

# Mapping users' goals and tasks to typical digital library functions

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## Abstract

This paper is an exploration of digital libraries (DL) for analysing how typical library functions support what users want. The overall research question to be explored is: How do the users' goals reflect on the actual design of digital libraries? 25 existing digital libraries have been analyzed regarding the users' goals and tasks they support. Typical goals and tasks of DL users were identified in a literature study. Our objective is to explore which kinds of DL functions satisfy these goals.

**Key Words:** goals, tasks, digital library functions

## 1.0. Introduction

Giving a definition of digital library is a thorny issue because there are so many different definitions (Schwartz 2000) and a lack of consistency between them. We will take a user-oriented perspective on digital libraries, a perspective to understand the challenges for users while searching for information. According to Kochtanek and Hein (1999) digital libraries are "organized collection of resources, mechanisms for browsing and searching, distributed networked environments, and sets of services objectified to meet users' needs". Following Deegan and Tanner (2002) "there are many different kinds of digital libraries creating, delivering and preserving digital objects that derive from many different formats of underlying data." The President's Information Technology Advisory Committee (PITAC) Panel on Digital Libraries gave a view of digital libraries as "the networked collections of digital text, documents, images, sounds, scientific data and software that are the core of today's Internet and tomorrow's universally accessible digital repositories of all human knowledge" (Reddy & Wladawsky-Berger 2001). Many other definitions can be found but the main points are: there are (1) many different kinds of digital libraries with (2) extremely heterogeneous content and (3) a variety of services and technologies.

From the users' point of view digital libraries are heterogeneous systems in many ways. Some examples are illustrating this situation showing what users have to pay attention to while looking for information in digital libraries:

- User authentication for access to collections: open access, need for individual registration or library licences
- Way of utilisation: offline (e.g. download full text as pdf) or online (e.g. e-books)
- Collection: books, journals, proceedings, films, pictures, electronic products and metadata catalogues
- Output format: .pdf, .doc, .avi, .mpeg, .xls

- Media type: text, still or moving images, audio sequences or multimedia applications
- Mechanisms for content representation: e-book reader or player for multimedia content
- Mechanisms for information retrieval: search, advanced search, query expansion, recommender system, browse, thesauri, ontology, glossary
- Mechanisms for collaboration:., blog, forum, ask a librarian, chat
- Mechanisms for personalisation: myLibrary, annotations, myClipboard, favourites, bookmark services (e.g. Delicious, BibSonomy)

The amount of DLs worldwide is still growing, just as the functions they are offering. In times of Web2.0 some DLs try to establish Library2.0 (Gavrilis et. al, 2008). The ICT Work Programme 2009-2010 funded by the European Union has foreseen a budget of € 69 million to support the research on digital libraries. As DLs are becoming more important, we want to explore how actual library functions are meeting the users' goals and tasks.

## **2.0. Methods and findings**

A task is what people need to do to achieve their goals. The goals are what users expect, want and need from the system and what they would like to do with the system (ISO 9241-11, 1998). The objective of our study was twofold: we wanted to achieve a better understanding of what users want to do and how they perform their tasks when looking for a specific topic within different digital libraries and on the other side we explored digital libraries in order to analyse how users' expectations and needs are supported by typical digital library functions. Thus, we conducted two studies: in order to identify typical goals and tasks several studies have been evaluated in a literature review. This analytical kind of approach is considered to be sufficient, because a number of findings have been mentioned over the last years and the results are adequately published. Furthermore, 25 existing digital library applications have been analysed collecting typical DL functions. Functions are defined as an aid or 'tool' the user can use in order to fulfil a task. As result a number of typical DL functions has been identified and matched to user goals and tasks.

### **2.1. Goals and tasks of DL users**

Within the last decade there have been several studies concerning with the description of users' information needs, requirements, habits and their expectations on how to perform their tasks in digital libraries. Paepcke (1996) suggests a broader image of what users should be able to do with digital Libraries, „not just search, but four other aspects of user tasks“. Within a series of semi-structured interviews he identified main activities that can be partitioned into five categories: (1) locating and selecting among relevant sources, (2) retrieving information from them, (3) interpreting what was retrieved, (4) managing the filtered-out information locally, and (5) sharing results with others. Another approach is presented by DELOS network gathering data in several case studies, a literature study and questionnaire survey. They are presenting a Digital Library Lifecycle containing the activities of administrators and users. The user activities are:

- (1) Discover: Search and find the appropriate digital library for the topics of interest
- (2) Access: Gain access to the digital library registering personal information and preferences

- (3) Use: Search or browse the available material in the digital library concerning personal interests and take advantage of the appropriate resources
- (4) Review/Comment: Provide feedback to the other users and administrators of the digital library regarding the value of the available resources
- (5) Personalise: Personalise the use of the digital library creating an appropriate plan of use that serves user's purposes

Goals (activities) of digital library users are presented by Goncalves et al. (2004) within „Taxonomy of digital libraries terms“. This formal model is mixing activities of administrators and users. The users' high-level goals are (1) Abstracting, (2) Creating, (3) Disseminating, (4) Organizing, (5) Personalizing, (6) Requesting/Selecting.

A comparison of these three approaches shows that there are some correspondences between the meanings of the different goals although the wording is not the same (table 2).

<b>Digital Libraries: Searching Is Not Enough</b> (Paepcke, 1996)	<b>Functional and non-functional requirements</b> (DELOS, 2004)	<b>A Formal Model for Digital Libraries</b> (Goncalves, 2004)
Discover/Selection	Discover	
Retrieval		Requesting/Selecting
Interpretation	Use	Abstracting
Information Management		Organizing
Sharing	Review/Comment	Disseminating
	Access	
	Personalize	Personalize
		Creating

Table 1: Comparison of users' goals in literature review

The goals described in Paepcke are supplemented with the goal "Personalize" in the DELOS approach. However, the description of using information resources in DELOS ("Use") is insufficient. The goal "Creating" is only considered by Goncalves but is becoming more and more prominent in times of Web2.0 or Library2.0. Finally, bringing together these different views we are defining the following goals and tasks of DL users:

- **Information Retrieval:** Search or browse the available material in the digital library concerning personal interests.
- **Interpretation:** Cogitate, reflect, examine and organise the results regarding the quantity and quality (relevance) to decide if the results are suitable for analysis in detail or if a new search has to be run.
- **Extraction:** Export, save, bookmark, print or purchase the results to get permanent access to the information outside the digital library and recommend results to other people that might be interested in the same topic.

- **Personalisation:** Tailor information, functions and DLs' User Interface to match the unique and specific needs of an individual or a community.
- **Collaboration:** Work together in networks to provide feedback to the other users and administrators of the digital library regarding the value of the available resources

In the following we present the results from our web-analysis of 25 digital libraries regarding the question how the goals and tasks are 'implemented' in DL functions.

## 2.2. Typical DL functions

The following digital libraries have been explored. The selected DLs are well-established systems, many of them existing for more than 5 years. Some of them are public funded (e.g. Europeana) others are in the private sector or services offered by publishers (e.g. Science Direct). The collections offer a great many of records between 10.000 and 150 million items and consist mostly of text documents. But there are some DLs like DMG-Lib or Internet Archive offerings also pictures, audio or video content. Most of the DLs were accessed via Athens Login provided by University of Technology Ilmenau. If registration were offered, we used this possibility to gain access to almost all functions.

Name	URL
1 National Film and Sound Archive of Australia	<a href="http://www.nfsa.ov.au">http://www.nfsa.ov.au</a>
2 The European Library	<a href="http://www.theeuropeanlibrary.com">http://www.theeuropeanlibrary.com</a>
3 The Library of Congress Memory Project	<a href="http://memory.loc.gov">http://memory.loc.gov</a>
4 ACM Digital Library	<a href="http://portal.acm.org">http://portal.acm.org</a>
5 Digital Mechanism and Gear Library (DMG-Lib)	<a href="http://www.dmg-lib.org">http://www.dmg-lib.org</a>
6 Ingenta Connect	<a href="http://www.ingentaconnect.com">http://www.ingentaconnect.com</a>
7 Science Direct	<a href="http://www.sciencedirect.com">http://www.sciencedirect.com</a>
8 Internet Archive	<a href="http://www.archive.org">http://www.archive.org</a>
9 SAGE Journals Online	<a href="http://online.sagepub.com/">http://online.sagepub.com/</a>
10 DRIVER - Digital Repository Infrastructure Vision for European Research	<a href="http://search.driver.research-infrastructures.eu/">http://search.driver.research-infrastructures.eu/</a>
11 Emerald	<a href="http://www.emeraldinsight.com">http://www.emeraldinsight.com</a>
12 Project MUSE	<a href="http://muse.jhu.edu/">http://muse.jhu.edu/</a>
13 PANGAEA	<a href="http://www.pangaea.de">http://www.pangaea.de</a>
14 The State Hermitag Museum, St.Petersburg, Russia (Digital Collection)	<a href="http://www.hermitagemuseum.org">http://www.hermitagemuseum.org</a>
15 CERN Document Server	<a href="http://www.cdsweb.cern.ch">http://www.cdsweb.cern.ch</a>
16 NetLibrary	<a href="http://www.netlibrary.com">http://www.netlibrary.com</a>
17 IEEE Xplore	<a href="http://ieeexplore.ieee.org">http://ieeexplore.ieee.org</a>
18 Inspec	<a href="http://ovidsp.tx.ovid.com">http://ovidsp.tx.ovid.com</a>
19 ISI Web of knowldege, Web of science	<a href="http://apps.isiknowledge.com">http://apps.isiknowledge.com</a>
20 Chemistry Central	<a href="http://www.chemistrycentral.com/">http://www.chemistrycentral.com/</a>
21 Zentralblatt MATH - ZMATH Online Database	<a href="http://www.zentralblatt-math.org/zmath/en/">http://www.zentralblatt-math.org/zmath/en/</a>
22 Periodicals Archive Online	<a href="http://pao.chadwyck.co.uk/home.do">http://pao.chadwyck.co.uk/home.do</a>
23 Nature	<a href="http://www.nature.com/">http://www.nature.com/</a>
24 Wiley InterScience	<a href="http://www3.interscience.wiley.com">http://www3.interscience.wiley.com</a>
25 Europeana	<a href="http://www.europeana.eu">http://www.europeana.eu</a>

Table 2 is showing the results of our web analysis. The identified functions are assigned to the users' goals and tasks mentioned before. In the fourth column we show the frequency of occurrence of the functions among the 25 digital libraries.

GOALS	TASKS	FUNCTIONS	Frequency of occurrence in 25 DLs	
Retrieving	Searching	<b>Search</b>		
		<b>Quick Search</b>		
		Enter a query and click search		
		Enter keywords or phrases for selected field		
		Limit results to		
		Search subscribed titles		
		Clear		
		<b>Advanced Search</b>		
		Enter a query and click search		
		Enter keywords or phrases for selected fields		
		Select keyword from a list		
		Select boolean operator (explicit)		
		Define phrase match (explicit)		
		Clear		
		Search within results		
		Limit results to (preselection)		
		Sort by (preselection)		
		Select display options, e.g. list or gallery view (preselection)		
		Select display format, e.g. citation or citation & abstract (preselection)		
		Display results per page (preselection)		
		Display search history on search page		
		Non-textual Search (e.g. Colour search)		
		Free form advanced search		
		CrossRef Search		
		Cited reference search		
		Acronym Finder		
		Auto Completion		
		Search Site pages		
		Browsing	<b>Browse</b>	
			Browse alphabetically (e.g. title, name)	
			Browse by category (e.g. topic, time period)	
			Browse recent additions	
			Browse subscribed content	
			Browse highly accessed records	
			Browsing links in metadata	
			Browse related content	
			Browse cited by	
			Browse citation map	
Browse collaborative colleagues of authors				
View all records				
Refine listing by browsing subcategories				
Go to next/previous page				
Feedback on amount of (sub-)collection				
Search within selected collection				
Save subcollection as alert and delivery by RSS				
Link to collection homepage				
Interpreting	<b>Quantitative Analysing</b>		Edit new search	
			Modify search	
			Search within results	
	<b>Qualitative Evaluating</b>		Refine results by	
		Refine listing by browsing subcategories		
		Limit results to		
	<b>Organizing</b>	Exclude from results (explicit)		
		Find Collaborative colleagues of authors		
		Go to next/previous page		
		Sort by		
		Group by		
		Show checked entries		
		Set display options (e.g. list or gallery view)		
		Set display format (e.g. abstract or no abstract)		
		Show details or view abstract (explicit)		
		Add to marked list (short-term)		
		Add a tag		
		Adding an public annotation to a record		
		Rate record (Sternchen)		
		Write review, comment		
		Open e-book reader to view article		
		Feedback on number of results found		
		Feedback on number of results found compared to total number of records		
		Display of number of results per page		
		Display of search request		
		Display of recent search requests		
		Display highly accessed records		
		Display of average rating		
Display bibliometrics (e.g. Downloads [6 weeks]: 43)				
Display of citing records				
View the Citation map				



DLs offer *Bookmarking* options (e.g. post to del.icio.us, Furl, CiteUlike, Connotea, Bibsonomy) and more than 50% enable the users to send record references by email. These functions seem to be 'easy' to implement and generate a real added value for the users.

Functions supporting personalisation or collaboration are not yet very common especially among the public funded digital library projects. Digital libraries with commercial interest and large collections (e.g. Science direct or Ingenta) provide more functions and services to meet the individual needs of their paying users. Nevertheless nearly all DL offer a personal account so that users have to register and login for each session. But the personal account is mostly only used for long-term saving of records or search requests. *Alert Options* seem to be quite helpful services but only a few DL are offering. Functions concerning collaboration are rare and mostly related to communication between user and DL. Functions that enable users to work together like *Add a tag* or *Comment a record* are provided by only one DL.

### **3.0. Conclusion**

According to these finding we affirm that there is a gap between 'what users want' and 'what DLs offer'. Searching and Browsing information is still the motor that pushes the use of DLs. But in times of increasing amount of information people want to have more options that support their retrieval work. They want to gain individual freedom to work with information and to share their findings with others. At the moment, DLs don't seem to have the ability to satisfy the users' needs. Much more work has to be done to offer more individual functions to users. Experts and laymen both will benefit from those novelties.

### **4.0. Future work**

In order to support the development of usable DLs we are going to describe User Interface Patterns. Patterns serve as documentation of proven solutions for recurring design problems. We are going to describe patterns of proven solutions supporting the typical goals and task of users as well as patterns that record typical library functions. Thus the above work is done to gain a broad collection of functions which need to be evaluated to identify proven solutions.

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