Student Usability Project Recommendations Define Information Architecture for Library Technology

Erika Rogers, Director, Honors Program, California Polytechnic State University, San Luis Obispo, CA. erogers@calpoly.edu

Introduction
This paper demonstrates how interaction and usability evaluation techniques (e.g., Preece 2002) support the restructuring of information in a number of functional library areas. Senior level computer science students studying human-computer interaction principles worked with library leaders on three different projects: i) a prototype of an interactive data visualization application for more effective collections management; ii) usability recommendations for improving access to the electronic database systems; and iii) design and development of a technology-mediated, Web accessible digital research portal. All three cases started out as quarter-long (8-week) class projects with teams of three to four computer science students whose goals were to explore the principles of user-centered interaction design, development and/or usability in the context of an in-depth practical application.

## Project 1: Bibliographic Data Visualization
The changing role of technology in the definition of the library and its function in the academic community implies corresponding changes in the responsibilities of library personnel. Current role definitions focus most often on how librarians can help students and faculty more effectively access online digital resources. However, when it comes to helping the *librarians* to assume new responsibilities by more effectively doing their current jobs – for example, cataloguing, updating and maintaining the physical collections in the library, technological tools are sadly lacking. Often the processes are cumbersome and time-consuming – with out-of-date interfaces to complicated, inadequate and inflexible databases, and much hand-written work to perform what should be simple, straightforward tasks. One such task is called "deselection", which is the library's process of selecting books for removal from the collection in order to create space for new material.

Our library currently has approximately 1.5 million books in its main collection, and uses a commercial library database that is accessed through a very basic vt100 interface. Following selection of sought-after fields, a query is made against the database and the results are dumped into a "flat-file" that is imported into MS Excel. The data is then manipulated into the desired format, and the list of books that are candidates for removal are printed. This process can take months to accomplish due to the library's limited resources in terms of time and personnel.

In this class project, a group of computer science students investigated the use of dynamic visualization techniques, pioneered by Ben Shneiderman at University of Maryland, to determine whether mapping library bibliographic information to a graphical

format would help the library staff more efficiently and effectively update and maintain the library's holdings. Such visual information seeking techniques have been successfully used in numerous domains (including bibliographic data) to support exploratory browsing to develop intuition, and to find patterns and exceptions. After exploring several options, and reviewing them with the library staff, the students decided to try to adapt the Graphical Interface for Digital Libraries (GRIDL), developed at University of Maryland to explore a limited number of records from the Kennedy Library's database (Shneiderman 2000).

The students used user-centered design techniques to combine software engineering with feedback from the librarians. After several iterations, they were able to display the data in a useful and meaningful format as shown in Figure 1. In response to the librarians' request, a report generator was also developed, as well as an additional custom scatter plot application that displayed the data in a different visual format, demonstrated in Figure 2.
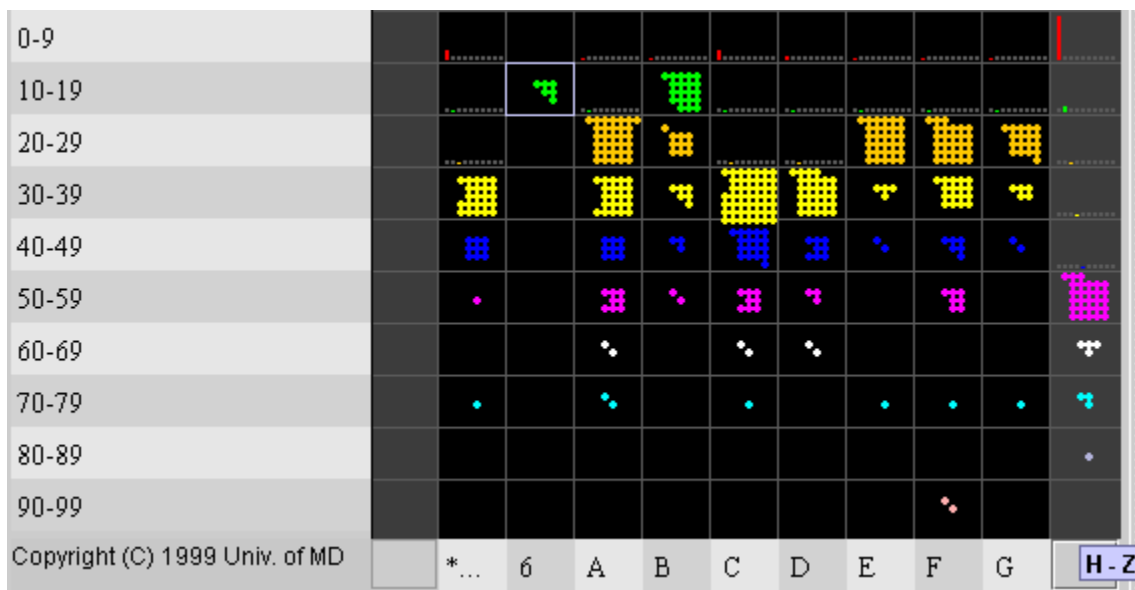
Figure 1. GRIDL with hierarchical categorization and coloring

It was clear from this project that in a relatively short time, a prototype user-centered technology support system could be developed as a cooperative endeavor between computer science students and the library staff. The use of dynamic visualization as a tool to help people understand and analyze large data sets has been demonstrated in numerous ways in the Human-Computer Interaction (HCI) literature. However, for this particular project to make a real contribution, a professional software development team would have been needed to take it over and to fully implement it. Unfortunately, to date, the librarians are still using their old system.
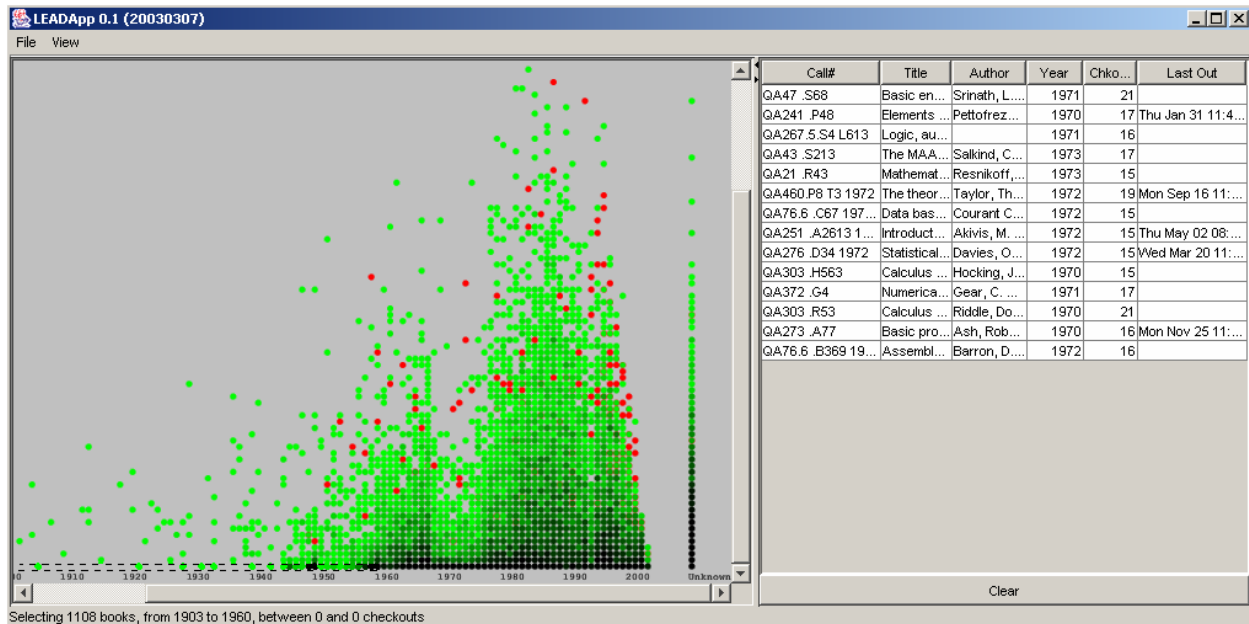
Figure 2. Custom Scatter plot Application

Project 2: Ex Libris Metalib Usability

The second project involved a usability study to make recommendations for improving the "out of the box" interface to an electronic meta-database retrieval system providing federated search engine access to the library's expensive online databases of scholarly journals, newspapers, and other research resources. Commercial products that search multiple databases and collect the results in a single interface are now widely available, and the Kennedy library decided to choose the MetaLib and SFX products developed by the company Ex Libris.

The student project was to help the library staff decide how to configure MetaLib's interface in order to meet the needs of Cal Poly students and faculty, with an emphasis on three main issues of concern: I) to design an overall branding for the site, ii) to propose a general color scheme and some ideas for possible graphics for the logo as well as the various widgets, and iii) to propose a design for an interface that would be functionally usable and efficient for the students and faculty of Cal Poly.

The initial part of the project included four stages of data collection and review - 1) analysis of earlier focus group results, 2) familiarization with the old and new library interfaces, 3) generation of a list of features needed to be changed, and 4) creation and execution of a walkthrough 'paper prototype'. Prior to our involvement in this project, the library had already conducted a focus group on the standard implementation of Metalib. Analysis of this data revealed primarily that users wanted a simple, Google-like interface whenever possible. In the second stage, the student team compared the original library interface (which provided individual database access) with the proposed Metalib multi-database search interface. This resulted in a proposed list of changes. The students also conducted a walkthrough with a small set of recruited participants. They developed four task scenarios that the subjects attempted to complete using both the original

library interface as well as the new standard Metalib product. This effort supported some of their own earlier findings, and also highlighted some additional problems that would need to be addressed. From the results of these efforts, the student team developed an evolutionary series of prototypes, ranging from chalkboard mock-ups to high-fidelity final products. These prototypes addressed all facets of the Metalib product interface including screen designs, navigation tabs, icons, logos and buttons. An example of one of the redesigned screens is shown in Figure 3.

Throughout the quarter, the student team met with the librarians and presented their designs and suggestions. Their overall results were submitted to the library in the form of a final project report. This work was found to be so productive and useful, that the library carried on and presented the recommendations to the product vendor, who has subsequently incorporated many of them into a new release of their commercial product.

Figure 3: Redesigned Metalib Results Page

Project 3: From Subject Specialist WebPages to Web Research Portal
This project was also initiated in the same course as the Metalib project described above. In this case, the goal was to have the students help with the design of "Subject Specialist" web pages. Subject Specialists are professional librarians who provide specialized assistance to members of the academic community for research papers, class assignments, senior projects, master's theses, and any other related research. Three students worked on this project and obtained user-centered input from students, faculty, and the Subject Specialists on what they wanted for this web site. The team suggested content in addition to possible page layout design. At the end of the quarter, two of the students continued the work as their senior projects. Over the summer, some of the web pages proposed by the students were implemented by the Subject Specialists together with the library web development team. In the following fall quarter, the final senior project continued with a shift in focus from a standardized approach to

the web page design to the creation of a two-dimensional user-centered content architecture, incorporating usability data with interaction design principles intended to better meet the needs of the student users (Rogers 2005).

In this project, we made use once again of multiple interaction design techniques, including user-centered design, usability testing and evaluation and personas-based design (Cooper 2003). These results were combined with ideas from instructional design theories including learning styles, scaffolding and Bloom's Taxonomy. Although the students have long graduated, their work on this project is still playing a fundamental role in the current efforts of the library's subject specialist team (now called Knowledge Managers) to reorganize old and new content into a contemporary Web Research Portal.
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Summary and Conclusions

This paper has attempted to demonstrate that the use of interaction or user-centered design techniques can promote rapid and effective changes in an environment such as a university library, which must respond to the ever-increasing demands of technology change, information accumulation and knowledge cultivation. However, in order to make these types of efforts actually work in the long run, two major steps should be taken. 1) Libraries should use the talents of students studying computer science, information technology, knowledge management, HCI, and technical writing to improve their systems by applying student work on concrete "real world" applications. (Libraries could advertise projects for masters' theses, senior projects, even class projects, such as the ones described in this article). 2) Given the limited time and resources usually available to students, libraries should also build up their own technical staff, or insist on access to the institution's technical staff in order to take the outcomes of the student projects and develop them into fully functional applications. Some of these efforts might even lead to commercialization opportunities. However, the key issue is to move promising projects from the "this looks like a good idea" prototype phase into workable, implemented tools that permit both library staff and library users to better find and use contemporary information resources.

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