

Usability of Digital Repository Software: A Study of DSpace Installation and Configuration

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Abstract. Usability of the installation and configuration of digital repository software is a key factor for the implementation of digital repositories. Many universities, laboratories and companies want to place their collections online but the installation and configuration processes of digital repositories are sometimes time-consuming and unnecessarily complicated. This paper describes efforts to highlight usability issues while setting up and configuring DSpace. The focus of three studies that were performed was not end-user usability but usability of the administrative functionality. User evaluations performed on a recent version of DSpace were followed by participatory design of a tool to increase usability by abstracting away the lower-level details. Users agreed that such a tool would be suitably usable. Thus it was found that significant usability problems exist, but these problems may in fact be easily addressed.

1 Introduction

The emerging Open Access movement has in recent years played a defining role in the evolution of digital repository software, which is used primarily to archive and disseminate research-related documents. In the 90s such tools were usually custom-developed to meet the objectives of specific organisations or projects. However, for Open Access to be widely adopted, it was necessary for repository tools to easily be redeployed in different scenarios. This led to or supported the creation and ongoing development of digital repository tools such as DSpace [2], EPrints [1] and Fedora [3]. The Budapest Open Access Initiative has as one of its core activities the monitoring and evaluation of such tools, as Open Access hinges on this to a large degree [4].

While the link between Open Access and reusable repository tools is acknowledged, less effort has gone into the degree of reusability. Tools that are easier to reuse should lead to greater use, hence more Open Access activities. This has not been a focus. Digital repository tools have not yet joined the growing Open Source software repositories - neither EPrints, DSpace nor Fedora are found in the standard Ubuntu software repository (with 25031 tools) or FreeBSD ports collection (with 18700 tools) as of early 2008.

End-user usability has improved to keep pace with developments in Web applications, for example by the incorporation of AJAX techniques in newer

systems. Administrative interfaces (such as installation and configuration), on the other hand, have not improved substantially. Historically, a systems administrator was required to install and configure digital library tools. Recent releases of both EPrints and DSpace, however, can be installed on MS-Windows. In addition, Linux-based OSes such as Ubuntu are being used by more end-users on the desktop. Sophisticated package management tools (e.g., Synaptic, emerge, MSI, FreeBSD ports) are available on all OSes to enable painless end-user installation of software - many of these tools handle the installation of dependencies automatically. Thus the underlying facilities are in place for end-users to install and configure their own repositories - all that remains is for the repository tools to present suitable interfaces to users for the tool-specific installation and configuration tasks.

The ultimate goal of this project is to abstract away the complexity of installation and configuration to lower the bar for adoption of digital repository tools. This paper discusses the initial stages of this process: confirming and highlighting problem areas in administrative usability that are previously only discussed informally; and formulating and testing a design for improved administrative usability based on the problems identified, using a participatory design approach with end-users. The paper has focused on DSpace as a candidate system, but the approach and results can be generalised to varying degrees to other systems.

The paper first presents some background on usability of digital repositories, then proceeds to describe the 3 user-centred studies that were performed, finally concluding and presenting avenues for further work.

2 Installation and Configuration in Digital Libraries

Like other open source projects, usability is often far behind other development-related issues, even if usability is a continuing topic of interest in the digital library community. Theng [5] stated in 2000 that little work has been done to understand the purpose and usability of digital libraries. Nichols [6] pointed out that there is possibly a general Open Source usability problem. He comments, though, that Open Source Software development has not completely ignored the importance of good usability.

Usability of digital libraries depends on three key components: content, functionality and the user interface [7]. In keeping with this theme, Dillion [8] defined digital libraries usability as how easily and effectively users can find information from a digital library, with an increasing emphasis being placed on the user. The JDCL 2002 "Usability of digital libraries" workshop emphasized usability, but with a focus on just end-user usability rather than usability of administrative mechanisms for the set-up and maintenance of DL systems.

Greenstone, produced by the New Zealand Digital Library Project at the University of Waikato, has paid more attention to usability than most other digital library systems. The distribution includes ready-to-use binaries for the most common operating systems. Many previous studies [9] [10] [11] evaluated Greenstone's user interface and customization - though most of the issues reported on

are traditional end-user usability issues. For example, the *Send feedback* button in Greenstone is an attempt to improve the usability of the Greenstone interface - every time someone makes use of the button, information is collected about which action was performed, which browser was used and the screen settings [12].

DSpace was created as a digital repository tool to capture the intellectual output of multidisciplinary research organizations. As of 2008, over 250 institutions are currently the DSpace software within their organizations in a production or project environment. The most common use is by research libraries as an institutional repository, however there are many organizations using the software to manage digital data for a project, subject repository, Web archive or dataset repository. During user studies Ottaviani [13] discovered that the DSpace administrator interface is difficult to navigate and stressed the importance of having a clear interface. In an analysis of activity of the DSpace-tech mailing list archive it was found that topics related to the installation and configuration issues were common. Messages about *installation* could be found in 1451 listings and *configuration* in 1168 from a total of 11815 messages [14]. This can be interpreted as a need for enhancement in the process of installation and configuration.

Most efforts have focused on the end-user. Usability of the installation and configuration of digital library systems has not often been a point of interest.

3 Methodology

The goals of these studies were to assess the impact of usability problems during the DSpace installation and configuration processes and develop and test a set of guidelines to improve on the usability of the administrative interfaces. There were 3 stages: a user study of the DSpace installation; a user study of the DSpace configuration; and a paper prototyping workshop to develop an interface design for a DSpace system tool to simplify the installation process.

3.1 User Study - Installation

This first study examined how average users proceed through the installation process of DSpace. The invited 10 participants were a homogeneous mix of digital library beginners, users and professionals, with various occupational and educational background. 5 participants had never worked with a digital library before but all had worked with computers on a daily basis and had installed software on a Linux operating system before. The 3 digital library users worked almost daily with a digital library system but had never installed or configured one before, while the 2 professionals had done that at least once. The 10 participants were asked to perform an installation of DSpace on a clean Ubuntu Linux operating system. They were allowed to use the DSpace online help and additional information to guide them in the installation. Users were observed and given a questionnaire which had to be answered after the installation. All participants successfully installed DSpace but most of them had significant problems. Comments from participants include:

- “You have to do everything by hand, why is there no wizard [that] guides [you] through the installation”
- “I installed software on Linux before, but this is challenging”

The fastest user, a librarian who had installed DSpace before, needed nearly 30 minutes, while the average installation time was more than 45 minutes. Observation showed that most of the participants struggled while working with the Linux shell and editing configuration files. 8 out of 10 participants strongly disagreed that “The installation process is simple” and “Overall usability is satisfying”. There was agreement from all users with “I would need documentation for a second installation” and “A system tool to ease the configuration and to reduce the single steps is necessary”. Figure 1 shows the results in detail.

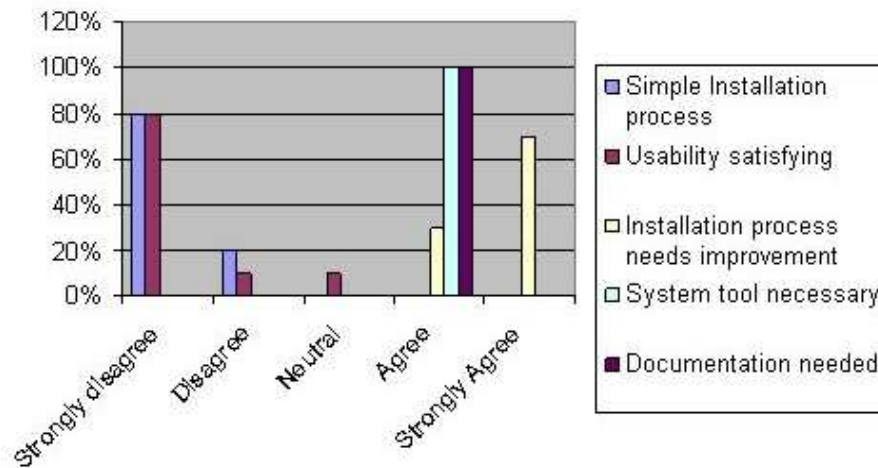


Fig. 1. Questionnaire User Study Installation

One of the users commented: “DSpace is such a great tool but the installation is just frustrating - I wouldn’t be able to set it up on my personal computer without help”. According to users, the most complicated step during the installation process was the task where users had to copy a database driver and edit the DSpace CFG file. The analysis of the results suggest that a wizard-style system tool is desirable to make the installation process easier.

3.2 User Study - Configuration

The second study investigated usability problems related to DSpace configuration. To complete the setup of DSpace various configuration steps are needed. These are, for example, database and file storage configuration and general settings like the log file directory or changing of the logo. There were 10 participants

in this study - this time not beginners but all with some background in digital libraries. 5 of the 10 participants had worked with digital libraries on a daily basis and the others had worked at least once on a digital library system. Observation and a user satisfaction questionnaire were used again as the usability testing methods. Most of the participants succeeded with the basic configuration, for instance customization of the base URL and editing the name of the site. More problems were caused when customizing the overall layout, where 7 of the 10 participants could not edit the HTML code from different JSP files. There was broad agreement with the question “I would need documentation for a second configuration” and disagreement with “The configuration process is simple”. Furthermore, 9 people strongly agreed that “A system tool to ease the configuration and to reduce the single steps is necessary”. Table 1 shows an analysis, rating each participant’s reaction to the configuration process on a scale of 1-10 for various satisfaction criteria.

Table 1. Configuration questionnaire analysis (figures indicate percentages)

	0	1	2	3	4	5	6	7	8	9	
Terrible		40	30	30							Wonderful
Difficult	20		50		30						Easy
Frustrating		80		10	10						Satisfying
Rigid	10	90									Flexible

A user who had previously configured DSpace several times commented: “I always need documentation for the configuration, the system is not self explaining at all”. Another participant stated: “It’s good that we’ve got our system administrators configuring DSpace for us, we users would need training”.

Together, these studies suggest that the installation and configuration process of DSpace is too complex for users who are not administrators. The lower level details of the process confuses users and makes it more difficult for them to install this open source digital repository tool.

3.3 User Development and User Evaluation of Prototype

The first 2 studies confirmed that usability of installation and configuration is a problem and that these processes can be improved. During these studies, users had suggested that abstraction of DSpace’s installation and configuration processes could possibly be achieved using a high level system tool. Thus, the impact of such a tool was investigated as a natural next step, to determine if such an intervention would indeed improve the administrative usability of DSpace.

An initial design was developed based on the feedback from the first 2 studies. Users were asked for feedback on the interface design and workflow through a paper prototyping workshop. There were 6 participants in this process - three of them were postgraduate computer science students with HCI experience while the other three had a library background. This design was developed in a 3-stage process, with 2 iterations of the process.

The first stage of each iteration involved discussion of the overall design of the wizard, with paper sketches and Post-it notes to represent the system tool screens and interface elements. Participants could rearrange single elements freely (see Figure 2). The next stage of the study was to determine if the elements in each window were logically grouped or not. Participants were asked to *click* through each window and comment on positive and negative aspects. All users were satisfied with the outcome.

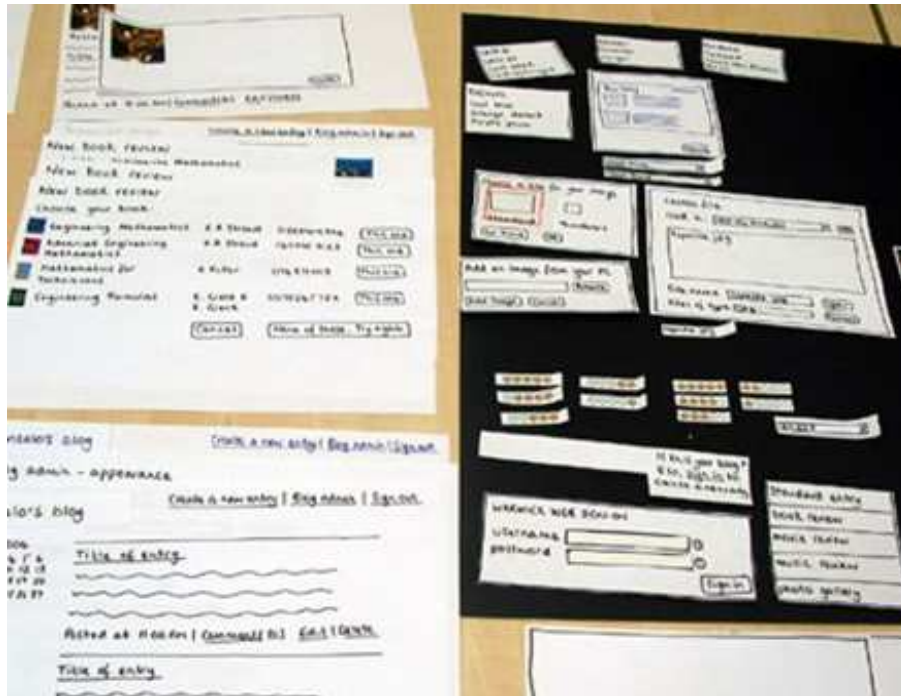


Fig. 2. Paper prototyping of system tool

The final stage in each iteration involved going back to the participants to determine the level of usability of the different individual elements and the whole interface. Participants had to evaluate the site using a usability checklist for clarity of communication, accessibility, consistency, navigation, design and maintenance and visual presentation [15].

A user who participated in both user studies and the interface design process commented after completion of the design process: “The usability will be improved, the interface design is promising”.

The final set of core features of the system tool, as designed by users, is as follows:

- Users should be guided through installation and configuration, with a wizard where appropriate.
- User should be able to manipulate existing repositories.
- Before setup, dependencies should be checked for automatically.
- Current repositories should be managed through a configuration manager, which reads and writes configuration information from and to from various sources e.g., the `dspace.cfg` file
- Cloning and deleting repositories should also be supported.

4 Conclusions and Future Work

This paper set out to formally identify problems with the administrative usability of digital repository tools, with a focus on DSpace. While this study was conducted with only DSpace, the results are arguably applicable to other similar systems as well.

The user studies confirmed the existence of usability problems in installation and configuration. Specific issues were highlighted and serve as a reference for any solutions to this problem. One solution that is proposed is the design of a high-level system tool to guide users through the process of installation and configuration, abstracting away the lower-level details. Participatory design with end-users rather than systems administrators should lead to greater usability of all aspects of the repository, including administrative interfaces. This study confirmed that, at a design level, usability of installation and configuration can indeed be improved.

This work thus suggests that it should be possible to develop digital repository tools as *any-user* applications rather than specialist administrator-only tools. Some of this is already possible with Greenstone (especially installation) but most other tools have poor administrative usability.

Future work will involve development of prototype tools for abstraction of installation, configuration and management of repositories, and further usability evaluation of such tools.

In future, it is hoped that digital repository software will enter the mainstream and be packaged and distributed through the emerging software repositories available for most modern operating systems, as this will contribute further to adoption of such tools.

Digital repositories should also integrate with software configuration management tools where they are available, thus making it easier to manage multiple instances of repository software and instances of different repository tools within a single environment, without sacrificing usability along the way.

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