Applying User-Centered Design Principles to Redesign the Interface to the Portal to Texas History: The IOGENE Project

Kathleen Murray and Dreanna Belden; University of North Texas Libraries; Denton, Texas, USA

Abstract

The IOGENE project at the University of North Texas Libraries applied user-centered design principles to redesign the interface to a unique digital library of cultural heritage materials, the Portal to Texas History[SM]*. Since its launch in 2004, the interface had become dated and implementation of new functionality was constrained by the underlying technical infrastructure. Genealogists, a significant and under-studied class of digital library users, participated in the redesign of the Portal's interface. At the outset of the project, focus group discussions provided insights regarding genealogists' information needs as well as their research practices in relation to online information systems. In large part, these insights informed the functional requirements for the redesign of the Portal's user interface. Subsequent to each of two public releases of the redesigned interface, genealogists were engaged in usability testing. An online survey measured user satisfaction prior to and after the new interface was released. Results determined that satisfaction with the Portal significantly improved after the final release of the redesigned interface. The project's process and findings will be of interest to archives and digital libraries facing similar challenges in regard to redesigning their user interface and involving users in the design process.*

Introduction

The Portal to Texas History[SM] is a digital archive of cultural heritage collections contributed by over 100 content partners, including archives, museums, libraries, historical societies, and individual collectors. Over 75,000 cultural heritage objects, including photographs, newspapers, maps, and books, are available on the Portal. Since it first debuted in 2004, the Portal's user interface had become dated and its technical infrastructure was unable to readily implement new functionality. Additionally, the Portal's unique visitors had grown from 1,000 per month to over 20,000 per month. Along with this welcome growth, came challenges for managing the collections and meeting the needs of users and stakeholders.

The IOGENE project was funded by the Institute for Museum and Library Services (IMLS LG-06-07-0040-07) to address these challenges. Two important aspects of the project were implementation of a rapid development framework to replace the legacy digital asset management system and creation of an application development model for digital libraries. The incorporation of genealogists as the targeted user group to assist in the redesign of the interface to the Portal was integral to the project and is the primary concern of this paper.

Genealogists

The popularity of genealogy continues to rise as more people become fascinated with exploring and documenting their family history. A 1995 demographic study by Maritz Marketing Research revealed that four out of ten Americans are somewhat interested in genealogy [1] and this number climbed to 60% in a 2000 study [2]. A 2005 study by Market Strategies, Inc. (MSI) indicated that the percentage of Americans interested in genealogy had grown to 73% [3].

Digital library design ought to be informed by the people served by the library [4]. Genealogists comprise a significant portion of both digital library [5] and archive users [6]. However, little research explores genealogists' information seeking behavior [7] [8] and how it might inform the design of user interfaces to online collections of cultural heritage materials [9]. The significance of this user group, and the fact that it is poised to grow in the future, motivated the selection of genealogists as the participants in this project.

User Centered Design

User centered design (UCD) methods informed the redesign of the interface to the Portal to Texas History[SM]. UCD considers the needs, context, preferences, and limitations of users at every design stage and typically involves users in: (a) initial needs assessment to identify interface requirements, (b) usability testing of prototype interfaces, and (c) usability testing of final interfaces. Interfaces are developed iteratively, with usability testing at each stage informing subsequent designs. Five typical phases of user centered design are depicted in Figure 1.
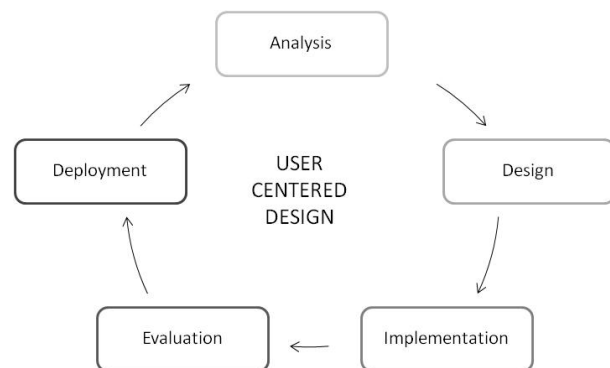

Figure 1. User Centered Design Process

Analysis
- Specify the context of use: Users and their information problems
- Conduct needs analysis to identify user requirements
- Specify requirements: functional, technical, and business-related

Design
- Create technical designs
- Create conceptual designs

Implementation
- Write code
- Produce product (e.g., alpha and beta versions)

Evaluation
- Conduct quality assurance tests
- Conduct usability tests with users

Deployment
- Launch product
- Maintain product

Only a few studies [10] [11] have included an iterative user-centered design approach for creation or redesign of user interfaces to digital library collections. The IOGENE project involved genealogists in the application development process beginning with an analysis of their needs and continuing through usability testing of the two public releases of the redesigned Portal interface.

Research Questions

A primary goal of the project was to involve users in the creation a user-centered application development model for digital libraries. To that end, the project investigated two research questions:
1. What are the information needs of genealogists as they interact with the Portal to Texas History[SM]?
2. What are the preferences of genealogists interacting with the Portal to Texas History[SM] in each of the following information seeking areas: (a) searching, (b) browsing, (c) presentation of search results, and (d) access to content?

Methodology

At the start of the project, genealogists (*N*=24) from three genealogical societies in Northeast Texas participated in two needs assessment activities: focus group discussions (*n*=19) and initial usability testing (*n*=5). The data collected from these activities informed a set of functional requirements for the redesign of the interface to the Portal.

Based on both feasibility and resources, the project team categorized the functional requirements and established two requirement sets for development over the course of the project. Additionally, the Portal's program director contributed requirements on behalf of two stakeholder groups: the Portal's content partners and funding organizations. The initial requirement set was implemented in Release 1 (June 2009), and the second set was implemented in Release 2 (October 2009). After each release,

genealogists once again participated in usability testing of the user interface (*N*=7 for Release 1 and *N*=6 for Release 2).

As one overall measure of the success of the project, an online user satisfaction survey was administered at three intervals during the project, resulting in a total of 618 responses. Initial baseline survey responses (*n*=318) were collected prior to the first release of the redesigned Portal interface. The survey was repeated following each of the two releases of the redesigned Portal, one in the summer of 2009 (*n*=157) and the second in the fall of 2009 (*n*=143).

Data Collection

Focus Group Discussions

During February and March of 2008, three focus group discussions were held with genealogists from two genealogical societies (*N*=19). Participants were primarily females (84%; n=16) and all were over the age of 50. On average, they had been doing genealogical research for 21 years.

Focus groups discussions explored the functional areas within the Portal: Search (basic and advanced), Browse, Search Results, and Object Navigation (photographs, maps, and multi-page documents). Potential new features and interface designs for the Portal were also discussed, primarily in the third focus group. Each focus group discussion was recorded and the audio recordings were subsequently transcribed and analyzed.

The major functional areas within the Portal provided the overall framework for analyzing the discussions. The project manager and another project team member categorized the content of the focus groups and areas of disagreement them were resolved. The results were the primary data source for the functional requirements.

Usability Tests

Eighteen volunteers from four genealogical societies were recruited for usability testing, which was conducted at three points over the course of the project. The participants included 15 females (83%) and 3 males (17%), ranging from 31-80 years of age. Most participants were over age 50 (78%) and had been doing genealogical research an average of 19 years.

Usability Testing Dates

Baseline (*n*=5)	Mar & Apr 2008
Release 1 (*n*=7)	Aug 2009
Release 2 (*n*=6)	Nov & Dec 2009

A talk-aloud protocol was used in each test session and participants were encouraged to state their thought processes as they made decisions and took actions. Audio, video, and screen recordings of each session were captured using Morae software from TechSmith. While each of the three testing periods utilized a unique test script to evaluate features and functions of the Portal, they shared in common a set of scenarios that corresponded to four research goals [12] or information problems that genealogists typically address: (1) Questions to answer, (2) Hypotheses to test, (3) Statements to prove, and (4) Topics to investigate.

Morae software was used to analyze each test session and to produce video clips illustrating user behavior. Findings of the

baseline tests informed the functional requirements that emerged from focus group discussions. The findings from Release 1 tests (32 tasks) informed the design of Release 2. Findings from Release 2 tests measured task completion for each of the 42 tasks in the test script. Each task was rated on a 3-point scale: 1=completed with ease; 2=completed with difficulty; or 3=failed to complete.

User Satisfaction Survey

User satisfaction with the Portal to Texas History[SM] was a key measure of the outcome of the project. An online survey questionnaire was created and administered at three intervals during the project. Initial baseline survey responses (N=318) were collected prior to the first release of the redesigned Portal interface. The survey was repeated following each of the two releases of the redesigned Portal, one in the summer of 2009 (N=157) and the second in the fall of 2009 (N=143).

The baseline survey consisted of 13 questions. An additional question regarding how respondents heard about the survey was added to the questionnaire for Releases 1 and 2. Prior to publishing the survey online, members of the project staff reviewed the questionnaire for clarity and face validity.

The survey was accessible via links in the navigation bar, page footer, homepage, and content pages on the Portal website [http://texashistory.unt.edu]. Any visitor to the Portal could complete and submit a survey. Additionally, respondents were recruited via notices to genealogical mailing lists, newsletters, and message boards, as well as from the Portal user community and the Texas digital library community.

Of the 618 total respondents, 41% identified themselves as "Genealogists/Family History Researchers" and 20% as "Lifelong learners". Seventy-six percent (n=467) of respondents were 50 years of age and older, with half (50%) reporting their ages as 60 years and older. There were more female (n=355; 57%) than male (n=263; 43%) respondents.

The survey measured two concepts: demographic characteristics and user satisfaction. Satisfaction was measured by satisfaction index scores for each of the three survey periods. Index scores were the average of responses to four survey questions that measured: usefulness of information, ease of use, overall satisfaction, and likelihood of returning to the site.

Data was analyzed with PASW Version 17. The Kruskal-Wallis H test determined if satisfaction index scores for the three survey periods were significantly different. Post hoc Mann-Whitney U tests identified significant differences between the index scores for each study period that contributed to a significant H value. A significance level of p≤.05 was used for all tests.

Findings

Requirements

Results of the focus group discussions provided insights regarding the information needs of genealogists and their research practices in relation to online information systems. In large part, these results informed the functional requirements for the redesign of the user interface to the Portal to Texas History[SM].

Information Needs

Genealogists conduct research both in regard to individual family histories and historical topics. Fundamentally, they seek information about people and historical context along three dimensions:
1. Names: primarily surname but also full name
2. Locations: county, city, town, township, community
3. Time Periods: range of dates

Names in particular pose many research challenges, primarily due to the variance in their spelling. When using online systems, genealogists are likely either to conduct a Soundex-based surname search or to perform multiple trial-and-error searches based on spelling variations.

Access to information by county is a major requirement for genealogical research. This is because many records, including vital, civil, and land records, are often retained at that level. Genealogists are accustomed to searching online genealogical information services by county and to filtering search results by county. The ability to conduct more refined location searches, including cities and townships, is highly desirable to them.

There is considerable variance among genealogists based on their experience with computers and technology. Sensitivity to the needs of both more and less experienced users is important in terms of their requirements. While more experienced users understand terms such as 'metadata', 'relevance', and 'permalink', less experienced users do not understand these terms as well as others commonly found in digital library and archive sites. In addition to the terms mentioned, they need explanations for terms such as 'fulltext' and 'creator' and for image options such as 'jpeg' and 'tiff'.

Similarly, more experienced researchers use: Boolean search techniques and phrase searches; 'right mouse' features to copy and save objects; and 'control F' to find terms within web pages. In contrast, less experienced researchers need examples or explanations regarding how to formulate searches, in particular Boolean and phrase searches. Additionally, these users have difficulty downloading and saving objects, and, in the absence of an explicit download feature, are more likely to print objects in order to retain a copy.

Some genealogists conduct family history research on behalf of others, either for payment or not. They often deal with family-owned information, in addition to information discovered in databases, archives, and repositories. Because genealogists often publish their findings, they strive to be in compliance with copyrights and need to identify rights-holders for materials. Likewise, genealogical practice encourages citation of source materials that support research findings. Access to either citations or the data needed to create them is important.

Genealogists often travel to locations to use or discover source materials. As part of their professional training, genealogists are encouraged to not rely solely on copies of source materials or 'copies of copies', but to actually view source materials from time to time. If a researcher discovers that one institution holds a number of resources of interest to them, they might well travel to that institution to see the originals. In this manner, resources discovered in archives or repositories actually result in visits to institutions that might not otherwise occur.

Functional Requirements

The functional requirements provided a foundation for the redesign of the interface. They were initially classified as pertaining to either one of six existing or one of six new functional areas of the Portal. The existing functional areas are consistent with those in most digital libraries and are listed below without further explanation. The new functional areas are briefly described.

Existing Functional Areas

1.	Search • Basic Search • Advanced Search
2.	Browse
3.	Search Results • List View • Grid View
4.	Metadata
5.	Object Navigation
6.	Help

New Functional Areas

1.	Obtain Allow users to save and print objects, along with their citations and metadata. Users may order high resolution prints of images.
2.	Comment Allow any user to submit error reports and registered users to add comments, view others' comments, and communicate with other registered users.
3.	Register Offer users a simple registration process.
4.	Create Lists Allow registered users to merge search result lists and create object lists.
5.	View Map Allow users to view search results on a map of Texas counties that visually indicates the variance in the number of hits for each county.
6.	View Timeline Allow users to view search results on a timeline.

Requirements in all functional areas were classified by the project team into one of four development priorities:
1. Release 1
2. Release 2
3. Consider for Future Releases (2010 and beyond)
4. No Development Planned

Significant enhancements, based on requirements were implemented in Release 1. Among these were:
- simple searches limited by object type (books, maps, photos, and newspapers)
- new browse interfaces, including a Texas county heat map that indicates the density of available content for each county
- RSS notifications for user-specific searches and new content

- persistent identifiers for all objects
- ability to download objects in a range of sizes
- print capability for all objects with their citations
- "share" feature for all objects
- user documentation for most features, as well as for discovering genealogical and educational materials
- global rights statement for Portal contents
- location and contact information for all content partners

Functional requirements for release 2 of the Portal were revised in June 2009. The major modification was to defer development of a commenting feature, which required development of a registration capability that was beyond the development resources available for Release 2. Significant enhancements implemented in Release 2 included:
- a "return to search results feature" from object display pages
- facets for limiting search results by content partner, resource type, county, decade, collection, language, and serial title
- full citations for each object, informed by genealogical citation standards
- wildcard searches of full-text

User Documentation

Both the functional requirements and experience with users since inception of the Portal indicated that revisions were needed to the Portal's documentation in several areas: information about the Portal itself, collections, content partners, digitization standards, metadata practices, and partnership options. Metadata for all content partners and collections was reviewed and harmonized to allow for ease of editing and consistent display within the interface. Also, information regarding options for becoming a content partner and the practices and standards employed for digitization and digital object metadata creation were reviewed and revised in conjunction with Release 1.

Additionally, user documentation was needed for each of the major functional areas of the Portal. The revised Portal included online documentation in the form of Help Guides, FAQs, and a Glossary of Terms. Specific guides for educational materials and genealogical materials were created.

Rights Designation

In the process of establishing requirements for the Portal, consideration was given to adopting a standard Creative Commons [http://creativecommons.org/] license or a Public Domain certification, as appropriate, for all Portal objects. It was determined that this was not feasible in the current project scope and instead a single rights statement regarding Portal content was included via a link in the footer of all pages.

In order to be positioned to consider this in the future, rights metadata needs to be identified for all Portal objects. This will involve adding rights elements and definitions to the Libraries' metadata scheme and template. Additionally, it will be necessary to review ownership and copyright details for all Portal content and to categorize each object as:

- Public Domain: no copyright issues with an object
- Public Domain: object is likely in the public domain but some issues may still exist in regard to stipulating this
- Copyright Ownership: object is copyright protected

Once this categorization is accomplished, follow-up will be needed with content partner(s) to resolve any issues with those objects likely to be in the public domain and to gain agreement from owner(s)/partner(s) in regard to an appropriate Creative Commons license designation.

Task Completion

As a measure of overall effectiveness of the Release 2 interface, a completion score was assigned to each of the 42 tasks in the usability test script. Figure 2 illustrates participants' (N=6) average completion scores for each of the 42 tasks: 1=completed with ease; 2=completed with difficulty; 3=failed to complete.

All participants completed 17 (40%) of the 42 tasks with ease. An additional 22 tasks were completed by most users, although some had difficulty doing so. The average completion scores for only three tasks were in the "failed to complete" range (i.e., average score greater than 2). These tasks were among those that tested users' ability to locate secondary navigation features.
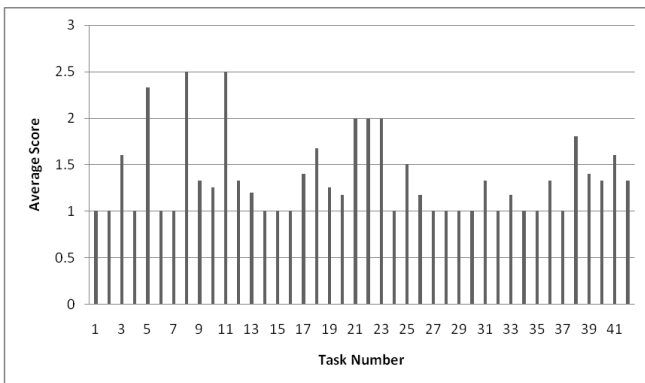

Figure 2. Task Completion Scores for Release 2 Usability Test

Usability testing of the Release 1 interface had also identified difficulties in locating secondary navigation features, for example, "About this Photograph" and "View this Photograph" (Figure 3) on photograph object pages (Figure 4). Design changes had been made to the secondary navigation display after Release 1 usability testing. However, users continued to have difficulty locating the secondary navigation options in Release 2 usability testing. Mitigating this difficulty was the observation that after discovering the secondary navigation features, users readily located and used them for future navigation.

User Satisfaction

Differences in user satisfaction for each of the three survey administration periods were measured by satisfaction index scores. The range of possible index scores was 1.00 to 4.00, with 4.00 indicating the highest possible user satisfaction. Median index scores for each survey period suggest that users were fairly

satisfied with the Portal in each period and more satisfied in the period following Release 2.

Median Index Scores by Survey Period

Baseline (*N*=318)	3.25
Release 1 (*N*=157)	3.25
Release 2 (*N*=143)	3.50

The Kruskal-Wallis analysis of variance by ranks confirmed that there was a significant difference in satisfaction index scores among the survey periods (H (2) = 5.991, p=.050). The Mann-Whitney U test was applied for post-hoc analysis of each pair of survey periods (i.e., baseline and release 1; baseline and release 2; release 1 and release 2). The results identified a significant difference between the baseline survey period, prior to the redesign of the Portal interface, and the Release 2 survey period, which followed the second release of the redesigned interface (U = 19597.500; p=.017). Overall, users were more satisfied with the Portal following Release 2 of the redesigned interface, indicating a successful project outcome.

Figure 3. Secondary Navigation for a Photograph Object

Figure 4. Photograph Object Display Page

Closing

A primary goal of the IOGENE project was to apply UCD methods to redesign the interface to an existing digital library, the Portal to Texas History[SM]. Through focus groups and usability testing the information needs and behaviors of genealogists were identified. This understanding informed a set of requirements in the following information seeking areas: (a) searching; (b)

browsing; (c) presentation of search results; (d) interacting with objects; and (e) obtaining objects. In turn, these requirements informed the design and development of two software releases of the Portal's interface: Release 1 in June 2009 and Release 2 in October 2009.

A key measure of the outcome of this project was user satisfaction following Release 2 of the new interface to the Portal to Texas History[SM]. Overall, users were significantly more satisfied with the Portal following Release 2 than they were with the original interface.
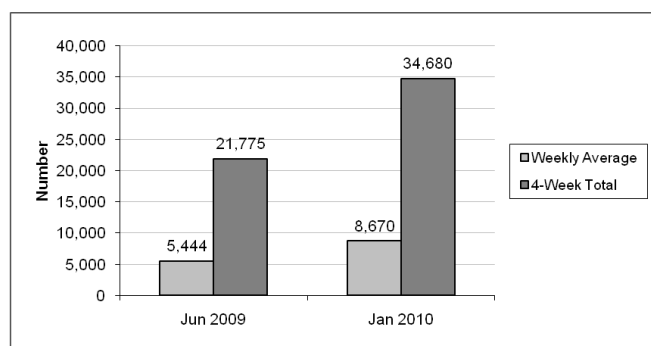

Figure 5. *Portal Visits (Data Source: Google Analytics)*

The technical infrastructure implemented in conjunction with this project has proved robust at handling an ever-increasing number of visitors. From June 2009 to January 2010 there was a 59% increase in the number of Portal visits per month (Figure 5). Not only did the infrastructure handle this increase in visitors with ease but user satisfaction improved significantly.

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Author Biography

Kathleen Murray, IOGENE Project Manager, received her PhD in information science from the University of North Texas (UNT, 2000). Her work focuses on user studies in the areas of digital libraries and web archives. Dreanna Belden (MLS, 2003) is Coordinator of Grants and Development for the UNT Libraries and program manager for the Portal to Texas History. In that role, she sets collection development priorities, coordinates partner relations, and directs external funding programs. She is a Board Member for Texas Heritage Online.