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A series of in-person and task-oriented usability tests were conducted to evaluate the functional interface of the new Carolina Digital Repository system. The participants were ten students affiliated with the School of Information and Library Science at the UNC Chapel Hill, who were also casual users of institutional repository systems. This research generated a list of usability findings based on a compact task evaluation framework, and the results could serve as guidelines for repository interface designers.

Headings:

Human-computer Interaction

Institutional repositories

Usability

User-centered design

User experience

User interfaces (Computer systems)

A TASK-ORIENTED USABILITY STUDY OF THE CAROLINA DIGITAL
REPOSITORY WITH CASUAL USERS

by
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Table of Contents

Table of Contents	1
1. Introduction.....	2
2. Literature Review.....	4
2.1 Institutional Repository	4
2.2 Usability: Testing and Approaches	5
2.3 Considerations for Casual Users	6
2.4 Usability Studies of Institutional Repositories.....	7
3. Methods.....	8
3.1 Recruitment	8
3.2 Data Collection.....	9
3.3 Task Evaluation Framework	11
4. Analysis.....	15
4.1 Quantitative Measures.....	15
4.2 Qualitative Findings	17
4.2.1 T-1 Search.....	17
4.2.2 T2-locate	18
4.2.3 T3-deposit	19
4.2.4 T4-edit.....	22
5. Discussions	27
5.1 Task Instructions & Learning.....	27
5.2 Finer Categorization of User Types	29
5.3 Understanding of Concepts and Terminologies	30
5.4 Comparison of Post-Task Metrics and Post-Test Responses	31
5.5 On Self-Blame.....	33
6. Limitations	34
7. Conclusion	36
Bibliography	38
Appendix A: Recruitment Email	40
Appendix B: Questionnaires	41
Appendix C: Consent Form	43
Appendix D: Planned Sequence of Events	47
Appendix E: Observation Guide.....	49
Appendix F: Information Sheet Handouts	53
Appendix G: Hierarchical Task Analysis (HTA) Breakdown.....	55
Appendix H: Selected Screenshots of the System Tested	58

1. Introduction

This research is a usability study focusing on the behaviors of casual users' needs to complete simple tasks in the new Carolina Digital Repository (CDR) interface. In the past, many different types of usability studies have been done for various institutional repositories. While there have been some focus on the user roles associated with an institution, such as researchers or faculty communities, there is generally a lack of research based on broader user types. The goal of this study is to uncover some insights from the perspective of casual users, who may only use the repository for a few times and for very specific purposes, as they do not seek to gradually develop a higher level of mastery with regard to the user interface in the long term. Consequently, the results from this study will help inform the repository designers on how to improve its interface so to provide a better experience for the casual users in the future.

Carolina Digital Repository, the institutional repository of the UNC Chapel Hill (UNC-CH) will be re-launching in 2019 with the new Hyrax front-end interface. As such, this research also fulfilled a sub-goal: to evaluate the usability of the new Carolina Digital Repository interface. While Hyrax is designed to be a repository solution, it is developed as widely adaptable for various kinds of repository and digital asset management platforms. As many customizations are implemented to cater for users of the UNC-CH

community, the interface already offers a deviated user experience compared to the default Hyrax interface, hence this study also generated some insights as to how the customizations would have improved or detract from the usability of the out-of-the-box interface.

Given the above factors, this study fulfilled two closely related purposes: to produce a usability report on a few of the common tasks performed within the CDR, and to do so from the perspective of casual users in order to understand their behaviors. The connection here is that most UNC-CH students who interact with the CDR can be classified as casual or occasional users, due to the fact that they only use it to do very specific things and that they do not aim to progressively achieve a higher proficiency with the interface. See the “Considerations for Casual Users” section below for more detail.

2. Literature Review

2.1 Institutional Repository

The value of an institutional repository (IR) in the modern age is not to be understated. With more research data and documents being produced electronically, members of an institution greatly benefit from the various functions that an IR is able to provide—ongoing stewardship of digital documents, increased efficiencies of technological management, a centralized place to store and showcase research, and a wider reach of distribution (Gibbons, 2009). Ever since the inception of the concept of IR in the early 2000s, its adoption rate has seen a steady increase, with more and more types of IR systems being developed by different groups (Lych 2003; Lynch et al., 2005). Suffice is to say that this trend will only continue to grow as digital technologies mature and more organizations put their eyes on IR as the solution for their scholarship needs.

However, as with any information management systems designed to serve a specific group of users, IRs come with their own set of expectations to meet and problems to confront. Among one of them is the usability of IR interfaces.

2.2 Usability: Testing and Approaches

An interface is truly usable when it allows the user to perform his or her intended tasks without difficulties and frustrations, and a usability test is the evaluation process that measures how usable an interface is, through the aid of iterative testing and observation techniques (Rubin & Chisnell, 2008). As such, it is crucial that any makers of digital systems strive to meet their highest level of usability so to better serve their users' needs and minimize their hindrance when using the interface. However, usability testing is merely one of the numerous usability research methods, as there are many approaches for evaluating and analyzing usability of digital systems. Depending on the data needed and objectives of the study, different methods can be employed, even modified or used in parallel, to achieve the desired research goal. Some of the common methods are diary studies, card sorting, and focus groups (Kuniavsky, 2003).

In this particular case, usability testing is useful for identifying problems that people may have with the CDR interface by revealing confusing language and difficult tasks.

Additionally, a common technique used alongside of usability testing is the think-aloud protocols: they are primarily meant to capture the cognitive processes of the users being tested by asking them to speak their thoughts out loud during or after their usage of a system or a product (van Someren, 1994). Though not without certain drawbacks, such as the side effect of potentially disrupting to the user during a test, the protocols are versatile and frequently used to assess perception and performance of information systems as well as their interfaces through the first-hand account of the end users (Wildemuth, 2016).

The other usability method employed in this research is the hierarchical task analysis (HTA). It involves only the practitioner to study the intended tasks to be performed by the system's prospective users. Originated from the fields of human factors and ergonomics, HTA is used for breaking down and understanding a system's functions in the hierarchical terms of goals, tasks, and sub-tasks (Stanton et al., 2017). When adopted into the domain of digital interface usability, this allows the practitioner to analyze the granular patterns of how an interface is intended to be navigated and used, and the results can then be used to aid the outcome evaluation of usability studies (Hornsby, 2010). In this research, HTA was used both to develop the tasks and to analyze the test outcomes, which were used in conjunction with usability testing and think-aloud protocols to evaluate the interface of the CDR in a per-task basis, hence the title.

2.3 Considerations for Casual Users

On the surface, a casual user appears similar to a novice user, as both of them have no high level of expertise towards a particular system. However, they are driven by fundamentally different motivations: while a novice user seeks to progressively acquire more mastery over time, the casual user is likely interested in completing specific tasks and has no interest in developing mastery after their needs have been fulfilled.

Furthermore, casual users are not necessarily similar to infrequent users, because they might still use a system regularly without seeking to improve their knowledge towards that system (Baker, 2012).

In the context of IRs, these users might be undergraduate, graduate students, or any members of the institution whose use of the system are short term needs and consist of simpler tasks, such as ad hoc searching for a topic of interest or depositing a thesis file towards the end of their academic career. These are casual users that belong to a different category compared to researchers and librarians who tend to have a more comprehensive understanding of the various aspects of IRs, and that are likely to be regularly using IRs for more complex tasks outside of merely searching and viewing deposited documents (St. Jean et al., 2011).

2.4 Usability Studies of Institutional Repositories

Due to increasing popularity of IR across the world, many usability studies have been conducted on various IR and IR-like systems. These studies are mostly done with a mix-methods approach on common tasks associated with the usage of the IR, such as documents depositing and searching, with quantitative measurement of performance metrics alongside of qualitative verbal feedback and interviews (Kim, 2006; Caccialupi et al., 2009; Zhang, 2013). It is worth noting that, however, these research tend to be usability studies that aim to improve the system for general purpose and mostly are not focused on any specific type of user. This created an opportunity for this usability study that specifically focused on only the casual users, which aimed to uncover particular insights beyond the general usability issues.

3. Methods

3.1 Recruitment

The participants were ten master's and undergraduate students recruited through the School of Information and Library student email listservs. This includes both students who are enrolled in the School of Information and Library Science, or have at least taken some courses from the program. The headcount of participants was based on Nielsen's recommendation for the number of users needed in order to make the most out of a usability study (2000). The email contained recruitment criteria so that students who might have had more expertise with IR systems are excluded from the study (Appendix A). Among the participants recruited, only two have had some experience with IR, and both of which obtained their experience through the existing version of the CDR.

The rationale for the convenience sampling was to minimize the difficulty of recruitment, given the limited time frame of the research. As one of the primary demographics of IR in universities is the student body, sampling from the UNC-CH School of Information and Library Science students partly sufficed the general purpose of this research.

However, it should be emphasized that students from this particular sample pool would tend to be more skilled in areas such as information searching due to their coursework and frequent exposure to information systems related topics.

ID	Current Degree	Prior IR Experience	Name of IR	Purpose of Using IR
U01	Master's	Yes	Carolina Digital Repository	"Just to explore" "Fulfill a class assignment"
U02	Master's	No	-	-
U03	Bachelor's	No	-	-
U04	Bachelor's	No	-	-
U05	Bachelor's	No	-	-
U06	Master's	Yes	Carolina Digital Repository	"Just to explore" "Download specific item(s)"
U07	Bachelor's	No	-	-
U08	Master's	No	-	-
U09	Master's	No	-	-
U10	Master's	No	-	-

Figure 1: Breakdown of the participants. 4 participants enrolled in the bachelor's degree program and 6 participants enrolled in the master's degree program.

3.2 Data Collection

All usability test sessions took place in the same location reserved and setup specifically for the study. Only one participant was present at each study, and only the participant and the researcher were present at the location. The study also took place in a windowless private room behind a closed door, which kept the outside distraction at the minimum level. Each participant was provided with a standard mouse and keyboard for control as well as two medium-sized monitors for using the websites; one screen was displayed the CDR website, while the other one displayed the questionnaires. When test was in progress, the participants' audio and facial expression were recorded using a high-definition webcam, and their onscreen interactions was recorded using the Camtasia software.

At the beginning of each session, the researcher would introduce the participants to the study and briefly describe the CDR platform. The researcher then asked them to complete

a pre-test questionnaire for gathering background information (Appendix B). Afterward, the recording began and the study proceeded to the testing phase. The test was untimed and contained four tasks of varying levels of difficulty. It should be noted that the researcher designed these tasks in collaboration with the Institutional Repository Librarian from the University Libraries of the UNC-CH to ensure their practicality. The workflow in each task was chosen based on the most realistic reasons that this demographic of participants would be using the repository for, such as searching for contents based on specific academic department or depositing a research paper (Appendix E).

In brief summary, the tasks are as follows:

- Task #1 (T1-search) instructs the participants to search for master's papers based on a topic that is also tied to a collection.
- Task #2 (T2-locate) instructs the participants to locate two pieces of metadata on a specific submission.
- Task #3 (T3-deposit) instructs the participants to deposit a file based on information provided to them.
- Task #4 (T4-edit) instructs the participants to edit a submitted work based on information provided to them.

By design, each task was intended to inform the participants about the subsequent tasks to a certain degree, as the steps for completing each task would progressively reveal different parts of the website. For instance, locating the metadata for T2-locate should

inform the participants that there are files attached to a work submission that contain their own separate set of metadata, which is part of the process for completing T4-edit.

Prior to each task, the researcher would read the task description as well as distribute a slip of paper containing the task description for the participants' reference. For reasons related to privacy, the researcher had already logged into the CDR prior to the test using a personal account, so the participants did not have to authenticate using their own.

Additionally, for T3-submission and T4-editing, an information sheet was provided to them to help with completing the data entry and editing requirements (Appendix F).

While the task was ongoing, the researcher allowed the participant to focus on the task, and only interrupted to remind the participants to think aloud or when they asked for assistance. After each task, the participants were also asked to complete an After-Scenario Questionnaire to rate their experience of working through the interface. During the period in between tasks, the researcher also navigated back to the homepage of the CDR, so that each task would begin from the same page. Lastly, after all tasks were completed, the researcher interviewed the participants with a set of staple questions and clarified any points of interest that might have arose during the test (Appendix B)

3.3 Task Evaluation Framework

While there may be multiple paths to complete each of the four tasks, there is a "best" path that can be taken. This was determined by whether the participant took the most effective route to achieve the main goal of the task, taking into considerations of the factors such as the accuracy of whether they interacted with key pages or page

components relevant to the task. This path was constructed based on the hierarchical-task analysis of each task (Appendix G). The participants were not specifically instructed to pursue the optimal path, however, it should be noted that the effectiveness here does not equate to time spent exploring the system, as “time on task” was not measured for this test design. Rather, it meant that the participants ultimately completed the tasks by having gone through the respective optimal path outlined below, regardless of how many other locations they may have explored during each task.

Based on the gathered data, the researcher has classified the outcomes of the task completion into four categories:

- Completed: when the participant managed to complete all steps in a task and achieves the main goal. He or she confirmed that the task has been completed.
- Partly completed: when the participant managed to complete some steps in a task and achieves the main goal. He or she confirmed that the task has been completed.
- Incomplete: when the participant may or may not manage to complete the steps of a task, but did not achieve the main goal. Additionally, he or she was not aware of the incompleteness of the task, but still confirmed that the task has been completed.
- Given up: when the participant may or may not manage to complete the steps of a task, or achieve the main goal, but verbally confirmed that he or she was not able to complete the task.

The main goal and the key steps to the completion criteria of each task are as follows:

1. Search Collection

- a. Main goal: report the correct number of SILS master's paper with the term "taxonomy" in the title.
- b. Key steps: navigate into the "SILS master's paper" collection OR filter search results by the "SILS master's paper" facet; count the search results returned using the term "taxonomy" within the collection.

2. Locate Metadata

- a. Main goal: report the width and height of the image file titled "Perfectly Safe" in the work view.
- b. Key steps: navigate into the work titled "Are We There Yet?"; navigate into the attached image file titled "Perfectly Safe".

3. Deposit Work

- a. Main goal: fill out the submission form using the information sheet and deposit the PDF file titled "paper-submission.pdf".
- b. Key steps: choose the "Master's Papers" deposit option; choose the "School of Information and Library Science" department option; upload the PDF file to the deposit form; correctly fill in all the required fields; utilize the extra information to fill in the optional fields.

4. Edit Work

- a. Main goal: make edits to the work titled "Multimedia and Digital Objects" using the information sheet and save the changes.
- b. Key steps: navigate into the work titled "Multimedia and Digital Objects"; navigate into the attached image file titled "Image Version 1"; correctly

change the deposit setting for the work; replace the attached image file;
correctly change the file settings for the replaced image file.

Again, this did not account for participants venturing into areas unrelated to the task, as the researcher did not interfere with their tasks unless the participants specifically requested assistance.

4. Analysis

4.1 Quantitative Measures

The testing tasks were originally ordered in terms of difficulty. While the researcher chose not to capture “time on task” because the extra time spent on thinking aloud would confound with the accuracy of this data, when reviewing the recordings, the researcher noticed that most participants were able to complete T2-locate faster and with fewer issues than task T1-search. This is also reflected in the post-task feedback in that the participants’ responses to both the ease of the task and the time spent are higher for T2-locate than T1-search (Figure 2). That said, both of these could be attributed to the fact that the participants spent some extra time to orient themselves in the system as a part of the first task.

Overall, T2-locate was rated most favorably with the summed mean score of 13.1, while T1-search was rated the least with the score of 9.1. Additionally, U08 gave the lowest ratings to the T2-locate in all three response categories, which also had contributed to the lowest summed score for this participant’s post-task feedback at 33.

ID	Task #1 (Search Collection)			Task #2 (Locate Metadata)			Task #3 (Deposit Work)			Task #4 (Edit Work)			Sum
	Ease	Time	Support	Ease	Time	Support	Ease	Time	Support	Ease	Time	Support	
U01	4	4	4	5	5	5	4	4	4	5	5	5	54
U02	4	4	4	5	5	5	2	3	4	1	2	2	41
U03	4	4	4	5	5	5	4	4	3	5	5	4	52
U04	2	3	4	4	4	4	4	3	4	2	2	3	39
U05	4	4	3	5	5	4	4	4	4	4	4	4	49
U06	2	2	4	5	5	5	4	4	4	2	1	2	40
U07	2	1	2	4	4	4	4	3	3	3	2	2	34
U08	2	2	2	1	1	1	4	4	4	4	5	3	33
U09	1	5	4	5	5	5	4	5	4	3	2	3	46
U10	2	2	2	5	5	5	5	5	4	4	4	4	47
Mean Value	2.7	3.1	3.3	4.4	4.4	4.3	3.9	3.9	3.8	3.3	3.2	3.2	
Sum (Mean)		9.1			13.1			11.6			9.7		

Figure 2: Participants’ post-task feedback on the ease of completion, time spent, and available support information, ranging from 1 (strongly disagree) to 5 (strongly agree).

Across the board, there were only 2 cases of “Incomplete” and 1 case of “Given up” (Figure 3). U06 had an “Incomplete” outcome for T1-search and a “Given up” outcome for T4-edit, while U08 had an “Incomplete” outcome for T2-search, which is also the only outlier case for that task as all other participants were able to complete the task and followed the best path. U01 was the only participant to meet the “Completed” criteria for all 4 tasks. U05 was the only participant to have taken the best path for all 4 tasks.

ID	Task #1 (Search Collection)		Task #2 (Locate Metadata)		Task #3 (Deposit Work)		Task #4 (Edit Work)	
	Completion	Best Path?	Completion	Best Path?	Completion	Best Path?	Completion	Best Path?
U01	Completed	N	Completed	Y	Completed	Y	Completed	N
U02	Partly Completed	N	Completed	Y	Partly Completed	Y	Partly Completed	N
U03	Completed	Y	Completed	Y	Partly Completed	Y	Partly Completed	N
U04	Partly Completed	N	Completed	Y	Completed	Y	Completed	Y
U05	Completed	Y	Completed	Y	Completed	Y	Partly Completed	Y
U06	Incomplete	N	Completed	Y	Partly Completed	Y	Given up	Y
U07	Completed	Y	Completed	Y	Partly Completed	Y	Partly Completed	N
U08	Partly Completed	N	Incomplete	N	Partly Completed	Y	Completed	N
U09	Partly Completed	N	Completed	Y	Partly Completed	Y	Completed	Y
U10	Partly Completed	N	Completed	Y	Partly Completed	Y	Incomplete	Y
Completed / Best Path Taken	4	3	9	9	3	10	4	5

Figure 3: Breakdown of the participants’ task completion outcomes and whether the best path was taken for the task.

4.2 Qualitative Findings

The findings below are categorized by task. The last two tasks generated more findings as they have more steps involved compared to the first two tasks. For visual reference, see Appendix H for screenshots of the relevant pages used during the testing.

4.2.1 T-1 Search

Some participants would start the task by attempting to click on the “Student Papers” deposit icon listed on the homepage. Most of them would then read the subtitle of “Deposit Your Work” and move on. The only exception to this was U08, who did not see the text until the researcher pointed it out during the interview session. This participant stated that, “it was just invisible to me.”

For the participants who managed to navigate into the “SILS master’s paper” collection and use the collection search bar within to filter out the results by keyword, the researcher asked them about the difference in the items count versus the works count, which was caused by other user accounts that had submitted works that were set to private or embargo (Figure 5). This question revealed that not all participants noticed this difference; for those who did notice both numbers, they were not able to explain the cause of this discrepancy and expressed confusion towards it.

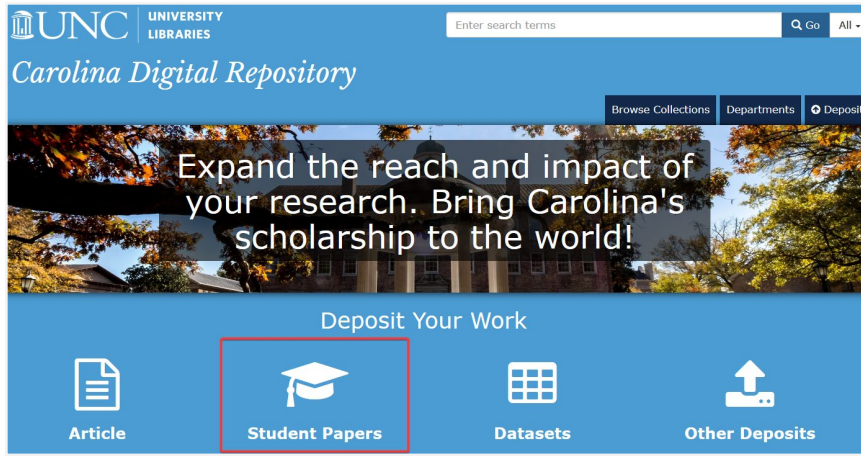


Figure 4: The “Student Papers” deposit action icon that was occasionally misunderstood as a search filter mechanism.

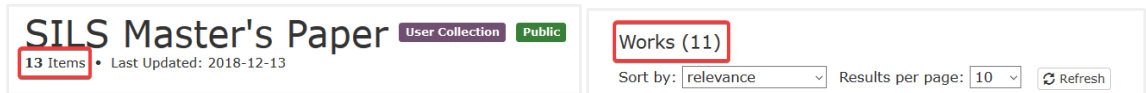


Figure 5: Discrepancy between the number of works listed versus the count of items in the collection due to private submissions and other reasons.

4.2.2 T2-locate

All participants were able to complete this task with relative ease with the exception of U08. As seen in the task completion chart, this participant had an “Incomplete” status for the task (Figure 3). The participant did not specifically navigate into the page that displays the target file, but instead downloaded and opened the PDF file of the work submission to search for the needed information. During the interview, the participant responded, *“I thought I needed to find the dimension of this picture, so I don’t have to look at the content of this picture (in the system).”*

4.2.3 T3-deposit

Most of this task surrounds the use of the master's paper deposit form to input information and submit a file, thus the findings are all related to the use of the form itself. The most common finding for this task was the inability to input the correct the creator or advisor's name format (Figure 6). Despite that the form field has a placeholder text listed for the "Last name, First name" format of the intended input, most participants did not follow the suggested format. When asked about this, the participants responded that they just did not see the suggested format. For U06, the participant was able to identify the placeholder quickly and commented, *"it's nice that it shows you the format."*

In the case of U08, the participant indicated that "Smith, John" was not self-explanatory enough as it could be interpreted as two different persons' first name. Similarly, a few participants were unable to spot that there is a "+" link underneath the creator form field for adding co-authors (Figure 7). These participants would end up typing both authors into the same field and separate them using commas. Interestingly, if the participants were able to identify the name format for the finding above, then they would be alarmed that the commas used for separating last name from first name could cause confusion when it is also used to separate individuals' name. Similar visibility issues also persisted throughout the task, such as the "Optional fields" button at the end of the form for displaying the rest of the form (Figure 8).

The second group of findings is related to the control and information display of the form fields. Frequently, the participants would attempt to type in keywords the "Degree" field

in order to jump to their desired option, only to find out that this function is not supported. This required the participants to have to scroll through the long list of degrees offered by the institution. In another case, participants had difficulty pinpointing the desired option because of the fixed height nature of the display field (Figure 8).

The last group of findings is the ambiguity of the labels and the uncertainty of purpose. While all participants displayed some hesitation throughout different points of inputting information into the deposit form—presumably due to that it was their first time using this input form—all participants were equally stumped when presented with the “Keyword” vs “Subject” upon entering the optional fields section (Figure 9). The intent of the former field is for users to input any words they would use to describe their work, while the latter adheres to a controlled vocabulary. However, the participants were not able to discern this difference until they attempted to enter information into the “Subject” field, which they were then presented with autocomplete suggestions. For instance, U03 at this point directly asked the researcher, “*what’s the difference between keyword and subject?*” Even after reading the form label instruction, most participants could not clearly explain the reasoning of having two fields that serve a similar purpose, with the exception of a few that have taken courses related to records management or have experience working in library settings. The same ambiguity issue would again arise with “License” vs “Rights statement” fields, but the nature of these fields being dropdown options, as well as a documentation link was provided in the label, made this issue easier to resolve compared to the other.

Creator required

Smith, John

Figure 6: The suggested input format for creator’s name in a light grey placeholder text.

Abstract required

A short paragraph describing your work.

+ Add another Abstract

Figure 7: The “Add another” action for form fields that may have multiple input items.

Graduation year required

2019

Resource type required

Select the category which best describes your work.

- Educational Resource
- Honors Thesis
- Image
- Journal
- Journal Item
- Map or Cartographic Material
- Masters Paper

Optional fields

Figure 8: The “Resource type” field in a scrollable but fixed height display; the “Optional fields” at the bottom of the default form that reveals the remaining non-mandatory form fields when clicked.

The image shows two separate form sections. The top section is titled 'Subject' and contains the text 'Headings or index terms describing what the work is about; these do need to conform to an existing vocabulary.' Below this text is a rectangular input field and a blue link that says '+ Add another Subject'. The bottom section is titled 'Keyword' and contains the text 'Words or phrases you select to describe what the work is about. These are used to search for content.' Below this text is another rectangular input field and a blue link that says '+ Add another Keyword'.

Figure 9: The “Subject” field and the “Keyword” field. The descriptive labels concisely explain the purpose of the two fields.

4.2.4 T4-edit

This task required the participants to navigate and make changes in multiple locations, which proved to be the most challenging task. The common issue was the mismatch in the participants’ expectation of editing the work versus accessing its attached files: when editing the work itself, the list of attached files was not displayed anywhere in the editing page (Figure 9). The file edit view is accessible separately for each individual file, which is listed at the bottom of the work record page when viewing a work. Most participants did not attempt to scroll down the page at first, and as a result, they struggled to locate the target file. However, most participants did eventually find the list of files below, while some others navigated into the target file using a roundabout path.

When asked to replace an existing file with a different file, some participants decided to delete the target file and upload the new file instead, not knowing that there is a replace function in the file edit view (Figure 11). By doing so, these participants had to confront

the issue above once again: since the view for editing a work did not list the files attached, they were unsure if this was the correct location for adding new files or if it was just the location for editing the information. This was made worse by the “Add to Collection” tab displayed on the top of the page, which is meant for assigning works to user created collections, as participants thought that it contained the function for adding files. All of the participants who chose this path were able to add the new file after a varying length of time, but this was immediately followed by another issue. After the upload process, the page redirects them back to the work view. However, the newly uploaded file would not be immediately updated on the list of attached files and the participants would have to refresh the page one or twice in order to see the change. Some were able to accidentally solve this problem by navigating to elsewhere and click back to the page, but one participant was unable to identify the issue, which resulted into the only “Given up” completion criteria above.

As stated earlier, some participants managed to get to the file edit view by going a roundabout path. This was achieved through the “File Manager” view (Figure 12). Incidentally, this page did not have the functions that the participants needed, although clicking on the pen icon beside the name of the files would redirect them to viewing each file separately, a few chose to exit this view and return to the work page without interacting with anything.

Some participants who chose to use the replace function accidentally lost the new title they edited. This was caused by the redirection right after adding a new version of the

image and clicked on the “Upload New Version” to upload the file, which did not save any information added or changed in the other two tabs in that view (Figure 11). As it turned out, the other two tabs each have a button that would save all the changes made if pressed, but the file upload button in the “Versions” tab would only perform the upload action and would not commit to include any of the other changes made. In the case of U08, the participant noticed that the edited title was not reflected after being redirected back to the file view page and was visibly confused as a result. The researcher later confirmed that similar issues also present in other parts of the interface, however, they were not accessed by the participants during tests.

Lastly, when instructed to set a specific file sharing permission with another user, a number of participants did not realize the functions were located inside the “Permissions” tab (Figure 13). They attempted to find it inside the “Edit Work” page once again. With the exception of the participant who gave up and one participant who made the sharing changes for the work itself, all other participants managed to find their way into the destination. When presented with the sharing settings, however, most participants were hesitant with their actions as they were unsure if they were making the correct changes, presumably due to the multitude of actions available in both the visibility settings and the sharing settings.

Edit Work

Work Deposit Form Add to Collection Sharing Settings

You can add one or more files to associate with this work.

+ Add files... + Add folder...

Drag and drop your files here.

Title required

The name of the work

Multimedia and Digital Objects

Save Work

Requirements

- ✓ Add files
- ✓ Describe your work
- ✓ Check deposit agreement

Visibility Who should be able to view or download this content?

This work is under embargo. You can change the settings of the embargo here, or you can visit the [Embargo Management Page](#) to deactivate it.

Embargo

Figure 10: A partial view of the “Edit Work” view when editing a work. The list of files attached to this work is not visible in this page.

Edit Image Version 2

Descriptions **Versions** Permissions

Versions

Upload New Version

Upload a file required

Browse... No file selected.

Upload New Version

Restore Previous Version

Current Version January 28th, 2019 15:33 [by donghy7]

Restore From January 25th, 2019 19:52 [by donghy7]

Save Revision

Download image

Figure 11: When editing a file, the functions “Versions” tab would offer the user to replace an existing file by uploading a new version.

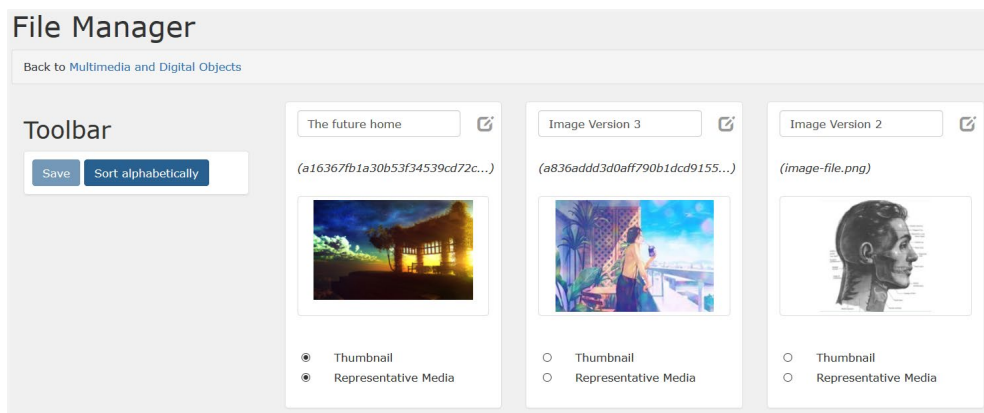


Figure 12: The “File Manager” page inside each work for quickly selecting thumbnail and representative media file, and batch editing file name.

Share With (optional)
 You may grant "View/Download" or "Edit" access for specific users and/or groups to files. Enter a valid My Institution Account Id, one at a time, select the access level for that user, and click +Add.

The list of groups in the drop-down marked "Select a group" is a list of User Managed Groups that you are a member of. You may select a specific group and assign an access level for a file within Carolina Digital Repository, similarly to adding user access levels.

Permission Definitions
View/Download: this file (both contents and metadata) is accessible from within Carolina Digital Repository.
Edit: this file (both contents and metadata) can be edited. You may only grant this permission to UNC-Chapel Hill users and/or groups.

Enter User (one at a time)

Search for a user Choose Access +

Select a group Choose Access +

Person/Group	Access Level	
Depositor (donghy7)	Edit access	
smithj15 (smithj15)	<input type="text" value="Edit access"/>	X
manager	<input type="text" value="Edit access"/>	X

Figure 13: The sharing settings at the bottom the “Permissions” tab, which allows users to set specific sharing options with individuals or groups.

5. Discussions

5.1 Task Instructions & Learning

The wording of the tasks was done so to provide the participants with just enough information to achieve the goal through untimed exploration, as well as to allow for as much flexibility as possible so that they could approach the tasks in their own way.

Consequently, this opened up for different interpretations of the task success criteria from the participants' perspective. For instance, the intended destination when the researcher designed T1-search was for the participants to browse into the "SILS master's paper" collection and used the local search bar within the collection itself. However, it turned out that the participants were able to achieve the goal through a different path, since the instruction slip did not specifically require them to navigate into the directory.

As stated earlier, the 4 tasks were designed to increment in terms of difficulty level as the participants worked through each one. Another intention of this was to help the participants learn and familiarize themselves with the interface and navigation structure along the way, so that they can leverage the knowledge they acquired from previous tasks to complete the more challenging tasks later, such as that browsing the specific attached file in T2-locate would hint at reaching the key step of locating the attached file in T4-edit, or reviewing the submission options for T3-deposit would inform them the location

of embargo setting for T4-edit. Interestingly, despite that 9 out of 10 participants completed the T2-locate as the researcher planned, most of them still hesitated when reaching the same step in T4-edit, indicating that the intended knowledge transfer was minimal. However, as with any usability tests, it is possible that any of the results discussed here can be attributed to nervousness of the participants.

This could also possibly be attributed to that the participants were given an additional information sheet for both T3-deposit and T4-edit, leading to somewhat of a multitasking scenario, which may have caused them to narrowly focus their attention on the information sheet rather than reflecting on their learned experience from the earlier tasks. The researcher also observed that participants utilized the information sheet in two somewhat distinct fashions: some participants were procedural in that they would focus on working through the information sheet one sentence or phrase at a time, such as U04, whereas some others would read through a paragraph or a chunk at a time before taking any action, such as U03. This phenomenon had a significant bearing on the task process. The loss of edited title from the T4-edit finding above, for example, was caused by the participant choosing to complete the title change and the file upload actions together without pausing in between the actions.

Furthermore, some had read or skim through the whole sheet before beginning the task and some did not, and this decision was not mutually exclusive from the action above. Which is to say, a participant could have read through the sheet and still chose to work through the information one small step at a time. This might also be related to the level of

carefulness that the participant exhibit with regard to the scenario of the study, which is discussed below.

5.2 Finer Categorization of User Types

A partial goal of this research was set out to study what potential issues that casual IR user might experience when they interact with such systems. In this case, the CDR is the particular sample used for the purpose. However, a question that the researcher had not considered to ask with regard to the IR user expertise is: generally speaking, do people who have a high-level of web expertise run into to fewer issues when using IR systems? Some participants were able to use the `Ctrl+F` shortcut to do keyword search on pages to quickly locate information, but that does not necessarily explain anything other than they were cognizant of such function.

While the studies were untimed, the researcher took note of the participants' proficiency when completing the tasks, and U05 stood out as exceptionally swift in terms efficiency compared to the rest, despite still practiced the think-aloud protocol effectively. This also coincides with the result of the task completion chart that U05 had almost completed all tasks perfectly. It was revealed in the interview that the participant is an experienced IT worker and self-identifies as an "avid user" of technology (Figure 3). It is possible that users with better web expertise can use IR systems more easily because these systems could be likened to other digital asset management applications and information systems. That said, given that the question is beyond the scope of this research and it was only one person out of ten, there is limited room to elaborate the discussion here. This is a potentially worthwhile direction to pursue for any future works on this topic.

As mentioned in the previous section, another point that is also worth discussing is participants' level of carefulness. For U01, the researcher took note that the participant was very thorough when reading the instructions, reading through the whole sheet in the beginning of the task and reviewing it again upon completion. When asked about this during the interview, *"I imagined I was submitting my graduation paper, so I was being careful as if I was actually doing it."* In the case of another participant, U10 went above and beyond with the think-aloud protocol, and periodically took pauses to elaborate the thought process when working through tasks. This participant also exhibited a similar attitude with U01, although for a slightly different reason, *"I wanted to do a good job for the study."* It is unclear if the slight difference in attitude have contributed to the task performance or not, as U01's carefulness might have helped this participant to reach the "Completed" criteria for all four tasks, meeting all the key task criteria, while U10's diligence might have instead had an opposite effect, both as reflected in the task completion chart (Figure 3). Interestingly, despite U01's claim of carefulness, the participant did not click to read the "Deposit Agreement" prior to submitting the work in T3-deposit, whereas U10 opened the page and skimmed through the content—along with U04, these two participants were the only ones that clicked on the deposit agreement page link.

5.3 Understanding of Concepts and Terminologies

Barring interface design issues, IRs are fundamentally not meant to be complex systems. Especially given the participant demographic of this study—students affiliated with the School of Information and Library Science—it is safe to assume that all students have at least used some kind of information systems before. This was verified in the interview

that the experience of using CDR reminded the participants about the university's library website, the university's student information portal, and search engine websites.

Furthermore, it is valid to claim that this group of participants have an above average understanding of concepts and terminologies related to the fields of information science or library science compared to most other user groups, due to their coursework or employment in libraries around the university. As a result, the participants' academic background could have aided, or at least influenced, their overall performance in the usability tests, and consequently the type of findings gathered. For instance, when asked about the decision to delete the image in T4-edit, U10 used the experience of working in the library as part of the rationale, citing the use of checksum in that the deleting the existing image and uploading a new one would guarantee the file be replaced entirely. Another example is U08's decision to only use space to separate the keywords in T3-deposit, in which the participant cited the knowledge from the topic of text mining that the system would remove the stop words as a part of processing the submission.

5.4 Comparison of Post-Task Metrics and Post-Test Responses

Given the above discussions, there are some additional insights that appeared after comparing the participants' self-reported task ratings and response to the "which task was the most difficult?" interview question.

As discussed, T4-edit was intended to be the hardest task by design, and this was accurately reflected in the interview responses: seven out of ten participants responded that it was the most difficult task due to reasons such as the complexity of the task,

uncertainty of the completion criteria, requiring more actions and navigations, etcetera. Essentially, there was not a reason cited that surprised the researcher. This aligned closely with the post-task questionnaire ratings in that the seven participants either gave the task lower or lowest ratings—such as U06, who gave up the task and gave the lowest ratings to this task out of all. The only exception here was U10, who gave T1-search a much lower rating. Revisiting the data, the researcher found out that the participant spent extra time exploring the interface for the task and ran into issues stated in the findings section above, which contributed to the discrepancy of self-reported metric and interview response.

It is worth highlighting that both U07 and U09 both reported two responses to the question, stating both T1-search and T4-edit as challenging tasks to complete. U07 explained that T1-search was difficult because the participant was not familiar with the system yet—this participant also gave a lower overall rating to T1-search than T4-edit. As for U09, the participant had expected to see more results retrieved for T1-search, but only obtained a low number. This had to do with the setup of the CDR website at the time of the study, which is clarified in the Limitations section below.

Participants U01 and U03 responded T3-deposit as the hardest task. The researcher also foresaw that fewer participants might report this task for the question, if any, and expected that participants might cite the tediousness of the form submission process.

Lastly, the only outlier in this context is U08, who had the only “Incomplete” outcome for T2-locate and gave the lowest rating for all questions of this task. Based on the explanation, the participant did not understand the conceptual difference between the master file, as in the submission itself, versus the attached files, which led to the belief that the information needed for the task must have been available inside the master file.

5.5 On Self-Blame

Throughout the sessions, many participants exhibited some degree of self-blame upon the researcher pointed out missed task criteria or when they experienced difficulty during tasks. A recurrent sentiment during various points of the tasks was related to visibility of interface elements, quoting U07 for instance *“It must be somewhere but I guess I just didn’t see it.”* The most severe instance of self-blame was uttered by U06 during T4-edit, *“I feel so useless,”* which was due to the participant’s perceived inability to complete the task. This is a particularly important motivation for the system maintainers to improve the interfaces and navigation experience of the CDR or IRs in general, so that users would experience less frustration and self-blame due to problematic designs.

6. Limitations

It should be clarified that this research was conducted while the CDR was undergoing development, thus the test environment was used, and not all the features were not completed at the time of the testing. At the time of testing, there were three notable issues that impacted the testing itself.

First, the user-facing documentation site was not yet updated, so the old CDR documentation site was linked instead, which did not contain some of the minor support information that the participant needed for T3-deposit. Second, the submission page went through a slight revision before the meeting with the last two participants. The change was to make the grouping of the “Creator” and “Advisor” more visually self-contained, which had likely contributed the T3-deposit performance difference for U09 and U10 compared to the rest. Third, due to a code bug, the participants would be redirected to an error screen at the end of the T4-edit if they were to complete the task based on the intended sequence. However, all of these have had a minimal impact on the testing since the main completion criteria of those tasks was not dependent on those more advanced and incomplete features; the participants were deemed to have completed the task if they had reach the destination. If the participants had opted to explore significantly beyond the intended task sequence, they would have been trapped in work-in-progress pages and

potentially unable to continue with the task at hand. Fortunately, this did not happen in all of the ten participants tested.

Another concern was related to the actual contents of the repository. The academic contents from the original CDR were not migrated at the time of the study, so the researcher created a small set of placeholder contents for the testing. While it did not have an impact on the task completion, it did lead to some minor confusion during the tests. For instance, the department collection listing page only had a limited number of departments shown due to the reason stated above, and participants who had attempted to navigate through that page all commented on the sparseness of the listing. A few participants were able to recognize that they were using a test environment and verbalized that sentiment, but most did not.

In terms of sampling and recruitment, it was a deliberate decision to opt for convenience sampling. This was to minimize the scheduling overhead due to the limited time frame of the study. Additionally, while IR workflows are largely similar at the highest level, specific instances can vary in different degrees, and this study only targeted a customized version of the Hyrax interface tested with students from the School of Information and Library Science. Naturally, these factors have impacted the generalizability of the study.

7. Conclusion

As IRs becomes more widely adopted by institutions across the world and are utilized by countless users from their respective scholarly communities, their ease of use should also become a top priority. While this usability research on the new CDR may have only focused on one particular IR and it only evaluated certain parts of the system interface, some of the findings can serve as high-level recommendations for IR interface designers.

To use two themes that arose from this study:

- More emphasis should be placed on optimizing the common functions for casual users. On top of providing a usable interface, the functionalities that are most commonly used by infrequent users should be relatively straightforward to operate with minimal learning curve. When possible, one approach is to model the designs after popular information systems, so that the users can leverage their existing knowledge to meet their needs when using an IR.
- Help information and links to documentation should be available and discoverable. This is particularly true for tasks or interface components that might prove challenging to casual users, such as the form field for selecting a Creative Commons license. Additionally, this information should be served in plain language and its overall structure should be well-organized.

In terms of future directions, it would be desirable to conduct a follow-up usability study a substantial period of time after the launch of the new CDR, to verify how the usability findings may have shifted in comparison to the current development state of the system. It is also recommended that stakeholders from various demographics should be included to gather a more comprehensive set of results.

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Appendix A: Recruitment Email

Invitation to participate in a website usability study

Hello,

My name is Hongyi Dong and I am a graduate student at the School of Information and Library Science. I am writing to invite you to participate in a usability research study of the new Carolina Digital Repository website.

To participate in this study, you:

- Must be 18 years of age or older,
- Must be a current student of UNC-Chapel Hill, and
- Should NOT have been or is currently an administrative staff of an institutional repository system, or using any institutional repository regularly (more than 10 times a month).

The study will take place on campus for about an hour. During the study, you will be asked to:

- Interact with the web interfaces of the new Carolina digital repository, and
- Answer questions about your experience.
- At the end of the session, each participant will receive a \$15.00 gift card for compensation.

Participation in this study is completely voluntary and all data will remain anonymous. If you would like to be a part of this study or if you have questions, please contact me at donghy7@live.unc.edu.

Thank you,

Hongyi Dong

MSIS Candidate, 2019

Appendix B: Questionnaires

Pre-test Demographic Questions

1. What degree program are you currently enrolled in?
 - a. Bachelor's
 - b. Master's
 - c. PhD
2. Have you used an institutional repository before? You may ask the researcher if you are unsure.
 - a. Yes
 - b. No
3. (If answered "yes" to question #2) What is the name of the repository?
4. (If answered "yes" to question #2) What did you use the repository for?
 - Just to explore, nothing in particular
 - Deposit file(s)
 - Download specific item(s)
 - Fulfill a class assignment
 - Other _____

Post-task Questionnaire

(Response scale of [1] "Strongly disagree" to [5] "Strongly agree".)

1. Overall, I am satisfied with the ease of completing the tasks in this scenario.
2. Overall, I am satisfied with the amount of time it took to complete the tasks in this scenario.
3. Overall, I am satisfied with the support information (online-line help, messages, documentation) when completing the tasks.

Post-test Interview Questions

1. Which task was the most difficult, and why?
2. Was there anything that stood out to you when using these interfaces?

3. Based on everything that you saw, was there anything that you would like to have changed or added?
4. Aside from the tasks that you have done today, what other things do you expect the interfaces should allow you to do?
5. Did this experience remind you of any other interfaces you have used in the past? If so, what are they and why?
6. Do you have any questions about the usability test today, or this study in general?

Appendix C: Consent Form

University of North Carolina at Chapel Hill Consent to Participate in a Research Study Adult Participants

Consent Form Version Date: _____

IRB Study # 18-2756

Title of Study: A Task-Oriented Usability Study of the Carolina Digital Repository with Casual Users

Principal Investigator: Hongyi Dong

Principal Investigator Department: University Library

Principal Investigator Phone number: (919) 962-8027

Principal Investigator Email Address: donghy7@live.unc.edu

Faculty Advisor: Bradley Hemminger

Faculty Advisor Contact Information: (919) 966-2998

What are some general things you should know about research studies?

You are being asked to take part in a research study. To join the study is voluntary. You may choose not to participate, or you may withdraw your consent to be in the study, for any reason, without penalty.

Research studies are designed to obtain new knowledge. This new information may help people in the future. You may not receive any direct benefit from being in the research study. There also may be risks to being in research studies.

Details about this study are discussed below. It is important that you understand this information so that you can make an informed choice about being in this research study.

You will be given a copy of this consent form. You should ask the researchers named above, or staff members who may assist them, any questions you have about this study at any time.

What is the purpose of this study?

You are being asked to take part in a research study. To join the study is voluntary. You may refuse to join, or you may withdraw your consent to be in the study, for any reason without penalty.

You may not receive any direct benefit from being in the study. We do not anticipate any risks to you for participating in this study other than those encountered in day-to-day life. Details about this study are discussed below. It is important that you understand this information so that you can make an informed choice about being in this study. You will be given a copy of this consent form. You should ask the researcher named above, or staff members who may assist them, any questions you have about this study at any time.

Are there any reasons you should not be in this study?

You should not be in this study if you:

- Are below 18 years old,
- Are not a current student of UNC-Chapel Hill, and
- Is currently or have been an administrative staff of an institutional repository system, or using any institutional repository regularly (more than 10 times a month).

How many people will take part in this study?

There will be approximately 10 people in this research study.

How long will your part in this study last?

Your participation will last approximately 1 hour.

What will happen if you take part in the study?

You will be asked to complete a background questionnaire at the beginning. If you have not participated in a usability test before, you will also be asked to do a 3-minute practice session to familiarize yourself with the think-aloud method. After that, you will work through a series of tasks on the Carolina Digital Repository website using a provided computer and answer few task rating questions; this part will take about 30 to 40 minutes in total. At the end of the test, you will be interviewed with a few open-ended questions. This study will record your onscreen interactions and audio from the beginning of the usability test through the end of the interview.

What are the possible benefits from being in this study?

Research is designed to benefit society by gaining new knowledge. The benefits to you from being in this study may be that you will be provided with an improved user interface when using the Carolina Digital Repository yourself.

What are the possible risks or discomforts involved from being in this study?

One foreseeable risk is potentially being embarrassed if you do not know how to complete a task. However, there are no right or wrong answers. Your performance and responses are not being judged; rather the functionality of the site is being evaluated. This risk will be minimized by testing participants individually. Additionally, there is a chance of breach of confidentiality if the encrypted data and files are accessed, but it is very unlikely to happen given the strength of modern encryption algorithms.

However, there may be uncommon or previously unknown risks. You should report any problems to the researcher. Please use the email address or phone number provided on the first page of this form if problems arise after you have completed participation.

What if we learn about new findings or information during the study?

You will be given any new information gained during the course of the study that might affect your willingness to continue your participation.

How will information about you be protected?

Participants' names, email addresses, or any other potentially identifiable information will not be linked to the recordings, questionnaires, or data gathered in the study. Each participant will be assigned a random study ID number that will be used in the file name(s) containing the data and on questionnaires the participant completes.

Screen and audio recordings and associated data files will be stored in a password-protected location, only accessible to the principal investigator. Participant names will be stored separately from the study data and participant names will only be used on consent forms as well as for receipt of compensation. At no time will participant names be associated with their study ID number. Participants will not be identified in any report or publication about this study.

Once the study has been completed and the results recorded, the recordings, any files associated with the participant's random study ID number, questionnaires, contact information, and correspondence will be deleted.

Check the line that best matches your choice:

- OK to record me during the study
 Not OK to record me during the study

What if you want to stop before your part in the study is complete?

You can withdraw from this study at any time, without penalty. The investigators also have the right to stop your participation at any time. This could be because you have had an unexpected reaction, or have failed to follow instructions, or because the entire study has been stopped.

Will you receive anything for being in this study?

You will be receiving a \$15 gift card for taking part in this study. Any payment provided for participation in this study may be participant to applicable tax withholding obligations

Will it cost you anything to be in this study?

It will not cost you anything to be in this study.

What if you are a UNC student?

You may choose not to be in the study or to stop being in the study before it is over at any time. This will not affect your class standing or grades at UNC-Chapel Hill. You will not be offered or receive any special consideration if you take part in this research.

What if you have questions about this study?

You have the right to ask, and have answered, any questions you may have about this research. If you have questions about the study (including payments), complaints, concerns, or if a research-related injury occurs, you should contact the researchers listed on the first page of this form.

What if you have questions about your rights as a research participant?

All research on human volunteers is reviewed by a committee that works to protect your rights and welfare. If you have questions or concerns about your rights as a research participant, or if you would like to obtain information or offer input, you may contact the Institutional Review Board at 919-966-3113 or by email to IRB_s@unc.edu.

Participant's Agreement:

I have read the information provided above. I have asked all the questions I have at this time. I voluntarily agree to participate in this research study.

Signature of Research Participant

Date

Printed Name of Research Participant

Signature of Research Team Member Obtaining Consent

Date

Printed Name of Research Team Member Obtaining Consent

Appendix D: Planned Sequence of Events

1. Participant respond to the recruitment email to schedule a meeting time with the researcher. The researcher will then book an appropriate location for the study and forward this information to the participant.
2. 24 hours before the scheduled session, the researcher will send out a reminder email containing the location and time information to the participant.
3. Before the scheduled session, the researcher will arrive to the location to prepare for the study.
 1. Boot up computer.
 2. Set up the recording software (Camtasia) to only capture audio and computer screen.
 3. Open up private browsing of a fresh installation of the Firefox web browser.
 4. Open up the Qualtrics questionnaire page.
 5. Add “paper-submission.pdf” and “image-file.png” example files on desktop.
 6. Lay out the paper printouts on the desk, including the consent form, this observation guide, paper version of the questionnaires, the tasks slip, and any accompanying information sheet.
 7. Set aside a clipboard for note-taking.
4. Participant will arrive to the designated location at the agreed upon time. The researcher will greet the participant and introduce himself, and proceed to the pre-test introductions:
 1. The researcher will read through the consent form, and then prompt the participant if there are any questions before signing the form. If the participant were to decline, the researcher will thank the participant and allow him or her to leave.
 2. The researcher will explain the overall structure for the remainder of the session, discuss the purpose of the Carolina Digital Repository, and inform the participant that he or she can ask questions at any time.
 3. The researcher will then guide the participant to the browser to fill out the pre-test questionnaire.

4. The researcher will suggest the participant to put both of their phones in silent or “Do Not Disturb” mode.
5. Once the above steps are completed, the researcher will ask participant if he or she has participated in a usability study before, and whether he or she has any familiarity with the “think-aloud” method. If not, the researcher will give a brief explanation of the method, and asked to do a 3-min practice task to warm up for the next stage.
5. At this point, the study will proceed into the usability test portion.
 1. The researcher will read through the general guidelines for this part of the study.
 2. The recording software will be started to capture the footage. The non-test related UI components will be minimized from the participant’s vision.
 3. The participant will be instructed to go through each task. The test information sheet will be provided for the tasks that require more details, such as entering information into a form. This is so that the participants will not have to use their personal information.
 4. During the tasks, the researcher may remind the participant to “think-aloud” if he or she forgets to do so, but will avoid interrupting the participant as much as possible.
 5. After the completion of each task, the researcher will ask the participant to take the ASQ questionnaire.
6. After all tasks are completed, the researcher will interview the participant using the post-test questionnaire.
7. Once the interview is over, the recording will be stopped. The researcher will thank and dismiss the participant.
8. The researcher will reset the task data submitted to the website, save the recordings, and transcribe the notes to the password-protected location.

Appendix E: Observation Guide

Hello, my name is Hongyi Dong and I'm a graduate student in the School of Information and Library Science at UNC-Chapel Hill. I will be moderating this study today and I wanted to let you know that I'm going to be reading from my script to ensure that this research study is uniformly administered to all participants.

First of all, thank you for agreeing to take part in this study. The Carolina Digital Repository has recently launched a new public-facing interface, and this study aims to understand what experience that casual users may have when using this new system. I will be asking you to complete a few tasks that are most likely to be done by students like you. I will also be asking you questions about your experience with completing these tasks. At some point during the tasks, you will be prompted to fill out a form, and I will provide you with an information sheet containing all the necessary details you will need in order to proceed.

While you are completing these tasks, I will be recording your screen interactions and audio using a recording software. I will also be taking notes during the study. I would like you to “think-aloud” as you work through the tasks, but keep in mind that there are no right or wrong answers—it is the interface that is being evaluated, not you. If you have questions at any point, feel free to ask them. I may not be able to answer them right away, since I'm interested in what people do when they don't have someone sitting next to them to help. However, I will try to answer your questions after we are done with the tasks.

[Distribute two copies of consent form and wait for participant to read and sign.]

Do you have any questions before we get started?

[Pause to wait if there are questions.]

First, I'd like to get you started some general questions.

[Open Qualtrics demographic pre-test questions and wait for participant to fill in answers.]

Before we move into the test, I'd like to ask if you have participated in a usability study before, or if you are familiar with the think-aloud protocol. If not, we will start with a practice as a warm up.

[Open up UNC homepage to begin practice task.]

In a think-aloud session, you just say whatever that comes into your mind as you work through a task. This includes what you are looking, thinking, doing, or feeling. If possible, don't take too much time to think and just say your thoughts out loud.

So, for this practice task, I'd like you to tell me the things you see in the UNC homepage.

[End practice task.]

Good, it seems like we are ready to move onto the actual test. I will start recording the study.

[Press record on the screen/audio recording software.]

I will be showing you the new Carolina Digital Repository interface, and we will be working through four tasks today. As you do them, try to think aloud as much as you can (if practice task was used, "like you just did in the practice task"). Again, there are no right or wrong answers, and we are testing the interface here, not you. For each task, I will hand you a print out of the task description and also read the task to you. For task #3 and #4, you will need some extra information to do the task, and I will provide them to you as well. You can use any of the functions in this website to help you complete your task, whether it be using the search bar or filling in a form. I also want to point out that I have already logged in using my Onyen account and you won't have to use your own account. This is for protecting your personal privacy and account security.

[Open new Carolina Digital Repository homepage and give participant a task print out.]

Task #1:

For the first task, imagine you are doing a research on taxonomy. You want to take a look at past student works, so you want to *find out how many SILS master's paper there are on the topic of "taxonomy"*.

Once you think you are done, please tell me "I am done with this task."

[Observe task progress and remind participant to think aloud if necessary.]

Now I'd like you to rate the task you have just done using this questionnaire.

[Open Qualtrics post-task questionnaire and wait for participant to fill answers for task #1.]

Task #2:

For this task, imagine you are looking up specific information about a file. *Find the submission called "Are We There Yet?". Inside it, find and tell me the width and height of the photo called "Perfectly Safe".*

Once you think you are done, please tell me "I am done with this task."

[Observe task progress and remind participant to think aloud if necessary.]

Now I'd like you to rate the task you have just done using this questionnaire.

[Open Qualtrics post-task questionnaire and wait for participant to fill answers for task #2.]

Task #3:

For this task, imagine you are submitting a paper into the repository, which is something you have to do as you finish your thesis or paper when you are about to graduate. *Based on the information here, upload the PDF file named "paper-submission.pdf" on the desktop.*

Once you think you are done, please tell me "I am done with this task."

[Hand over the first information sheet, observe task progress, and remind participant to think aloud if necessary.]

Now I'd like you to rate the task you have just done using this questionnaire.

[Open Qualtrics post-task questionnaire and wait for participant to fill answers for task #3.]

Task #4:

For this task, imagine you have previously submitted a work already, and you found out that you needed to make some changes to it. *Find your submission titled "Multimedia and Digital Objects" and make changes based on the information here.*

Once you think you are done, please tell me "I am done with this task."

[Hand over the second information sheet, observe task progress, and remind participant to think aloud if necessary.]

Now I'd like you to rate the task you have just done using this questionnaire.

[Open Qualtrics post-task questionnaire and wait for participant to fill answers for task #4.]

Great, now that we have finished all the tasks, we are done with the usability testing part. I have a couple of questions I'd like to ask about your experience today.

[Ask interview questions and any clarifying questions.]

Great. This will be the end of our session today. Please let me pause the recording first.

[Stop recording software.]

Before I hand you the compensation, I'll need you to sign this receipt to confirm that you have received it.

[Wait for participant to sign and hand over the compensation.]

Thank you for your help today, I really appreciate it for you to take time to join in this study.

Appendix F: Information Sheet Handouts

Information Sheet for Task #3

Your name is Evan Johnson. A MS student in the Information Science program. You will be graduating in 2019.

Your advisor is Anne Winston. She is a professor in your program.

The master's paper was completed in December 13, 2018. The title is "A case study of heavy machinery user interface in complex systems". You co-authored this paper with Lana Gramova. Lana is also a MS student in Information Science.

You haven't decided on the abstract yet, so put "tentative" in the abstract.

You also hope to provide as much information as possible, so it will make your submission look more polished.

- You know the paper is about user interface, systems analysis, and it's a case study.
- You want to make sure that people must credit you for the work when they use it.
- You did the data collection in Raleigh, NC. The company name is STAN Machines Inc.

After you think you are done, submit your paper.

Information Sheet for Task #4

Change the setting of this work from "Public" to "Embargo" for "Institution" until May 5, 2019.

There are a few files attached in this submission. Find the file "Image Version 1" and replace it using image-file.png on desktop, then change the name of this file to "Image Version 2".

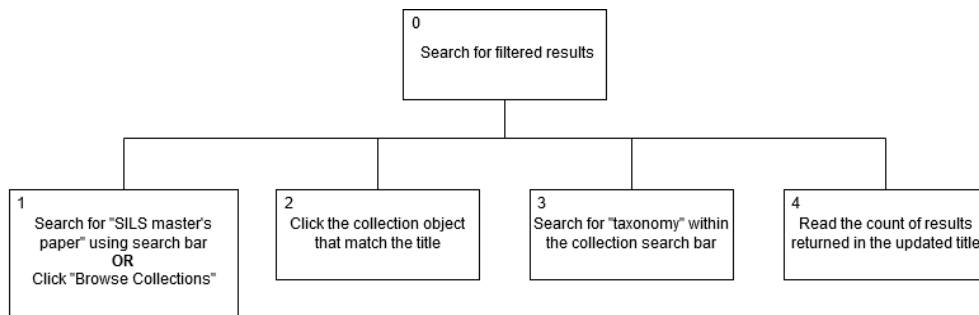
Make the file available only to yourself. Also allow the user with the email of “hong@example.com” to edit it.

After you are done, save your changes.

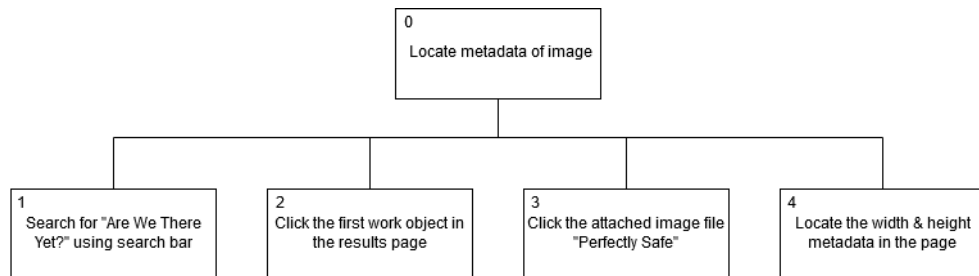
Appendix G: Hierarchical Task Analysis (HTA) Breakdown

These sets of HTAs only include the first-level of the steps involved in each task, without further breakdown of each step, as granular analysis is not relevant for the main goal of this study.

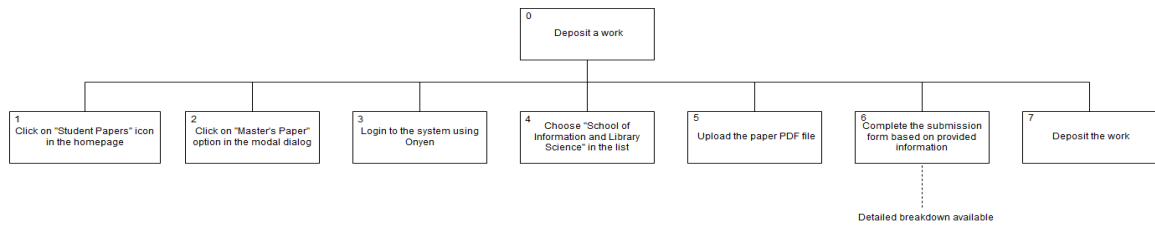
Task 1 rationale: steps 3-4 guarantees that the filtered results count is accurate and not a guesswork. However, for the sake of using the test environment in this study, reading from the facet label is considered an acceptable alternative.



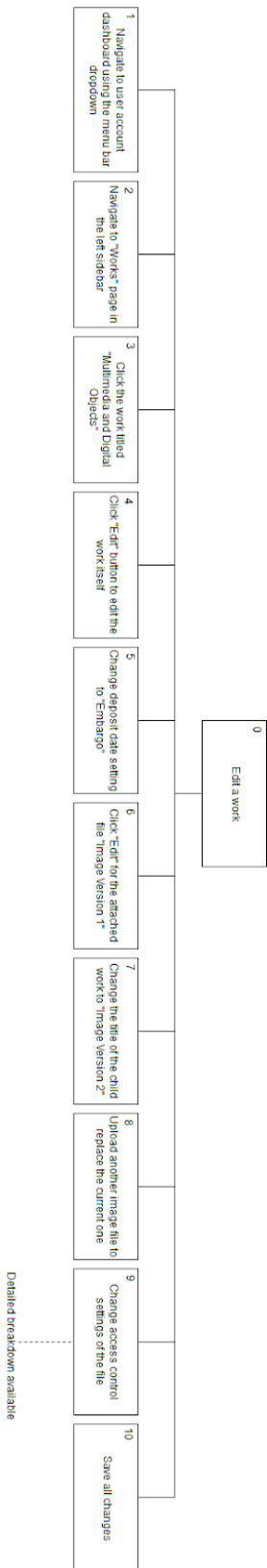
Task 2 rationale: searching based on the work title in step 1 would guarantee that the user is taken to the correct object in the first place.



Task 3 rationale: steps 1-2 can be achieved multiple ways, but the most obvious path is located on the homepage.



Task 4 rationale: there are minor steps that are required for the task, and the task can still appear to be completed despite not having gone through those steps.




Appendix H: Selected Screenshots of the System Tested

Collection view for T1-search.

The screenshot displays the UNC Carolina Digital Repository interface. At the top, the navigation bar includes the UNC logo, 'UNIVERSITY LIBRARIES Carolina Digital Repository', and user information 'donghy7'. Below the navigation bar, there are tabs for 'Collections', 'Departments', and 'Deposit', along with a search bar containing 'Enter search terms' and a 'Go' button. A breadcrumb trail shows 'Home > Back to search results'. The main content area features the collection title 'SILS Master's Paper' with a 'User Collection' and 'Public' status, and '13 Items • Last Updated: 2018-12-13'. To the right, a 'Collection Details' box lists: 'Total Items: 13', 'Size: 1.86 MB', and 'Date created: 2018-12-13'. Below this is a search bar for subcollections and works. The 'Works (11)' section is sorted by 'relevance' with 10 results per page. A table lists 11 works with columns for 'Title', 'Date Added', and 'Visibility'. The works include titles like 'The Complexity of Mobile Interface Patterns', 'The Value of Special Collections Materials', 'The Hidden Patterns of Taxonomy', 'The Retrieval Formula of the Next Decade: A Survey', 'Collections Analysis of the Littenpine Public Library', 'Numerical Principles of Taxonomy', 'MAN and Machine', 'User Interface Guidelines', 'The Field Guide of Taxonomy', and 'Taxonomy: A Study 2'. The table also shows dates and visibility statuses such as 'Public' and 'Embargo'. At the bottom, there are pagination controls showing '1' of 2 pages and social media sharing options for 'Tweet' and 'Share'. The footer contains links for 'Home', 'Browse Collections', 'Help', 'Contact Us', 'Library Home', 'Privacy Policy', and 'Accessibility'.

Title	Date Added	Visibility
The Complexity of Mobile Interface Patterns Is part of: SILS Master's Paper	2019-01-05	Public
The Value of Special Collections Materials Is part of: SILS Master's Paper	2019-01-05	Public
The Hidden Patterns of Taxonomy Is part of: SILS Master's Paper	2019-01-05	Embargo
The Retrieval Formula of the Next Decade: A Survey Is part of: SILS Master's Paper	2019-01-05	Public
Collections Analysis of the Littenpine Public Library Is part of: SILS Master's Paper	2019-01-05	Public
Numerical Principles of Taxonomy Is part of: SILS Master's Paper	2019-01-05	Public
MAN and Machine Is part of: SILS Master's Paper	2019-01-01	Public
User Interface Guidelines Is part of: SILS Master's Paper	2018-12-14	Public
The Field Guide of Taxonomy Is part of: SILS Master's Paper	2018-12-14	Public
Taxonomy: A Study 2 Is part of: SILS Master's Paper	2018-12-14	Embargo

Work view for T2-locate.



UNIVERSITY LIBRARIES Carolina Digital Repository

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Go

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Download image

Analytics
Edit This File
Delete This File

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Perfectly Safe Public

File Details

Depositor: donghy7	Characterization: Height: 1920 Width: 1060
Date Uploaded: 2018-12-14	File Format: tiff (TIFF EXIF)
Date Modified: 2018-12-14	Original Checksum: 1f401035bda2cc045cd9b167304edf1bf
Fixity Check: Fixity checks have not yet been run on this object	Mime Type: image/tiff

User Activity	Date
User donghy7@live.unc.edu has updated Perfectly Safe	on Dec 13, 2018
User donghy7@live.unc.edu has attached 2018_Hopler_6.tif to Are we there yet?	on Dec 13, 2018

Single-Use Links

No links have been generated

Create Single-Use Link

Tweet Share

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Deposit view for T3-deposit.

The screenshot shows the 'Add New Master's Paper' form in the UNC Carolina Digital Repository. The interface includes a top navigation bar with 'UNC UNIVERSITY OF NORTH CAROLINA Carolina Digital Repository' and user information 'donghy7'. A left sidebar contains navigation options like 'Your activity', 'Collections', 'Works', and 'Review Submissions'. The main content area is titled 'Add New Master's Paper' and has tabs for 'Work Deposit Form', 'Add to Collection', and 'Sharing Settings'. It features a file upload section with 'Add files...' and 'Add folder...' buttons, and a 'Drag and drop your files here.' area. The form contains several required fields: 'Title', 'Creator #1' (with a dropdown menu showing 'Smith, John'), 'UNC affiliation (Creator #1)', 'Additional affiliation (Creator #1)', 'ORCID (Creator #1)', 'Abstract', 'Advisor #1', 'Date of publication', 'Degree', 'Graduation year', and 'Resource type'. The 'Resource type' dropdown is currently set to 'Masters Paper'. On the right side, there is a 'Save Work' section with 'Requirements' (Add files, Describe your work, Check deposit agreement) and 'Visibility' options (Public, UNC-Chapel Hill, Embargo, Private). A 'Save' button is located at the bottom of the 'Save Work' section.

Work view for T4-edit.

UNC UNIVERSITY LIBRARIES Carolina Digital Repository Help Contact Us 1 donghy7

Collections Departments Deposit Go All

Home / Dashboard

Multimedia and Digital Objects Embargo Deposited Analytics Edit File Manager


Attach Child - Add to collection Request Deletion

CONTENTS << Multimedia and Digital Objects >> Image 1 of 3 Go

The Future

Image Ver...

Image Ver...



Citation

[f](#) [t](#) [8+](#) [t](#)

Last Modified
January 28, 2019

Creator
Johnson, Evan
o Affiliation: College of Arts and Sciences, Department of Art

Date of publication
December 13, 2018

Resource type
Art




Rights statement
In Copyright

Abstract
Multimedia object collections

Embargo release date
May 5, 2019

Parents:
This work has no parents.

Items

Thumbnail	Title	Date Uploaded	Visibility	Actions
	The future home	2018-12-14	Embargo	Select an action -
	Image Version 3	2018-12-14	Embargo	Select an action -
	Image Version 2	2019-01-25	Embargo	Select an action -

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File edit view (Permissions tab) for T4-edit.

The screenshot shows the 'Edit Image Version 2' page in the UNC Carolina Digital Repository. The interface includes a dark sidebar on the left with navigation options like 'Your activity', 'Collections', and 'Works'. The main content area has a header with 'UNC UNIVERSITY LIBRARIES Carolina Digital Repository' and a breadcrumb trail 'Home / Dashboard / Works / Browse View'. Below the header, there are tabs for 'Descriptions', 'Versions', and 'Permissions', with 'Permissions' being the active tab. The 'Permissions' section is titled 'Permissions' and contains several sub-sections: 'Visibility' with a question 'Who should be able to view or download this content?', an 'Embargo' section with a date range 'Restricted to UNC-Chapel Hill until 2019-05-05T00:00:00' and a dropdown for 'then open it up to' set to 'Public', a 'Share With' section with explanatory text, and 'Permission Definitions' for 'View/Download' and 'Edit'. At the bottom, there is a table for adding users and groups with columns for 'Person/Group' and 'Access Level'. The table currently lists the depositor 'donghy7' with 'Edit access' and a new entry for 'hong@example.com (hong@example.com)' with 'Edit access'. A 'Save' button is located at the bottom of the permissions section.

UNC UNIVERSITY LIBRARIES Carolina Digital Repository

Help Contact Us donghy7

Home / Dashboard / Works / Browse View

Edit Image Version 2

Download image

Descriptions Versions **Permissions**

Permissions

Visibility Who should be able to view or download this content?

This work is under embargo. You can change the settings of the embargo here, or you can visit the [Embargo Management Page](#) to deactivate it.

Embargo Restricted to until then open it up to

Share With (optional)
You may grant "View/Download" or "Edit" access for specific users and/or groups to files. Enter a valid My Institution Account ID, one at a time, select the access level for that user, and click +Add.
The list of groups in the drop-down marked "Select a group" is a list of User Managed Groups that you are a member of. You may select a specific group and assign an access level for a file within Carolina Digital Repository, similarly to adding user access levels.

Permission Definitions
View/Download: this file (both contents and metadata) is accessible from within Carolina Digital Repository.
Edit: this file (both contents and metadata) can be edited. You may only grant this permission to UNC-Chapel Hill users and/or groups.

Enter User (one at a time)

+

+

Person/Group	Access Level
Depositor (donghy7)	Edit access
hong@example.com (hong@example.com)	<input type="text" value="Edit access"/> X

Save