Evaluation Insights to Key Processes of Digital Repositories

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Abstract: Digital repositories are considered essential information tools for scholarly communication. Their acceptability and extensive use by communities and institutions, as well as the users' commitment in self-archiving, highlight the need for developing alternative channels of communication to expose scholarly productivity. Furthermore, the digital repositories community is interested into transforming them into viable, reliable and useful systems. This interest is primarily expressed by intense research activity, including - among the others - the evaluation and the usability of the technological solutions that support these services. On an institutional level, digital repositories are systems supported by physical organizations, such as libraries, which undertake many tasks in order to enable a variety of processes associated with these systems, such as submission, editing and access.

In this paper, we present a multifaceted evaluation initiative that aimed at the redesign of University of Patras' institutional repository, namely 'Nemertes'. 'Nemertes' is operating on a DSpace installation and the 'Theses and Dissertations' collection was placed at the center of evaluation as the most important collection accommodated in the service. Emphasis was given to key processes held inside the repository by conducting surveys and interviews with typical classes of users. In order to collect data from these sources three different studies were held. First the quality of Submission process inside the physical and the digital space was evaluated through a questionnaire survey, which was addressed to people who had earlier submitted in the 'Theses and Dissertation' collection. Secondly, the information retrieval processes and the interface were evaluated by Human-Computer Interaction savvy students using the usability heuristics principles. Finally, the Editing processes and the quality of the delivery of services were assessed through interviews with the librarians that support the service.

The findings of these studies point to areas that the system can be improved and help to eliminate the barriers that prohibit the service to be upgraded and host new collections. The areas identified concern both the way of delivering the service and the operation of the system. While the contextual parameters make the generalization of the findings about the service more ambiguous, the findings concerning the system performance and the interface intuitiveness validate the results of previous studies, such as the case of terminology, the affordances and the effectiveness of search interfaces. It is anticipated that the findings of the study can be further exploited by organizations with similar repository services and technological infrastructures.

1. Introduction

Digital repositories have undertaken the heavy task for the advancement of scholarly communication through the invention of new channels. For the successful provision of their services, several repositories, mostly institutional, rely on physical agents, such as libraries and IT centers. These repositories are dedicated to the collection, curation and preservation of institutional publications and research outcomes, such as theses and dissertations, learning objects, scholarly publications, technical reports and so on. They host a significant amount of the scholar productivity and they provide alternative means for communicating science and research, often complementary to subject defined repositories. Despite their wide adoption by institutions in a global level, digital

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repositories are not well understood, due to contextual variations and different political frameworks. Moreover, the work on the technical level, such as the systems available for realising such activities, is more solid; yet there remain open research issues on the enhancement of user interaction.

To the end of understanding some critical factors that affect IR operation, we conducted a multifaceted evaluation activity. In this paper, following the example of previous studies [Ebenezer, 2003; Marchionini, 2000], we present the results of an evaluation initiative, assessing the operation 'Nemertes', the IR of University of Patras, Greece. 'Nemertes' is a digital repository, supported by the University's library, that collects, organizes, disposes and preserves digital assets of the institutional productivity, such as electronic theses and dissertations and full-text pre/post prints. The present evaluation took place after the completion of the first two years of IR operation on the DSpace platform and was based on the emergence of new needs, such as creating other collections. The evaluation focused on several aspects of the processes held inside digital repositories, such as submission, retrieval and editing.

The following section briefly presents the previous work, while Section 3 outlines the research setting and the methodology. Section 4 gives a presentation of the results and the following section, Section 5, holds a discussion on the main findings.

2. Background

IRs are undergoing various evaluations and assessments, with the evaluators trying to identify the best possible practices. This search seems to be infertile due to contextual conditions and uniqueness of each application. However many threads of evaluation can be traced, like the managerial challenges, the stuff awareness, the introduction of new metrics in the assessment of scholarly progress, the reasons that propel participation in IRs and self-archiving, institutional policies towards encouragement or mandating etc. These threads signify the dependence of IRs to geographically defined constrains, the amalgamation of these systems and the increased difficulty to evaluate them in whole.

One important area is the evaluation of software solutions and the technical aspects of the implementation of these systems. Up to now there are many solutions proposed with three open source options, namely DSpace, Fedora and EPrints, dominating the scenery. In particular DSpace is a widespread platform, as recorded in studies from both sides of the Atlantic. The 2008 Survey of the EU-funded project DRIVER II [Van Der Graaf, 2008] showed that DSpace holds almost one third of the applications that took part (increased by 10.1 percent since 2006), while a survey of the MIRACLE project [Markey et al., 2007] listed that 46.4 percent of the CNI, CARL and ARL members are using DSpace. Several studies have tried to conduct comparisons between these systems. Kim [2005] has evaluated the efficiency of users as they had to search for information in two established repository systems, EPrints and DSpace. He found that the DSpace interface required a refinement in several areas, such as the support during searching, the help in the results pages review and the terms used. However, DSpace has been evaluated individually with the results of the University of Calgary [Atkinson, 2006] expressing a criticism on the search and browsing functionalities, and the findings of the short study in Oregon State University [Boock, 2005] suggesting a strengthening of the instruction pages. A recent study by Caccialupi et al. [2009] highlighted problems in the terminology and the provision of navigational aids in the interface. Caccialupi et al. evaluated a recent version of DSpace (v. 1.5), and included both retrieval and submission interfaces.

3. Setting and Research Questions

3.1. 'Nemertes': The Institutional Repository of University of Patras

'Nemertes' is the IR of University of Patras, Greece. 'Nemertes' is provided by the Library and Information Center (LIC) of the University and it was first developed on an in-house application. For over two years, 2004-2006, 'Nemertes' run on this application, before moving to the widely known repository platform DSpace. This was decided due to the need to rely on a reliable open source platform. While 'Nemertes' started by developing only the 'Theses and Dissertations' collection, recently new collections, such as the 'Technical Reports' and the 'Journals/Proceedings Publications of the LIC personnel' collections, were inaugurated. Both are very limited collections, but they highlight the will of LIC to host diverse collections and to support in multiple ways the concept of self-archiving. The most ambitious and challenging collection is the one of 'Faculty Members Publications', which aims to host pre/post-prints of the faculty members of the University.

3.2. Research Questions

Usage and submission are the two main activities in an IR regarding end user tasks. Other activities, such as editing, moderating and administrating, refer to librarians or technical personnel. All of these activities were agreed to be evaluated by different methodologies. Therefore, the following research questions were set to drive this study:

(1) What is the opinion of users for the submission process in the physical and digital space?
(2) What is the opinion of end users regarding interface and retrieval features?
(3) What is the opinion of the librarians regarding their interaction with the users and the level of service delivery?

4. Methodology

The evaluation was held in different stages within the last year and included many agents in order to acquire a representative view of the IR operation. Figure 1 summarizes the research procedure, by showing the research foci and the evaluation methods used. In more detail they are outlined below:

Questionnaires: In order to address the first research question, an online questionnaire survey was conducted, with only registered users taking part. These users had at least one deposit, most probably their own thesis/dissertation. They were invited by a mail call, which included information about the process, the consent policy and a link to the questionnaire that remained online for over a month. From the 1129 registered users in the system at that time 126 participated, resulting to a 11.16 percent response rate. The questionnaire was comprised by 25 questions and the measurement scale ranged from 1 to 5, with 1 reflecting negative opinions and 5 reflecting positive. The questionnaire was addressing issues of service delivery and system usability, with only the former being discussed in this paper.

HCI user study: To answer the second research question we conducted a user study. Participants in this study were 24 graduate students from the Department of Electrical Engineering that had a Human-Computer Interaction background. They were instructed to walk through the repository and to evaluate the retrieval

interfaces, i.e. searching and browsing, against the ten usability heuristic metrics, proposed by Nielsen [2005]. The participants had to write a report of their findings, naming the problems they discovered and assigning a severity rate, namely minor, medium, serious and catastrophic. This approach varies from the usual one of the method, which requires the implication of expert evaluators. Though fully qualified experts were available, it was decided to follow this approach in order (a) to exploit the comprehensiveness of the heuristic metrics, as indicated by previous studies [Peng, Ramaiah, & Foo, 2004] and (b) to simulate the state of occasional users.

Librarians: The third research question was addressed by interviewing the five librarians that support the IR and interact with the system at the back end. The interviews had an average duration of 19.32 minutes and they were held in a semi-structured way. The discussions were audio-recorded, coded and analyzed.
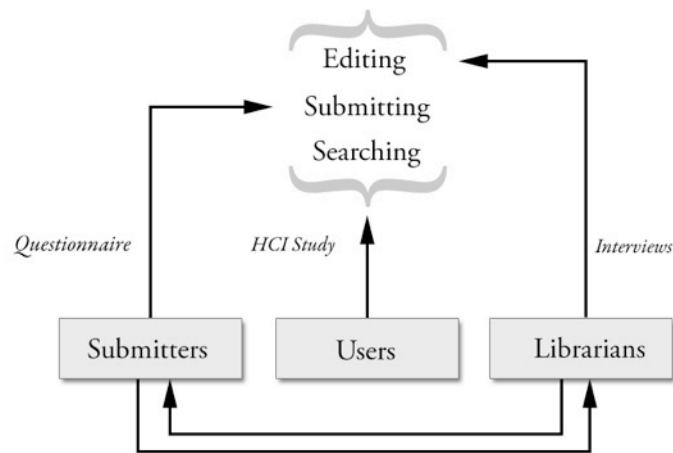

Figure 1: Evaluation foci, classes of users and methodologies.

5. Results

5.1. Insight one: Submission

The submission process was investigated through a questionnaire survey. Users, who had prior deposited their documents in 'Nemertes', expressed their satisfaction regarding service delivery in the physical and digital space.

Concerning delivery service users evaluated the registration into the system, the help provided, the metadata entry, as well as 'Nemertes' bilingual character. The participants were satisfied with the registration options that 'Nemertes' offer, namely personal or institutional, giving an average rate of 4.21 out of 5.

Help facilities during submission are mainly expressed by the submission wizard, while in the physical space assistance is provided by the librarians. According to the users, the help and the wizard of 'Nemertes' is quite efficient, as the average rate (3.98) reflects a slightly positive opinion. They assessed also the effect of librarians' support on their own performance, stating their general appreciation towards their contribution. In particular, they believe that the guidance of librarians assisted them to deposit their work successfully and quickly to an extend of 51.6 and 43.4 percent respectively.

In this self-archiving repository users have to enter their own descriptions of the submitted documents and almost half of the sample (46.8 percent) reacted in a positive manner. In particular, an average rate of 4.29 highlighted the overall satisfaction with the process of entering their own metadata. They stated also that they are satisfied by the

ability to deposit their documents in two languages, Greek and English. 'Nemertes' bilingual character absolutely satisfies the participants in our study as 49.2 percent of the sample rated it extremely positive with an average of 4.31.

In terms of copyright policy, LIC provides users with an agreement paper, a 'contract' between the library and them, while also offers them the opportunity of choosing a supplementary Creative Commons license. Users evaluated this highly with an average of 4.3, although there is an important share of 15.1 percent that answered 'Don't Know/ Don't Answer', making us conclude that copyright issues, despite their importance, are not well established among the users. Submitters may choose three options of exclusion period (three, six and twelve months) and after that period their theses are published. The participants were very satisfied with these options with an average rate of 4.37. When asked for alternatives, most of them (29.4 percent) preferred a maximum period of two years, while a small percentage (4.8) requested a five year period.

'Nemertes' is freely accessible, without any constrains, allowing everyone to search and download documents. This policy gathered the slight acceptance of the participants scoring an average rate of 4.06. Once again when the participants were asked for alternative suggestions, 36.5 percent asked for controlled access to everyone, while only 2.4 percent asked for a closed to everyone policy. Moreover, the survey respondents are slightly positive towards the creation of new collections in 'Nemertes', rating this prospect with 3.97 out of 5. Generally, 54 percent of the sample was satisfied with 'Nemertes' rating it with a mean of 3.98, indicating thus that 'Nemertes' is covering most submitters' needs.

5.2. Insight two: Retrieval and interfaces

The 24 participants reported they found 303 usability problems. All these reports were coded, grouped in one principle, if reported on two different heuristic principles, and cleared from purely subjective judgments (e.g. like/dislike of aesthetic items) or problems attributed to temporary technical instabilities. This coding resulted to 84 unique problems, which are presented in Table 3, together with the number of reports per severity rate. Table 3 highlights the absence of catastrophic problems with the important ones resulting to almost 65 percent of the overall reports. This means that the reported problems were not reflecting system deficiencies that could injure severely users' performance. The larger part of the reports were found to refer to the aesthetic appearance of the interface, the comprehension and clarity of labels, terms and graphics, and the levels of consistent design. Table 3 shows also that two principles, 'Aesthetic and minimalist design' and 'Match between system and the real world', accounted for almost 50 percent of all unique problems. The principle with the least unique problems was the 'Recognition rather than recall', which meant that the system supported satisfactory the cognitive processes of users' tasks. Due to limited space, a selection of indicative problems per principle is presented in Table 4.

Table 3: Number of reported usability problems per severity rate

Principle	Unique problems	Severity		
		Minor	Important	Serious
Visibility of system status	4	2	4	3
Match between system and the real world	17	10	29	20
User control and freedom	6	3	9	3
Consistency and standards	12	5	24	8
Error prevention	4	1	14	2
Recognition rather than recall	3	1	11	4
Flexibility and efficiency of use	9	9	13	5
Aesthetic and minimalist design	20	0	74	18
Help users recognize, diagnose, and recover from errors	4	0	11	7
Help and documentation	5	5	6	2
TOTAL		36 (11.88%)	195 (64.36%)	72 (23.76)

Other significant findings regarded imperfections in interface design and texts, such as variant labeling, font coloring and sizing, inconsistent appearance of menus, etc. Though not requested in their task, a few participants attempted to deposit an item. During their attempts they reported several problems, with one particular raising important design questions about users' control of the submission process. It concerned the use of the 'Cancel/Save' button, which is available in the depositing forms, with one participant characterizing it as "frustrating".

While the majority of problems seemed to affect interface and texts, a significant amount of problems revolved around retrieval. Two were identified as the most crucial problems. The first is that the list of retrieved results does not support relevance sorting, but instead it presents a page with the most relevant items appearing in a list of terms or names. The second one is regarding the terms' indices, where mistyped terms, mainly due to malpractice in keyboard language selection, e.g. an English descriptor starting with the equivalent Greek letter, prohibit the users to find the desired items. One participant identified the inability of the search engine to retrieve documents on words' stems and therefore decreasing the precision and recall ranges of the results.

Table 4: A Selection of unique usability problems

Aesthetic and minimalist design
1. Redundant use of search text boxes in the main page
2. Wrong and pale colors in various pages (e.g. subscriptions, links)
3. Empty collections, while named
Match between the system and the real world
1. Dewey numbers in subjects (affecting also the 'Recognition' principle).
2. Abbreviations that are not easily comprehended (affecting also the 'Recognition' principle).
3. Unclear terminology, such as 'communities', 'collections', 'identifiers' etc.
Visibility of system status
1. Better use of breadcrumbs as navigational aids.
2. No knowledge which fields are mandatory before entering information.
3. Unclear icons on the right side of the page.
Recognition rather than recall
1. Abbreviations that are not easily comprehended.
2. Dewey numbers in subjects.
Consistency and standards
1. Inconsistent labeling, such as 'Work' and 'Item'.
2. Inconsistent date writing, e.g. full or only the year.
3. Index of 'Title' letters in English language.
Flexibility and efficiency of use
1. Appearance of pop-up information while requesting to deposit a document.
2. Lack of a/Non operating communication form.
3. Small icons at the right menu.
User Control and Freedom
1. More ranking/sorting options - More results per page.
2. Repetition of the last item of the previous page as first of the next page.
3. Log out period quite short. No such order on behalf of the users.
Help users recognize, diagnose, and recover from error
1. No error prompts while entering wrong login information.
2. No error prompts while entering wrong information in numerical data fields.
3. Control buttons in the pop-up information, such as 'Save', 'Cancel', 'Help'.
Help and documentation
1. Better structuring of help files. Integration of 'Instruction' file parts in the 'Help' file.
2. Absence of index in help
3. Better grouping of the links 'Submission issues' and 'Contact'
Error prevention
1. Losing of information typed in fields when using browser navigational aids (e.g. 'Back' button)
2. Return of results without indicating the most relevant.
3. Self entry of date/No selection from controlled lists

5.3. Insight three: Editing and service delivery

The third insight was supplied by the librarians that participate in the service delivery team, being responsible for works of reference, support and cataloguing.

The librarians stated their satisfaction about the procedure of editing in general. They commented that, although the three steps that they follow to edit documents are minimizing the possibility of errors, they are time-consuming, doubting about the necessity of only the first step. Currently, the procedure of editing and uploading a thesis consists of three stages. At the first stage the librarians accept or decline the submitted document, while at the following two they correct the metadata and check quality aspects of the full-text file, such as file accessibility, conformance to common formats, etc. Trying to mine options on alternatives for the acceleration of the process, one librarian suggested that the editing should be fragmented, with different groups of librarians undertaking

different tasks. Retrospective editing of metadata and corrections to damaged files is considered fatal by the personnel concerning their productivity. They demanded more managerial rights, such as the ability of making corrections after the document's upload, without the assistance of the database technician.

According to LIC personnel, the metadata schema is quite satisfactory, describing completely a thesis and providing all means to retrieve a record. Regarding retrieval, the majority of the librarians stated that the keywords submitted by the authors are usually precise; acknowledging thus that their expertise enhances retrieval due to natural language. Users' keywords are also guiding them in their own subject indexing tasks, but they also identified problems with consistent and correct keyword entry. As a resolution, they proposed adding keywords from auto-suggestion fields, supported by thesaurus or subject headings occasionally. Librarians stated the most usual problems in self-archiving is the absence of abstracts and keywords, especially of those in English, the errors in bibliographic descriptions, like capitals or mixed keyboard languages, and the uploading of damaged or non compliant files.

Furthermore commenting on the submission policy of LIC, the personnel agreed with the mandatory character. According to two of them the mandatory submission in the IR is safeguarding the research process. They also agreed on the decision of mandatory entry of key metadata in English. They believe that the mandatory entry of English keywords, title and abstract is enhancing document exposure and retrieval, because in several scientific fields English terms are dominant in describing documents.

The library's personnel believe that the academic community should be familiarized with 'Nemertes', adding that the Faculties and the Departments should assist the library in promoting the significance of the IR in research and education. Many of the problems are also found in the way users orientate in the physical space to accomplish a submission. In the current practice, submitters are visiting two different areas in the library building, one to deposit their printed thesis and another to submit their electronic version. According to the librarians, the users encounter problems signing up to 'Nemertes' via their personal mail, while they stated that the users are unsatisfied with the way the system supplies the copyright license. Thus, they suggested that a useful addition to the system should be the automatic completion of the license. They concluded their suggestions with the proposal of extending the service working hours and centralizing the procedure in only one department of the library.

While orientation in the physical space is awkward, they believe that the navigation in the system is satisfactory. Yet, their opinions regarding document sorting options in the pool differ, as half of them does not face any problem, while the other half is unsatisfied asking for sorting filters. As far as searching for documents in 'Nemertes' is concerned, the library's personnel are totally satisfied, while they added that the users have never referred to any search problems. Finally they think that the terminology used by 'Nemertes' is easily comprehended by both them and the users.

6. Discussion

The present study revealed a significant number of problems in the operation of 'Nemertes' and collected a few suggestions to refine the service. It was found that the users who had submitted earlier in the system had a general good opinion about the system, as nearly all constructs of the questionnaire scored above 4 out of 5. On the other hand, the participants in the HCI study and the librarians were more critical towards the system and

the service respectively. For instance, the majority of the users stated their appreciation towards self-archiving procedures, yet the librarians were quite strict on the same issue, identifying problems that do not show commitment, such as writing in capital or 'greeklish' script.[2]

The HCI study showed that 'Nemertes' requires fine-tuning in terms of interface design and texts. The outline of the study findings referred to important, yet recoverable, problems, dealing mainly with unnecessary interface elements and design inconsistencies. Concepts and terms that are essential for the DSpace architecture are not easily comprehended by the users. These problems were similar to the ones in previous studies [Caccialupi et al., 2009], but they were found to extend to texts and labels that were introduced locally. The registration to the system is also nebulous, as problems were reported by the librarians and were amplified by some users of the HCI study. Thus, the question raised concerned the scope of limiting the registration options to only one, that of institutional logging-in, as followed in previous studies [Boock, 2005], instead of the current two options.

The retrieval functionalities of DSpace have been found to be cumbersome in several previous studies [Atkinson, 2006; Kim, 2005]. The problems are more evident in a repository that is bilingual, like 'Nemertes'. For instance it was found that the parallel writing of Boolean operators in the advance search interface should be separated in each language, avoiding thus redundancy. An important problem of the browsing functionality is the dislocation of descriptors, if one mixed the lettering between the two languages. While the users who have submitted declared their appreciation towards the bilingualism of the system, however a significant share of responsibility for the correct entry of data relies on their side. Another significant part resides on the librarians, who are expected to find malpractices and safeguard the correctness of the records. This correctness will consequently minimize the retrieval problems witnessed mainly in the browsing of indexes. Information retrieval is expected to be further enhanced, if the system search engine would retrieve items on the basis of words' stems. An activation of the Lucene Analyzer for Greek language has been routed in order to address this problem. Currently, Ajax technologies have been employed to indicate relevant terms in the repository during typing search queries. These techniques have been also recommended by a librarian in the form of automatic suggestion of names and subjects in the submission forms, as a means towards encouraging selection of terms and eliminating false descriptors.

The problems with browsing lists and sorting items were not manifested only in the retrieval interfaces, but in the administrative ones as well. During the interviews with librarians, it was reported that ranking filters would be a useful addition in following versions of 'Nemertes', as they could help trace easier their selections and thus elevate their performance.

Librarians suggested that centralization would enhance the whole procedure and would make the interaction of the users with the service more intuitive. Right now the process is unclear and under time constrains the submission becomes appalling. Certain collaborations with other University units, such as Department secretariats, should take place to proactively inform the community. Instruction courses should be introduced to the library's instruction program. It would be expected to familiarize the users with the scope of the service and assist them navigating in the physical space, while the revision of in-system help files and guidelines should lead them into succinctness. The users who had

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[2] 'Greeklish' is a script of Greek words with Latin letters. It is mainly performed to increase typing performance, e.g. avoid changing keyboard language, as well as to address encoding problems in IM applications.

submitted in the system also regarded that the helping functionalities in the system had some improvement margins. While the mean score touches 4 out of 5, it is one of the lowest in the questionnaire survey. All these coincide with the librarians' demand to shorten the procedures of submitting and editing. The librarians would like to formulate a practice that is quick, accurate and effective, keeping the bibliographic paradigm safe. By including the users and self-archiving however this becomes very challenging and unarguably a puzzling task.

7. Conclusions

The present study synopsized the results of heterogeneous evaluation study that aimed towards gaining an insight to the operation of 'Nemertes'. It was a multifaceted evaluation study with diverge methodologies and several classes of users participating, in an attempt to cover the many facets of the IR. The problems found were assessed to be addressable and therefore the administration team of 'Nemertes' has already started redesigning some aspects of the system and the service. Problems that will remain are presumed to be lessened with the proper instruction and further dissemination of the idea of self-archiving. Despite all deficiencies found, the users who had submitted in the system recognized 'Nemertes' as a valuable service, while the librarians supporting it consent on its usefulness for academics and scholars.

8. Acknowledgements

9. References

Atkinson, L. (2006). The rejection of D-Space: Selecting theses database software at the University of Calgary Archive. In *9th International Symposium on Electronic Theses and Dissertations, Quebec City, Canada*. Available from *https://dspace.ucalgary.ca/handle/1880/43513*, retrieved 04.01.10.

ARL (2006). *Institutional Repositories*. Washington, D.C.: ARL.

Boock, M. (2005). Improving DSpace@OSU with a usability study of the ET/D submission process. Ariadne, (45). Available from http://www.ariadne.ac.uk/issue45/boock/, retrieved 05.01.10.

Caccialupi, R., Calvi, L., Cassella, M., & Conte, G. (2009) Usability evaluation of a multimedia archive: B@bele. In *Proceedings of the 13th European Conference on Digital Libraries, LNCS 5714*, (370-376). Berlin; Heidelberg: Springer-Verlag.

Davis, P.M. & Connolly, M.J.L. (2007). Institutional repositories: evaluating the reasons for non-use of Cornell University's installation of DSpace. *D-Lib Magazine 13*(3/4). Available from *http://www.dlib.org/dlib/march07/davis/03davis.html*, retrieved 07.12.09.

Ebenezer, C. (2003). Usability evaluation of an NHS library website. *Health Information & Libraries Journal, 20*(3), 134-142.

Kim, J. (2005). Finding documents in a digital institutional repository: DSpace and Eprints. *Proceedings of the American Society for Information Science and Technology, 42* (1). Available at http://dx.doi.org/10.1002/meet.1450420173, retrieved 24.11.09.

Markey, K., Rieh, S.Y., St. Jean, B., Kim, J., & Yakel, E. (2007). *Census of Institutional Repositories in the United States: MIRACLE project research findings*. Washington, D.C.: CLIR.

Marchionini, G. (2000). Evaluating digital libraries: A longitudinal and multifaceted view. *Library Trends, 49*(2), 4-33.

Nielsen, J. (2005). *Ten usability heuristics*. Available from *http://www.useit.com/papers/heuristic/heuristic_list.html*, retrieved 05.01.10.

Peng, L.K., Ramaiah, C.K., & Foo, S. (2004). Heuristic-based user interface evaluation at Nanyang Technological University in Singapore. *Program, 38*(1), 42-59.

Van Der Graaf, M. (2008). *The European Repository landscape 2008: Inventory of digital repositories for research output in the EU*. Amsterdam. Available from *http://dare.uva.nl/document/150724*, retrieved 11.01.10.