

Usability Testing:  
A User-Centered Approach to Improve Electronic Resource Design

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Abstract

Some academic and research libraries have expanded their roles in providing access to information. No longer are they simply the information gatekeepers, but they are making available old and hidden knowledge by creating new resources such as digital library collections and by customizing vendor produced resources. Although there is growing use of digital libraries by researchers to discover information, researchers also have access to more and more content online from which to search. Users may not understand the importance of using library provided resources and instead use a site solely based on how easy it is to search and navigate. Pitted against the multitude of web resources available, the institutions that produce digital libraries then must be cognizant of user expectations in their design process and provide a useful and appealing resource.

User centered research and development are important methods to discover the expectations and required functions of a resource during the design. Generally identified as usability testing, the evaluation and design of a user interface based on data collected from real users of a system focuses on maximizing the success of an interface.

This workshop will increase awareness of the importance of designing products and services with a high degree of usability to increase the use of library provided electronic resources. Topics include the justification, planning and implementation process for usability testing. Presenters will provide participants with a framework for the evaluation of electronic resources, including the methods to effectively develop and conduct testing, as well as a chance to participate in the usability testing of the Digital Library of the Caribbean.

The Digital Library of the Caribbean (dLOC), a joint project of the University of Florida, University of Virgin Islands and Florida International University in partnership with institutions in the Caribbean and circum-Caribbean, serves as the access point for scholars, students and citizens of interdisciplinary Caribbean and circum-Caribbean research, gathers together a critical

mass of cultural, historical and research materials originally held in archives, libraries and private collections. This unique digital library provides content submitted directly from dLOC partners and members and allows users to browse materials or search the text through multilingual interfaces. The structure of dLOC presents a challenge for designers to ensure that the end product is easy to use and navigate and meets a diverse body of researchers' expectations.

During this workshop participants will learn about both the theory and application of usability testing. By evaluating dLOC themselves, participants will help to identify opportunities to improve this resource while learning how to analyze tasks, identify issues and provide recommendations for any resource.

## **Introduction**

Some academic and research libraries have expanded their roles in providing access to information. No longer are they simply the information gatekeepers, but they are making available old and hidden knowledge by creating new resources such as digital library collections and by customizing vendor produced resources. Although there is growing use of digital libraries by researchers to discover information, researchers also have access to more and more content online from which to search. Users may not understand the importance of using library provided resources and instead use a site solely based on how easy it is to search and navigate. Pitted against the multitude of web resources available, the institutions that produce digital libraries then must be cognizant of user expectations in their design process and provide a useful and appealing resource.

### **Conceptualizing usability: What is usability?**

Although usability has been discussed since the 1970s, in the early 1990s, human computer interaction research and instruction made it clear that usability has an important role in design and implementation of computers, interfaces and other technology products (Nielsen, 15). The usability component of HCI is now often taught to software engineers and training departments. According to the world's largest developer and publisher of International Standards, International Organization for Standardization, "Human-centered design is characterized by: the active involvement of users and a clear understanding of user and task requirements; an appropriate allocation of function between users and technology; the iteration of design solutions; multi-disciplinary design"(ISO 13407).

In practice, usability testing, a part of human, or user-centered design, consists of the methods used by organizations and their designers, to obtain information from end users to discover how they think and work through a product to obtain what they need. According to the U.S. Department of Health & Human Services Usability.gov site, usability refers to how well users can learn and use a product to achieve their goals and how satisfied they are with that process; usability means that people who use the product can do so quickly and easily to accomplish their tasks (Dumas and Redish 885). Overall, usability measures the quality of a user's experience when interacting with a product or system, a website or software application--"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 user" (ISO 9241-11).

Usability is a combination of many factors. Usability considers such factors as cost-effectiveness and user satisfaction. The quality of documentation can affect a user's perception of the usability of the interface. However, although help information may be provided, it is important to make the resource as learnable and easy to use as possible. Ease of learning addresses how quickly a user who has never seen the user interface before can learn it well enough to accomplish basic tasks. Efficiency of use measures how fast experienced users can accomplish desired tasks and signifies that productivity using the resource will be high. Memorability assesses whether a casual user who has used the system before can remember enough to use it effectively the next time, without having to learn the system all over again. Error frequency and severity determines how often users make errors while using the system, the severity of the errors, and how users recover from these errors; the expectation is that errors will be low with users making few mistakes that they can recover from easily. An important component that is difficult to quantify is the subjective satisfaction of the users. These aspects of usability, and many others, together provide an overall assessment of a user interface.

Formative and summative evaluations make up the two purposes for usability testing. Formative testing seeks to improve interface as part of iterative design process, while summative tests consider the overall quality for use in deciding between 2 interfaces, etc.

### **Why is usability important?**

Technological change is stressful for many users and often developers focus on the newest developments rather than on what is most useful and important from the user perspective. End users are often not part of the project development process which creates difficulties for them to understand the resource and therefore have their expectations met with it. The goal for developers should be to create user-centered products to help users achieve their goals/expectations from a particular resource. Since the users are usually far removed from the development stage, developers must find strategies to actively engage them in the development. Users offer a fresh perspective on the resource tested. With users and developers having differing priorities and expertise with the resource/interface, each should contribute to the final product. Usability testing is important to ensure that the interface or resource meets the goals of the end user and the organization.

In addition in the future it is anticipated that more accessibility rules and regulations may be mandated. Compliance to these standards for developed resources will be necessary; testing should be conducted.

**Managerial Buy-in:** Managerial buy-in can sometimes be difficult to obtain because testing is perceived as a time consuming and expensive step in the design process. A usability specialist can explain that testing is actually an often inexpensive solution for the organization in the long run. With so many websites to choose from, developers need to ensure they provide users with resources that they are satisfied with, in navigation and content, so that they will want to return to it. With buy-in, testing can help determine how well the site, resource or interface meets user needs based on usability factors, and designers would be encouraged to make the changes as discovered in and recommended through testing.

**Cost:** Cheap methods for testing are available and payment to specialists to plan, run and analyze tests may be the biggest cost. Users' time needs to be compensated in some way, and space (lab or other test space) along with cost for testing materials need to be added to the final budget. As Nielsen suggests, however, the nature of the resource would determine the actual budget. For example answers to questions such as does the resource need broad acceptance or will this site experience daily use may require that a larger investment in testing might need to be made. (Nielsen 7).

### **What are the practical benefits?**

If developers involve the user from the very beginning of a design and throughout it, this ensures that the final implemented design improves the quality of their expected users' experience with using the interface by making it easy to learn, easy to remember and intuitive and also meets the desired expectations of the organization. Involving actual users in testing also increases the value of the product by providing exactly the content that the users desire. With the modifications resulting from testing, the cost benefits to the organization means less time by developers making features available that might not be what the users want.

Also, by identifying and even anticipating problems before they arise, the long term costs of support and future redesigns are reduced. Plus, usability testing creates goodwill between user

and organization by showing the users that their input matters, and even encourages users to take ownership of the resource. Ensuring the resources meet these usability factors will translate into more use and better reputation for the resource, although these may not be immediately tangible.

### **Types of Usability Testing**

Many types of usability test methods exist but user testing is the fundamental usability method. Testing should come sometime (and repeated) in the development lifecycle, not necessarily at the final evaluative stage.

There are four techniques that are easily employed for usability testing: user and task observation, scenarios, simplified think aloud and heuristic evaluation. Because an interface has many components that a user may be faced with, using the scenario based testing method enables the usability facilitators to target an area for consideration. There are many aspects to any given resource that may need to undergo usability testing. Each element on the page can be a source of difficulty for the user to be tested in a formative evaluation, or if a big picture view is taken, the summative evaluation needs to be explored. Identifying the intended use of the resource and type of user are essential in defining the purpose of the testing. Because even minor interface details have can affect the way a participant uses the resource, a very narrow approach to the testing can be effective to get at what might improve the resource. This honing in on an area forces the user to follow expected paths/links to answer the question.

The think aloud method enables facilitators to learn both how and why users complete the tasks. This type of testing provides the added benefit for developers who learn a little more about the thought process behind using the interface and can be identify problems needing to be fixed; the difficulty users experience when completing tasks can identify what is not intuitive about a particular feature. As part of the managerial buy-in idea, it is noted that this type of testing can be done cheaply; all that would be needed is someone to write down the responses and behavior of the test taker.

Heuristic evaluation focuses on the guidelines for usability applied to a site, as determined by developers or usability specialists. Such areas addressed in this evaluation can be whether the dialogue used is simple, the site is consistent, or documentation is useful.

Other cheap methods exist for gathering data and supplemental data. For example, paper prototyping when it is early in design can test using simple paper sketches; card sorting exercises can be done using index cards or sticky notes and a pencil; and scenario based testing requires just a computer with internet connection on live site. Focus groups enable the assessment of the resource to obtain supplemental data about the errors that might be found and the general strategy problems of the interface. Analysis of web site search logs gives a snapshot of how users are already using a particular resource. Card Sorting uses cards that represent all the items on the interface that a user will sort and name into categories. This sometime time-consuming testing can reveal issues in terminology.

Combining various testing methods enables usability specialists to more fully capture the issues about a resource or interface. For example, often user testing will focus on specific interface problems while focus groups can reveal general strategy problems. In whatever format of tests selected, the testing is not about the answer to the questions asked but about the process to find the answer using the resource/interface. Testing aims to review the tool not the user's abilities

and seeks to answer major questions such as: does the user understand the purpose of the site and its organization and can the user complete tasks using the resource?

## **Preparing to develop a Usability Test**

### **The Why and Who**

When managers agree to usability testing, the specialists should begin planning by reviewing the interface/resource itself and determining who the intended audience is. Understanding the culture, mission and objectives that developed the resource/interface is also critical; meeting with an organizational representative/designer will help to define these areas. In that meeting, the organization should explain the overall purpose of testing—to provide a formative or summative evaluation of the resource/interface.

Further, who the intended audience is should be revealed along with the expected or perceived needs/behavior/preferences of those users that drove the initial design. Determining user profiles is a part of defining the purpose of testing. Identifying the background of user and level of experience expected is the foundation for the recruitment plan for test participants. This will include how many of each group is needed. Nielsen suggests that between 5 to 7 participants can be in group or up to five for each user group in individual testing. These participants should be representative users of the interface and if possible include both novice and expert users.

Specific tasks/functionality based on expected interactions of users with the interface/resource, or the reasons why users go to it, can be defined. Tasks need to be representative of the uses of the system and cover the most important features of the interface. The purpose for the testing identified early in the planning stages can determine the tasks and specific testing method ultimately selected.

Tasks are best if related to a particular overall scenario, and questions, especially if in talk aloud testing, should yield precise results and be answerable within the time limit defined prior to testing. The test method selected should encourage collection of the necessary data to analyze.

### **The Where, When and How**

Once testing type is determined, logistical issues about the type of testing need to be addressed. Where, when and how long each session should be is among the issues to consider. The testing environment—either formal (in a laboratory) or informal (at a public workstation or an office)—computer support and software needs need to be decided. Tests can be conducted in a space that is comfortable but it can be done in a formal laboratory setting.

Choosing and training experimenters/facilitators is relatively easy and can affect when testing will occur. They should have some familiarity with resource, enough to answer questions if they should arise but be able to politely explain that in most testing situations s/he cannot assist in navigating through the resource/interface. Facilitators must not lead participant and do not interfere with user but observe and record participant activities. In infrequent cases where a user gets stuck on a question and is no longer productive can a facilitators to give a hint to move the test forward or stop the user. Overall, the facilitator must be objective, patient, observant, and be able to record what is done.

The type of data is collected had already been decided but a developing the actual test questions and other instruments and deciding how data will be analyzed will be finalized.

Once the questions have been drafted, it is good practice to pilot the test, or test the test. This enables the specialist to determine if time allotted is correct. In addition specialists can make improvements to the wording of test, questionnaires or other survey instruments if necessary.

### **Conducting the usability testing**

Usability testing as part of user-centered design involves users throughout all stages of site development, in order to create a site that meets users' needs. Individual sessions are often best so that developers can actually see where real users are having difficulty using the resource. It is often commented that developers themselves, not simply the usability specialists/ facilitators should be there to watch how users navigate through what they think is an easy interface; this allows developers to truly understand and accept what changes need to be made to make the resource usable.

Because testing requires direct contact with end users, most institutions require that a human testing protocol be developed and approved prior to testing. At the University of Florida the test protocol includes an informed consent and all survey instruments. Once this protocol is approved, recruitment and scheduling of test participants can begin.

During the testing, all questions should be given to the participant in writing, preventing misinterpretation of what is sought. Facilitators observe user behavior, identifying glaring errors that the user had, etc. A record of the test is done via note-taking, screen capture, and exit or post test interview or questionnaire. After the test is complete, often compensation such as refreshments, gift cards, etc. is provided (but this needs to be budgeted in). After the participant leaves, it is best that a preliminary report on individual tests is drafted while the session remains fresh in the mind.

#### **Generally how is usability testing conducted?**

1. Introduce purpose of test: improve interface, voluntary participation, results confidential, recording method, facilitator role of not answering questions, time for questions before testing
2. Run test: facilitator refrains from answering questions/interacting, 1 observer to remain quiet
3. Debrief: Fill in satisfaction questionnaire before discussion, ask for comments or suggestions
4. Prep analysis: label test materials by code, write up report: well organized notes and preliminary report on individual tests make the work easier later on

After all testing, a full analysis of the collected data is conducted and is reported to the organization managers and developer. The data is often analyzed by finding patterns; specialists interpret and suggest recommendations while also documenting mistakes for future redesign. The recommended changes are reviewed and possibly implemented. Normally this becomes an iterative process where the usability testing is a systematic part of the development lifecycle; usability experts and developers retest the modified interface, revisiting the process. Depending on the type of test conducted, the time for testing itself may be short. In addition, only a relatively small number of usability participants are usually necessary to get effective feedback about the resource.

#### **Generally, steps to designing/completing a usability plan are:**

1. Planning: Defining the purpose (goals and objectives) of testing

2. Identifying the intended use of the resource and type of user
3. Determining user profiles is a part of defining the purpose of testing
4. Define top tasks completed using the tool/site:
5. Define method of testing
6. Select evaluation measurements and draft test
7. Pilot test/rewrite test
8. Select participants and facilitators
9. Test and reward
10. Analyze and report
11. Implement
12. Retest

### **How does an actual test work? Digital Library of the Caribbean as a model**

The Digital Library of the Caribbean (dLOC), a joint project of the University of Florida, University of Virgin Islands and Florida International University in partnership with institutions in the Caribbean and circum-Caribbean, serves as the access point for scholars, students and citizens of interdisciplinary Caribbean and circum-Caribbean research, gathers together a critical mass of cultural, historical and research materials originally held in archives, libraries and private collections. This unique digital library provides content submitted directly from dLOC partners and members and allows users to browse materials or search the text through multilingual interfaces. The structure of dLOC presents a challenge for designers to ensure that the end product is easy to use and navigate and meets a diverse body of researchers' expectations.

Currently the library houses over 3,000 titles from ten of our thirteen current partners. Topics include historical photographs, current social science publications, institutional historical memory, maps, books and more. This project has facilitated the development of the website, online content submission tools, purchase of high quality digitization stations in the Caribbean and the training of our Caribbean partners in state of the art digitization for preservation. The decentralized organization structure of dLOC where our partners choose the content for submission has resulted in a variety of information being housed together under one dLOC banner. Our goal as we move forward is to continue to support our partners as we develop more defined topical collections through both human and technology aided selection.

It is precisely at this crossroads that we are implementing a usability study to guide our development process. The dLOC has already benefited from previous testing of the University of Florida Digital Library Center. This test will allow us to analyze dLOC and to make adjustments to the current site and move forward with new designs developed with user input. The examples and exercises in this workshop will be modified and implemented in our upcoming multi-site Usability Assessment. The dLOC Usability team is currently seeking volunteers to conduct testing at various sites.

### **Conclusion**

This workshop addresses the major steps necessary to conduct usability testing of an electronic resource and provides concrete examples of how such testing is being approached in the case of the Digital Library of the Caribbean. The investment of time and resources in such testing serves to guide the development process to ensure that the resource meets the expectations of the end user and organization.

## Post Usability Testing Questionnaire

Thank you for participating in the usability test of the Digital Library of the Caribbean. Please complete this short questionnaire about the resource.

1. How would you rate the overall ease of use of dLOC resource?

5      4      3      2      1  
very                  somewhat      difficult  
easy                  easy

2. How would you rate the overall navigability of the resource?

5      4      3      2      1  
very                  somewhat      difficult  
easy                  easy

3. How would you rate the overall learnability of the resource?

5      4      3      2      1  
satisfying      somewhat      frustrating

4. How likely would you use this resource for online research?

5      4      3      2      1  
somewhat      likely                  not  
likely                                  likely

5. How likely would you recommend this resource to someone for online research?

5      4      3      2      1  
very                  somewhat      difficult  
likely                  likely                  likely

6. How would you rate your overall experience with dLOC resource?

5      4      3      2      1                          5      4      3      2      1  
Excellent      Good                  Poor                          Satisfying                          Frustrating

7. Which areas did you find easiest to navigate:

\_\_\_ collection pages                          \_\_\_ result list pages                          \_\_\_ help pages  
\_\_\_ search pages                                  \_\_\_ individual item records

8. What were your impressions of the Help information?

5      4      3      2      1                          5      4      3      2      1  
Clear                                  Confusing                          Adequate                          Inadequate  
Information    Information

9. What did you find to be the most exciting feature of the UFDC?

10. Please indicate which areas could be improved (provide more information if necessary):

- |   |   |  |
|---|---|--|
| <input type="checkbox"/> site design                | <input type="checkbox"/> navigation within result pages | <input type="checkbox"/> page loading          |
| <input type="checkbox"/> search interface (general) | <input type="checkbox"/> content                        | <input type="checkbox"/> format output options |
| <input type="checkbox"/> Basic                      | <input type="checkbox"/> terminology                    | <input type="checkbox"/> other, please specify |
| <input type="checkbox"/> Advanced                   | <input type="checkbox"/> help pages                     |  |
| <input type="checkbox"/> navigation throughout site | <input type="checkbox"/> result pages                   |  |

### **Focus Group**

The purpose of this study is to examine information discovery and retrieval using the digital Library of the Caribbean resource. We now wish to ask questions about your experience with and impressions of the resource. We hope to determine how well dLOC matches your expectations and needs and allows for ease of learning and use.

1. After continued use of dLOC, what features of the resource would you definitely use? Why?
2. After continued use of dLOC, what features of the resource would you definitely NOT use? Why?
3. Why would you want to use this resource?
4. Would you use this resource?
5. How important is it for you to find scholarly or academic articles? Does dLOC provide you the types of resources you want to find?
6. What other databases do you use for finding information for Caribbean and circum-Caribbean research?
7. Question about type of formats needed
8. Were results pulled up in a reasonable timeframe (seconds versus minutes)? Did you have any trouble retrieving results due to connection speed?
9. Was it difficult to figure out how to search from within dLOC? What could make this easier?
10. Should there be more ways to search database content?
11. When performing searches in the library catalog or an online search engine, do you care how the results are sorted when displayed (e.g., by relevancy, by title, by author)? Explain why.
12. Question about what kind of documentation they might want/need
13. Question about trilingual interface...Abstracts and subject headings are translated to another language...
14. Does it matter to you that you cannot print or E-mail your saved citations/records within the e-shelf section?

## Resources

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