The Role of User Interface Design in a Digital Document Reader

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Bachelor Degree Project in User Interface Design

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Abstract

User Interface Design is the center concept of this thesis. It was used throughout this thesis in order to remedy the design issue of a product called Loredge. Loredge was a digital document reader that contained a Library page with a very simple design. The ultimate goal was to create design suggestions that provides users with a lot of convenience in navigating items for Loredge’s Library page. The solution was proposed by introducing the design process and the concept of Human-Centered Design, which were the essentials in compliance with Loredge users’ desires. The end results demonstrated some interesting facts about users that researchers did not think about at the beginning, which was very helpful to recognize what users want the most for themselves. Despite some predictable answers, the outcome indeed gave the problem a potential solution. The solution was to introduce categories/groups to users and design for menus and buttons that helps user filter out the items they want to navigate. This was implemented to digital mock-ups using a wireframing tool called Axure. The mock-ups could be found within this degree project.

Keywords:
navigating experience, digital document reader, human-centered design, human-computer interaction, front-end development, user interface design, user experience, design analysis, user research, design process, efficiency analysis, Axure
Sammanfattning


Nyckelord:
Navigationserfarenhet, digital dokumentläsare, human-centrerad design, interaktion mellan människor och datorer, front-end-utveckling, användargränssnitt, användarupplevelse, designanalys, användarforskning, designprocess, effektivitetsanalys, Axure
### Glossary

<table>
<thead>
<tr>
<th>Abbreviation</th>
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<tr>
<td>pdf</td>
<td>Portable Document Format</td>
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<tr>
<td>ACM</td>
<td>Association for Computing Machinery</td>
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<tr>
<td>GUI</td>
<td>Graphical User Interface</td>
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<td>HCI</td>
<td>Human-Computer Interaction</td>
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<td>HCD</td>
<td>Human-centered Design</td>
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<tr>
<td>KTH</td>
<td>Kungliga Tekniska Högskola (Royal Institute of Technology Sweden)</td>
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<td>TUI</td>
<td>Text-based User Interface</td>
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1. **Introduction**

This bachelor degree project consists of two students enrolled in the programme of Information and Communication Technology at Royal Institute of Technology Sweden (KTH), in cooperation with a start-up company called Loredge to deliver a suggestion for their product, which is a digital document reader. The students could be considered as the researchers for this project and they contributed to this thesis with equal effort. The degree project was carried on under the supervision of two lecturers at KTH (Dr. Fredrik Kilander and Dr. Patric Dahlqvist) and the CEO of Loredge (Anna C.T. Abelin).

The focus of the project was to optimize the User Interface (UI) design of the Library page for the latest released Beta version of the product, which is a digital document reader, in order to provide a better document navigating experience for end users. Thus, the research question of the project was initially formed as followed:

“How to change the outlook of items in a digital document reader such that the users can navigate their desired items with great convenience?”

1.1 **Background**

Although nowadays students are immersed in a world of digital text, they are still seeking for the convenience of using print papers [1]. In an article about Reading Evolutions, Cull mentioned a very interesting study of students at the Universidad Nacional Autónoma de México: 63 percent of the students reportedly admitted that “They could bear reading a document on a computer screen for no more than one hour” [1]. Because of this, it comes to an acknowledgment that digital text is not entirely cognitive.

This project focused on the latest product that the company Loredge had been developing, which was a digital document reader available for multiple platforms such as MacOS and Windows, aiming to replicate the physical reading experience for digital readers; the name of the product was also called Loredge. The workspace user interface for Mac version is shown in Figure 1 below.
One highlight function that Loredge has, compared with other digital document readers was that it has a notepad function where readers could make anchors from the text file (one the left hand side) to the notepad (on the right hand side) and write notes on the notepad. Figure 1 above shows the anchoring functionality. By clicking on one anchor point on the notepad, the text file would automatically jump back to the corresponding anchored part of the page to show the acquired content; and in the case that the text file was not open, the system would first open the file and then jump to the page where the notepad was anchored to. One notepad could be anchored to as many text files as wanted and one text file could also have as many notepads as wanted. In this way, the knowledge points could be mapped onto the notepads.

Figure 2 above shows the Mac version’s Library user interface of Loredge. All imported text files and created notepads were displayed in the Library page, and this page was also the focus of the study in this project.
1.2 Problem
There existed several problems about the software as a whole when it comes to UI design. However, the scope of this project would concentrate on the Library page of Loredge, as instructed by the company Loredge. Through a discussion with Loredge, it came to agree that the research question above could be broken down into the following points:
- The ordering of items was only a simple list view of all items, ranked by name
- There were no means of sorting the text files and notepads. The document navigating experience was neither efficient nor intuitive.
- Too much redundant information was shown on the page, which was time-consuming to navigate an item.
- Too small icons and too many items were drawn due to zero-spacing. This in turn led to difficulties on recognizing an item during navigation.

In short, the original user interface design of the Library page of Loredge was simple and redundant in information, inefficient and non-intuitive when it comes to navigating items. These problems came down to engage in a part of Human-Computer Interaction, which we are going to drill down into.

1.3 Purposes and Goals
This project had the purpose of evaluating how UI design could help to improve the user experience in navigating documents. Consequently, it would also propose the design prototypes for Loredge’s Library Page.

The ultimate goal was to have an aesthetic and intuitive user interface design for the Library page of Loredge, and thus making it easier for users when looking for an item on the Library page.

1.4 Benefits, Ethics, and Sustainability
In terms of benefits, the company would be provided with an evaluation of a sample of the targeted end user group, and a proposal based on academic study and scientific research. The targeted end users are the campus students. As customers, users of Loredge may also encounter a positive change in the products they are using, which means they would be able to navigate their items so much easier.

The ethics that came to our concerns were from the interview sessions we had to conduct as part of the design process. Honesty, respect and integrity [2] were the values we kept in mind before handing out any kinds of user research with users. With this code of ethics, respondents had all rights to accept whether or not to perform the tests or answer the questions. They must have been well informed and understood the purpose of the user research before performing or answering anything [2]. The project members considered the
fact that data collected was limited and could be biased. Respondents’ identities are kept anonymous to protect their privacy.

The project looked promising to alleviate the sustainable issue of overusing papers. This could potentially prevent cutting down of more trees, in turn leading to decrease in levels of carbon dioxide and other types of environmental pollution. It would also introduce the sustainable benefits that one could gain from maintaining the green resources of Earth. For example, one of them could be a reduction in climate change, which complied with United Nations’ 13th Sustainable Development goal [3].

1.5 Methods

To find out the knowledge about UI design, literature study was made. Google Scholar and big databases such as Association for Computing Machinery (ACM) and KTH Library were the good sources that contained a large number of articles within the Human-Computer Interaction (HCI) subject. The most important finding was that the design process consisted of 6 stages according to Chicago Architecture Foundation [4]:
- Define the problem
- Collect the information
- Brainstorm and analyze ideas
- Develop solutions
- Gather feedbacks
- Improve

The theory of these 6 stages were set for engineering designers in general who solve a variety of problems, e.g., architects, engineers, scientists. However, Figure 3 below showed the design process (also the work flow) for software user interface design in particular.

![User Interface Design Process](image)

*Figure 3 User Interface Design Process [5]*)
The process of UI design is complex due to the involvement of human. There are many kinds of developing methods and theories existing, and the actual design cases are different in practice. But one crucial thing is to conduct the iterations of user research and improvements in the design process. The project members combined the above theories of the Chicago Architecture Foundation and the User Interface Design Process, and formed the design process for this project as the followings:
1. Defined the problems needed to solve.
2. Made a user research of an online questionnaire on some detailed design ideas.
3. Brainstormed and prototyped several layout designs.
4. Made a user research of the first iteration of the Usability Testing, a few tasks were tested.
5. Selected and merged few more suitable layout designs based on the evaluation of the first iteration of the Usability Testing from end users’ feedback, and came up with few partial executable prototypes.
6. Made a user research of the second iteration of the Usability Testing, a few scenarios were tested.
7. Came up with a final design prototype.

1.6 Stakeholders
The primary stakeholder of this project was the company Loredge, the secondary stakeholders were their clients. The participated students, the examiner and the supervisor were also the stakeholders since they were all parts of this degree project.

1.7 Delimitations
The study of the project was entirely based on the latest released Beta version of the product Loredge at the time when the project started, therefore the adjustments in the future versions of the product would not be considered. For a simple and consistent illustration, the study was only based on the Mac version of Loredge, and so was the design process and all activities related to it, e.g. brainstorming, investigation, surveys.

The final design prototype was planned to be developed with prototyping software but no coding would involve in the scope of this project. The reason was because of the higher contribution of problem solving time. Depending on the prototype tool selected, some functions would not be fully present in the prototype.

Pre-loading example books in the mock-up design was initially considered for the more intuitive and hands-on user experience, but the idea was against one of the visions of
Loredge. The company’s vision was not to advertise anything within the software, and thus by following that vision, no books would be pre-loaded onto the prototype.

1.8 Outline

The project showcases how one should perform to create good design for a user interface, especially for a digital document view. It also points out which field is essential when it comes to design UI for users. Design Principles are the foundation for this project. Iterations of prototyping and user analysis are supposed to serve the purpose of improving the experience for users.

In this chapter (Chapter 1), the problem statement of the degree project and introduction of the theories are addressed. Goals, ethics and sustainability concerning the problem statement are also discussed. Delimitations are also mentioned to clarify the project’s feasibility.

Chapter 2 is about Theoretical Background. It introduces the fundamental theories concerning this project and explains how the related terminologies are linked to the design process that could solve the design problems.

Chapter 3 illustrates the detailed design process and the reasons of using the selected methods.

The in-depth development of the design process can be found in Chapter 4. Snapshots of the mock-ups are shown, as well as stressing the key features that were decided to implement on the prototypes. Furthermore, it explains why those decisions were made and how those decisions assisted the navigating experience.

In Chapter 5, readers can expect an analysis of user feedbacks, evaluate the results and see how they correlates to the problem statement we address at the beginning of the degree project.

Last but not least, Chapter 6 covers a conclusion. It is a short reflection of the design process and the results. We look back at the problems and affirm the solution we have managed to find out.
2. **Theoretical Background**

This chapter introduces some significant theoretical background relating to some User Interface Design principles and commandments, user research methods, and some fundamental concepts which are closely associated with the problems and goals of this project. In order to dig further into the practical process of solving the design problem, only a few significant terminologies will be discussed in further context in this chapter.

2.1 **Human-Centered Design**

According to Alan Dix [6], “Design is the process of designing products so that they can be used by as many people as possible in as many situations as possible”. This indicates that design is meant to assist the needs of human.

Human-Centered Design (HCD) is a universal concept within the field of Human Computer Interaction (HCI). The understanding of HCD [7] is crucial because it involves “ensuring that the product meets the needs and capabilities of the users”, e.g. a convenient navigating experience particularly in this project. It is thus important to understand the user needs and the characteristics of human perception, in the process when making design decisions.

HCD is a complex process since it involves with human, and there could be a lot of verities and uncertainties to evaluate on to fully understand the user needs and the capabilities of the users. “The term HCD was coined in the 1980s by Donald Norman who put forward guidelines that designers could follow for their interfaces to achieve good usability outcomes. From that point on, many designers, researchers, and policy makers have proposed various methodologies and techniques that seek to involve the end users in the design process” [7]. Thus, in this project it is very necessary to involve the target end users throughout the design process, to make usability tests and thus to come up with a good design.

2.2 **Navigation Experience**

Achieving a better navigation experience when looking for an item on the Library page is one of the principle goals of this project, an efficient navigational structure is also “the most important element in system usability”. [8] A good navigation experience means the ability to easily and quickly locate a desired item in a software application, and thus it is essential to keep a simple and clear navigational structure.

“A system’s organizational structure and its navigational tools, including elements such as menus, links, toolbars, and command buttons influence the system’s navigational ease of use.” [8] Some of these elements are also the focus of the user research and the design process of this project.
2.3 Designing for People: The Five Commandments

Within the field of HCD, there are a few commandments needed to be considered during the design process, which are of the followings:

1. Understand the Users

The first thing to consider is to “Gain a complete understanding of users and their tasks” [8]; designers need to truly understand what the user needs are and what tasks they would like to perform.

2. Involve the Users at Early Stage

It is also significant to involve users at the early stage of a design process, and thus getting an early and clear direct feedback to improve or to make a good decision [8].

3. Continually Perform Prototyping and Testing

“Prototyping and testing must be continually performed during all stages of development to uncover all potential defect” [8]. Because prototyping and testing the design will quickly identify problems and allow the designers to come up with solutions.

4. Make Modifications and Iterations

Modifications and iterations should be done in the design process when it is necessary, because the un-expected problems that were detected on one stage might force back the designers to the previous stage to make some changes. [8]

5. Independent Pieces and Integration

It is very efficient if all pieces of the design can be made independently with different versions or choices, and integrate the most desired ones after user research [8]. Thus it is necessary to perform different parts of the design individually, and then integrate the design of all the system components.

2.4 UI Design Principles

One of the most important objectives in UI design is to understand the UI Design principles, which consist of User Familiarity, Consistency, Minimal Surprise, Recoverability, User Guidance, User Diversity [9]; but the aims of this degree project mainly cover three of them, which are User Familiarity, Consistency and User Guidance.

UI Design principles are the pedestal from which to tackle Loredge Library Page’s design issue. User Familiarity means that “The interface should be based on user-oriented terms and concepts rather than computer concepts” [9]. For example, this digital document
reader should use terms like delete, notepads rather than, destroy, hints. Consistency stands for the overall design and format of elements. Users should see the same design scheme for icons as well as the same format for text (with commas, dots, etc.). And User Guidance shall be expected to be clear and concise. Different types of users should share a fair amount of guidance in order to understand the context of the software icons, instructions and prompted text.

Creating groups is one of the aesthetically pleasing approaches as a principle of UI design. This is also an important factor to evaluate in this project. [8]

2.5 User Research and Requirements Analysis

“A product description is developed and refined, based on input from users or marketing” [8]. Analysing users gives a realistic perspective of an effective interface. As the users are the centre of design, this assures that we can produce the ultimate UI that meets the user needs and user wants. The outcome of the analysis at the same time needs a good amount of time investment in terms that users and other designers would be able to comprehend and evaluate further.

There are many various ways for performing the user research and capturing information for determining requirements, the techniques are generally classified as direct methods and indirect methods. “Direct methods consist of face-to-face meetings with, or actual viewing of, users to solicit requirements. Indirect methods impose an intermediary, someone or something, between the users and the developers.” [8]

There are many types of methods existing, yet only the ones that were applied in this project are introduced.

2.5.1 Direct Methods

“The significant advantage of the direct methods is the opportunity they provide to hear the user’s comments in person and firsthand. Person-to-person encounters permit multiple channels of communication (body language, voice inflections, and so on) and provide the opportunity to immediately follow up on vague or incomplete data” [8]. There are various types of direct methods, including Individual Face-to-Face Interview, Telephone Interview or Survey, Traditional Focused Group, Facilitated Team Workshop, Observational Field Study, Requirements Prototyping, User-Interface Prototyping, Usability Testing, and Card Sorting for Web Sites. User-Interface Prototyping and Usability Testing are the two direct methods applied in this project.

User-Interface Prototyping
This is a demonstration model or an early prototype presented to users, in order to uncover the further user needs and wants, and the problems in the current design that need to be solved [8].
Usability Testing
This method is about constructing a special laboratory and performing a set of particularly designed scenarios/tasks to users to uncover user behaviors and the problems of the design. “The users are observed and the results are measured, and evaluated to establish the usability of the product at that point in time. Usability tests uncover what people actually do, not what they think they do. The same scenarios can be presented to multiple users, providing comparative data from several users. Problems uncovered may result in modification of the requirements” [8]. The biggest advantage of Usability labs is that they can generate much useful information, but the labs are expensive to create and operate in terms of time and man force.

Measures of Usability Testing
“Usability is to describe the effectiveness of human performance” [8]. There are a lot of human factors that can be observed in Usability Testing, relating to the effectiveness of the performance. The project members could observe whether the users are asking a lot of questions or making irrelevant actions when trying to perform a task, to see how learnable the UI is. User attitudes, reactions, speed are also some important factors that could be observed in tests.

2.5.2 Indirect Methods
“An indirect method of requirements determination is one that places an intermediary between the developer and the user. This intermediary may be electronic or another person. Using an intermediary can certainly provide useful information” [8]. There are various types of direct methods, including MIS Intermediary, Paper Survey or Questionnaire, Electronic Survey or Questionnaire, Electronic Focus Group Similar, Marketing and Sales, Support Line, E-Mail, Bulletin Boards or Guest Book, User Group, Competitor Analysis, Trade Show, Other Media Analysis, and System Testing. Electronic Survey or Questionnaire is the indirect method applied in this project.

Electronic Survey or Questionnaire
“A questionnaire or survey is administered to a sample of users via e-mail or the Web” [8]. The advantages of this method are that it is fast to receive user feedback, cheap to spread out, and simple to operate on a large sample size of users. There are some objectives as the following:
“Determine the survey objectives.
Determine where you will find the people to complete the survey.
Create a mix of multiple choice and open-ended questions requiring short answers addressing the survey objectives.
Keep it short, about 10 items or less is preferable. Keep it simple, requiring no more than 5–10 minutes to complete” [8].

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2.6 Direct Manipulation

It is important to pay attention to the concept of direct manipulation when designing an interface. The system should be “portrayed as an extension of the real world” [8]; as it should replicate the real-world environment onto the screen, so that the users will be familiar when using the application. The actions of preformation should be “rapid and incremental with visible display of results”. Also, the actions should be reversible.
3. **Design Process**

This chapter describes briefly the step-by-step actions of the design process, how user research was performed and how prototypes were developed upon them. The user research and evaluation stage was conducted several times throughout the design process, using both of the direct methods and the indirect methods. Because of the time constraint resisted the capability to code the prototypes in actuality, the following workflow was chosen and coding did not come to the concerns.

The process started by investigating the problems that this project had in the current design of Loredge’s Library page, which were already introduced in chapter 1.

An online questionnaire was then made based on the problems, and the purpose was to understand the user’s preferences on some details of the design. User feedback was then brought forward to developing the mock-ups in further context and to improving the quality of the design.

The problems of the current design were the base for the brainstorming step, where the two project members tried to be as creative as possible in coming up with different versions of the layout prototypes.

So as to figure out which of the layout prototypes were the more suitable versions to be developed or how to merge/modify them, a user research of the first iteration of the Usability Testing was conducted with the targeted end users.

The observed feedback from the first usability test was taken into consideration on formulating few better versions of the layout design. Two new versions of the layout design were formed after the evaluation, and more details (including the feedback from the first questionnaire) were added to a partial executable prototype.

Another Usability Testing was then performed as a new iterative test with the targeted end users to uncover new findings and improve the design, a few scenarios were designed to be tested in this iteration.

Axure was used as the prototyping software for this project, to develop the mock-ups that equipped with real-life interactions, so that the users could give better feedbacks during the tests. The final prototype came out from refining/merging the previous prototypes with user analysis to ensure that the applications meets the users’ expectations.

3.1 **Defining the Problems**

The problems of the current design of the product were already introduced in chapter 1, being listed as the following:
- The ordering of items was only a simple list view of all items, ranked by name
- There were no means of sorting the text files and notepads. The document navigating experience was neither efficient nor intuitive.
- Too much redundant information was shown on the page, which was time-consuming to navigate an item.
- Too small icons and too many items were drawn due to zero-spacing. This in turn led to difficulties on recognizing an item during navigation.

3.2 User Research (Online Questionnaire) on Some Detailed Choices

To be able to have a better understanding of users’ preferences on some details of the user interface, e.g., options of the ordering sub-menu, content of the pop-up window showing the properties of an item, user research has to be made. An online questionnaire was then made with the targeted end users. The project members chose to make this user research using the online questionnaire method due to the reason that it is simple to spread out, fast to manage with the feedbacks and operate on a large number of people. In order for the respondents to better understand the questions in the questionnaire, a sample mock-up was made and provided to the respondents.

From an existing number of surveying tools on the Internet, the project members decided to go with Google Forms (suggested from the company) as it had the most practical survey editor and it allowed dynamic change of questionnaire. The sample mock-up was made using Axure, and a generated clickable URL link of it was contained in the questionnaire for the ease of distribution.

The substantial goal of UI evaluation is to assess whether the UI meets its usability requirements and whether it can assist with solving the problems of the project. The target groups of respondents were repeated with different individuals to provide a fairly objective results of user feedbacks. Because Loredge’s targeted customers were students or researchers from academic institutes, the project members also tried to reach students from within KTH School of Information and Technology. They would be valuable subjects to support this very first phase of design since their profession, to an extend, relates to HCI field and studying a number of documents. The project members sent out the URL link of the questionnaire to the students, they then also distributed the questionnaire to their friends (also students in academic institutes) to increase the number of survey takers. At the end, the project members managed to gather valuable feedback from about 30 people.

The results of the online questionnaire would be brought forward to the further design.
3.3 Layout Prototyping

Layout prototyping was the first step in the prototyping sequence. Six layout designs were brainstormed from the two project members’ own thoughts and inspirations from some of the existing platforms. The inspirations came from some popular products such as Netflix and Kindle. Similar reading applications or software were also where the project members dug in to look for ideas.

Having had experience from working with Axure, the project members thought about using it to quickly sketch the mock-ups. Creative Bloq [10] also said that Axure was one of the best wire framing tools in the market at that moment, so it was chosen to use as the prototyping tool. The mock-ups aimed to give users a real-life interaction, nonetheless still leaving rooms for innovation. User’s feedback also got involved in the layout designs were selected and merged into new layout designs as the results of the more suitable layout designs for further development.

3.4 First Iteration of Usability Testing

The aim of the first Usability Testing was to figure out the most suitable layout prototypes based on the feedback from observing users performing certain tasks. The user research method of Usability Testing was chosen due to the reason that it helps to perceive the direct reactions from the users and could thus improve the quality of the design. The targeted end users were campus students. This was because campus students often came across document editing software or had to search for resources almost every day. In almost all subjects that they encountered, they had to use some sorts of a PDF reader in order to store their documents, retrieve them whenever they can and that was when fast navigation came into place. Thus, they are believed to relate the most to the problem statement mentioned above. The individuals were selected at random in different school campuses studying different professions e.g civil engineering or medicine.

The project members requested the tested users to perform several tasks during the usability test, and observed their attitudes and reactions, e.g., whether the tested users are asking a lot of questions or doing irrelevant actions when performing a task, whether the tested users can understand the UI with some limited instructions; the project members also measured the time taken that the tested users perform tasks and asked a few questions. By doing so the project members could compare and evaluate how learnable the layout designs are and which ones are more effective on solving the problems that the project is aiming at.

3.5 Second Iteration of Usability Testing

This second iteration of usability testing focused on improving the first prototypes towards meeting more of user needs and user expectations, as well as engaging more user interactions into the prototypes. Thus, results from the first iteration was analyzed and evaluated in order for the project members to brainstorm more ideas and implement them in the prototypes. Also, the results from the first questionnaire were also used in some
details of the design. For this round, it was decided to use a testing group of the same quality as the first usability testing. The reason was that they still met the criteria needed, which was somebody who understood the pain points of navigating resources.

Before testing, a number of scenarios were also created with a couple of given tasks that the researchers should use to ask users to do. Observation came strongly forward at this point; user behaviors were taken down to notes for later analytics and evaluation.
4. Developments

This chapter illustrates the development details of the design process. In order to create the design prototypes that suited user needs and wants and could solve the problems of this project, the project members decided to make two iterations of the usability tests after the initial user research. Later on, analysis and evaluation on user feedbacks were made.

The user research and the UI design were all formed under the basis of solving the problems that the current design of Loredge has, and evaluating how UI design can help with improving user experience in navigating documents. Therefore, approaching the ultimate goal of the project to have an aesthetic and intuitive user interface design for the Library page of Loredge, and thus making it easier for users when looking for an item on the Library page.

4.1 End-users’ Questionnaire on Some Detailed Choices

The first user research was done by an online questionnaire with 30 people, on the purpose of evaluating some detailed design choices and gather more suggestions. The questionnaire consisted of three multiple choice questions and one open question. The respondents were the targeted end-users, which were a sample of campus students. The basic functionalities that Google Forms could offer include creating questions in form of Multiple Choices, Checkboxes, Drop-down Lists, etc; which were more than enough for the project members’ needs. One could easily select their favorite type of questions, describe and insert pictures to the questionnaire and get a shareable link to spread out at the end.

In order for the respondents to better understand the questions in the questionnaire, a sample mock-up was made and provided to the respondents as a link on the questionnaire. The mock-up was made using Axure and also under the suggestion from the company Loredge. Screen-shots of the mock-up were also included in the questionnaire for better indicating the questions when needed.

The project members got inspirations mainly from Kindle, Netflix, the system that Mac OS has, and formed the questions that they thought were meaningful to solve the problems of the current design.

There is no ordering of items in the current design, thus the project members decided to include a submenu to order the items on the Library page. However, it was not certain which ways of ordering the items would best suit user needs. Thus, a question relating to how to arrange the items on the Library page was formed as the following:

“1. How would you like to sort the items? Select three options. (It’s the same as when you sort items in a folder.)”
In figure 4 above, it shows five options that were proposed to be evaluated for the “Arrange By” sub-menu. This system menu shows up when right clicking on an empty space on the Library page (see figure 4), and the “Arrange By” option is used to sort all the items in some ways. An investigation was made here due to the reason that it was not certain whether all five options are necessary, and how to rank them. Thus, the project members were trying to consider whether it is needed to eliminate any options or the ability to rank the options. To have a result that could better reflect user wants, the number of selection was limited to three exactly.

The current design of Loredge has too small icons and too many items were drawn due to zero-spacing. This in turn led to difficulties on recognizing an item during navigation. A way of solving this problem can be that to let the users customizing the view properties (e.g., icon size and the grid spacing) themselves. However, it was not certain which properties would best suit user needs. Thus, a question relating to how to customize the view properties on the Library page was formed as the following:

“2. How would you like to view your items? Select three options. (You might want to change some properties of all items displayed on a Library page, the icon size, the spacing between them, the text size, the background color; you might also want to show/hide the authors.)”
In figure 6 above, it shows five properties that were proposed to be evaluated for users to customize the items as view options. The properties were planned to show up in a pop-up window, when the “Show View Options” option is selected, in the system menu when right clicking on any empty space (see figure 4). An investigation was made here due to the reason that it was not certain whether all five properties are necessary. Since the results were expected to evaluate whether it is needed to eliminate any properties and the order to rank the properties, selection is limited to three exactly.

The current design of Loredge has too much redundant information shown on the page, which was time-consuming to navigate an item. The redundant information includes the information shown on the UI page when enters the system, and the properties shown on the pop-up window when right click on an item and select the “Properties” submenu. Being inspired by most of the major digital reading software, it was decided that only the front covers and the item names will be shown on the Library page. However, which kind of properties of an item should be included in the “Properties” pop-up window was not certain. Thus, a question relating to the properties of an item was formed as the following:

“3. Which properties would you like to see for a file item? Select as many options as desired. (When you right click on a file (a book) and select the "Properties" option, a list of properties of the file is displayed; which ones would you like to see?)”
Figure 7 shows the original window that shows up when right clicking on a file and selecting the “Properties” option. It was considered that some information might not be needed here and thus an investigation was made, in order to evaluate whether it is needed.
to eliminate any properties and the order to rank the properties. The options “a.” to “m.” were given from the company after the discussion with the two project members (in figure 8). No limitation was set on selection for this question (the question was mandatory so the least selection number is one) due to the difficulty on estimation.

4.2 First Iteration of Usability Testing

To kick start the design process, the project members started to look at the existing design that had already considered files navigation. The project members expected that this would help to save a lot of time and at the same time tailor the designs to the right direction.

Since Netflix was a major movie company, which provided users a large database of movies where they can choose from, the project members tried out their products and learnt from how they help users navigating their movies. Next, it was Kindle – a company that provided users with a large books collection. The UI they have helps users quickly find their books was also a good take away for our design preparation. Last but not least, the project members noticed immediately from the Mac OS that people are using. Mac’s Finder had its special filters that assisted users with quick navigation of their files. Hence, the project members took all these ideas and gave them a twist for the start of the design prototypes for Loredge, thus avoiding copyright issues. The project members also tried to be creative and come up with their own ideas for the design prototypes.

As the project members were done gathering the inspiration, they managed to put together six prototypes. To represent files or documents in general, it was decided to use virtual book covers generated from the Internet. The same 20 items were displayed in all six prototypes. The details of each prototype will be illustrated below.
Figure 9  Prototype 1 of the First Usability Testing

In prototype 1, only a simple UI look with all the items getting displayed was wanted. There existed no UI features whatsoever to assist user's ability to navigate their documents because it was planned to evaluate how difficult the navigating interaction could become without any sorting of groups.
In prototype 2, the inspiration arose from Mac Finder software. The way Apple helped user was to create a filter called Cover Flow where the user’s currently viewed files are displayed.
in a large horizontal scroll. From that idea, this prototype’s selling point is a row displaying 5 books at a time, also with arrow buttons which allows users to move the entire bookshelf like a stream, thus giving users the “Cover Flow” feeling. On top of that, the project members also considered using Groupings or Categories.
Figure 11 Prototype 3 of the First Usability Testing
In prototype 3, the project members wanted to observe how users’ reaction would change without the Cover Flow, but only Groupings as the assistance for file navigation.

The 4th Prototype has the inspiration from the Kindle application. Kindle utilized a side menu with different groups so users could easily sort out their documents according to the groups. Also, only the items that belong to the certain group would appear when a group is selected; which saves a lot of space. This prototype was designed in a very similar way to Kindle, however the project members kept the design of their UI elements original to avoid plagiarism.
Prototype 5 was formed under the project member’s own thoughts. This prototype perhaps looks like Cover Flow with arrow buttons and sliding effect. However, there is only one book getting displayed at a time. Again, the books are divided into various groups.
Last but not least, the prototype 6 presents almost the same concept as Prototype 5. The twist here is the sliding orientation. Arrow buttons are instead positioned vertically and users could watch their books go up or down while searching for their documents. The generated online URL of the mock-up is: https://z8ne75.axshare.com/#g=1&p=home

Once the design prototypes were ready, the first iteration of the Usability Testing on the layout prototypes was conducted with two test users individually, and the purpose was to observe and put down user's behavioral response from performing the formulated tasks and draw conclusions from it. The tasks for the test users were formulated as the followings:
1. Select a randomly named book from layout 1, and then select the same book that was named in step 1 from layout 2.
2. Select different randomly named books from layout 2 to 6 in turn.
3. Personalize the groups (the project member directly applies the test user’s arrangement on the mock-up), wait for a minute (for the test users to forget the new arrangement), and select different randomly named books from layout 2 to 6 in turn.
4. Name one good and one bad thing of each layout and in general (if have any).

The instructions of the test were limited on only introducing what the test is about and what tasks should be done. This is for testing whether the test users can understand the UI system. The project members observed the test users’ attitudes and reactions, e.g., whether the tested users are asking a lot of questions or doing irrelevant actions when performing a task, whether the tested users can understand the UI with some limited instruction; the project members also measured the time taken that the tested users performed the tasks.

The intension of step 1 was to evaluate whether it is necessary to have groups, thus the tasks were to select the same book in two layouts. The intension of step 2 was to gather feedback from different layouts, thus different books were asked to be selected in each layout. The intension of step 3 was to evaluate the importance of personalization on improving the quality of the design, e.g., allowing the users to categorize groups themselves. Measuring the time taken to select a book was only supporting the qualitative of the observation.

4.3 Second Iteration of Usability Testing

The development of 2nd Usability Testing started with learning from the feedbacks of the first test. This gave a summary of the points that needed to be brought forward to the development of the incoming design. These points were:

- Having groups would help to navigate items on a Library page
- The ability to personalize group would improve the navigating experience
- The Kindle type is a suitable layout for further development
- Good to have a page displaying all items
- Good to have all items listed in alphabetical order

Every point was gone through and integrated into the testing mock-up. It was decided that the Kindle type’s layout was the most suitable layout, and it was good to have a page displaying all items. Therefore the mock-up of this testing was designed based on the Kindle’s type of layout, and a page displaying all items was also added onto the new mock-up design. A few clickable features were added to the mock-up combining with the results from the first questionnaire and the first usability testing. The newly added features are demonstrated below.
Figure 15 shows the feature of “Add a Group” in this mock-up. A scenario of creating a new group and copying a book to the new group was also designed in this second usability testing.

Figure 15 “Add a group” feature

Figure 16 shows the feature of a menu when clicking on an item. A scenario of moving a book to another group was designed in this second usability testing.
Figure 16 A right-click menu

Figure 17 and figure 18 shows the feature of arranging all items by name.

Figure 17 “Arrange by Name” option
Having the above features implemented, the mock-up was then tested with two test users performing several scenarios. The generated online URL of the mock-up is: [https://5qwsrb.axshare.com/#c=2](https://5qwsrb.axshare.com/#c=2).

The intention of this usability testing was to figure out how understandable the new mock-up is, on which level could users comprehend and perform the requested tasks. The tested users were expected to be able to understand and perform the following tasks:

- How to arrange all items by name, find view settings and properties of the items;
- How to add a new group, copy some books to the new group;
- How to move a book to another group.

Three scenarios were created below to serve the testing purpose:

1. Arrange all items by name, then look for a book, and look at its properties. At last check the view options of the page.
   - Open the mock-up, ask the tester to arrange the items by the alphabet order on “All Items” page. (right click on the empty space, select “Arrange By” -> “Name”)
   - Ask the tester to look for the book “Cookbook”.
   - Ask the tester to check the properties of the book “Cookbook”.
   - Ask the tester to close the property window and check the view options of the page. (right click on the empty space, select “Show View Options”)

*Figure 18 Items sorted in Alphabetical Order*
2. Add a new group, copy some books to the new group, then check up the new group.
   - Reopen the mock-up (must reopen it!), ask the tester to create a new group and give it a name. (right click on the left empty grey side, select “Add a Group”, put down the group name and click “OK”).
   - Ask the tester to copy the first row to the new group. (right click on books, select “Move to Group” --- “New Group”).
   - Ask the tester to go to the new group and check the copied books.

3. Move a book to a group
   - Ask the tester to open the group of “Food and Travel”.
   - Ask the tester to move the book “Cookbook” to the group “Lifestyle”.
   - Ask the tester to look for the book “Cookbook” in the group “Lifestyle”.

The instructions of the test were limited on only introducing what the test is about and what tasks should be done. This is for testing whether the test users can understand the UI system. To make a report based on this usability testing, the behavior of the tested users were observed carefully. A couple things that this test was looking for were: long time or short time to perform a task, misunderstanding, visual cues for users to recognize the actions, etc.
5. **Results**

This chapter presents and discusses the results from the first online questionnaire, the first usability testing and the second usability testing.

5.1 **End-users’ Feedback on Online Questionnaire**

This session presents and discusses the statistical results from the first survey (questionnaire with 30 persons), certain choices for the detail designs will be evaluated and decided, e.g. the options to arrange the items, view properties’ elements and file properties’ elements.

The final selection on the multiple-choice questions were based on the principle of whether having over 1/3 of the sample population (the people who did the questionnaire) chosen; this was because there had to be some ways to decide whether some options are unpopular and needed to be eliminated, having less than 1/3 chosen means the option is only wanted by very few people. Refinements and improvements were made after the evaluation on the survey (questionnaire).

![Number of Users by Users’ Favorite Way of Sorting Items](image)

*Figure 19 Number of Users by Users’ Favorite Way of Sorting Items*

Question 1 in the questionnaire was about evaluating the options to sort the items on the Library page, deciding which options to keep and how to order them in the menu. In figure 19, results for Question 1, over 90% of people chose option “a. Name” and option “b. Date Last Opened”. Only 13% of people chose option “e. Size”, which was less than 1/3. Thus “e. Size” was eliminated from the menu, and the order for the rest of the options in the menu was Name, Date Last Opened, Data Modified, and Date Added.
Figure 20  Number of Users by How users like to view their items

Question 2 in the questionnaire was about choosing the view options for the file items at the Library page, deciding which elements to keep and how to order them in the pop-up window. In figure 20, results for Question 2, the majority of people chose option “a. Icon Size”, “b. Grid Spacing”, and “c. Text Size”. Less than 1/3 of people chose option “d. Show/Hide Author” and “e. Background Color”. Thus, elements a, b, and c were kept, and the order in the pop-up window was Icon Size, Grid Spacing, and Text Size.
Question 3 in the questionnaire was about evaluating the properties’ elements for the file (book) properties on the Library page, deciding which elements to keep and how to order them in the pop-up window. In figure 20, results for Question 3, 33% of people chose option “e. Pages” and “m. Preview”. By rounding up 1/3, these two elements were selected in the pop-up window. Option “f. Type”, “g. ISBN ID”, “i. Last Opened Page”, “k. Volume” were eliminated from the pop-up window. Thus, options a, b, c, d, e, h, j, l, and m were kept, and the order in the pop-up window was File name, Author(s), Published Year, Abstract, Journal Name, Edition, Last Opened Date, Pages, Preview (ordered in alphabetical order if having the same percentage).

There was one person who thought the customization in the mock-up was very good and it would be even better to have a “Settings” window to adapt to user needs. This was also a good point to consider.
### 5.2 Outcome of First Usability Testing

The first usability testing was conducted with two test users and the results are shown as the following:

<table>
<thead>
<tr>
<th>Time Taken (seconds)</th>
<th>Layout 1</th>
<th>Layout 2</th>
<th>Layout 3</th>
<th>Layout 4</th>
<th>Layout 5</th>
<th>Layout 6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>User Task</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Task 1</td>
<td>11s</td>
<td>8s</td>
<td>22s</td>
<td>17s</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Task 2</td>
<td>11s</td>
<td>7s</td>
<td>3s</td>
<td>10s</td>
<td>6s</td>
<td>8s</td>
</tr>
<tr>
<td>Task 3</td>
<td>6s</td>
<td>4s</td>
<td>2s</td>
<td>7s</td>
<td>6s</td>
<td>9s</td>
</tr>
<tr>
<td>Task 4</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

- Could have all items ordered in alphabetical ordering.
- Good to have all items listed.
- Layout 1 gives a good overview of all book names, but it takes more time for navigation due to no orders and categories
- Layout 2 occupied less space, but it gets a bad first impression. Users don’t know whether they could slide left or right
- Layout 3 gives direct overview due to no animation, but it takes up a lot of vertical space
- Layout 4 gives a rather small and direct space for categories. It helps navigation and is very logical. But it relies heavily on picking categories first before documents. Consider using both with and without categories
- Layout 5 has a very little space needed, but too many clicking required to find a book in worst case.
- Layout 6 receives the same feedbacks as Layout 5. It is suggested to display more books during each showing.

*Table 1 A sample result from the First Usability Testing*
Table 1 shows the results of the time taken for the two test users to perform tasks. Both of the two users took relatively less time to select a book in layout 2 than layout 1, thus it means that having groups would help to navigate items on a Library page. The time taken from task 2 and task 3 indicates that it took less time for the users to select a named book after they have personalized the books themselves, meaning the ability to personalize group would improve the navigating experience.

The test users did not ask a lot of questions or make too many irrelevant actions during the test. However, both of them hesitated a little on layout 2, 5 and 6, due to the reason that they did not know whether they could slide left or right.

The average time taken to select a book from layout 2 to 6 is 7s, 5.5s, 7.25s, 16.25s and 10.75s respectively. This result shows that layout 3 is the most efficient design if the time taken aspect was considered only, and layout 2 and 4 are of the similar efficiency. Since layout 5 and 6 takes too long time than others, it was decided to exclude them in further development.

Since time taken is not the only aspect that would affect user experience, user comments would also be considered during layout selection. A test user strongly suggested that having horizontal scrolling would confuse a lot, thus Layout 2 was then also excluded due to the fact that it is not very intuitive even though it takes less space and less time.

A user comments that Layout 3 is a direct overview due to no animation, but it takes up a lot of vertical space. This vertical space problem cannot be solved, thus Layout 3 was also excluded for further development.

A user comments that Layout 4 is very logical but it relies a lot on picking up a group, it lacks an overview. This could be solved by adding a group with all books onto it, which is also the same as Layout 1. The project members discussed about merging Layout 1 and 4 could would be a good choice. Also, under the consideration that a user suggested that it is good to have all items displayed, an additional page displaying all items will be added to layout 4.

5.3 Outcome of Second Usability Testing

The second usability testing was conducted with two test users and the results are of the following.
**Scenario 1:**
- User A performed the tasks smoothly, almost without any hesitation.
- User B was more curious towards the categories, and it took a while for user B to figure out how to arrange items by Name and to look for the book “Cookbook”. Other tasks were quickly learnt.

**Scenario 2:**
- User A did not know where to add a new group and clicked several places to look for it, but then successfully performed the consecutive tasks.
- User B experienced that a feature was not working. The expected behavior did not achieve. The reason might be that because user was tested on a Windows environment, with Microsoft Edge browser. However, user B noticed the right click menu and understood how to move a specific book to a specific group.

**Scenario 3:**
- Both user A and B had no difficulties performing the tasks as they had seen what’s on the right-click menu previously.

The second usability testing’s results showed that users think in different ways. An intuitive task for a certain user can be not very intuitive for another user.

For example in Scenario 1, while user A has a very easy time, user B was not able to figure out how to arrange items until they got a hint. Hence to make it even more convenient, a “give hint” feature could be added to improve these layouts.

For Scenario 2, this seems to give out an impression that the position of “Add New Group” is not intuitive. More research or experiments could be done to find out a more suitable position. Also, it is realized that web browser and operating system consistency wasn’t kept for User B. This is also an important lesson for future testing.

Last but not least, Scenario 3 indicates that users are generally quick to learn and they tend to look for similarities between an action and other similar actions. Thus, being able to provide the initial hint intuitively is believed to result in a better convenience for users as whole.
6. Conclusion

Looking back at the introduction, the problem of this project was the poor design of the Library Page of Loredge, which was non-intuitive for users to navigate their desired items. After a few surveys and 2 usability testing, a few solutions to the problem were proposed.

Usability testing was indeed a very effective method since it conditioned the project members to improve the layouts according to user feedbacks, making sure the result is constantly revised in accordance with realistic user needs and wants. All problems addressed at the beginning are no longer seen in the new layouts. Provided the software comes with these new design layouts, users now have their items sort by categories/groups, which in turn makes it easy for them to find what they want. Now, sorting is also hidden in the right-click menu, redundant information is taken away and icons size are adjusted responsively to various computers. All of this simplifies the overall look of the user interface, avoiding the confusion for users. A demonstration of such solution is presented below:

![Figure 22 First glance at the Final Design, displaying various categories and “Arranged by” capability](image_url)
Figure 23 Second glance at the Final Design, displaying right-click menu on a document.

Figure 24 Final glance at the Final Design, displaying a Properties window dedicated for each document.
Despite the problems that have been solved, it is still good to pay attention to the struggles that users had during the usability testing, and more tests should be done to address all the potential issues with the design. Fixing those struggles can provide an even better convenience to users in terms of navigating experience.
References


Appendix 1

The Google Form used to conduct user research can be accessed at https://goo.gl/forms/JXSRTbgWDsowuRuB3. It is expected to be accessible at all time in the future. However change in Google policy or products may suspend the availability of this online survey.

The first mock-up for the first usability testing is available online from 2nd Nov 2017 at https://z8ne75.axshare.com/#g=1&p=home
It is expect it to be available for about one year. Later access to this URL may encounter errors or faulty information.

The second mock-up for the second usability testing is available online from 15th Dec 2017 at https://5qwsrb.axshare.com/#c=2
It is expected to be available for about one year. Later access to this URL may encounter errors or faulty information.