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## Usability Testing of Digital Libraries: The Experience of EPrints

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### Abstract

Digital libraries should provide a qualified service in allowing their users to access data within a well-organized format. It is critical to enrich interaction among users and the interface. To measure the level of interaction, common analyses such as usability tests or socio-technical analyses are practiced throughout the literature. The interfaces can be enhanced with the data gathered from these types of analyses. The main aim of this study is to realize a qualitative usability test for the users of the Digital Archive of Hacettepe University Department of Information Management. The archive in question was exclusively created by this paper's authors who have participated in the project. In our case, a formal usability test was chosen for the analysis and a total of 5 participants -not only from library staff or those who practiced information sciences- but also from different areas have participated in the study. The test was divided into three sections; pre-test, usability test and post-test. A total of 4 questions were identified which aimed at measuring the ease of finding an article, accessing full texts, signing up for a new account and finding a given author. The preliminary findings showed that the most convenient option that EPrints software provided was in finding an article, as all of the participants have managed to answer this question fairly easy and quick. On the other hand, the most challenging situation proved to be signing up for a new account. The main reason behind this was discovered to be the sending and receiving of the confirmation e-mails in the activation procedure. There are a few papers in the literature which evaluates EPrints through utilizing a usability test. Consequently, the results from this study can be considered important in not only improving the quality of the tested archive, but also the EPrints software itself.

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## 1. Introduction

All digital libraries serve their users via an interface. It is important to correctly analyze and report the interaction between the user and the interface, as way of improving interfaces. The main purpose of this study is to evaluate the Digital Archive of Hacettepe University Department of Information Management (<http://bbyeprints.hacettepe.edu.tr>). This archive was created in March 2013 by this paper's authors and within the scope of a doctoral project by using EPrints software. The archive was limited to any kind of publication by Hacettepe University Department of Information Management.

Publications included in Publications Digital Archive are chosen through Digital Archive of Hacettepe University Department of Information Management Database articles, thesis, books, and chapters of books, project reports and newspaper articles. Publications digital archive, in its testing phase was brought to life through indexing of approximately 60 publications. The number of items indexed was primarily intended to discover potential problems in the system. In the original archive, there are almost 600 items in total, which will be added into the system, once the technical difficulties and other problems are successfully overcome.

### 1.1 Usability and Digital Libraries

Usability is defined as "the study on a product or system to make it easier to use" (Tiryaki Ersen, 2004, p. 35). According to International Organization for Standardization (ISO 9241-11, 1998); usability is "the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use". Usability is practiced in various areas for different purposes (Jeng, 2005, p. 48). Usability, in the context of digital libraries means the ease of use, prolificacy and the extent of satisfaction it provides to its users (Joo and Lee, 2011, p. 524). Nielsen (1993, p. 26) states the 5 characteristics of usability;

- ◆ Learnability: Users should be able to learn the system easily.
- ◆ Efficiency: Users should be able to use the system efficiently.
- ◆ Memorability: Users should be able to remember the system easily.
- ◆ Errors: The system should work as correctly as possible and free of major errors.
- ◆ Satisfaction: Users should take pleasure in using the system.

There are several tests for measuring the usability of systems. Usability testing signifies a process of systematic evaluation by using human-computer interaction (Reeves, Apedoe and Woo, 2005, p. 28). Usability testing is an important tool for the development of virtual systems such as interface design (Ferreira and Pithan, 2005, p. 314). It is not a requirement for professional laboratories to conduct usability tests; a convenient environment and adequate equipment may suffice for an accurate analysis. Therefore, alternative methods and techniques may be used in usability analysis (Reeves, Apedoe and Woo, 2005, p. 28-29).

Evaluation of usability in digital libraries is commonly realized through experimental and analytical methods. Experimental methods are based on data gathering from system users and the analytical methods rely on expert judgment. Heuristic evaluations, checklists, cognitive walkthroughs are examples of analytical methods.

Kim (2005) focused on the how users interact with the system to find information and examine the usability of the features of DSpace and Eprints software in the context of Australian National University institutional repository. He collected quantitative data such as; "the time spent for each task" as well as qualitative data, such as "user satisfaction". Silva, Laender, and Gonçalves (2007) describes a user experiment that aims at evaluating the Brazilian Digital Library of Computing system. They recorded the average submission time under different conditions; such as users' experience, expertise and content types and recorded their opinions on to the ease of use of the e-print archive. Tsakonas and Papatheodorou (2008) conducted a questionnaire with 131 participants to explore the concepts of usefulness and usability of an e-print archive. The research showed that information retrieval performance, ease of use and learnability affects user interaction and satisfaction.

Formal usability tests, interviews, focus groups and questionnaires are examples of experimental methods. Formal usability tests are used frequently to evaluate digital libraries (Joo and Lee, 2010, p. 525). This test is basically, a "watch-learn" approach based on the pre-prepared tasks. "Think aloud" data collection technique is widely used and is recommended by professionals. All stages of the user's movements are recorded, monitored and followed throughout the test (Tiryaki Ersen, 2004, p. 41).

It is recommended that the evaluation of digital libraries are performed at seven levels, which are social, organizational, personal, interface, engineering, processing and content levels (Saracevic, 2000, p. 363-364).

Interface level usability studies that contain search, navigation, browsing and interaction are overall accepted in evaluating digital libraries (Saracevic, 2000, p. 364; Chowdhury, Landoni and Gibb, 2006, p. 667).

For usability, there is little need to test a huge number of users. According to Nielsen (2000), determining usability problems can be made possible with the testing of 15 users. In addition, a test with 5 participants can reveal many of the problems (app. 80%) easily.

Çağiltay (2011, p. 116-119) lists the strategies of usability tests as follows;

- ◆ Determining goals
- ◆ Determining expectations of users from the system
- ◆ Determining user profiles
- ◆ Creating to-do lists for pre and post tests
- ◆ Implementation of the test
- ◆ Data analysis
- ◆ Reporting the findings

## 2. Methodology

The aim of usability analysis is to assess the level of interaction of Digital Archive of Hacettepe University Department of Information Management users with the system interface and determine its ease of use concerning data gathering and making appropriate changes and developments in the system according to the results gathered. In the testing of usability and user experience, an official usability test tool, which is widely used in the field, has been preferred. The usability test has been realized with the participation of 5 volunteers who were randomly picked without taking into consideration; any differences regarding age, sex, educational background, computer and internet skill levels. The users have been informed on the purpose of the study, as well as the method to be followed and their consent has been taken. The users have also been notified that the gathered data would exclusively put to use for research purposes. Being aware of the fact that providing a quiet comfort zone for users throughout the test would ensure the unbiasedness of the answers they'd provide, precautions has been taken to make available, an environment which would feel natural to each participant.

During the first phase of the study, a pre-questionnaire has been administered to gather basic information on the users. Second phase consists of the execution of tasks on using the Publications Digital Archive. The users have been informed that they should not in any case ask for assistance, as it would damage the overall accuracy of the test. It was also stated that any question that they fail to answer can be left blank. The pre-determined tasks regarding the use of the interface -that are based upon system attributes- have been completed by each user. Google Chrome browser was preferred to provide for a standard platform to each user. To collect opinion of each user about the use of the system, they were required to "think aloud" as they went along. Their voices were recorded alongside mouse and keyboard movements, through the use of Camtasia Studio software. Test observers have been banned from interfering or leading the users throughout the execution of tests. A post-questionnaire has been administered in the final step, to collect opinions on the usability of the system. Data collected has been analyzed, interpreted and were put to report.

## 3. Findings and Evaluation

A total of 5 participants who have attended the tests can be introduced as follows: An undergraduate (S1, Age: 21) and a graduate student (S2, Age: 31) of Information Management studies and three others who have attended different studies –an undergraduate (S3, Age: 35), a graduate (S5, Age: 36) and a post-graduate (S4, Age: 29). None of the users have stated that they felt themselves incompetent in either computer or internet use. Two of them (S1, S2) had previous information on digital libraries/archiving applications in general but were unfamiliar with EPrints software. Other users (S3, S4, S5) have stated that they had no information regarding neither the digital libraries/archiving applications or EPrints.

In the scope of the research, the questions which users were required to answer and the tasks which they were required to complete have been as follows:

- ◆ Gain full access to an article on bibliometrics, published in year 2012.

This question aims at assessing search by subject, date, or publication type along with full text access features.

- ◆ Sign up to the Digital Archive.

This question aims at assessing the conveniences/difficulties behind the membership process.

- ◆ Find the article by Bülent Yılmaz with topic: Social Communication and Libraries.

This question aims at assessing user reach to an article with a known author and topic.

- ◆ Access a chapter of a book that has been published in 2010 and list its author/authors.

This question aims to discover how a user finds a source with a known publishing date.

Right and wrong answers that are given by users to each question, the number of clicks through answering a particular question and the time spent to provide an answer are defined as quantitative findings. These findings which are derived from answers of users to 4 questions are listed below. Table 1 marks right and wrong answers given to questions by each user and the total of right answers for each question.

Table 1. Right & wrong answers by subject (user)

Questions	User					# Right Answers
	S1	S2	S3	S4	S5	
q.1 Full access an article	√	√	√	√	0	4
q.2 System sign-up	0	√	√	√	0	3
q.3 Listing articles	√	√	√	√	√	5
q.4 Listing authors	√	√	√	√	0	4
# Right Answers	3	4	4	4	1	16

As can be seen from Table 1, the rate of right answers directed at users was found out to be above average. Three of the users (S2, S3, S4) have answered all questions correctly while 2 of them (S1, S5) failed to do the same in some questions. Where S1 failed to give the right answer to a question (q.1), S5 gave the wrong answer to 3 of these questions (q.1, q.2, q.4) which could be related to the technical troubles that have been experienced in Hacettepe University's internet connection during the testing of the subject. Question 3, which aims at assessing user reach to an article have been replied correctly by all users. Questions 1 and 4 which aim at assessing full access to an article and listing an author have also been replied correctly by all 4 users. In signing up to the system (q.2), 2 of the users have failed to provide any answer. Also, this question proved to be the most challenging for all users. The response mails which have been sent to e-mail addresses, provided by users during sign-up were later discovered to have been marked as spam. This was identified as the main reason for the low rate of answers provided for this particular question.

Response time was an important criterion in assessing the usability of the system. In situations where the response time is low, it can be said that the data in question is relatively easy-accessible; whereas higher response time indicates for data that is harder or more challenging to gain access to. In the scope of the analysis, response times for each question have been calculated and no time restrictions have been imposed upon users. Table 2 shows response times for each question in minutes.

Response times show an alteration according to the type of questions. The least effort for answering questions spent for listing articles and listing authors. However, response time for the question about signing up for system is higher than other questions. This situation can commentate as normal by the reason of requirement for controlling mails for activation. In addition, some activation mails can be identified as spam by mail providers, so realizing activation mails can take long time.

While answering the questions, numbers of clicks or tab key usages are taken into account for formal availability test results. Low numbers of clicks indicate that users haven't spent too much effort for answering questions. It is important to reach less clicking for usability of interfaces. The distribution of questions with respect to users, average clicking counts and the minimum and maximum clicks are shown on Table 3.

As seen on Table 3, number of clicks to answer questions is generally high. Participants used clicks, mostly for becoming member and listing articles. Questions that require less response time -like gaining full access to an article and listing authors (see Table 2) also require fewer clicks. When considering click numbers in respect to the users; it is seen that the under-graduate level user (S1, age: 21) clicked more than other participants. This situation can be identified with differing factors like age, experience and excitement level.

Table 2. Duration of answers

Questions	Users					Response Time		
	S1	S2	S3	S4	S5	Minimum	Maximum	Average
q.1 Full access an article	01:36	01:16	02:02	02:30	02:39	01:16	02:39	02:06
q.2 System sign-up	04:20	01:18	02:30	02:00	03:48	01:18	03:48	02:47
q.3 Listing articles	01:59	01:40	02:00	01:49	02:45	01:59	02:45	02:02
q.4 Listing authors	00:49	00:46	00:40	01:40	02:03	00:40	02:03	01:11
<b>Total</b>	08:44	05:00	7:12	7:59	11:15			

Table 3. Number of clicks to answer questions

Question	Users					Click Count		
	S1	S2	S3	S4	S5	Min.	Max	Avg.
q.1 Full access an article	14	9	11	9	4	4	14	8,6
q.2 System sign-up	48	9	9	6	9	6	48	16,2
q.3 Listing articles	14	12	12	6	10	6	14	10,8
q.4 Listing authors	7	5	3	4	2	2	7	4,22
Total	83	35	35	25	25			

### 3.1. Opinions of Users about Digital Archive

On the last stage of the study, a survey was conducted in order to learn users' opinions concerning the Digital Archive of Hacettepe University Department of Information Management. A total of 10 questions were directed at users within this survey covered questions that are related to archive navigation convenience, assistance and guidance options, the visual features, layout, language, swiftness, handling and instructions, memorability and system errors. User opinions are gathered in a Likert scale, sorted from weak to strong (see. Table 4).

Table 4. User opinions on the digital archive

	<b>Hard</b>	<b>Normal</b>	<b>Easy</b>
Finding a source	1	4	0
Utilization and learning	1	2	2
	<b>Inadequate</b>	<b>Moderate</b>	<b>Adequate</b>
Adequacy of assistance/guidance in searches	2	2	1
	<b>Poor</b>	<b>Normal</b>	<b>Strong</b>
Visual features (color, fonts etc.)	0	5	0
Menu arrangement	0	2	3
Language	1	2	2
Speed	1	2	2
	<b>Hard to remember</b>	<b>Moderate</b>	<b>Easy to remember</b>
Access features	0	2	3
	<b>A lot</b>	<b>Several</b>	<b>None</b>
System errors	0	1	4

Overall, the user opinions are distributed in moderate levels. Users have indicated that they have found the menu arrangement to be good and accessing features is easy to memorize in general. However, guidance is defined as inadequate. Users who use EPrints for the first time have indicated that they expected more assistance, which can be considered normal. Also most of the users have indicated that they encountered no error in the system interface. The visual features are evaluated satisfying overall. Still, it can be said that in order to guarantee full satisfaction, interface should be developed even more.

### 3.2. *Qualitative Findings*

Throughout the research, qualitative data, as well as quantitative data was collected. In terms of reflecting on the thoughts and views of the participants, think-aloud technique was used verbatim in the qualitative phase of data collection. Difficulties in answering the questions, all positive and negative comments, suggestions and criticisms are identified as qualitative data. Below are the questions directed at the participants, their thoughts and opinions in the process of answering these questions and the difficulties they've faced as well as their comments in their own words.

*Question 1: Gain full access to an article on bibliometrics, published in year 2012.*

To fulfill this task, the following steps should be followed:

- ◆ On the main page; click the "Search the archive (Arşivde arama yap)" link.
- ◆ In the Topics section select "Bibliometric Methods"
- ◆ In the Date field, type "2013"
- ◆ Click "Search" button.
- ◆ Click the thumbnail next to the recorded information to access the full text.

S1, S2, S3 and S4 answered this question correctly. Here are some comments by the participants regarding this question:

- ◆ "Here (homepage) could have been better if there was a search button." (S1)
- ◆ "It could have been better if I can access the full text without downloading it first." (S1)
- ◆ "When you type 'bibliometrics' in the search box, only the results which have 'bibliometrics' in their title are returned. If full-text search is made possible, one could access any time to an article dated in 2012, which is what I'm looking for" (S3)
- ◆ "Where is the Advanced Search?" (S3)
- ◆ (Search page), "What is the meaning of 'Documents?'" (S3)
- ◆ "It is hard to search and find something via the eye icon in the topics ". (S3)
- ◆ "Not knowing what "Bibliometrics" is a time-waster" (S4).
- ◆ "Year (number) input is not accepted in the search box on the sidebar. I guess I'll have to search again." (S5)
- ◆ "Where the search produced no results, the "Export" pull-down menu on the page becomes confusing." (S5)

*Question 2: Sign up to the Digital Archive.*

To fulfill this task, the following steps should be taken:

- ◆ Click the link "Create Account (Hesap oluşturun)" at the top-left.
- ◆ Enter the required information.
- ◆ Click on the "Register (Kayıt ol)" button.
- ◆ Check the activation message delivered to your e-mail address (make sure to check the spam folder.)
- ◆ Click on the activation link in the e-mail.

S2, S3 and S4 gave the correct answer to this question. Some lines from users regarding the question are as follows:

- ◆ "(Explanations displayed after creating the account) could have better been in Turkish."(S1)
- ◆ "Again, there was a problem. Actually I would have given up signing up at this point if it wasn't for the test"(S1)
- ◆ "Becoming a member is difficult". (S1)
- ◆ "The confirmation message did not arrive. It has arrived (in spam folder). "(S1)

- ◆ "I do not understand why it wants to renew my password. I think it's wrong, it would have explained better." (S1)
- ◆ "'Create an account' should have been the label here instead of 'Subscribe'." (S3)
- ◆ "Becoming a member looks easier". (S3)
- ◆ "Instead of 'Become a member' label, 'Create an account' would have been smarter." (S4).
- ◆ "The system had no special requirements in determining the Password. It is ok from a point of view but may be thought-provoking on the user-side. They may think that the site is hacked" (S5)

*Question 3: Find the article by Bülent Yılmaz with topic: Social Communication and Libraries.*

This task can be accomplished through the following steps:

- ◆ On the main page, click the "Search the archive (Arşivde arama yap)" link.
- ◆ Select "Any" option in the writer section and input "Bulent Yılmaz" in the text field.
- ◆ Select "Any" option in the Title section and input "Toplumsal İletişim ve Kütüphane" in the text field.
- ◆ Click the "Search" button.

All users have correctly answered this question. Some comments from the users have been as follows:

- ◆ "I search the archive according to the author." (S1)
- ◆ If the "Advanced Search" link is placed in the top menu, it can be accessed via a shorter path. (S3)
- ◆ "'All / any' options would prove to be more useful if the choices were not pre-determined in the combo box" (S3)
- ◆ "When I typed "Bülent Yılmaz" into the "Writer" text field in "Advanced Search", it produced no results. I could access the information I'm looking for from the Simple Search option via typing the writer's name much easier" (S4).
- ◆ "I answered this question easily" (S4).

*Question 4: Access a chapter of a book that has been published in 2010 and list its author/authors.*

To fulfill this task, the following steps should be followed:

- ◆ Click "Search the archive (arşivde arama yap)" link on the main page.
- ◆ Type "2010" in the History field
- ◆ Select "Books in the chapter" option in Item Type field
- ◆ Click the "Search" button.
- ◆ The names of the authors will appear in the tags.

All subjects except S5 (S1, S2, S3, S4) gave the correct answer this question. Here are some of the comments that are specific to this question:

- ◆ "I look for books in 2010." (S1)
- ◆ "When I type '2010' into to the keyword field and select 'chapter in book' option from the element, I accessed the result immediately" (S4).
- ◆ "There are no chapters in the book from year 2010. In the search box on the sidebar; when I write 'chapter in book' it returns 4 results. However, none of them belongs to the year 2010." (S5)
- ◆ "Görüntüle" (view) is not an intelligent term, a term like 'gelişmiş arama' (advanced search) may be used or the parts below "Görüntüle" may be more visible and clear." (S5)

The participants stated their opinions on many different aspects of the Archive throughout the usability test. Most participants complained about search features being unsatisfactory, that they had a hard time understanding terminology and the language used; some reported that the activation messages are delivered to the unwanted message folder and membership process being too difficult. It was observed that the search box on the top right corner of the home page had not been noticed by some of the participants. Searches and the presentation of results in this section were indicated as insufficient. "Arşivde arama yap" (advanced search) link in the top menu could have been better in terms of easy Access. In addition, the difficulty of finding an item among the topics via visual inspection was noted. In this context, placing a search box there to allow browsing through the topics was thought to be a facilitating factor.

#### 4. Results

The results of this study which aimed at evaluating the usability of Publications Digital Archive at Hacettepe University Department of Information Management can be summarized as follows;

- ◆ The rate of answering of questions and fulfilling of duties were high, excluding a question about signing up to the system.
- ◆ Users had spent less time for finding an article or an author and more time for signing up.
- ◆ The question regarding signing up into the system had showed a higher number of clicks.
- ◆ System interface and menus were reviewed as being average by the users.
- ◆ Language of system, its speed and features were defined as convenient by the users.
- ◆ According to the users, access features of the system are easy to remember.
- ◆ The negative opinions about the system can be listed as; inadequacy of search features, inapprehensible terminology and defining activation mail as spam.

Suggestions below are to be taken in consideration, according to obtained findings;

- ◆ Activation mails should be prevented from being identified as spam. This problem has been solved for Gmail, however it's been ongoing for several other mail servers.
- ◆ "Search the archive (arşivde arama yap)" phrase should be changed with "advanced search (gelişmiş arama)".
- ◆ Instructions and explanations should be improved overall.
- ◆ Understanding terminology of the Digital Archive has proved a challenge for users from different fields of study. Therefore, the terminology should be made clearer and more easy to attract new users' attention.
- ◆ Usability test should be repeated later on. The findings from the tests should be taken into account and the system should be revised in regards to these findings.

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