Original scientific paper

Evaluation of Digital Collections' User Interfaces

Radovan Vrana
Department of Information Sciences
Faculty of Humanities and Social Sciences, University of Zagreb
Ivana Lučića 3, 10 000 Zagreb, Croatia
rvrana@ffzg.hr

Summary

Digital information resources play a very important role in today's world. They eliminate or reduce prior constraints of distance, fragility of resources, or limited physical access to resources premises a freedom and flexibility in information access unprecedented in human history (Bates, 2002). Their existence would be impossible without information systems that enable their functioning. The life cycle of an information system consists of the standard sequence of development phases. This sequence of development phases includes the process of evaluation or assessment of the information system. Only thorough and frequent evaluation of the information system and its components will ensure its flawless functioning. During the process of evaluation, special attention is given to user interfaces, access points to the content of online information resources. The process of evaluation can be carried out by application of several different methods. This paper puts focus on selected methods for evaluation of information systems and their user interfaces that can be also applied to digital collections (and their user interfaces) available on the Internet. It also presents results from the research of the Croatian national heritage digital collections available on the Internet and common characteristics of their user interfaces.

Key words: digital libraries, digital collections, evaluation

Introduction

Digital information resources play a very important role in today's world. They eliminate or reduce prior constraints of distance, fragility of resources, or limited physical access to resources premises a freedom and flexibility in information access unprecedented in human history (Bates, 2002). Despite the system developers' efforts, design of information systems that make possible functioning of online digital information resources is rarely without flaws. To discover weaknesses of such information systems, and to improve their functioning, designers and developers use different methods of evaluation of the whole information system or its respective components. This paper puts focus on one such component – front end of online information resources i.e. user interface of

digital collections on the Internet. User interfaces are important because they serve as access points to the content of the online information resource. In case of digital collections and digital libraries, user interfaces can be quite complex and require substantial knowledge from user for their use. Their design should be carried out in compliance with the current user interface development standards and with end users and their needs in mind. End users are not always included in the process of the information system development, but are rather imaginary category excluded from the direct involvement in that process. As a result, components of the information system are built separately with no knowledge of the user interfaces of other components they may be composed with and this can result in component-based applications with inappropriate, inconsistent interfaces. Problem with use of such user interface may appear due to the user’s level of expertise, the task and role being performed, and user’s personal preferences. Every new additional component that may be integrated, can introduce further problems or inconsistencies to the overall application interface (Grundy and Hosking, 2002). The idea behind every user interface is to make access to digital content as easy as possible, and that is the goal of an information system developer. Despite the existing usability standards, a certain number of user interfaces of online information resources is still difficult to use or doesn’t have all the necessary functions the user would expect from a modern user interface. In such cases, evaluation process can indicate weak points of tested user interfaces and help information system designers to improve those inadequate parts. Result should be better understanding of the process of design of user interfaces and their easier use.

Design and structure of user interfaces

The user interface is a part of the computer and its software that people can see, hear, touch, talk to, or otherwise understand or direct (Galitz, 2002). Proper user interface design will provide a mix of well designed input and output mechanisms that satisfy the user’s needs, capabilities and limitations in the most effective way possible. The best user interface is one that it is not noticed, one that permits the user to focus on the information and task at hand, not the mechanisms used to present the information and perform the task (Galitz, 2002). A well-designed user interface can help users to use the system more easily by reducing the effort to identify a particular object on the screen, or providing smooth navigation among screens (Thong, Hong and Tam, 2002).

Behind every user interface is a conceptual model. One such model was proposed by William Arms in his book on digital libraries. His model describes the manner in which the system is used. His conceptual model contains 4 layers (Arms, 2001): interface design, functional design, data and metadata and computer systems and networks.

Interface design encompasses what appears on the screen and how the user manipulates it (fonts, colors, logos, keyboard controls, menus and buttons). Func-

tional design specifies the functions that are offered to the user (selecting parts of a digital object, searching a list or sorting results, obtaining help, and manipulating objects that have been rendered on the screen). Enumerated functions are made possible by the data and metadata that are provided by the digital library and by the underlying computer systems and networks.
The user interface development would be very difficult if not impossible without fundamental design principles that apply to the structure of the user interface and all its parts (Dennis, Wixom and Roth, 2006):

- Layout: the interface should be a series of areas on the screen that are used consistently for different purposes: navigation (top area), input and output (middle area) and system status (bottom area)
- Content awareness: user should be aware of where they are in the system and what information is being displayed
- Aesthetics: interface should be functional and inviting to users through the careful use of white space, colors and fonts
- User experience: some users will prefer ease of learning and some will prefer ease of use
- Consistency: it enables users to predict what will happen before they perform a function
- Minimize user effort: the user interface should be simple to use.

Despite the existing principles of user interface design, we are still aware of very different user interfaces we use every day. Generally speaking, the structure of a user interface includes three fundamental parts (Dennis, Wixom and Roth, 2006):

- Navigation mechanism: the way in which the user gives instructions to the system and tells it what to do (buttons, menus)
- Input mechanism; the way in which the system captures information (Web forms etc.)
- Output mechanism: the way in which the system provides information to the user or to other systems (reports, Web pages)

These fundamental parts are starting points for evaluation of user interfaces of various types of online information resources.

Evaluation of digital collections

Digital collections are key parts of digital libraries and are central point of this paper. Digital libraries are revolutionizing the ways library services provide access to digital information (i.e. data or articles) through their collection, repackaging, and online distribution via local or international networks, such as the internet (Sutradhar, 2006). Digital libraries are therefore networked information space in which users can discover, locate, acquire access to and use information (Greenstein, 2000). Their functions are similar to those in conventional libraries, but they differ in storage and retrieval, where digital libraries are dependent

almost exclusively on computer and electronic network systems (Waters, 1998). Digital libraries can be also perceived as sets of electronic resources (i.e. digital collections) and associated technical capabilities for creating, searching, and using information. They are extension and enhancement of information storage and retrieval systems that manipulate digital data in any medium (text, images, sounds; static or dynamic images) and exist in distributed networks (Borgman, 2003). To make the assessment of the current state of development of digital collections and digital libraries, they should be constantly evaluated.

The term evaluation has many connotations ranging from highly focused and well-defined product testing to the highest form of cognitive reflection (Marchionini, 2000). In case of online information systems, one can perceive as if the content (information) itself is badly prepared and presented rather than to put the blame on the poorly designed front end of the information system. According to Norman, who compared evaluation of information and information systems, information cannot by itself be good or bad; it can only do so within the context of a person being informed. However, an information system can be assessed —issues of usability, speed and reliability are open to objective measurement and are largely independent of the context of an information transaction (Norman, 1997). When speaking about evaluation of digital libraries Chowdhury and Chowdury point out that they may be evaluated from a number of perspectives, such as: system, access and usability, user interfaces, information retrieval, content and domain, services, cost and the overall benefits and impact (Chowdhury and Chowdhury, 2003).

Evaluation of digital collection user interfaces

Evaluation of user interfaces can be a very difficult task. As the information and communication technology develops, so change the user interfaces that help us access the digital content on the Internet stored in digital collections. When referring to user interfaces of digital collections available on the Internet, we usually refer to Web interfaces, and less frequently to other types of user interface that exist too (e.g. JAVA applications etc.).

According to Dennis, Wixom and Roth the objective of user interface evaluation is to understand how to improve the user interface design. User interface evaluation should begin in the design phase when design problems can be identified and corrected (Dennis, Wixom and Roth, 2006). User interface evaluation is necessary because it is difficult if not impossible to design an user interface that for all users and all tasks on all occasions will function perfectly (Tedd and Large, 2005).

Savage (Savage, 1996) compared three methods for user interface evaluation:

- Expert reviews: conducted in the presence of human factors specialists and consist of a combination of standard inspection methods (in this case, heuristic evaluation, cognitive and pluralistic walkthroughs, and consistency and standards inspections) all bundled into one inspection session

- Reviews: conducted by end users
- Usability Testing.

Dennis, Wixom and Roth added another four approaches to for (user) interface evaluation (Dennis, Wixom and Roth, 2006):

- Heuristic evaluation: examines the interface by comparing it to a set of heuristics or principles for interface design; as this approach does not involve the users, it is considered the weakest type of evaluation
- Walk-through evaluation: it is a meeting conducted with the users who will ultimately have to operate the (information) system who go through various parts of the interface; the users identify improvements to the interface
- Interactive evaluation: the users work with the prototype of the user interface with the project team behind the information system
- Formal usability testing: it is done with the help of commercial software products; the user participates in one-on-one session in which he or she works directly with the software to accomplish given tasks; the evaluation is conducted in a special lab equipped with video cameras and special software that records each keystroke and mouse operation so they can be replayed to understand exactly what the user did;

Another common and widespread evaluation approach is evaluation against the set of pre-selected criteria. Set of criteria should encompass most vital parts of the evaluated user interface. Tedd and Large (Tedd and Large, 2005) suggest five evaluation criteria that can be applied to any interface: the time it takes to learn how to use the interface properly; the speed at which the interface performs actions requested by the user; the rate of errors committed by users at the interface; the ease with which users can remember the interface and its features from one session to the next session and the level of individual satisfaction that users derive from their experience with the interface.

The final part of the paper will present the results of the comparison of user interfaces of digital collections that are part of the Croatian national cultural heritage against the set of pre-selected criteria.

Research: Comparison of digital collection user interfaces

This part of the paper introduces comparison of digital collections user interfaces that are part of the portal about the Croatian Cultural Heritage project, a national project for the digitization of archival, library and museum material (Croatian cultural heritage, 2007) available on http://www.kultura.hr. This Web site offers information about current digitization projects in Croatia and it was used as a staring point for the creation of the list of digital collections accessible on the Internet that will be compared against the list of criteria. The final list for the comparison was created from the list of all registered projects of digitization in all regions of Croatia (the complete list is available at: http://www.kultura.hr/

hr/zbirke/po_regijama). On April 26th 2009, 214 digital collections were registered on this Web site. It must be noted that not all of 214 digital collections were accessible online, since some of them are available for use only in the premises of libraries, archives and museums where collections are stored. Web pages of 66 out of 214 digital collections were reachable online at the moment of the creation of the list of digital collections that were used in the comparison.
The hypothesis for this research was that most digital collections available on the portal of the Croatian cultural heritage share common screen / user interface elements which make their use easier. The second hypothesis was that user interfaces of digital collections available in the Croatian Web space are still underdeveloped. The aim of this research was to collect the data which would confirm or reject these hypotheses. Based on the results of this comparison, software developers can make the necessary improvements to those digital collections user interfaces that are found to be underdeveloped or inadequate in some areas.
The list of comparison criteria will be based on work of Xie and Cool (Xie and Cool, 2000) who selected six tasks which users have to achieve in order to accomplish their search tasks in online information retrieval systems and which are realized in an user interface as functions: database selection, query formulation, query reformulation, access to help function, organization and display of results and delivery of results. These tasks are common in digital libraries today.
The list of criteria suggested and used by Xie and Cool (Xie and Cool, 2000) will be expanded for the evaluation of interfaces of digital collections:

- Category 1. Access: browsing capabilities; searching capabilities (simple and advanced)
- Category 2. Query formulation: simple; complex (AND, OR, NOT operators), query reformulation
- Category 3. Help: general; contextual
- Category 4. Organization and display of results: sorting capabilities; limiting number of results
- Category 5. Delivery of list of results: file, print, clipboard, e-mail
- Category 6. User interface language choice.

These tasks are essential for the successful completion of users’ tasks. For instance, the search and browse tools that a site provides to its users are increasingly important as users become more and more sophisticated in their search strategies and, at the same time, become less inclined to spend a lot of time learning the ins and outs of a Web site (Shiri and Molberg, 2005).

Results and discussion

The results will be presented jointly in each category.

Category 1. Access (n=66)

	Browsing	Searching: simple	Searching: Advanced
N	57	8	7
%	86,36%	12,12%	10,60%

The comparison of digital collections user interfaces in this category shows that the large percentage of them are built with the browsing function in mind. The amount of content in a particular collection is very small, and therefore it is easier for users to browse the collections instead of searching; this is especially true for new users.

Category 2. Query formulation (n=66)

	Simple	Complex	Reformulation
N	6	3	5
%	9,09%	4,54%	7,57%

The results in previous and this category indicate that searching is not included frequently as a function of digital collection user interface. Very few collections (9,09%) offer even simple query formulation while even smaller percentage collections (4,54%) offer complex query formulation (use of AND, OR, NOT operators). As searching and browsing are two main access points to digital content available not only in digital collection in archives, libraries and museums but also on the Internet, this results should be taken into consideration when implementing the search function into user interfaces of future digital collections.

Category 3. Help (n=66)

	General	Contextual
N	4	0
%	6,06%	0%

Novice users of digital collections would find themselves in very difficult position if they are not familiar with the content of digital collections registered at the Ministry of culture of the Republic of Croatia. Help option was found in 6,06% of digital collections included in this comparison. Digital collections in the comparison do not offer any instance of contextual help that is necessary when the collection user moves from one part of the collection to another. In case of change of type of content or type of content handling, the collection user cannot count of any type of help. As digital collections available on the Internet grow in number, and are still very different, general and contextual help will

become necessary parts of every digital collection. The problem is even more delicate when one thinks about including the digital collection in educational process in schools or at universities.

Category 4. Organization and display of results (n=66)

	Sorting	Limiting no. of results
N	1	1
%	1,51%	1,51%

This category is dedicated to the management of search results. Organization and display of the search results help users to find results that suite best to his or her needs. In case of the 66 compared digital collection, only 1 collection offers mechanism for sorting and limiting number of the search results.

Category 5. Delivery of list of results (n=66)

	File	Print	Clipboard	E-mail
N	1	0	0	1
%	1,51%	0%	0%	1,51%

In addition to results from previous category, only 1 collection offers delivery of search results in file or by e-mail. These options have been standard for information retrieval systems for decades. They help user to transfer the search results to their personal computers.

Category 6. User interface language choice (n=66)

	User interface language choice
N	17
%	25,75%

In today's multilingual world, the possibility of change of language of a user interface is vey important, as users come from different parts of the world. Only one quarter of collections offers such a possibility which is not enough if web want to internationalize digital collections of the Croatian heritage.

Conclusion

Evaluation of user interfaces of digital collections available on the Internet is an important, complex and necessary activity during the process of development and use of digital information resources available on the Internet. As the number of available digital collections grows, so grow the expectancies of their users. User interfaces are undergoing changes and new types of user interfaces are being introduced frequently and thus are becoming a new challenge to digital collection software developers as well as to the users of these digital collections. Their evaluation should be carried out frequently in order to improve the access

to the content stored in online information resources. The results of the research in this paper show similarities between user interfaces of digital collections which is not unexpected since use of the previous knowledge and experience from interaction with digital collections worldwide can help users to access the content of reasonably high number of new digital collection they will encounter on the Internet. The results may also motivate digital collections developers to compare the user interfaces of their digital collections with other heritage digital collections available on the Internet, and to make the necessary improvements.

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