics, as well as attributes such as name and type of systems. Outputs produced by the tool include analyses of responses compared with other studies and summaries of usability problems detected.

In the present experiment, subjects' responses were entered into the databases using the web-based questionnaire (see http://www.cs.mdx.ac.uk/dl/) and heuristic form (see http://www.cs.mdx.ac.uk/heuristics/) provided by the prototype usability tool. The 45 subjects consisted of a group of 15 who evaluated NCSTRL, a group of 15 who evaluated the NZDL, and a group of 15 evaluating ACMDL. The subjects in the studies were also asked to evaluate the DLs using established usability heuristics [1].

There are many ways to analyse and display usability results. We made the assumption that if an area scores 75% or above, it implies that the feature is well-implemented. The report http://www.cs.mdx.ac.uk/tool/results_3.html, for example, shows, for each design category, how well ACMDL performed when compared with the benchmark 75% and against the average scores obtained from NZDL and NCSTRL. With some exceptions, subjects rated ACMDL less favourably when compared with NZDL and NCSTRL — not all design categories were well implemented in it. In two other reports, http://www.cs.mdx.ac.uk/tool/results_5.html and http://www.cs.mdx.ac.uk/tool/results_7.html, subjects' overall ratings of ACMDL were also not favourable.

As the number of subjects increases, the measure indicating ACMDL's usability in design categories when compared with NZDL and NCSTRL seemed to converge to a uniform pattern, indicating that small studies could also give similar impressions of usability compared to larger studies.

A list of usability problems, detected by the subjects completing the heuristics evaluation, automatically compiled to correspond with the design categories, can be displayed using the tool interactively. For example, a list of usability problems for a design category could be obtained.

Information about usability problems identified could be meaningfully used by designers to carry out, for example, severity ratings of the problems with the same group of test users [2]. Designers could strategically allocate the most resources to fix the most serious problems, or to obtain a rough estimate of the need for additional usability design or evaluation investment in terms of cost and time.

CONCLUSIONS AND FUTURE WORK

On-going work involves increasing the number of subjects as well as getting a wider subject range (e.g., non-computing science staff/students) to get a broader understanding of the purpose of DLs. Further work will also includes validating the tool and the approach it represents with different types of DLs and larger numbers of subjects, as well as strengthening the analysis, display and reliability of the usability results.

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