

Collaboration and Crowdsourcing: The Cases of Multilingual Digital Libraries

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Abstract

Purpose – This study aims to understand key features of existing multilingual digital libraries and to suggest strategies for building and/or sustaining multilingual information access for digital libraries.

Design/methodology/approach – A case study approach was applied to examine four American multilingual digital libraries: Project Gutenberg, Meeting of Frontiers, The International Children’s Digital Library, and the Latin American Open Archives Portal. This examination used a framework derived from digital library evaluation practice. The missions, goals, funding, partners, users, collections, services, and technologies of these digital libraries were analyzed to present their key multilingual features . The collaboration and crowdsourcing characteristics were highlighted and discussed.

Findings – These four multilingual libraries benefit substantially, both in the creation of the library and in its access, from the collaboration of groups domestic and international with different language expertise. For building the multilingual collection and services, some libraries involved both staff and users. For multilingual access to the collection, however, none of the libraries used machine translation or cross-language information retrieval technologies.

Research limitations/implications – The four cases are all publicly available digital libraries in the United States. Their features may not be applicable to digital libraries in other countries or to commercial digital information services.

Practical Implications – With the advancement of machine translation technologies and the wide application of social media, multilingual digital libraries may have even better opportunities to sustain their multilingual capabilities through crowdsourcing and the application of new technologies.

Originality/value – This study summarizes the key features of four existing multilingual digital libraries. It provides insights into important factors for building successful multilingual digital libraries. The suggested strategies may help digital library developers to design appropriate multilingual information access services.

Keywords: multilingual digital libraries, multilingual information access, collaboration, crowdsourcing

Type of Paper: case study

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Introduction

Digital libraries can be defined in many different ways. Kresh (2009) defined digital libraries as repositories where “resources are available in machine-readable format (as opposed to print or microform), accessible by means of computers.” This basic concept is widely acknowledged, but digital libraries also generate new digital content for scholars, students, and the general public by increasing access and awareness to open access materials (Wooldridge et al, 2009). Through analysis of mission statements, project proposals, and definitions of existing digital libraries, the following list of digital libraries’ characteristics was compiled:

“Serve a defined community or set of communities; may not be a single entity; are underpinned by a unified and logical organizational structure; incorporate learning as well as access; make the most of human (“librarian”) as well as technological resources; provide fast and efficient accessing, with multiple access modes; provide free access to a community or communities; own and control their resources; have collections that are large and persist over time, are well organized and managed, contain many formats, contain objects, not just representations, contain objects that are unobtainable, and contain some objects that are solely digital” (Schwartz, 2000).

Online digitized content provides an avenue for access and communication. The objects and documents represented through digital libraries must be provided in such a way to clearly communicate and make accessible information in user-friendly systems that will engage the user. The value of the Internet is that it can enable people from multiple nations, speaking multiple languages to employ multiple media while interacting with each other (Borgman, 1997). In order for the global community of Internet users to access and share information using digital libraries, the information needs to be presented to users in a language he or she understands.

Language is critical to bridging the gaps between cultures and offering a window for international collaboration. As a vehicle for thought and communication, language manifests itself in cultural identity. Multilingual digital libraries, which allow users to access digital collections using different languages, provide a portal for strengthening individual cultures, promoting diversity, and enhancing global information infrastructure by highlighting underrepresented languages in worldly communities (Nichols et al, 2005). They open opportunities for a wider international development, understanding, and cooperation (Fox & Marchionini, 1998).

Multilingual digital libraries have been developed in the United States, Canada, the European Union, and many other countries and regions. Examples include: The Perseus Digital Library, Project Gutenberg, The International Children’s Digital Library, Meeting of Frontiers, The Latin American Open Archives Portal, The European Library, and The World Digital Library. These multilingual digital libraries provide various linguistic access tools and interfaces online. However, there is little analysis or examination of these repositories or their services. For researchers and developers who are interested in building multilingual digital libraries or providing multilingual information access to existing monolingual digital libraries, it is important to understand the key features of existing multilingual digital libraries and their strategies of implementing multilingual information access services.

Research Purposes and Research Design

The purposes of this study are to identify important features of existing multilingual digital libraries (MLDLs) and to explore possible strategies for building and sustaining MLDLs.

A case study approach was applied to examine the key features of four existing MLDLs. Case Study is a method of evaluation used to observe, record, and assess a subject. Yin (2009) states, “The distinctive need for case studies arises out of the desire to understand complex social phenomena...the case study method allows investigators to retain the holistic and meaningful characteristics of real-life events (p. 4).” We chose four digital libraries (DLs) as the subjects for our studies: Project Gutenberg, Meeting of

Frontiers, the Latin American Open Archives Portal, and the International Children’s Digital Library. These DLs are American based, publically available, and have multilingual interfaces and content.

A framework derived from DL evaluation practices was employed to guide the case studies. No matter what methods it applies, DL evaluation examines many aspects, such as content, interface, and services of target DLs (Saracevic, 2005; Reeves et al, 2005). We therefore examined these aspects of the four MLDLs. Our assumption was that understanding the key features of these DLs would help DL developers identify appropriate strategies for developing or maintaining a MLDL.

Table I presents the framework. It includes the major aspects and questions under each aspect that should be investigated. For each of the four DLs we examined their websites and all relevant publications we could find from the researchers, developers, and staff in order to answer the questions in the proposed framework in Table I. We also applied a comparative approach; the four DLs were compared to each other in order to discover the various key features of MLDLs.

Table I: Framework Guiding the Case Studies

Aspects	Questions to be Answered
Mission & Goals	1. Do the mission and goals indicate the desire of serving broad users?
Funding	2. How is the DL funded?
Partners	3. Is the DL the product of collaboration? 4. Who are the collaborators/partners? 5. What are the roles of each collaborator?
Users	6. Who are the users? 7. Do the users participate in the design, implementation and operation of the DL?
Collections	8. What are the digital objects? 9. How many digital objects? 10. Are there multilingual digital objects?
Services	11. Does the DL provide multilingual services? 12. What kind of multilingual services are provided?
Technologies	13. Does the DL apply machine translation? 14. Does the DL apply cross-language information retrieval technologies to provide service?

In the Results Section, we report the findings from our case studies. It describes the DLs in regards to Mission & Goals, Funding, Partners, Users, Collections, Services, and Technologies.

Results

Overview of the Four Multilingual Digital Libraries

Project Gutenberg (PG) [1] is a non-profit initiative founded by Michael Hart in 1971 (Hart, 1992). This digital repository consists of classic books published before 1923. The main website for PG is in English and includes an option for Portuguese. Meeting of Frontiers [2] is a congressionally mandated project to digitize a collection of archived material housed within the Library of Congress (Billington, 2003). Its Website was launched in 1999. Meeting of Frontiers displays collections in a bilingual interface with all text appearing in English and Russian. The Latin American Open Archives Portal (LAOAP) [3] is a collaborative project of the Latin Americanist Research Resources Project (LARRP) and the Latin American Network Information Center (LANIC) sponsored through the University of Texas Austin and the UCLA Library. LAOAP began in 2002. This site features English and Spanish language collections. The International Children’s Digital Library (ICDL) [4] was developed in 2002 by an interdisciplinary team at the University of Maryland. ICDL provides three user interface languages to navigate the information tabs on their main website: English, Spanish, and Mongolian. Once the user enters the Simple Search page to access the books, there are 17 user interface languages from which to choose.

Below we present the comparative analysis of the four DLs based on the questions listed in Table I.

Comparative Analysis Results

A thorough examination of the websites and related publications of the four DLs led to the results presented in Table II.

Table II: Features of the Four Digital Libraries

Questions	PG	Meeting of Frontiers	LAOAP	ICDL
1. Do the mission and goals indicate the desire of serving broad users?	Yes	Yes	Yes	Yes
2. How is the DL funded?	Individual Donors, Corporate	Government	Government, Grants, Educational Institutions	Educational Institutions, Donors, Government
3. Is the DL the product of collaboration?	Yes	Yes	Yes	Yes
4. Who are the collaborators/partners?	Corporate, Individual, Sister/Other projects	Library of Congress, Institutions in the US and Russia	US and International Institutions	Educational Institutions, Individual, Corporate
5. What are the roles of each collaborator?	Support and affiliate with DL	Contribute material, sponsor repository	Contribute material, Support the repository	Fund and sponsor the DL
6. Who are the users?	Adults, Children, Scholars, Students	Scholars, Students, Researchers	Scholar, Students, Researchers	Students, Children, Adults, Researchers, Educators
7. Do the users participate in the design, implementation and operation of the DL?	Yes	No	No	Yes
8. What are the digital objects?	Classic books published before 1923	Maps, Photographs, Sheet Music, Books, and others	Documents, Pre-prints, Articles, Statistical documents	Children's books
9. How many digital objects?	34,291	100,000+	14,000+	4,456
10. Are there multilingual digital objects?	Yes	Yes	Yes	Yes
11. Does the DL provide multilingual services?	Yes	Yes	Yes	Yes
12. What kind of multilingual services are provided?	Multilingual Search	Multilingual Search	Multilingual Search	Multilingual Search
13. Does the DL apply machine translation?	No	No	No	No
14. Does the DL apply cross-language information retrieval technologies to provide service?	No	No	No	No

Next we would like to explain the results in Table II according to the seven aspects: Mission & Goals, Funding, Partners, Users, Collections, Services, and Technologies.

Mission & Goals

All four DLs had explicit missions and goals that indicated the desire of serving broad user groups or multilingual users. The following describes what the four DLs seek to achieve. The mission of Project Gutenberg (PG) is to “encourage the creation and distribution of eBooks” [5]. It was designed for a universal user group to access materials that are not under copyright restrictions. Meeting of Frontiers has set a goal to tell “the story of the American exploration and settlement of the West, the parallel exploration and settlement of Siberia and the Russian Far East, and the meeting of the Russian-American frontier in Alaska and the Pacific Northwest” [6]. The mission of Latin American Open Archives Portal is to improve access to social science grey literature in Latin America. The International Children’s Digital Library has a distinct statement representing their mission to serve children around the world. The developer of ICDL has stated their goal is to accumulate over 10,000 books in over 100 languages for viewing, searching and user accessibility [11].

Funding

Most public domain digital libraries are funded by non-profit organizations and public institutions that promote open source and freely accessible collections for teaching and research. Not only is funding important for initial development, but also for maintaining services after initial development. Similar to other active DLs, the four DLs receive funding from different sources.

PG is funded through donations and fundraising opportunities through the Project Gutenberg Literary Archive Foundation (PGLAF). This corporation is a non-profit group that garners funds to sustain the DL. Meeting of Frontiers (MF) has received over two million dollars from the U.S. Government and continues to be sponsored through the Library of Congress. It was funded by Congressional appropriation in the 1999 fiscal year budget of the Library of Congress and is maintained by the staff of the European division and Area Studies Conversion team at the Library of Congress. Many scholarly researchers contributed their expertise to this project. LAOAP is sponsored through the University of Texas Austin and the UCLA Library and was developed under a U.S. Department of Education grant. This DL is sustained through partnerships with Latin American Network Information Center (LANIC) and Latin Americanist Research Resources Project (LARRP). Contributors must provide their own service provider and data provider. These requirements greatly cut down on cost. ICDL is housed by the University of Maryland’s (UMD) College of Information Studies (CLIS) and the UMD Human Computer Interaction Lab (HCIL). Additionally, ICDL has numerous supporters through publishers, library sponsors, the National Science Foundation, Microsoft, Adobe Systems Incorporated, and the Institute of Museum and Library Services. The ICDL Foundation promotes donations through membership and sponsor contributions.

Partners

DLs are complicated information systems. The collaboration of multiple partners is necessary not only for reducing cost for individual institutions, but also for achieving their mission and goals. All four DLs are products of collaboration. For example, Meeting of Frontiers is sponsored by the Library of Congress and is a collaborative effort with the University of Alaska Fairbanks, Russian State Library (Moscow) and the National Library of Russia (St. Petersburg), plus eighteen other Russian institutions as part of the Open Society Institute of Russia [7]. Collectively these entities maintain this DL and ensure its accessibility to users. For LAOAP, various partners have contributed to the making and compiling of information on its website. Its base operation is stationed at the Teresa Lozano Long Institute of Latin American Studies at the University of Texas Austin. Some of the project partners who contribute content and data to LAOAP include Facultad Latinoamericana de Ciencias Sociales (FLASCO) Chile, Centre de Investigación Regionales de Mesoamérica (CIRMA) Guatemala, Universidad Torcuato Di Tella (UTDT), Conjeso Latinoamericano de Ciencias Sociales (CLASCO), and the Teresa Lozano Long Institute of Latin American Studies (LLILAS). These international institutions ensure that multilingual content is deposited and represented in this DL.

Users

Each of the four DLs has different user groups. All of them target not only users in the US, but also in other countries. PG appeals to a wide user base that includes adults, children, scholars, and students. It has working affiliations with PG Australia, Canada, and Europe in addition to others. MF also garners scholars, students, and researchers from around the world, but primarily sees the most traffic from the U.S. and Russian communities. The LAOAP is designed predominantly for adult scholars, researchers and students with a concentrated community in Latin America. ICDL's primary audiences are children three to thirteen years of age and adults who study international children's literature or work with children (Hutchison et al, 2005). Scholars, researchers and adults are also attracted to this multilingual interactive DL. ICDL welcomes users from every nation and is seeking to make their materials more accessible to everyone.

Users of two DLs are encouraged to participate in the library's development and maintenance. PG encourages users to volunteer by providing missing pages, proofreading eBooks, contributing eBooks or collections of eBooks through scanning, procuring eligible paper books, recording audio books, and promoting the DL by distributing the materials to other users through DVD and CD duplication. ICDL calls for volunteers to be translators of metadata records and interfaces. More details are available in the Discussion Section.

Collections

The collections for these four DLs are not only multilingual, but also contain an array of materials and objects. PG offers their collection of eBooks in 60 languages. The top five languages to date include 28,791 eBooks in English, 1,685 eBooks in French, 718 eBooks in German, 544 in Finnish, and 501 in Dutch[8]. This DL primarily focuses on novels, but also includes poems, short stories, reference works, periodicals, cookbooks, sheet music, and movies. MF includes digitized images, manuscripts, maps, films, photographs, sheet music, and sound recordings from all the collaborating library collections [6]. Although the interface is in English and Russian, materials can be found in seven languages. When the DL was launched in 1999 it had more than 2,500 items. By 2008 the collection consisted of "about 100,000 images" (Billington, 2003).

The LAOAP website interface features two languages to access documents, English and Spanish. In 2007 estimates of more than 1,600 items were currently included in LAOAP. Before the end of 2007 nearly 14,000 more items were scheduled to be integrated into the portal (Block, 2007). This unique DL allows researchers "access to working documents, pre-prints, research papers, statistical documents, and other difficult-to access materials from the 'deep web'" [3]. Although ICDL has only seventeen languages available in their Simple Search interface, the DL contains approximately 4,000 books in 54 languages [9]. The primary objects in this digital repository are children's books.

Services

Similar to other DLs, these four DLs provide search and browse services, social media tools, and multiple information formats. Some of these services are multilingual. The PG website's main page is searchable by author, title word(s), or EText number in English or Portuguese. The advance search offers the user additional searching tools: subject, language, category (for format preference), Library of Congress Classification, file type (PDF, MP3, etc), and full text. Additional features available on the website are the ability to access the collection using a mobile device and an RSS subscription to notify users of new books added to the collection.

Upon entering MF, the user is presented with links to exploring the frontier through theme, types of material, and catalog search. The website's search tool is limited to English searches; however, bibliographic information is in the language in which it was originally written. Users may search using keyword search terms for descriptive information with the option to search by document format such as audio, video, photos, maps, manuscripts and printed text, or sheet music. The two other keyword searching options are interpretive text and inside books with searchable text. Search results are provided by Global Gateway, the cataloging subsidiary for the Library of Congress international digital collections.

The LAOAP offers the user interface to their website in English and Spanish. Once the documents are retrieved they are limited to the language in the individual organizational archive. Subject terms, rights and titles are not translated into English within the interface. The LAOAP provides access through three search tabs: browse, full text search, and advanced search. The Browse tab allows the user to search "All" or each individual organizational archive by author, title, and subject. Full-Text search is designed to input text and retrieve relevant documents found in the LAOAP archives. Advanced search has more detailed options such as identifying author, publisher, description and language in the search fields. The user can also narrow down his or her search terms in one specific repository and by publication year. Results can be sorted by title, author, and date.

The ICDL interface provides users with four options to aid in searches: Simple Search, Advanced Search, Location Search, and Keyword Search. Once a user clicks on the "read books" link, the Simple Search interface appears that features a list of 17 languages to interact with the content on this search screen. Simple Search is the deluxe search screen that offers colorful icons, a featured books list, and a shelf list to navigate the ICDL collections. Once a user selects a language, he or she can search for books by color, length, chapter, pictures, characters, and themes. The Advance Search screen allows the user to search by audience, appearance, content, type, and subject. The featured books list and shelf list appears alongside the Advanced Search screen's page. Some of the more specific topics under audience are age, language, and publication date. Type addresses categories such as rating, feeling, and genre. The Location Search is an interactive globe that allows the user to point and click on which country they would like to explore. There is also a text version of the location destinations if the globe does not meet the user's need. The Keyword Search is a basic search box that includes brief instructions for searching plus a drop down list of all 54 available languages. Other available features include browsing by full book list, author and illustrator, recently added books, award winning books, exhibitions, and activities.

Technologies

There is not much information on what technologies have been employed by the four DLs in order to provide multilingual information access. However, the websites demonstrate that some of them provided multilingual browsing and search services, as described above. Machine Translation (MT) and Cross-language Information Retrieval (CLIR) are two areas that explore technologies related to multilingual information access. Researchers have suggested that DLs would benefit from MT and CLIR technologies (Chen & Bao, 2009; Oard & Diekema, 1999). However, we found that none of the four DLs have applied current technologies in MT or CLIR for developing multilingual information services.

MT aims to automate the process of translation, which normally includes analyzing and understanding information in one language and expressing it in another language. CLIR is a subfield of traditional Information Retrieval (IR). It allows users to automatically retrieve information that is in a different language from their queries (Chen, 2006). It appears to us that DLs have not yet made use of MT or CLIR although they have implemented Web 2.0 and other innovative technologies. Investigation into how these technologies can be implemented in DLs could provide cost-effective methods to MLDLs.

Discussion

Key features of the MLDLs

The American DLs explored in this paper emphasize the universal goal of open access information services. All four American libraries are serving a broader linguistic and cultural user base than just English speaking American citizens. PG and ICDL are making classical literary works and children's literature available to everyone. PG aims to have over one million free eBooks that share cultural heritages around the world by 2015. The ICDL focuses on eventually providing over 100 languages to users around the world to provide literature where physical books are inaccessible. Meeting of Frontiers links two cultures by common history of exploration. The LAOAP focuses on Latin American user groups by partnering with Latin American organizations that contribute and support the digital archives.

The use of human translators is relevant and acceptable method for translating materials into multiple languages. PG provides a good example for creating multilingual information access and retrieval. Meeting of Frontiers offers resources in only English and Russian. Because of its focused collection, the limited language requirements are appropriate. The LAOAP did not specifically translate the documents in their archives for the patrons. Only the user interfaces were bilingual in Spanish and English. The ICDL used human translators to translate books into as many languages as possible.

Collaboration and Crowdsourcing for MLIA

The four DLs discussed in this paper are the products of collaboration. Collaboration is extremely important for building MLDLs. The models of collaborating with foreign institutions, like the example of the LAOAP, should be an appropriate strategy for building MLDLs. LAOAP has two basic components. The first is a network of data providers that provide publications in an electronic format (Bravo et al, 2004). The second is a service provider that includes a metadata harvester, a metadata database, and a user interface for searching and additional services such as access and services through LARRP and LANIC. It seeks to promote collaboration and compatibility between libraries and digital repositories focused on the same interest in Latin American Studies. The OAI (Open Archives Initiative) protocol for Metadata Harvesting is utilized as a solution to disseminate and share digital resources through the portal from participating data providers. Each member institution must also be able to generate Dublin Core metadata for their object collection [10]. This strategy shares the expense instead of one institution housing and cataloging all of the objects.

Crowdsourcing occurs when an entity seeks input from an undefined group of users. Holley (2010) defined it as “using social engagement techniques to help a group of people achieve a shared, usually significant, and large goal by working collaboratively together as a group.” Crowdsourcing has become a popular tool with social networking sites such as Facebook and LinkedIn. Users can create their own content and specify their preferences. Wikis have also become a popular mechanism for collaboration where users can freely edit content seen by a universal audience. Wikipedia is one of the most popular applications that allows for communal input and editing [12]. It has been developed into a valuable multilingual information resource through the collective effort of numerous voluntary authors all over the world. Another example of crowdsourcing is Google, which uses peer production as its page-rank algorithm to categorize search results per the preference of the users (Schweik, Mergel, Sandfort, & Zhao, 2011).

Digital libraries have made use of crowdsourcing to sustain digital collections and services. As discussed before, PG has many methods of seeking assistance from the crowd, or the users. It partners with volunteers through collaborative projects. Some volunteer opportunities include posting a PG banner on individual websites and blogs, burning DVDs for use in other countries where people cannot access the site online, and proofreading eBooks. In addition to multilingual translation, ICDL allows users to contribute books along with scanning the material and entering metadata for the DLs catalogers. The ICDL also enlists Library Ambassadors who are volunteers that assist with acquiring new materials, testing software, promoting multilinguality, and recommending books. Children and adults can voice their opinions as a Featured Books contributor. This volunteer duty includes recommending books to be highlighted on the DL's main page.

Crowdsourcing will be extremely useful for dealing with language issues like multilingual information access. For example, Facebook enlists its users (for free) to assist with translating the visible framework into two-dozen languages, thereby broadening their customer base (Hosaka, 2008). Users can also help to build MLIA for digital libraries: they can be encouraged to voluntarily translate digital objects into other languages for a digital library or to correct errors produced by machine translation systems.

In summary, another strategy of building and sustaining MLDLs is to combine crowdsourcing with collaboration. Digital libraries can be developed and maintained through partnerships and efforts of countless volunteers.

The Use of Advanced technologies for MLIA

When resources for digital libraries are limited, a strategy that makes use of advanced CLIR and MT technologies could be explored in combination with collaboration and crowdsourcing to enable MLIA. For example, metadata records of digital objects could be automatically translated into other languages and stored in a database for retrieval. The quality of machine translation could be improved by employing volunteers with the language expertise to post-edit the translation results.

The four DLs currently do not employ CLIR or MT for their MLIA services. The application of CLIR and MT to digital libraries needs further investigation. One of our future research purposes is to explore effective and efficient Multilingual Information Access services built on current MT or CLIR technologies.

Conclusion

We examined four multilingual digital libraries (MLDLs) in order to understand their key features and gain insights into possible strategies for developing and sustaining them. Digital libraries (DLs) are invaluable information resources for their users regardless of their languages. They must be designed and marketed to a diverse user population. Supplying users with a multilingual interface to communicate in their native language allows the users to quickly identify and use relevant information within a digital library (DL).

We discovered that collaboration and crowdsourcing are important features and strategies of these DLs, which enable them to provide multilingual information access (MLIA) services to their users continuously. The development and operation of MLDLs depends heavily on collaboration. Collaborating with all possible partners including individual users ensures the successful development and sustaining of a DL. There is much to explore regarding effective strategies for collaboration and crowdsourcing for MLIA.

None of the four DLs made use of MT or CLIR techniques to provide information access services. We suggest that DL developers consider strategies that integrate advanced technologies such as MT and CLIR with human collaboration or crowdsourcing in order to develop new MLDLs or to sustain existing ones. For future research, we will evaluate machine translation of metadata records extracted from different DLs. In addition, we expect to work with one or two DLs to explore different strategies for implementing MLIA services, especially strategies integrating MT & CLIR technologies with crowdsourcing.

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She interned at the Houston M.D. Anderson Medical Research Library where she contributed to the digitization of their oral history collection.

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