University of
St Andrews

School of Computer Science
Supervisor : Dr. Mark-Jan Nederhof

MSc Human Computer Interaction

Presentation of OCR'ed Historical Documents on the Web

Caroline Olsienkiewicz
170024591

24th August 2018

Abstract

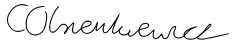
Research of the department of history usually seeks to understand the past and its aspects. For the linguists in the field of history this encompasses understanding the evolution of the language over time. Their work includes the examination of ancient manuscripts and the comparison between different copies of the same text. This project aims to facilitate this line of work by presenting a website, that offers the OCR'ed scans of ancient French Bibles and juxtaposes their transcriptions. The project was initiated by gathering the user requirements and followed by the sketching of ideas and thus forming a conceptual design. The design decisions are based on this concept as well as on a selection of guiding principles on Human-Computer-Interaction.
The resulting website offers the images of the scans and their transcriptions, which can be manipulated and interacted with in order to achieve the necessary tasks. These include adjusting the image or selecting lines. It also includes the possibility to search the text for words, phrases, abbreviations and others.
This initial product was tested in an online user study, asking the participants to fulfil certain tasks and finally rate their experience. The study results suggest an overall good usability of the website. The user feedback included aspects on what to improve, which was then incorporated into the system. The final version of the website therefore includes more information on the introductory page, an improved search feature and an adjusted navigation structure.

Declaration

"I declare that the material submitted for assessment is my own work except where credit is explicitly given to others by citation or acknowledgement. This work was performed during the current academic year except where otherwise stated.
The main text of this project report is 14,598 words long, including project specification and plan."

"In submitting this project report to the University of St Andrews, I give permission for it to be made available for use in accordance with the regulations of the University Library. I also give permission for the title and abstract to be published and for copies of the report to be made and supplied at cost to any bona fide library or research worker, and to be made available on the World Wide Web. I retain the copyright in this work."

St. Andrews, August 23, 2018



.....

Caroline Olsienkiewicz

Contents

1 Introduction

Technology is centred around the human and often focuses on facilitating or supporting human lives. It is nowadays omnipresent both visibly and invisibly and people might use it, whether they are aware of it or not. In the department of history, technology is trying to help build bridges between the past and the present. Historians generally seek to reveal new aspects and information about the past, in order to enhance their understanding and fill the gaps in our present knowledge. One specific field in this department, is the work with ancient manuscripts and their transcriptions. In this work, these manuscripts are examined, involving different techniques. This project focuses on the automatically created transcriptions of such scanned manuscripts and their presentation on the web It aims to support the work by facilitating the execution of those techniques.

This report presents the development of an interactive web-application, offering a range of features that focus on the work of OCR'ed scanned French Bibles. The following sections provide background information to this project, present its objectives and their achievements and finally offer an overview of the report.

1.1 Background

OCR, or "Optical Character Recognition", describes the extraction of the text in scanned documents or images. It has been the object of research for a long time and keeps being further studied [29]. OCR is a combination of pattern recognition and machine learning to create an algorithm that identifies forms of characters and words.
There are a variety of tools and platforms, that offer OCR for the public, hosted by big providers such as Google [16] or Github [13], or sites specifically set out for this purpose [15, 30, 14]. They usually emphasise what features of an image provides the best results, such as high quality, clarity or contrast. These tools are however generally designed for "normal" use, hence for scans showing typical modern fonts and signs.
The line of work this project focuses on however, needs an OCR software, that specialises in ancient fonts and characters, in order to correctly identify and translate these characters into a text format. The University of St. Andrews is currently working on developing such a software. Their focus is on the transcription of ancient French Bibles. This software aims to not only correctly recognise characters and words in ancient lettering, but furthermore capture the coordinates of these words and lines in the image. This information then enables the transformation in the text, providing possibilities of interaction with the image itself, such as selecting or encircling the text. This project is based on this work, taking the scans and their transcriptions, including this extra information. It creates a website, exposing them on the web and enabling their examination.

1.2 Objectives

The primary objective of this project was to build the client side of a responsive web-based application, which provides the possibility to view and interact with the OCR'ed scans of historical French Bibles. The interaction should include zooming and readjusting of the image, as well as selecting lines both in the image and the text. This selection should be made visible by highlighting of some sort. The website should provide guidance about what the site offers and how to utilise its features. As the foundation of six pages and their transcriptions is currently being worked on to be extended in the near future, the website ought to be set out to be enhanced.

The secondary objective, encompasses further interaction for the user, such as the ability to

leave a comment about a transcription and the possibility of searching for words in the text.
Lastly, the website should provide a good user experience, which should be assessed in a user study. The results should then be analysed and applied.
A tertiary objective was set to implement a full logged in user experience, offering personalisation and optimised error alerts or feedback.

1.3 Achievements

The project achieves its primary and secondary objective, presenting a fully functional client side of the website, providing features to zoom and move the image, interact and highlight both text and image, a word search and the possibility to leave comments. An online user study was conducted to evaluate the usability and assess the user experience, revealing overall good results and leading to the implementation of the analysed user comments.
Due to the limited amount of time, the tertiary objective however, was out of scope and should be implemented in the future.

1.4 Report Overview

This report is divided into ten chapters. Following this introduction, the second chapter discusses the context survey, encompassing the research on related work and important Human Computer Interaction Principles.
The third chapter describes the requirements specification and the process of how they were extracted and defined. The next chapter clarifies any ethical issues of this project.
How these requirements were interpreted and translated into a design concept, as well as the final design decisions will be shown in the fifth chapter, followed by an overview of their implementation, which will be presented in the sixth chapter.
The seventh chapter describes the methodology, recruiting and procedure of the user testing, including the discussion of limitations of the study. The results are then displayed in the following part, the eighth chapter.
The last two chapters evaluate and critically appraise the work and close the report with a concluding paragraph.

2 Context Survey

This chapter discusses the literature review of this project. The first part presents the related work with regard to websites showing digitalised historical documents as well as the work that has been done regarding OCR and displaying the content of historical documents. The second part encloses the Human-Computer-Interaction (HCI) aspects in web design and visualisations on the web.

2.1 Related Work

There are several tools and websites with the purpose of making text of historical documents available or enhance the representation of information in order to support the work in a specific domain, discover links that would be difficult to reveal by a single human or simply facilitate access to these ancient documents. This subsection first portrays websites that offer similar information to what this project is aiming for. It then presents the research, that focuses on presenting images on the web.

2.1.1 Digitalised historical Documents on the Web

A website by the Oxford University [52] offers the viewing of the manuscript of the "Jesus College MS.57", the Laws of Hywel Dda in Welsh from c. 1400. All images are made from the original manuscript and are at a resolution of 385 dpi. All 307 pages of the manuscript are displayed and the user can choose which to view in a slightly larger format, as well as click through them one by one. This can be done on a small icon-like picture display, where the manuscript is displayed as a book. When selected, the larger picture is zoomable by mouse click. The website offers no additional information than the one cited above.

The "Bibliothèque nationale de France" [11] hosts a website that gives access to a variety of different books, manuscripts, images, maps and so on. The manuscripts are presented in the form of an online book reader, that allows, amongst other, zooming, switching pages, modifying the number of images to be seen and reporting anomalies in the information of the document or technical problems. There is a button to search the document, it is however greyed out, providing no functionality.
Similar to this is the digital library website "Roman de la Rose" [50]. It offers a range of books, which can be selected through different methods in the left sided navigation bar. After selecting a book, the user can view the images by clicking on a specific page in the description or opening the page turner by selecting it directly or browsing through the images. The so called "page turner" is an embedded tool, simulating a real-life book experience. This tool also offers the option to view the images and juxtapose their transcriptions on their right. The website and tool do not offer any possibility of interaction with the scans nor their transcriptions other than clicking through the pages and choosing from three different sizes of display.

The website of the Hathi Trust Digital Library [28] is comparable and holds a selection of different books, also to be viewed in the form of an online book, or catalogue reader. This reader bares functions of modifying the viewing style (i.e. single page view, double page or thumbnails), zooming and rotating of the pages and displaying the transcription instead of the image itself. The pages are presented next to each other and animated to reproducing the experience of an actual book. The website also offers some information on the library itself, their partners and their research, as well as information on the author and the books.

Furthermore, there is the feature of a word/phrase search. This search displays the results in a simple text display with the option of jumping back to the document by clicking the link to the page, on which the word or phrase was found. This word or phrase is highlighted in this searched text display and the transcription of the page, however not in the image itself. It is also necessary to return to the word search after having clicked on one of the result lines to examine different results.

Similarly, the University of Aberdeen makes available a website, presenting the "Aberdeen Bestiary" [1]. This website shares images of the scanned document one by one, with the same functionalities as the other websites. In addition, however, it offers a commentary on the displayed image or page of the document as well as the transcription and its translation juxtaposed. It also supports the search feature. The results are displayed on a new page, similar to the Hathi Trust website, which are then clickable to get to the page with the searched word or phrase. There is no highlighting of those words or phrases in any way.

Moreover, "e-codices" [46] presents a website, which also provides a variety of scanned manuscripts. These can be examined individually, or the user can click through the images via arrows situated underneath the navigation bar, which then disappear on a small screen size. The other possibility is to choose the page from the book via a drop-down menu. This function remains unchanged, no matter what screen size.
The books can either be viewed two at a time or in thumbnails of four screens arranged in a square. The user can choose which book they want to examine and where it should be displayed. In this arrangement it is possible to switch through the pages with the help of arrows located on either side of the images directly. All images are zoomable with no further interaction identifiable. The website also provides information about the book and image on demand, such as annotations regarding the particular page or a summary of the whole manuscript. However, no form of transcription belonging to these texts could be located, nor a search function to identify words or phrases in the text.

Lastly, the "Textual Communities" website, a product of the collaboration between the University of Saskatchewan and "Innovation.ca" [43], offers the possibility to assemble material, invite people to work together on a transcription or editing existing transcriptions. These gathered scans can be viewed and examined in an image reader above the transcription file. This file can be modified, when the user has successfully created and logged into their account. The current project is on the "Canterbury Tales".

This section provided a summary of existing websites displaying scans of historic documents. Research on retrieving and displaying the content of such documents on the web will be presented in the next subsection.

2.1.2 Displaying the Content of Images

This subsection comprises the work that has been done to extract the content of documents in order to display it and simplify the work of historians.

Ide and Woolner [21] worked on developing a model for historical documents and its associated data in order to present it on the web using W3 standards. Their project is about providing historians of World War II with an intelligent search and access methods to enable them to compare documents as well as categorise them. This will allow them to find links between documents and thus enhance their data. The researcher's work first describes the encoding and annotation of the documents and building the links between parts of the collection. Secondly, they enhanced a web-based interface to enable the search and retrieval functions to full extend.

A similar aspect was researched by Ciula et al. [5]. They created a way to enhance the given historical documents by presenting relations between the people that occur in these documents. They introduce a form of markup to encode these relations and therefore enabling the dynamic process of scholarly interpretations, which is based on a combination of the core mark-up TEI and an ontology encoded in RDF and OWL.

Biller et al. [4] created the first web-based system, based on Ajax, to help users produce ground truth data for scanned images, named WebGT. This system should help historians and computer scientists to work with these documents as well as the data by enabling the online annotation of these historical documents. They created a user-friendly interface, which allows the simultaneous work on one document, being situated in different locations. The online semi-automatic strategy is one of the most important features of their system, which automatically defines the outline of a clicked component in the document. The annotation process of the system is based on the selection, grouping and annotation mode, which the user can utilise to accurately create ground truth data.
Further research by Esposito et al. [8] proposes the use of the document processing system WISDOM++, which first uses machine learning techniques, to then optimise OCR to transform printed documents, such as images into XML files.

The paper by Pridal and Zabicka [38] focuses on the display of large images such as old maps or other, similarly large historical documents using a kind of tiling approach instead of the complete geo-referencing of the maps. They worked on the presentation of historical maps on the web, which are too big to be uploaded as normal pictures. Their web-based tool relies on the tiling technique of systems like Google Maps or Google Earth and was created in order to help online libraries or other memory institutions, that do not have the resources for correct geo-referencing.

The next paragraph summarises these findings and formulates an analysis of the existing work, highlighting the contribution of this project.

2.1.3 Analysis

Analysing these existing websites discloses, that all provide scanned documents of some kind. Many of them enable the most common interactions with the images, such as zoom, selection of specific images or juxtaposing two consecutive images with the help of a book reader tool, which all offer these functions in similar ways. However, only three make available the transcriptions of their documents and only two provide a search function to find words or phrases in the text of the manuscripts. Of those only one highlights the searched word in the transcription, whereas none highlight them in the image itself.
Another noticeable common ground for most of the listed websites is a rather cluttered navigation, that often poses difficulties to find the information of interest or the needed feature.

The research on visualising the content of images shows many different aspects on displaying the data of these documents and how to enhance the given data, in order to facilitate their analysis and interpretation. There is however no literature on how to present OCR'ed scans and their transcriptions in order to enable the work of linguists.

In conclusion, the findings show, that there is a great general interest in the transcriptions of historical or printed documents and making both available for the public. How best to do so, is however still to be explored. This project joins here and proposes a platform to view and interact with historical documents and their transcriptions at the same time, offering features of interaction

for both.

This subsection described the related work in the field of OCR'ed scans and their transcriptions. The following section gathers what researchers found to be important regarding the presentation of information on the web and user interactions.

2.2 HCI Components

This subsection first elaborates the aspects of Human-Computer-Interaction on the web and their impact on usability. It then exhibits the research on how to display information on websites and how to design user interactions.

2.2.1 HCI on the Web

Human-Computer-Interaction is a wide-ranging domain, that focuses on the user and the user's needs. Following researchers investigated different aspects of HCI and how to apply them to the design and implementation of websites in order to improve their usability and information communication.

Firstly, Ivory and Hearst [23] state the importance of incorporating HCI principles into the design process of websites, as poorly designed websites can be counter-effective regarding productivity and revenue. They emphasise the difficulty of finding the right guidelines for the given purpose and their implementation. They therefore explored automated approaches to help improve websites and present a tool which measures informational, navigational and graphical design aspects of a web page and delivers an assessment.
Heijden [18] investigated an extension of the Technology Acceptance Model (TAM) in an empirical study, to understand the acceptance and patterns of use of the single user. The results suggest that the user's attitude towards using a website is influenced by its enjoyment, ease-of use and usefulness, which in turn are influenced by the website's visual attractiveness.

Hoffmann and Krauss [19] reviewed the current state of literature on visual aesthetics for the web and laid a specific focus on the author's perception regarding the importance of visual aesthetics, how these affect the communication and what guidelines to follow when applying visual aesthetics.
The authors provide a framework of knowledge and formulate principles and guidelines for the application of visual aesthetics in order to most effectively support communication, such as the directive that it should support the intended message to make the user unconsciously choose to become involved in this particular message. Furthermore, they state, that visual elements rarely operate alone and that it is important to decide which research approach to follow in order to choose the right ones.
Lavie and Tractinsky [27] also address the importance of visual aesthetics in websites and developed an instrument to measure the perceived website aesthetic and validate it. They initially conducted four studies to first generate items and develop a scale using exploratory factor analysis and then conducted confirmatory factor analyses to assess validity and replication. Their results suggest that a user's perception consists of two main dimensions, namely the "classical aesthetics", which emphasises orderly and clear design and the "expressive aesthetics", which focuses on the designer's creativity.

Klett [26] focuses on e-learning and how to improve the learning efficiency of students by choosing the right implementation pictures, sign and media, regarding opportunities as well as

limitations for new aspects of presentation and interaction with the presented information. The researcher emphasises the importance of the user interface as it concerns the development of a learning model. This model will then itself emphasise an active construction of concepts and knowledge instead of merely inducing a passive learning experience of factual data. It is stated to provide various reality-close forms of presentation, as well as integrating a diverse range of media formats. This facilitates the context-based linking of contents and therefore improves the learning process of the presented content.

Furthermore, Issa and Turk [22] discuss the importance of usability and HCI principles in the development of marketing websites and explain how these aspects can reduce user frustration. Through interviews and questionnaires, the participants stated, that including such principles would enhance business, lower costs of development and maintenance and increase sales as the clients will be more pleased with the outcomes of the website.
Raward [40] presents the importance of these principles with regard to academic library websites and developed a checklist for best practice in the design process of this area of implementation. This checklist comprises around 100 questions divided into four main sections: Finding the information, understanding the information, supporting user tasks and presenting the information. Her research also shows, that user acceptance and usability are majorly important in the design of such websites and that the inclusion of an HCI model, is the key to being most successful.

Lastly, Bevan [3] compared guidelines for effective web design of three different sources: The 187 guidelines of the Department of Health and Human Services (HHS), the current draft of ISO 9241-151 and the 121 guidelines from the Joint Information Systems Committee for higher education (JISC). The research results in a revised and combined list of recommended guidelines and when to apply them.
This resulting checklist is analysed alongside other resources of web design and HCI principles and summarised in the following section.

2.2.2 HCI Principles in Web Design

There is a variety of guidelines and principles, that all have the intention of improving usability and user experience. A range of resources on HCI principles and guidelines that concentrate on web design and the display of information were analysed. This subsection concludes this analysis in a summary of rules applicable to the intended work.

Design Process
Designing a user interface needs to be carefully thought-through, as there are many ways of designing the same functionality with different outcomes of usability [3]. It is important to follow a goal-oriented process [10] by first establishing user requirements and then using an iterative design approach and evaluate websites before and after making changes [3].
Actions should be possible by direct manipulation, as this visually presents task concepts, allows easy learning and encourages exploration. Actions should generally be designed to be intuitive [10]. Furthermore, websites should provide menu selection to reduce keystrokes and learning, use form fill-ins and provide enough information to reduce short-term memory load for the user [45, 44].

Web User Experience Principles
In order to optimise the user experience, a website should display information in a directly usable format and avoid displaying unsolicited windows or graphics, as well as avoid opening unnecessary windows. It should provide assistance to users and standardise task sequences.

Furthermore, important links should be put in the content, as that is the user primarily focus their attention on [3, 45].
To increase usability, it is necessary to know the user and the task [9] and thus reduce the time to learn how to interact with the website, as well as the time to fulfil a certain task to a minimum [45]. Usability in general can only be assured by ensuring the attributes of effectiveness, efficiency, user satisfaction, learnability and flexibility [9].

Design Choices
A website should ensure accessibility not only by colour alone to convey information, providing text equivalents for non-text elements, ensuring that scripts allow accessibility and enable users to skip repetitive navigation links [3, 45, 31, 35]. Hardware and software should be considered, as to design for common browsers and operating systems and to take their differences into account [3].

Content Organisation
The information of a website needs to be clearly organised, and critical information put near the top of the page. This facilitates scanning of pages, which supports reading patterns (e.g. F-Pattern) [3, 31]. Furthermore, it is important to create visual hierarchies [10] and group related elements [54, 10, 35]. Elements should also be aligned to provide visual connections [54], which should also be established by grouping, as well as contrast elements by colour [3, 10]. It is also important to make a website responsive [31].

The Homepage
For the Homepage of a website, it is important to create a positive first impression [3, 31] and insure that it looks like a Homepage [3]. It should enable direct accessing of relevant information and show all main options that are provided [3, 31]. In general prose text and the total length should be limited [3].

Layout
The layout of a page, as well as all text lines should have an appropriate length [3, 31, 35]. Shorter lines increase readability [54]. The content should fit the expected size of the display area [3], with the navigation taking not more than 20% of the page [31]. Important items should be placed at the top centre and be placed consistently [3, 35]. Items in general should always be aligned [3]. It is also advised to stick to familiar interface conventions and practicing simplicity [35]. Animation should always be kept to a minimum and only be used sensibly [3].
Furthermore, scrolling should also be handled carefully and be used for reading comprehension, as users won't look for content, that might be hidden, if they do not expect it (white space at the end of paragraph for instance indicates end of page) [3, 35]. Horizontal scrolling should be eliminated completely [3].

Navigation
The navigation of a website can be crucial for good usability. It should always provide feedback on the user's location and use appropriate menu types, also considering that breadth beats depth [3, 10, 45, 31]. Tabs should be presented effectively and have descriptive labels [3, 10]. The navigation should be easily learned [10] and be organised in a meaningful manner, as to have a suitable structure [3]. Furthermore, it should remain consistent [10, 45] and support the user's behaviours and navigation strategy [3, 10].

Page Content
Headings and titles on pages should use clear category labels and be unique as well as descriptive [3, 31, 35]. Links should be descriptive text and provide consistent click ability cues and avoid misleading cues. They should be highlighted after being visited. Important links should be

repeated [3].
Text should be black on plain, high-contrast backgrounds and ensure visual consistency both in general and specific text items [3, 31, 35]. It is best to use familiar fonts and at least 12-point [3, 35]. There should not be more than two different font sizes on a page [45]. Important content should be emphasised, whereas contrast should be made visible: if it is not the same it should be very different [3, 54]. Overall, the content should not take the whole width of the page [3] and not contain more than four different standard colours. Additional colours can be used occasionally [45].
Finally, when writing content for the web specifically, it is important to use familiar words [3, 31, 35], make first sentences descriptive and write in active voice, while being careful to limit the number of words and sentences on one page [3]. Instructions should be in the affirmative [3].

This summary forms the foundation, the design process of this project is based on. The next and final section of this chapter recapitulates the overall findings to formulate this foundation.

2.3 Conclusion

This chapter first presented the related work focusing on the display of historical documents on the web, by introducing existing websites that display similar content to what this project intends to, as well as the research that has been done in this field. Both show a lack regarding the work that has been done to present historical documents alongside their transcriptions to enable interactivity such as selecting and highlighting text lines, searching for words or phrases in both text and image.
Secondly, this chapter substantiated the importance of Human-Computer Interaction in web development and provided a summary of HCI ground rules, which are essential to create a good user experience. This project intents to fill this existing gap and hereby enhance the field of work, respecting the listed HCI principles and methods. This starts by identifying and specifying the requirements during the design process, which will be discussed in the next chapter.

3 Requirements specification

One of the guiding principles in designing user interfaces is to remember that the user is in the centre of everything [17]. It is crucial to keep in mind, that the user is not the person designing the tool or system, but that this person is designing it for the user. It is therefore essential to gather as much knowledge about what the user needs in order to create something the user will want to utilise [45, 9, 17]. In order to abide by this principle, the initial requirements for this project were enhanced and revised with information gathered from a user interview.
This chapter first states these initial requirements. It then describes the design process of gathering the user requirements by means of a contextual inquiry. Finally, it establishes the revised requirements by analysing all retrieved information.

3.1 Initial Requirements

The initial requirements comprise the creation of a web-based application, enabling the interaction with OCR'ed historical documents. They also specify the interaction to include a range of features, as well as certain directives for the website implementation. All of the above will be discussed in the following.

3.1.1 Website Implementation

The project momentarily encloses six scans of a manuscript of the ancient French Bible, as well as XML files containing their transcriptions and coordinates of each text line. The website is however intended to host up to all pages of this manuscript and possibly a variety of books in the future. It should therefore be implemented in a way, that easily allows enhancement, once more scans have been made available.

3.1.2 Features

The features of this application should include the possibility to see the scanned documents as well as their transcriptions. Additionally, the user of the website should be able to interact with the scans and transcriptions in order to facilitate the work these users are looking to engage in. These interactions should include zooming in and out of the image, switching through the available scanned pages and their transcriptions, as well as selecting them directly. It should also be possible to click on lines to highlight them, both in the transcription text and the image.

As already stated, in order to be able to build a usable website for the targeted end user, it is essential to integrate the user into the design process [45, 9, 17]. Therefore, the next step involved the definition of the end user profile, the questioning of one potential user and the analysis of the interview. Each of these aspects will be discussed in the following subsection.

3.2 Defining the User Requirements

Defining the user requirements consists of first understanding and defining who the intended end user is. Knowing who will be using the system is crucial for making this system appealing and usable for its target. The next step is to get an overview on how this user works and acts, in order to incorporate these interaction strategies into the interaction sequences of the system. Finally, the definitive user requirements can be extracted by compiling all gathered information and their analysis and interpretation. In the following, these three steps are discussed.

3.2.1 The User

The intended end user of this project's resulting web application are primarily historians and linguists who's work include the exploration of historic manuscripts. The website has the intent of constituting a way to facilitate this work in general, as it places these manuscripts at the disposal of the web and therefore of anyone who is interested.
The primary target at this point of the development however are historians and language specialists that work with the manuscript of the French Bible, of which the pages 506v to 508v are the only pages the website will initially provide.

3.2.2 Contextual Inquiry and Analysis

Before setting the conclusive goals for this project, an interview was held with one potential user of the website. This interviewee has a special interest in the resulting website of this project and was therefore fairly elaborative. This allowed the retrieval of the necessary information.
The semi-structured interview concentrated on the interviewees line of work. It sought out to identify all important interactions with this sort of manuscripts to understand the needs of this end user. This section first elaborates the interview questions as well as their intention and then presents the resulting information. The full record of the questions and the noted answers can be viewed in Appendix 10.

Interview questions
In the introductory part of the interview, the intentions and the scope of the project were explained, as well as the ethical issues clarified. No personal data was taken.
The questions concerned the field of research, what the interviewee is currently working on and what work or interactions is performed on historical documents in general.

The next part of the interview centred on the work with OCR'ed scans. The questions asked about interactions with this kind of scans and the work that is performed specifically on OCR'ed scans of historical documents.
Next, the focus concentrated on the use of websites and tools that present such scans and their transcriptions. It was asked whether the interviewee had ever worked with such a tool or website and what interactions they would appreciate in general both in a website or tool.
Furthermore, it was queried what features they would like to see and use as a user of a website, which presents historical scans and their transcriptions, in order to perform their work. It was asked, if they could think of a feature in particular, that would be essential for their work and what other information they would want the website to make available.

Results
The introductory questions revealed that the interviewee's research field is the analysis of old documents and to find and understand the history and the development of words. At the moment they are looking to find the origin of the word "du" rather than "del". In order to do so, they need to find all occurrences of those words to track the time at which the change took place. The work on historical documents in general involves understanding the language differences of different copies of the same text. The texts are being analysed to find usages of specific words, spaces or punctuation to explain their evolution over centuries.

Next, the main questions concluded that the interaction with OCR'ed served the purpose to get information about what scan of which document it is, as well as examining the transcription thoroughly in order to identify mistakes and compare it to other transcriptions of the same

document if applicable. The work on OCR'ed historical scans in particular includes searching for words or phrases in the transcription, looking for patterns of words, word endings, abbreviations etc. and identifying spaces of different sizes, as each size of a space has a different meaning.
The interviewee has never worked with a tool nor website that presents OCR'ed historical scans and says that the feature they would appreciate most in such system was for it to be absolutely intuitive. Furthermore, they would like to be offered the possibility to find patterns of words and to identify the frequency of the occurrence, as well as concordances in a text. These concordances should be offered to save for the next text or scan. It should also be possible to search for words and phrases, abbreviations and word endings and allow for a distinction between them. A reader should also be notified about abbreviations, however someone that is not interested in them, should not be bothered by their notification.
Additionally, a website should show the scan as well as the transcription, for the users to be able to interpret the text themselves. They explained, that transcribing ancient manuscripts is a matter of perception and interpretation, which is why it is possible to get multiple transcripts of the same text.

The interviewee identified the website being intuitive as the most important feature for it to be useful in this line of work. The navigation for instance should be well thought-through, especially when there are multiple books available. Finally, the website should be usable for many different purposes and inform the user in detail about what it has to offer.

3.3 Interaction and Design Requirements Extraction

Interaction design requirements define all functionalities a system or tool needs in order to fulfil a job, as well as all the tasks a user needs to accomplish in order to fulfil a job [17, ch. 5, p. 161]. These requirements should not be equated with software specifications. They are not about how the system needs to be implemented, but a description on what needs to be possible after the implementation is finished.
The interaction design requirements for this project were extracted from both the initial requirements and the user interview. The outcomes were assessed and ordered by their importance to fit three main categories "Absolutely necessary", "Important" and "For future enhancement", and are illustrated in the table below (see figure 3.1).

Absolutely Necessary	Important	For future Enhancement
Website should be absolutely intuitive	Allow the user to make own suggestions for transcription	Compare different transcriptions of the same text
Display scan AND transcription	Show information of what website has to offer	Facilitate enhancement of website
Enable search for words/phrases/ abbreviations/word endings	Well thought-through navigation (Becomes more important with a growing amount of available books)	
Allow user to select specific page		
Show the user where they are at all times		

Figure 3.1 – Table of all extracted requirements for the website.

This chapter presented the design process of the project and how the definitive requirements were extracted and categorised. The next chapter will clarify any ethical issues.

4 Ethics

This project focuses on the creation of a web-based application. Therefore, the user needs to be involved in the design process as well as in the evaluation process. The project did not need to involve nor required the use of any personal data or information, therefore the questioning of a potential user as described in section 3.2 did not gather any personal information nor was any data recorded in any way that could identify the interviewee and was therefore freed of any ethical issues.
The testing and evaluation of the resulting product, described in 7 was an anonymous online study and stated this in the introductory text. The participants were not asked to enter any personal data. There are no ethical issues that arise from the website itself at this stage.
The ethical approval document for the user study can be found in Appendix D.

This concludes the ethical issues regarding this project. The next chapter will present how the requirements stated in section 3 were interpreted and what design decisions were made to comply to them.

5 Design

Designing a new system or tool for user interaction purposes is a step by step process. After retrieving and defining the definitive user requirements, ideas and designs are modelled [17, ch. 6-8]. This chapter describes the design process by first explaining and illustrating the conceptual design and sketching process, then presenting the overall design decisions and finally elaborating on the design of the main features.

5.1 Conceptual Design and Sketching

The ideation process was initiated by working out the conceptual design. It has the purpose of communicating the design visions of a system or product with the goal of translating the ideas into a concept [17].
In this project, a work flow model was created, as well as two hierarchical task models (see in Appendix B), each describing one of the main tasks performed on a historical document. These models visualise the actions a user will undertake in order to accomplish a certain task. This process deepened the understanding of the user interactions, that need to be possible with the website, and outlined the three main parts: Examining the manuscript, searching for words or phrases and comparing two versions of the same manuscript.

These results were then interpreted by sketching out the ideas for the structure of the website, before starting the implementation. The sketches focused on the three main parts outlined above and visualised possible arrangements, variations of the positioning of elements and interactions. This process not only helped getting an overview of what is possible, but also induced the creativity and ideation process. The sketches can be viewed in Appendix A. Based on these sketches, as well as the preceding research, design decisions were made for the overall website and the individual pages, which will be presented in the following section.

5.2 Design Decisions

All design decision rare based on the research and the design process, including conceptual design and sketching. Building on the requirements and intended usage, the website is laid out to be desktop-first, responsive to different screen sizes and accessible according to the POUR principles [7]. For best experience, the screen should however be large enough to show image and transcription next to one another. All final designs are discussed in the following, detailing the fundamental structure, navigation and interface.

5.2.1 Structure

The core structure is written in Hypertext Markup Language (HTML) and visually styled with Cascading Style Sheets (CSS), integrated by an external style sheet. All interactions with and within the website are implemented with JavaScript and jQuery, a fast and small JavaScript library, that facilitates and simplifies HTML document manipulation, event handling, animation and addressing elements in the Document Object Model (DOM) [25].

The website is a single page web-application. The different "pages" or tabs are handled and animated with JavaScript by only showing the relevant DOM content and hiding all other elements. This way, the entire content is loaded once in the beginning and does not need to be reloaded, after the user switches between the different tabs. This increases the site's speed and therefore offers a better user experience. As the images of the scanned manuscript pages are considerably big, loading and reloading of the images could have a significant impact on the

website speed.
Another aspect considering speed is the way the images are loaded. The images are all saved in two different sizes, having different resolutions. One low-resolution and one high-resolution image. The website loads the low-resolution image first, presenting the user with a visual component instead of a black screen until the high-resolution image is ready. The high-resolution image is then necessary for all close-up examination of the document, utilising the zoom function. Furthermore, both the images and transcriptions are stored and loaded solely on the client side. This design offers a more robust alternative, as opposed to storing the files in a database and calling them on the server side. It helps preventing website failures due to loading issues on the server side or problems with the database, also facilitating maintenance.
Finally, the individual transcriptions are stored in JSON files. Each file contains information about the page number, both width and height of the image, and the transcription lines. The lines are further specified with the line number and the coordinates of the line in the image and lastly the text of the line. JSON was chosen due to its simplicity [31, 35]. Furthermore, it is data-oriented, which makes it easier to map it to object-oriented systems.

5.2.2 Navigation

As previously stated in section 2.2, the navigation is one of the most important components of a website. Considering the page content on the main pages, the navigation menu was set to be a top navigation bar, visible at all times. This allowed to leave the whole width of the page to the content, without taking space away on the sides. It consists of four main menu tabs, representing the four main "pages" of the website: "Home" for the Home Page, "Transcription" for the transcription page, "Search" for the page presenting the search results, and "Compare Manuscripts" where different manuscripts will in the future be able to be compared.
The tabs are placed next to each other, abiding by the principle of "breadth beats depth" [3, 10, 45, 31]. At the moment, for the scope of this project, all navigation elements are single links, however, they can be further enhanced, when the website content grows. This enhancement might be done by a drop-down menu or additional tabs.

5.2.3 Interface

The interface follows the rules of simplicity to not disturb the user with distractions or elements that do not contribute to fulfilling their tasks or needs. Guiding principles and research suggest using sans-serif fonts [41], however it is also said to match the design to the content and that the use of familiar fonts in general is most advised [54]. The choice of font-style therefore is "Times", which is serif and one of the most common fonts [41]. It matches the theme of ancient documents, as those are written in serif font-styles themselves.

On the website, all items are aligned to one another to form a visual consistency.
Consistency is also ensured by using the same two colours in different shades, but no more than 2 shades. The core colour is part of the St. Andrews University colour palette [48], called "St Andrews Mid Blue". This colour appears in the navigation bar, signalling the active tab, as well as in the highlighting of the textiles in the image. The highlighted lines in the transcription have a lighter shade of the same blue. The second colour appearing on the site is a light grey, which indicates that the mouse is hovered over a clickable element (e.g. in the navigation bar, the arrows to switch between the manuscript pages and the feedback-feature element). Clickable elements are always introduced by the change of the cursor.

5.3 Main Components

The website consists of four main sections, which are presented as different pages and can be navigated to and from via the navigation bar. This section discusses their structure by mapping out their elements and content.

5.3.1 The Home Page

The Home Page of this websites is the first page visible, when the website is first loaded. It consists of one main container, setting out the content and what the website has to offer.
After a small introductory text, it holds a table of content, showing the features that this website provides, as well as the available book pages (see figure 5.1).

Figure 5.1 – Image of the Home Page screen of the website.

5.3.2 Transcription Tab

The second feature of the website, the transcription menu, can be found by clicking on the "Transcription" tab in the navigation bar. This section contains the most elements.
Underneath the navigation bar sit all further navigational items, including two arrows to switch between the pages of the manuscript, as well as the selection drop-down menu in between, to select the pages individually. Furthermore, there is the text input field to search for words, etc. followed by the button initiating the search function. Below this input field is situated the check box "Search whole Book", which defines whether the search is executed on all pages or solely on the visible page.
This line stays the same for both the transcription tab and the search tab, which will be discussed in the following section.

Below this, the main content is featured, divided into two parts. The left-hand side shows the image of the scanned book page, and the right-hand side the corresponding transcription. The lines of the transcription imitate the lines in the scans with regard to their content. This means, every new line in the scan is a new line in the transcription. Figure 5.2 shows all main aspects.

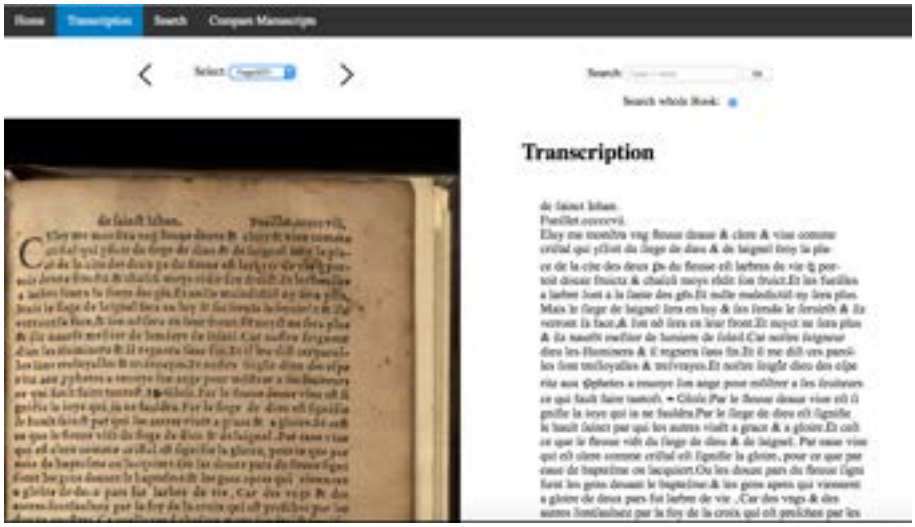


Figure 5.2 – Image of the Transcription page of the website.

5.3.3 Search Tab

The search tab can be activated by clicking on the "Search" tab in the navigation bar, or by initiating the search function.
Its structure is similar to the transcription page - only the content in the container on the right changes. Instead of showing the transcription pertaining to the image, it features the search results. If no search has yet been made, this content is empty. Otherwise, it shows the results of the last search, line by line, including the page on which the word can be found, and the actual text line (see figure 5.3).

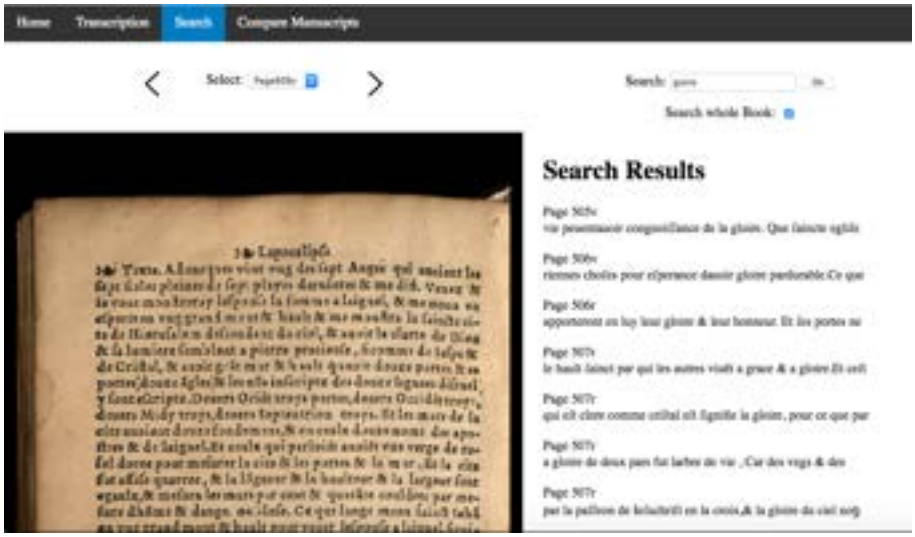


Figure 5.3 – Image of the Search page of the website, illustrating a successful search.

5.3.4 Feedback Feature

The feedback feature is a hidden pop up container. After a headline, it states the current book, book page and line that has triggered the feature. Below this information is shown the part of the image containing the line and its transcription below.

Next, there are two text input fields, asking the user to put in the word or phrase they want to comment on and its correction, followed by a text input area to leave a larger comment about this correction and a final submit button.

This pop-up window, when opened, covers the transcription but stays on the right as to still allow the viewing of and interaction with the image (see figure 5.4.

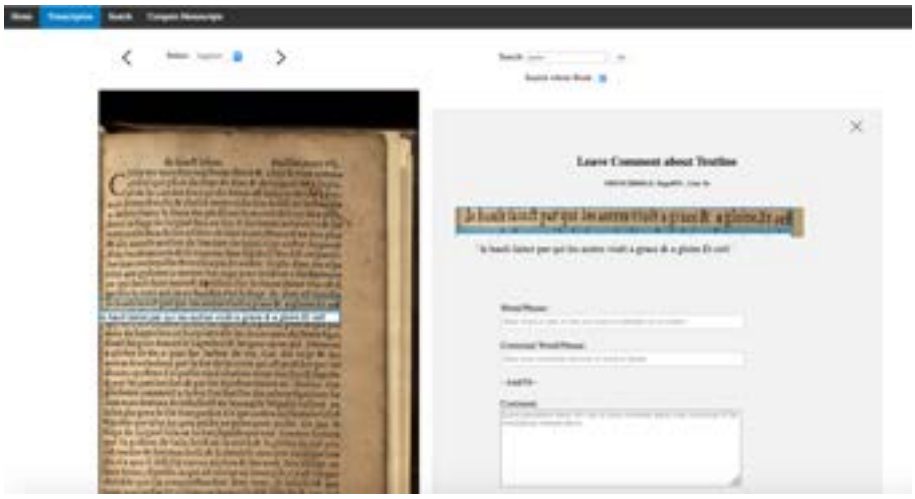


Figure 5.4 – Image of the opened pop up to leave a comment. The scan is still visible on the right.

5.3.5 Comparing of Manuscripts Tab

This last part of the website goes beyond the scope of this project. It is for now a place holder, however additionally serves as introduction to this feature.

This concludes the design characteristics of the website. This chapter first outlined how the requirements were transformed into conceptual ideas and then described the design decisions that were made to implement these ideas. The next chapter details the implementation.

6 Implementation

After displaying the design and structure of this project, this chapter discloses the implementation of each of the main features. The core code follows an object-oriented structure.

6.1 Transcription Feature

The transcription feature represents the biggest part of what this website has to offer. It therefore encompasses the majority of the code and functions. The following sections explains the main functionality of these parts respectively.

6.1.1 Loading and Display of Images

All images need to be stored in one low-resolution format and one high-resolution format.
The loading of the images happens as follows. In the main script, an image is "added" to be loaded and stored as an instance of a class, which stores all image records. Then, first the smaller image with less resolution is loaded and displayed in a canvas in the DOM until the high-resolution image is ready. If so, the canvas is reloaded with the high-resolution image.

The canvas then offers several ways of interaction with the image, namely zooming in and out, moving the visible part of the image in order to display different extracts of the image and clicking on the text to highlight a line. The implementation of the latter will be discussed in detail later on.
The zooming is induced by mouse scroll or equivalent behaviour (e.g. scrolling with a trackpad). It is handled by a range of functions, which calculate the zoom factor and the image size, in combination of the current zoom factor. They then redraw the canvas according to the position of the mouse and the new sized extract of the image.
Changing the shown part of the image works similarly. When the user clicks on the image, the new image cutout is mathematically computed, using the coordinates of the former position of the cursor, as well as the new position of the cursor. These functionalities, as well as the loading of the images were based on the code provided by the "Stela of Iy" website [6] and adapted accordingly.

6.1.2 Displaying of Transcriptions

Transcriptions are loaded similarly to the images. Their files are also individually added in the main script to be loaded. For each transcription, all information from the associated JSON file is extracted and individually stored in a class instance of the transcription data. The coordinates are extracted, calculated to fit the canvas size and stored separately in respective class instances as rectangles, to be used on demand. In order to be able to use them correctly, these rectangles are mapped to their line as well as their book page.
The text is also extracted from the JSON files and inserted into the DOM, creating one new container for each page and a new paragraph for each new line, added to this container. Each container is given a unique attribute (ID), as is each line. These ID's are a compilation of the book name, the page number and the line number. This enables them to be addressed individually, which is necessary for the highlighting of the lines. The highlighting is ensured by additionally enclosing a click-listener to each line.

6.1.3 Highlighting of Lines

The functionality of highlighting lines uses both the information from the paragraphs in the DOM and the information stored for each page and line.
Highlighting can be triggered either by clicking on a line in the text or in the image. When the text is the source of the clicked object, the ID from this object is extracted and compared against the stored rectangles for this ID. This rectangle is then visualised in the image, surrounding it and adding the superimposed text line below, whereas the paragraph in the text is changed to have a background colour.
When clicking the lines in the image, a different function takes the position of the cursor and checks the area that has been clicked to compute the ID mapped to the surrounding rectangle. This ID is then compared to those of the existing text lines in the DOM and if matched, both are visualised and highlighted.

In order to facilitate the work when going through each line of the text, an additional functionality was implemented, which allows the consecutive highlighting of lines by pressing the key "n" for "next" and going through them in reverse by pressing "p" for "previous".

6.2 Search Feature

The second important feature of this website is the possibility to search the transcriptions for specific words, characters, phrases or others. This section discloses how this function was implemented and the display of its results.

6.2.1 Search Function

Searching for words, etc. is possible both on the "Transcription" page and the "Search" page directly. The results are always shown on the "Search" page, which also shows the current scan. The scan keeps its functionalities. Empty searches are not allowed and alerted to the user, as well as searches without results.

When initiated, the search function first checks, whether the search should be conducted for all book pages or only the selected page. It then retrieves the user input from the input field and compares it gradually to targeted text lines. Using regular expressions, a line ending in a hyphen evokes the addition of the next line's first word to ensure the inclusion of hyphenated words in the search. Each match is recorded and added to the DOM to be displayed.
To change the search into being specific to the selected page only, the responsible check box needs to be unchecked. This is possible before or after a search has been executed and adjusts the display accordingly.
The search function is case-sensitive to allow the search for start of sentences.

6.2.2 Displaying of Results and Highlighting of Lines

Displaying the results of a search happens almost identically to the displaying of text lines of the transcription. Each line receives an ID compiled from the book title and page, and the line number, as well as a click listener. In addition to the text line, a paragraph is added to show the page number on which the line was found. If the searched word includes a hyphenated word, the next line is also displayed.
The highlighting of the text and image, also acts identical to what was explained above. In

addition however, the function handling this event changes the presented image, if the selected line was not found on the currently visible page.

6.3 Feedback Feature

The feedback feature is the third important feature. The following describes its functionalities and their implementation.

6.3.1 Displaying of Feedback Form

The hidden feedback form is called by clicking on the feedback icon. This icon is added onto every line, when created in the DOM. However, it is only visible on highlighted lines. What is more, a tooltip stating "Leave Comment" is displayed, when the mouse hovers over the icon.

The function handling the opening of the feedback form gets passed the information of the clicked object and extracts the necessary information of the object's ID. It then takes this information and fills the form, displaying the book title, the currently visible book page and the highlighted line number. This is furthermore needed to fill a small canvas inside the feedback form, which depicts the content of the rectangle surrounding the selected text line.
The canvas is filled by getting the coordinates matching the currently visible rectangle and displaying the part of the image with these coordinates.

Exiting the feedback form is possible by clicking the "Submit" button at the bottom of the pop up and thus submitting the entered content. Or by closing the form without submission via the exit icon in the top right corner.

6.3.2 Leaving a Comment

As the project encompasses only the client side of the website, leaving a comment is not yet connected to any form functionalities. For testing purposes, the entered information is stored in a local variable.

6.4 Testing

All features have been tested by creating unusual circumstances. These are summarised in the following.

Website
The website was opened in different browsers and works perfectly on Firefox, Safari and Google Chrome. Internet Explorer fails to display the canvases.

Highlighting
The highlighting of the next or previous lines via keystroke only continues as longs as there is a "next" or "previous" line and otherwise stays still.

Search As stated, an empty search is caught and alerted to the user. The testing of searching for words, which are known to be hyphenated revealed that even though the function matches the

first line of the next page, the result was unsuccessful. As the next page states the page number in the first line, the matched word is false.

This chapter outlined the implementation of the main functionalities of this project's website and summarised their testing results. These functionalities as well as the overall usability of the website were then evaluated in an online survey. The setup and outcomes of this survey are discussed in the following chapters.

7 User Testing

Testing a product or system is one of the four essential parts of the universal abstract activity cycle [17, ch.2]7.1 and is generally acknowledged to be crucial for designing good user experiences [2][17, ch. 2][35, ch.1][42, 32][45, ch.1]. Applying HCI and usability guidelines to the design is important, however every guideline will evidently be interpreted for the existing purpose and might therefore bring different outcomes. A definitive guideline or protocol does therefore not exist to predict usability [35]. User testing is a way to estimate the actual usability of a product or system, gauge how the users react to it and get feedback on how to further improve it. One key in testing a product is - the earlier in the development process the better [17, 42].

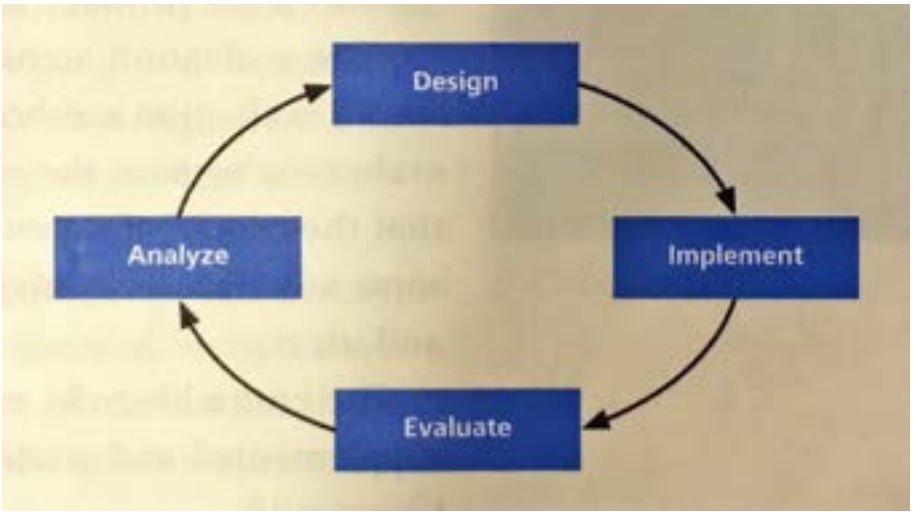


Figure 7.1 – Scan of the "Universal abstract activity cycle", illustrating the process of developing a new system [17, ch.2, p.53]

One of the main goals of this project was to provide a good user experience by ensuring good usability, as this is necessary for making users want to stay [32]. After the initial implementation process, the website was evaluated by conducting an online user study, asking the participants to fulfil certain tasks and appraise the performance. This chapter first discusses method, recruiting and procedure of this study and concludes by disclosing its limitations.

7.1 Methodology

Utilising a quantitative approach, the study was conducted as an online survey, with the possibility of gathering qualitative information on the participants' thoughts by providing an opportunity to leave comments. The study sought to identify usability deficiencies of the main features and gauge overall user satisfaction to eliminate design problems and thus prevent user frustration.

Opinions on the number of participants needed for such a study vary between researchers. Nielsen argues that five participants are enough to find 80% of all usability problems [34]. This was however refuted by researchers on several occasions, stating that five users are not nearly enough and reformulating the rule to suggesting 10-12 users are needed for general testing [20, 47]. This number may vary depending on the level of expertise of the users, meaning that 8 experts could find the same amount of usability problems as 10-12 non-experts.
The number of participants for this study was therefore set to a minimum of 12 participants.

Opting for an online survey rather than an in-situ lab study allowed for reaching out to more possible participants from more diverse backgrounds. However, not being able to observe the participants movements meant, it would be more difficult to understand their actions and their thoughts behind them. The participants of this study were therefore given detailed instructions and answer questions after each action, rather than letting them browse the site on their own. They were asked to open the website on a different browser window or tab to be able to switch back and forth between the website and the survey.

The questionnaire was analysed by transcribing the text-input answers to identify patterns, as well as gather all user feedback. For all quantitative questions, the mean and standard deviation were calculated to identify trends.

7.1.1 Qualtrics

Qualtrics [39] is a company seeking to help build technology which enriches experience. It is situated in nine different countries over the world. One of their services they offer, is providing a platform to create, host, manage, and analyse online surveys. The University of St. Andrews allocates access to this platform for its students. This access to an individual account was utilised to create and launch the survey, as well as building the groundwork for the analysis.

7.1.2 User Tasks

The user tasks needed to elicit specific actions in order to test whether these actions come naturally to the participants or if they have trouble finding the right action to fulfil the given task. Each task therefore served the purpose of testing one or several targeted features of the website. A task is initiated by asking the user to find a way to answer the provided question(s) by manipulating or browsing the website. After each task, the participant should return to the survey and answer the corresponding questions. The answers to these questions should elaborate if the participant was able to correctly accomplish the task.

7.1.3 Usability Testing Questionnaires

The second part of the user study was a questionnaire focused on the evaluation of the website's usability and the participants' experience. The questions are a compilation of carefully researched sources presenting evaluation questionnaires.
The items of the Likert-scales in sections "Ease-of-Navigation" and "Statements" were based on the items, which have been tested and assessed by Wang and Senecal [53]. The rest of the Likert-scale items were based on the questionnaire, provided and tested by Tullis and Steson [51]. All other questions were created specifically for this survey.

7.2 Recruiting

Participants for this study were recruited by sending out emails to acquaintances from a variety of backgrounds and ages, asking them to forward the link to this survey to others that might be interested in taking part. This evoked avalanche effect drew together participants situated in France, Germany, USA, Italy and the UK and enabled the recruitment of at least two linguists, interested in this website for future usage, in addition to the minimum of 12 non-expert users. All responses were anonymised and do not reveal any personal information or identity of

the participants.

7.3 Procedure

The study consists of two main parts. In the first part, the user is asked to fulfil certain tasks in order to answer specific questions. The second part constitutes of the evaluation of what the user just experienced.
The detailed structure and survey questions will be presented in the following.

7.3.1 Study Structure and Tasks

The study starts by introducing its purpose and structure and informing the participants of what they will be asked to do and that no personal data will be taken. It is emphasised that they have all rights of terminating their participation at any time, without explanation.

After agreeing to participate by clicking to continue, the user is first asked to open the website, under the provided link, in a second window or tab, before answering the first question.
This initiates the first part of the survey. It consists of five segments, each with the aim of testing a specific feature of the website.

The first question "What items can you identify as being links on the initial page, the Home page?" has the objective of finding out if the navigation bar is recognised and identified as such.
The second section asks the participant to go to the transcription feature before answering the next questions. These questions seek to make the user try to identify all possible interactions with both the image and text respectively, as well as determine whether the drop-down menu for selecting the book pages on the website is sufficient to indicate what page is currently shown.
The third segment of questions focuses on testing the word search feature in general, by asking the user to search for certain words. The fourth part aims to identify whether the user notices the checkbox, that specifies the scope of the search.
The fifth and last segment first asks the user to examine a specific line on a specific page. This aims to induce the usage of the zoom and moving of the picture, in case the participant did not identify this earlier. Then, they are asked to imagine the first word of this specific line was not correct and are asked to try to leave a comment about it, without giving any other indications or instructions. Following a successful interaction with the website, the user is asked for a detailed description of the undertaken steps and to rate the ability to understand how to fill out the feedback form for this purpose. Concluding this first part of the study, the user is then asked to identify the features, they noticed on the website, by checking all applicable options. The next question shows the same options again, this time asking the user to select all the features they have used.

What follows is the usability questionnaire, which will be explained in the next subsection.

7.3.2 Evaluating Questions

The questionnaire for the evaluation of the general usability of the website consists of four parts, concentrating on different aspects of usability: Ease-of-Use, Speed, Interactivity and Attitude and Interface.

The first section shows three 7-items-likert-scales, one to rate the difficulty of fulfilling the tasks and therefore answering to the questions, one to rate how much time it took to find the

feature that enabled the execution of a task and one to rate how much time it took to find the feature that helped answering the given question. This aims to assess the noticeability of the features as well as gauge how intuitive the presentations of these features are.

Next, the ease-of-navigation is estimated by a set of nine sentences, the user is asked to agree or disagree with on a 7-item-likert-scale. The next block, containing four sentences are for the assessment of the website speed, the third block with five sentences seeks to evaluate the interactivity and the user's attitude towards the website in general. The final block, encompassing eight sentences focus on the assessment of the interface.

The closing section of the survey asks the user to estimate their experience with computers. This aims to assess the diversity of the participants. Lastly, the participant is free to leave any kind of further comment in an open-ended question box.
The printed version of the survey can be viewed in Appendix C.

7.4 Limitations

One of the most common and successful methods of user testing is the cognitive walk-through, where the participant is asked to do certain tasks with the product or system in a lab-setting and express any thoughts and explanations regarding their actions while performing this task [49, 33, 37]. This ensures a full understanding of what users think and how they act, while observing them in action, being able to compare their thoughts to their actual gestures. This form of testing, however was beyond the scope of this project, due to its short time span. An online survey is a valid alternative, it relies however entirely on the honesty and cooperation of the participant, which can never be guaranteed.

Furthermore, it was not possible to recruit solely from the targeted user pool, as there were not enough potential participants available. This is for one due to this time period, as many of them might be on holiday, and secondly, they are difficult to be sought out. This means, that the features might be assessed differently by users who are familiar with the kind of work they are intended for.

This chapter disclosed the undertaken user study, by explaining the importance of user testing, describing its methodology, how the participants were recruited and outlining the procedure. Finally, the limitations of the user study were explained.
The following chapter presents the results.

8 Study Results

The user study was kept in progress for a total of seven days and recorded 16 responses. One response however only showed five of the answers and was therefore excluded from the analysis. The computer affiliation amongst participants was equally distributed (see table 8.1). This chapter first presents the user responses regarding the user tasks, then shows the resulting user assessment of the usability and states the feedback added by the participants throughout all text-input questions of the survey. Finally, these results are interpreted and discussed.

Computer Specialist	2
Above average computer affiliated	6
Average computer users	4
Below average computer	2
Complete computer novice	1

Table 8.1 – Summary of how the participants categorised themselves regarding their affiliation with computers.

8.1 Results of User Tasks

The participants managed to fulfil their user tasks and answer to the corresponding questions as follows. 73.33% of the participants correctly identified the navigation bar as being clickable items on the Home Page. All others entered something not applicable to the Home Page. Next, 80.00% entered "505v" or "first one" as being the initial presented page. One answer showed "506" and another "506v". Two answers were not applicable.
The interactions, the participants recognised as possible with the image were clicking on the lines in the image (80.00%), zooming (53.33%), scrolling (20%), clicking on the lines in the transcription (13.33%) and downloading the image (13.33%). Only one identified "move". Further single answers were "taking screenshot", "changing page". What other interactions with the page could be identified, participants answered with "search for words" (66.66%), "click on lines" (60.00%), "comment on line" (53.33%), "search whole book" (46.66%), "select pages" (13.33%), "switch through pages" (13.33%). Two participants replied "nothing" and one said "comparing of lines".
The next sequence of tasks showed 14 correct answers on how many times the word "femme" appears overall (93.33%). One participant stated to not being able to search for the word, as the cannot copy and paste the word from the transcription into the search bar. 86.66% stated the correct pages to contain the word "patriarches", "505v, 506r, 507r" (8) and "505, 506, 507" (5). One only entered the first of the correct pages and one stated the same copy-paste problem as before. The similar question on how many times the word "gloire" was used on page "507r" in the next task sequence revealed 73.33% of the correct answer being four times. 20% answered "6" and one person said "0".
The last task required leaving a feedback comment and explaining the step-by-step process. The answers varied in their elaborateness. Ten participants (66.66%), however explained they first clicked on the line and then on the feedback-icon at the end of the line. Two (13.33%) first searched for the word and then clicked on the line in the search results, before clicking on the icon. Another two only stated to have clicked on the icon. Moreover, the participants said the form to be clear (33.33%), rated positively (20.00%), very easy (20.00%), rated 8/10 (13.33%) and two (13.33%) answered "not easy" and "icon too small". Some participants added comments, which will be discussed in a later subsection.
Lastly, which features have been identified by the participants and which they used, is illustrated

in figure 8.1.

Feature	Identified by (%)	Used by (%)
Switching through tabs in the navigation bar	15 (100%)	14 (93.33%)
Zoom on image via mouse scroll	10 (66.66%)	8 (53.33%)
Zoom on image via key strokes	2 (13.33%)	2 (13.33%)
Moving the image in the window when zoomed in	8 (53.33%)	8 (53.33%)
Switching between images with arrows	7 (46.66%)	5 (33.33%)
Selecting images via drop down menu	12 (80.00%)	12 (80.00%)
Clicking on lines in text	14 (93.33%)	15 (100%)
Clicking on lines on image	13 (86.66%)	12 (80.00%)
Switching through lines with the help of the keyboard (n - next, p - previous)	3 (20.00%)	1 (6.66%)
Entering a word in text entry line for word search	15 (100%)	13 (86.66%)
Changing the word search to only search in the shown page	14 (93.33%)	12 (80.00%)
Using the word search on the transcription page	13 (86.66%)	13 (86.66%)
Clicking on the "Search" tab to go to the search page and use the word search there	12 (80.00%)	11 (73.33%)
Feedback feature by clicking on feedback icon to leave a comment or correction	13 (86.66%)	12 (80.00%)
Switching through pages with arrows on keyboard	1 (6.66%)	0 (0.00%)

Figure 8.1 – Summary how what features were identified by the users and which ones they utilised.

8.2 Assessment of Usability

The evaluation of how usable the website is to the users yielded the following results, the scale items are shown in figure 8.2.

1	2	3	4	5	6	7
Extremely easy	Moderately easy	Slightly easy	Neither easy nor difficult	Slightly difficult	Moderately difficult	Extremely difficult
Extremely fast	Moderately fast	Slightly fast	Average	Slightly long	Moderately long	Extremely long
Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree

Figure 8.2 – Display of Likert items and their encodings.

On average, the users rated, it was slightly easy to fulfil a task in order to answer to a question (M=2.94, SD=2.11). They were slightly fast in finding the feature in order to fulfil a task (M=3.00, SD=1.84) and slightly fast to find the feature to answer a question (M=2.94, SD=1.78).

The statements rating the ease-of-navigation showed that in average the users agree that it is simple to accomplish the wanted task (M=2.33, SD=1.89), the website is easy to use (M=2.47, SD=1.71), it is easy to find needed information (M=2.36, SD=1.67), they could imagine most people to learn very quickly how to use this website (M=2.40, SD=1.82) and that they were able to complete their tasks in a reasonable amount of time (M=2.33, SD=1.92). They somewhat agree that the functions were well integrated (M=2.67, SD=1.92) and that performing a task is straightforward (M=2.73, SD=1.81). Furthermore, they somewhat disagree that the website is unnecessarily complex (M=5.20, SD=1.76) and that there was too much inconsistency in the

website (M=5.20, SD=1.83).

Next, the users strongly agree, that the speed in which the computer provided information was fast enough (M=1.40, SD=0.61), the rate of displaying information was fast enough (M=1.47, SD=0.72) and that the pages download quickly on the website (M=1.47, SD=0.62). They agree, that the website loads quickly (M=1.53, SD=0.72).

Regarding the website's interactivity, users somewhat agree, that the website can treat you as a unique person and respond to your specific needs (M=2.87, SD=1.09), it provides content tailored to the individual (M=3.20, SD=1.22) and it provides adequate feedback to assess the progression when performing a task (M=2.87, SD=1.41). The participants attitude towards the website is that they somewhat agree to be satisfied with the service the website provides (M=2.60, SD=1.67) and to feel comfortable using the website (M=2.73, SD=1.73).

Lastly, the users agree that it was easy to move from one page to another (M=1.73, SD=1.48), the overall organisation of the site is easy to understand (M=1.93, SD=1.53), the terminology is clear (M=2.47, SD=1.63), the content met their expectations (M=2.47, SD=1.67) and that overall the website is easy to use (M=2.20, SD=1.83). They somewhat agree, that the website is visually appealing (M=3.47, SD=1.78), the individual pages are well designed (M=2.73, SD=1.77) and that they are likely to use this website in the future (M=3.00, SD=2.10).

8.3 Participants Feedback

Participants of the study had multiple opportunities to leave additional comments or feedback about their thoughts and experience regarding the website and were absolutely encouraged to do so. The more information the user is willing to give, the clearer it makes their overall results.

The main source of feedback, is the last question of the survey, asking the user if they had any further comments or annotations about a specific part or feature of the website, or if there was something (feature or information) missing anywhere.
The results show two comments about the searched word being lost after switching tabs or similar, recommending that it should remain in the text input field. Further comments regarding the search function included to change the button from "Ok" to something more precise like "Go!" and that it would be more intuitive to be able to activate the search by pressing the return key.
Regarding the search algorithm, one participant suggested, that the search should integrate or translate old lettering in order to be searchable.

Next, one user suggested to rename the last tag in the navigation bar to being more explanatory, as "Comparing of Manuscripts" might be misleading, if there will be the possibility of comparing not only the manuscripts, but also the transcriptions. The participant further commented, that this should be possible, once the feature is implemented. One other participant commented on the zoom feature being not intuitive enough and expressed the need for directives. Finally, one user suggested a stronger separation between the transcription and the search page.

Additional feedback, from different parts of the study, for one suggested to allow copying from the transcription text in order to facilitate the search and the completion of the "Leave Comment" form. Secondly, also regarding the feedback feature, one user would like to have the option of sending the correction of the line to the administrator of the website, or to leave the suggestion on the website itself.

The following section discusses these findings and interprets them in order to improve the website and formulate suggestions for future enhancement of the site.

8.4 Interpretation and Discussion

The results of this study show an overall positive resonance of the website. Both the user tasks and the usability evaluation suggest, that the features can be found and easily be used and that the website is able to serve its intended purpose. However, as outlined above, there were some suggestions and comments made by different participants, pointing out minor issues. These were compared to the outcomes of the user tasks questionings, leading to the following conclusions.

8.4.1 Need of Information

Judging how many times the different features were correctly identified, some features stand out as staying almost unnoticed. These features include most interaction with the keyboard instead of buttons (e.g. zooming, switching through lines, etc.). This suggests, the user needs information on hidden features the site offers, additionally to the ones already advertised. This is backed up by the participants' annotations and the final comment.
The navigation bar tags should be revised, as they are not absolutely intuitive to everyone. For instance, the fourth tab should be changed accordingly, once it is clear, what this feature will include.

8.4.2 Transcription/Search

Another issue was revealed regarding the combination of the transcription page and the search feature. While users found it to be intuitive to find and use the function, participants mentioned it to be confusing, that they had to use the navigation bar in order to come back to the transcriptions. This might for one be based on the change of active page occurring unnoticed, and secondly due to the similarity of the two pages. A solution might be to make the distinction between both pages more prominent or incorporate the search results in the transcription page.
The search function itself should be enhanced to allow old lettering. This is backed up by a user who was not able to use the function, as they were not able to copy the word of interest out of the transcription.

8.4.3 Feedback Feature

The several comments regarding the feedback feature revealed, that its access might not be visible enough. While most of the participants showed no problems with finding and using this feature, some mentioned the icon to be too small and one user was missing the icon next to the text in the image. Another user suggested to make the tooltip visible at all times, instead of only on hover.
Considering, that 13 out of 15 participants were able to identify the feature, suggests, that it can be found, when looked for. It might however be advised to add information about it on the Home Page as well as making it more distinctive on the other pages.

8.5 Conclusion and Changes

In summary, the evaluation of the website was positive and good feedback was given to improve the website. The users were overall satisfied with the implementation and performance

of the site and with what it offers, suggesting, these features cover the users' main needs.

Succeeding to the analysis and interpretation of the study results, the website has been enhanced by applying the worked out recommendations. Following changes have been implemented.

Home Page
Information about invisible features, such as manipulation via keystrokes was added to the table of content and leads to the feature when clicked (see figure 8.3).

Figure 8.3 – The new Home Page.

Transcription/Search
The search is now fully integrated into the Transcription page, represented by a button, which opens the search input. And can be closed by another button. Also, the search function can now be invoked by press of the enter key or the button now showing "Go!" and allows for normal lettering of "s". After a search, the searched word stays in the input field (see figures 8.4, 8.5, 8.6).

Figure 8.4 – The new transcription page when search closed.

Figure 8.5 – The new transcription screen when search opened.

Leave Comment
This feature is now advertised on the Home Page. The size of the feedback icon was enlarged.

Lastly, the user study resulted in suggestions regarding features, that are not yet implemented. These encompass the following.

Figure 8.6 – New search results screen.

— Implement the comparing of manuscripts functionality to offer the possibility to also compare transcriptions
— Allow the user to choose to send their comment to the administrator or to save it for personal purposes/share with other users. This would include a full user experience with log in and user profile.
— Offer the search functionality to include more than one book, once there are multiple books available.

9 Evaluation and Critical Appraisal

This chapter recapitulates critically what has been done. It then compares this project to the related work and where it fits in, to finally summarise the project, appraising its evaluation.

9.1 Achievements vs. Objectives

The requirements listed in section 3.3 (see table 3.1) formed the foundation for this project. The design process sought to incorporate these into one concept and the implementation process sought to translate this concept into action. Whether these requirements were achieved was inspected with the help of a user study.

The results show, that all "absolutely necessary" requirements were met. The transcription page shows both the scanned manuscript and its transcription, they can be selected individually and the user can search the documents. The navigation bar shows where the user currently is on the website via "active" tabs. The user study evaluated the website to be intuitive for a variety of different users with different backgrounds and levels of expertise.

The "important" requirements were furthermore met, as the user is able to suggest own opinions or versions of transcriptions by submitting a comment through the leave-a-comment-form. The revised Home Page now shows all needed information about the website's features. It will however still be enhanced to show background information on the featured books, once this information is available. Lastly, the navigation was assessed to be intuitive. This might be getting more difficult and complex, when the website content grows and require the need to be re-evaluated.

Finally, the requirements "for future enhancement" were further elaborated and clarified and their groundwork laid. The design and structure of the code already allows enhancement of adding new pages to a book or adding multiple books.

However, the website still needs to be expanded to offer the log-in experience and the possibility to compare manuscripts.

9.2 Comparison to Related Work

The work presented in section 2 showed several websites offering the viewing and examining of ancient documents. As already stated, there were almost no websites showing the transcription next to its manuscript and none that offered any interaction between the image and the transcription nor the search results. This website fills this gap by providing the user with the possibility of clicking on lines in the transcription as well as the image and superimposing the transcription on the image. It further features the search results next to the scan, thus allowing the same interaction as the transcription.

There are however some aspects, that are not yet available in this product. For one, the code allows the addition of rectangles surrounding single words on the image, the information needed is however not yet available. Next, search words are not highlighted singularly in the results. This might be something worth making available in the future, to ameliorate the search experience, as other websites already offer this feature. Secondly, this website is still in the beginning of its development. Therefore, its resources are limited.

Also, one other feature that was anticipated in the very beginning of the project, was to implement a full user experience, including registration and user profiles. This is offered by many of the existing websites and allows the exchange and communication with other researchers and is definitely something to be implemented in the future.
Lastly, the website will need to be retested, in order to assess whether the most recent changes meet the user expectation and improve the user satisfaction. Due to the short time span of the project, this was not feasible.

9.3 Conclusive Statement

In summary, this project succeeds in reaching its main goals and fills an important gap in the existing work. Nonetheless, it still offers a wide range of possible enhancements, some of which might be necessary to offer a fully developed product. Moreover, the current website requires further testing to evaluate the usability of the most recent changes. This chapter discussed how this project reached its goals and where it assimilates itself with related products. The next chapter concludes the project and gives recommendations for future development.

10 Conclusion

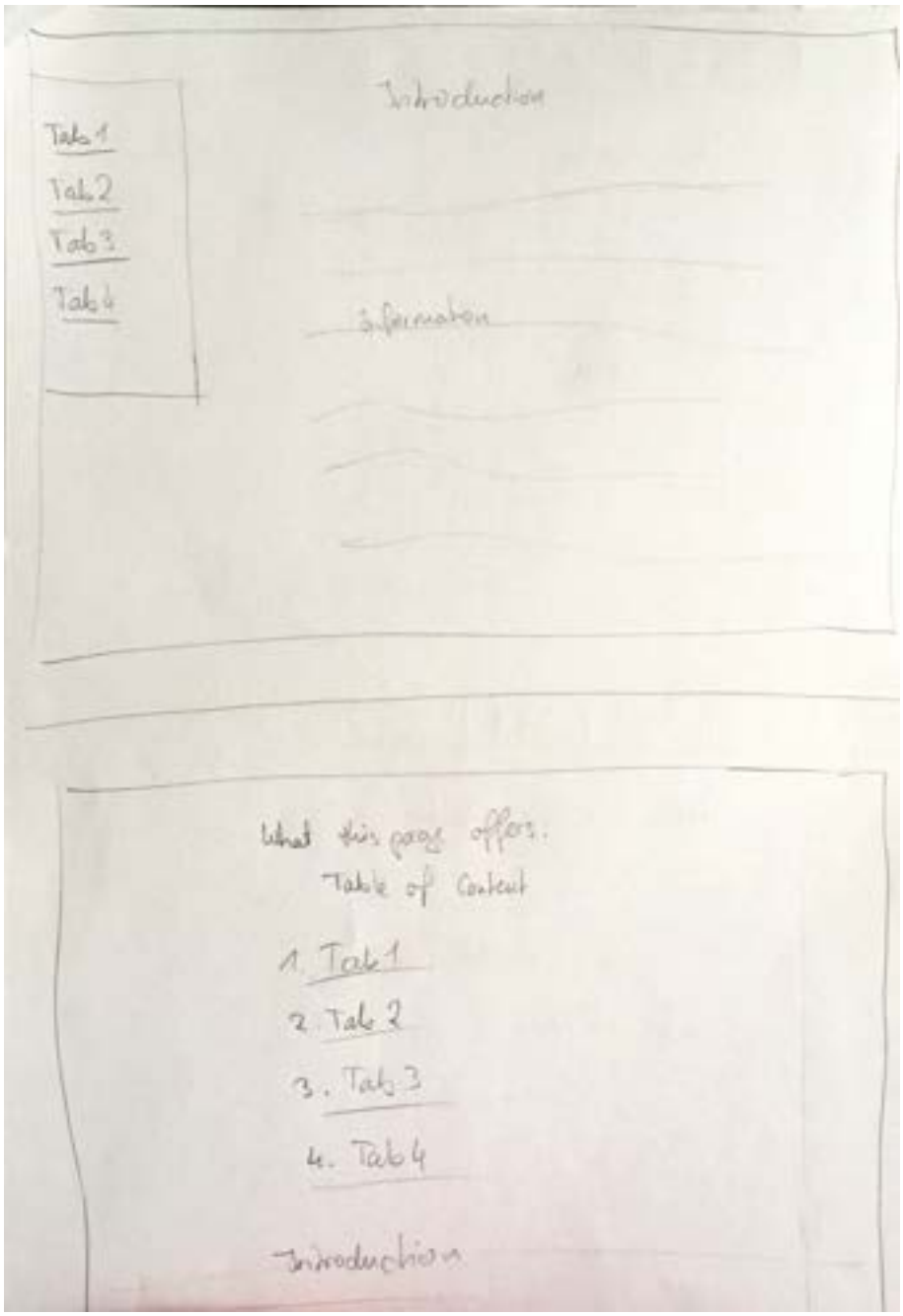
This project produced a website, which allows the user to view and examine ancient historical documents by providing the display and interaction of both OCR'ed and scanned images alongside their transcriptions and various features.
The development process began by researching related work, as well as important HCI principles and guidelines, in order to build a foundation for the design and implementation of the website. Next, the user requirements were gathered in addition to the initial project specifications and the adequate scope for this project was identified. This was done by interviewing a potential user of this website to understand how the intended customer will want to operate with the product. These requirements were then translated into design and interaction specifications, which combine the researched foundation with the extracted requirements and finally formulating the concluding design decisions.
Following the design process, the website was developed and tested in an online user study. The results revealed an overall satisfaction of the user and yielded valuable suggestions for improvement, which were implemented, producing the definitive stage of production for this work.

Overall, the project achieved its goals and therefore already fills an important gap in this field of work by offering something, others fail to. Nonetheless, there are still aspects of the user requirements, which were beyond the scope of this project, but need to be implemented. Future work on this website should include the implementation the comparison of either two different manuscripts or their transcriptions, offering the user the ability to change this on demand. Furthermore, the search function needs to be expanded, adding the option of searching all available books, maybe even offering the option of selecting which books should be included in the search. This search could then result in the highlighting of this specific search target and enabling the accentuating of this result in the image and transcription.
Moreover, in order to round off the user experience, there should be the possibility of creating an account and registering with the site. This would allow for many more functionalities and features, such as user forums, user chats, creating profiles to save configurations or settings, and so on.
There are evidently many ways of enhancing this product and increase its value amongst different user with different backgrounds. Some ideas might require the progression of other researchers' work before being able to be implemented and some might already be possible. It is however clear, that this work will not lose in value, but more likely gain in importance, as the technology evolves, offering more and more possibilities.

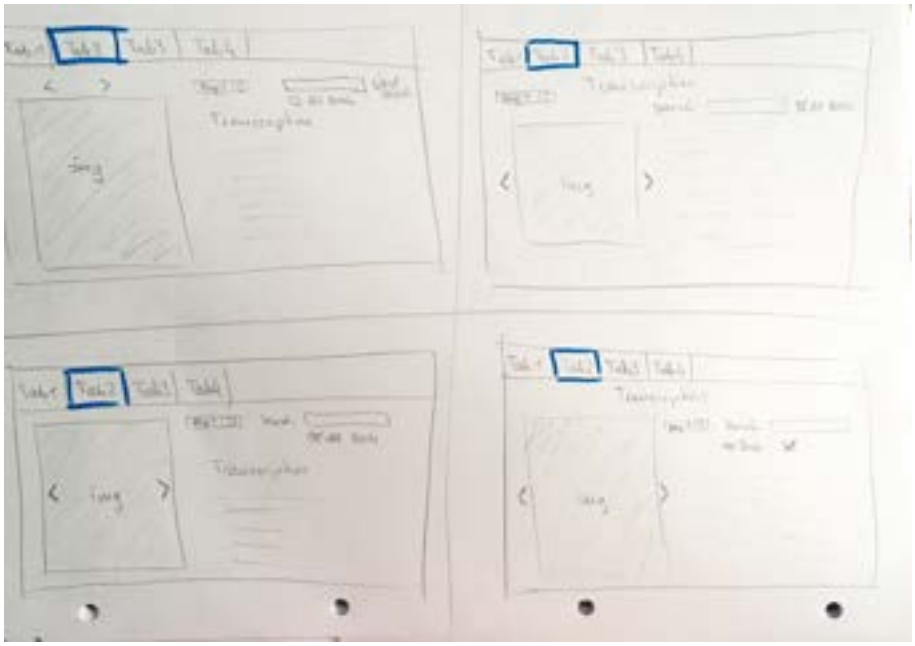
Appendix A - Sketches

Sketches of Home Page.

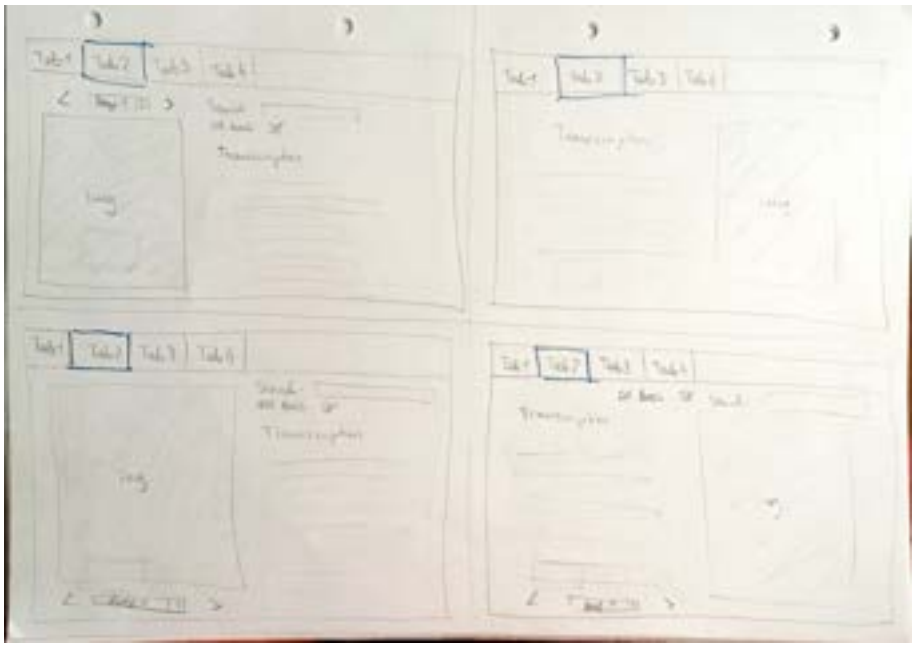
APPENDIX A



Sketches of Home Page.

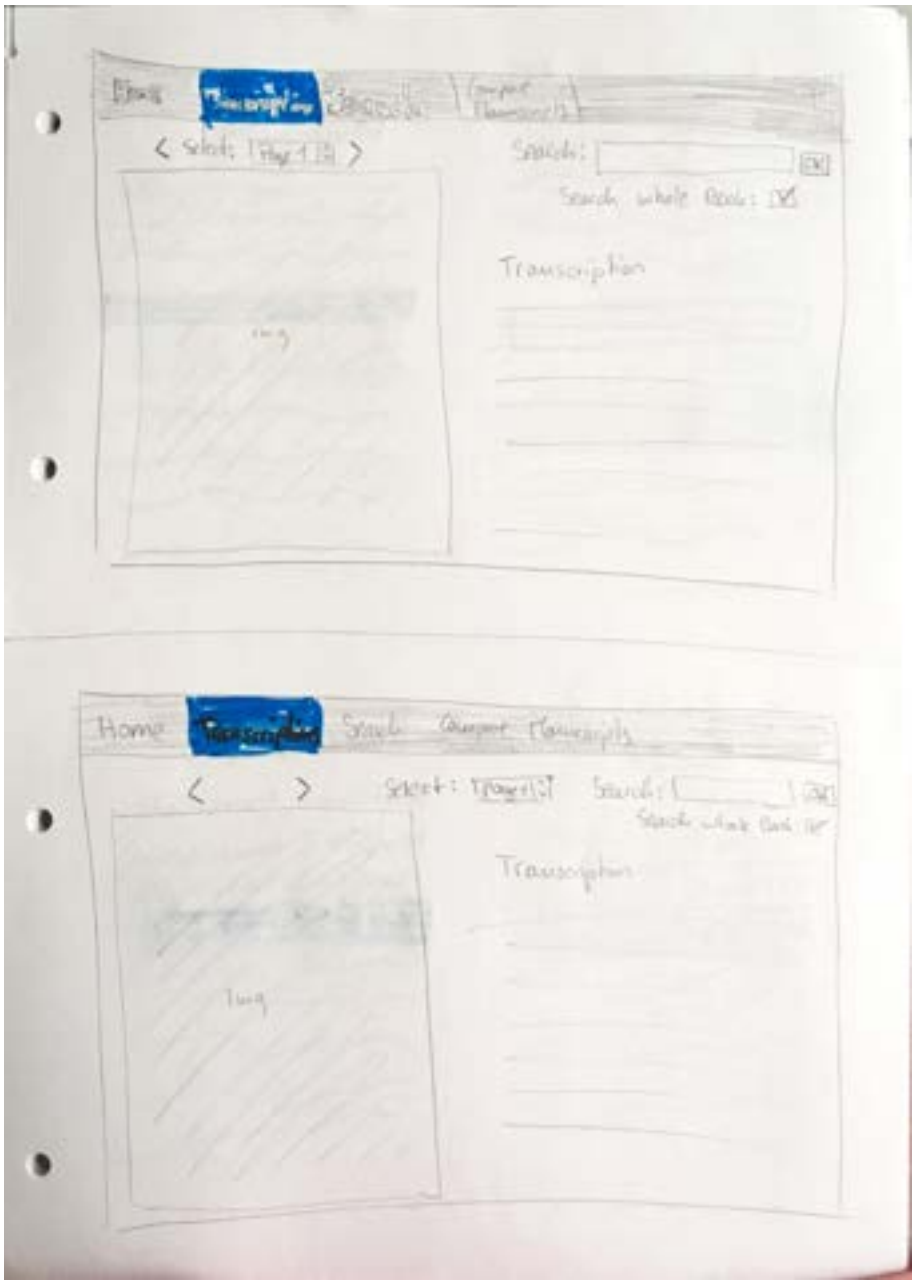


Sketches of Transcription Page.

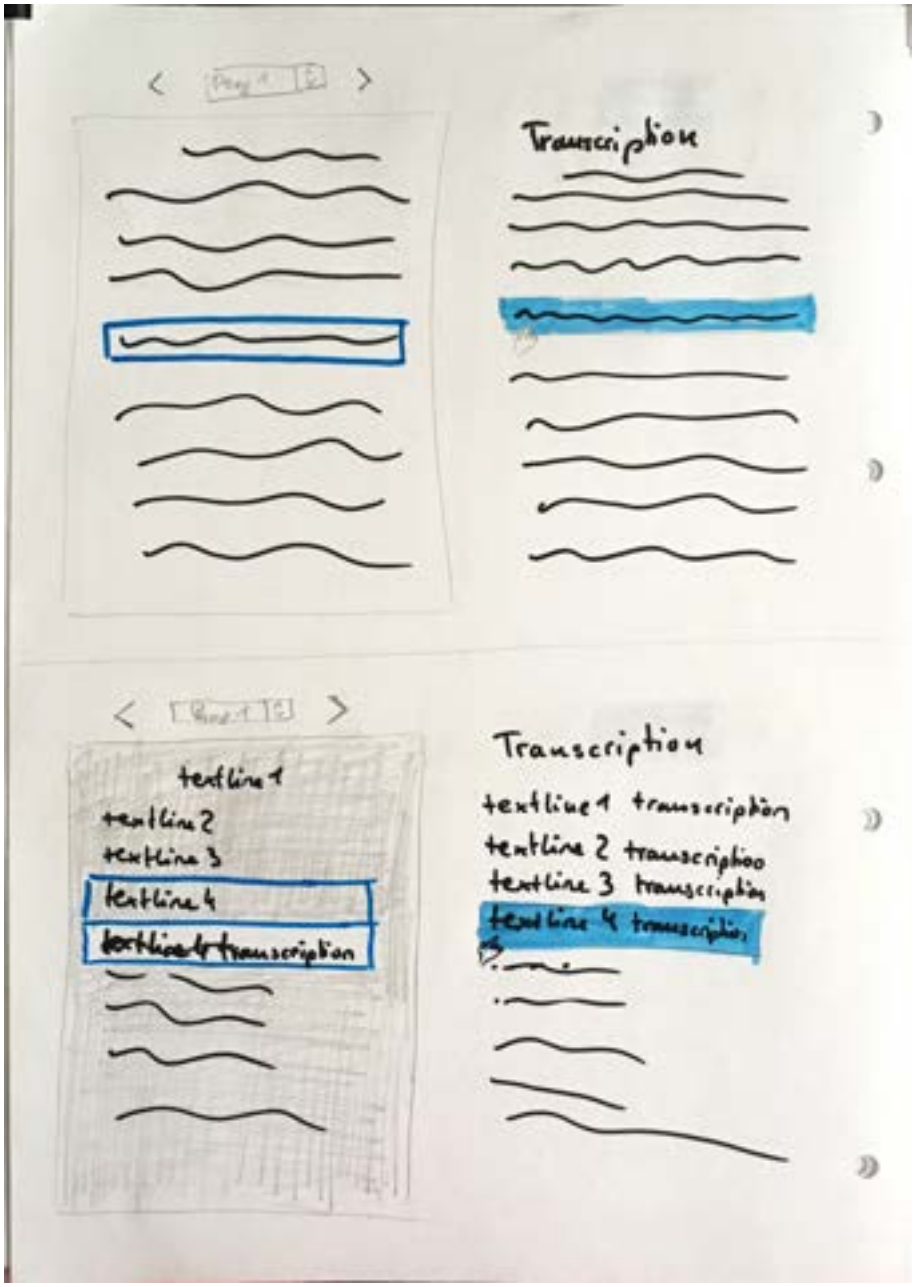


Sketches of Transcription Page.

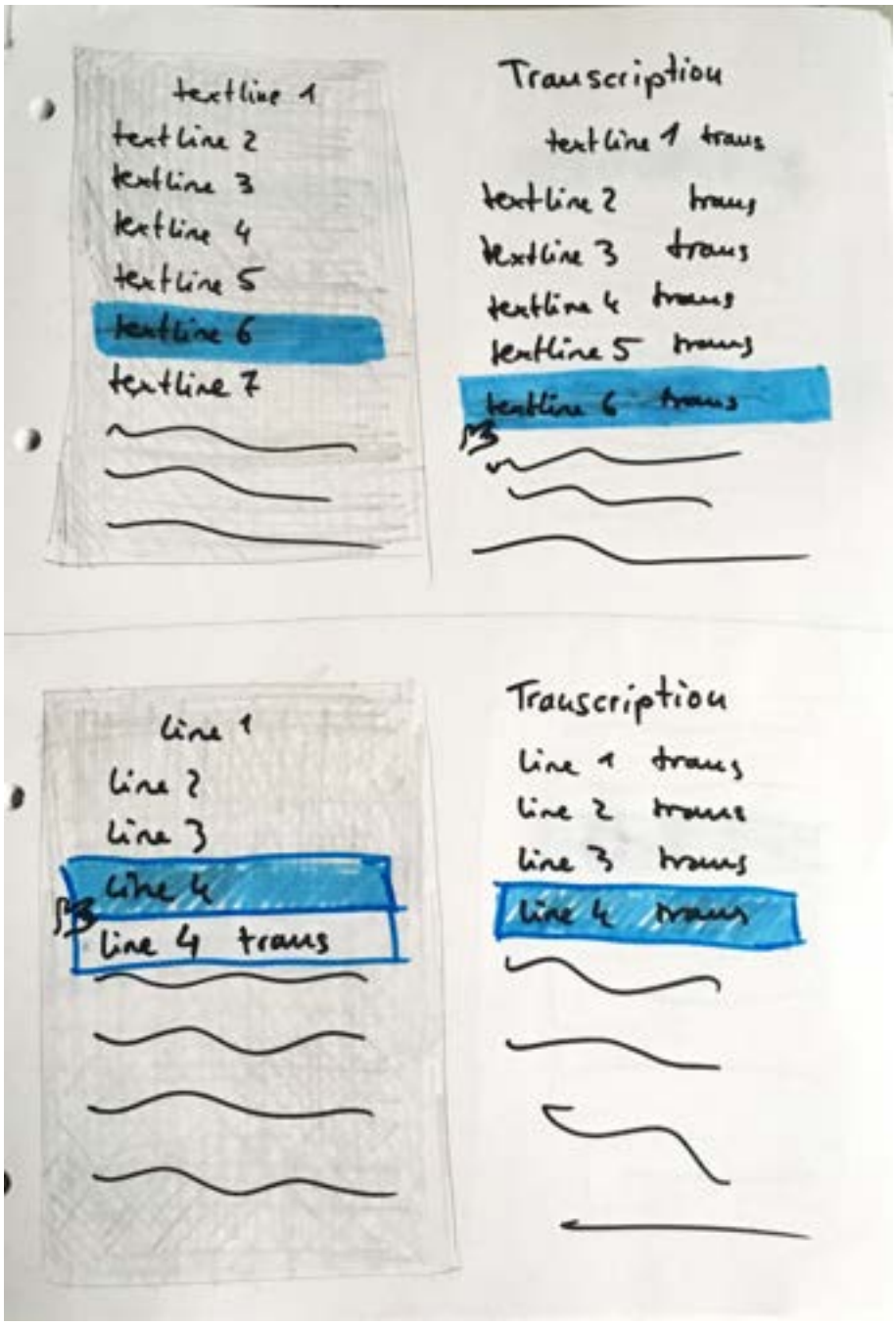
APPENDIX A



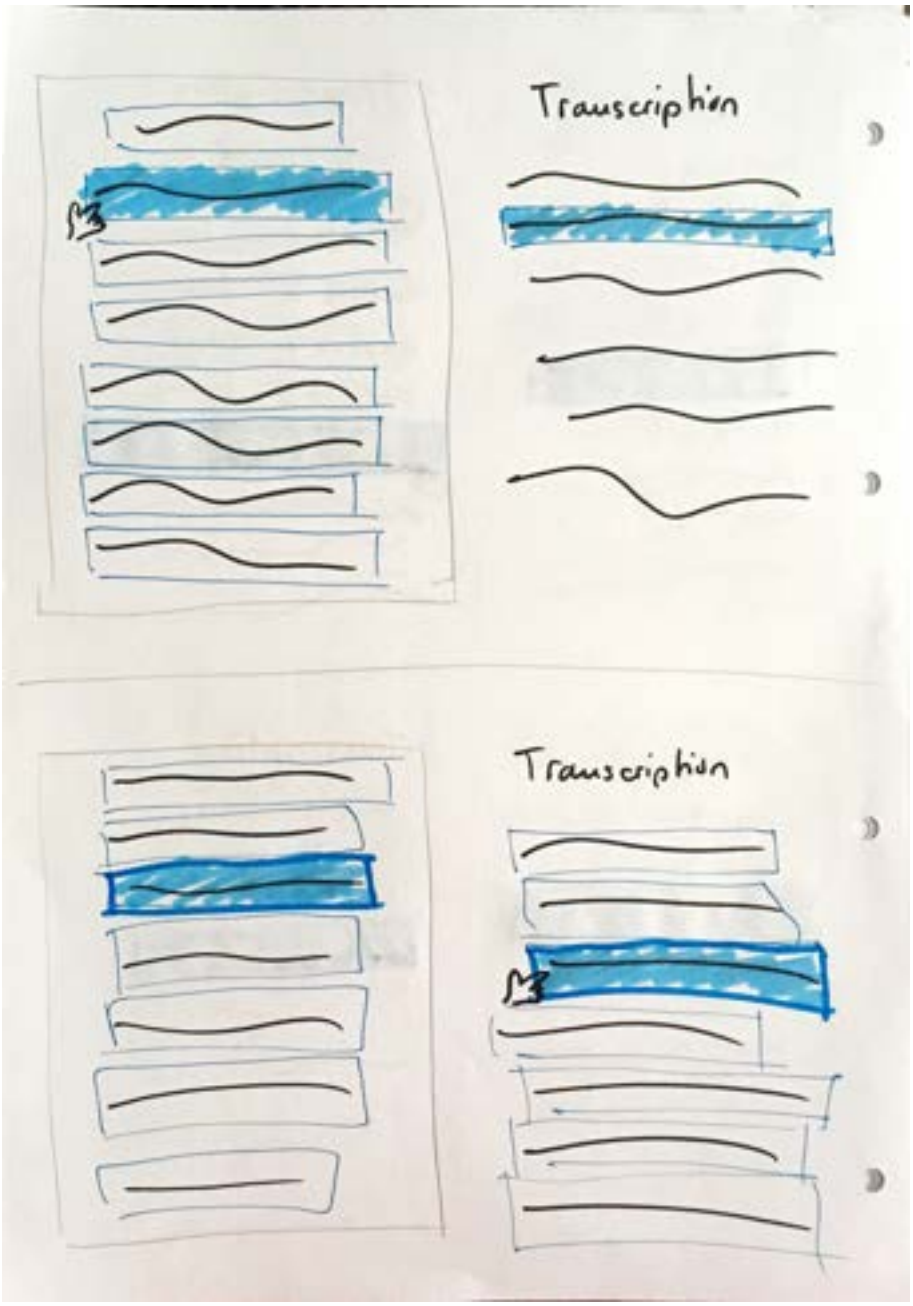
Sketches of Transcription Page.



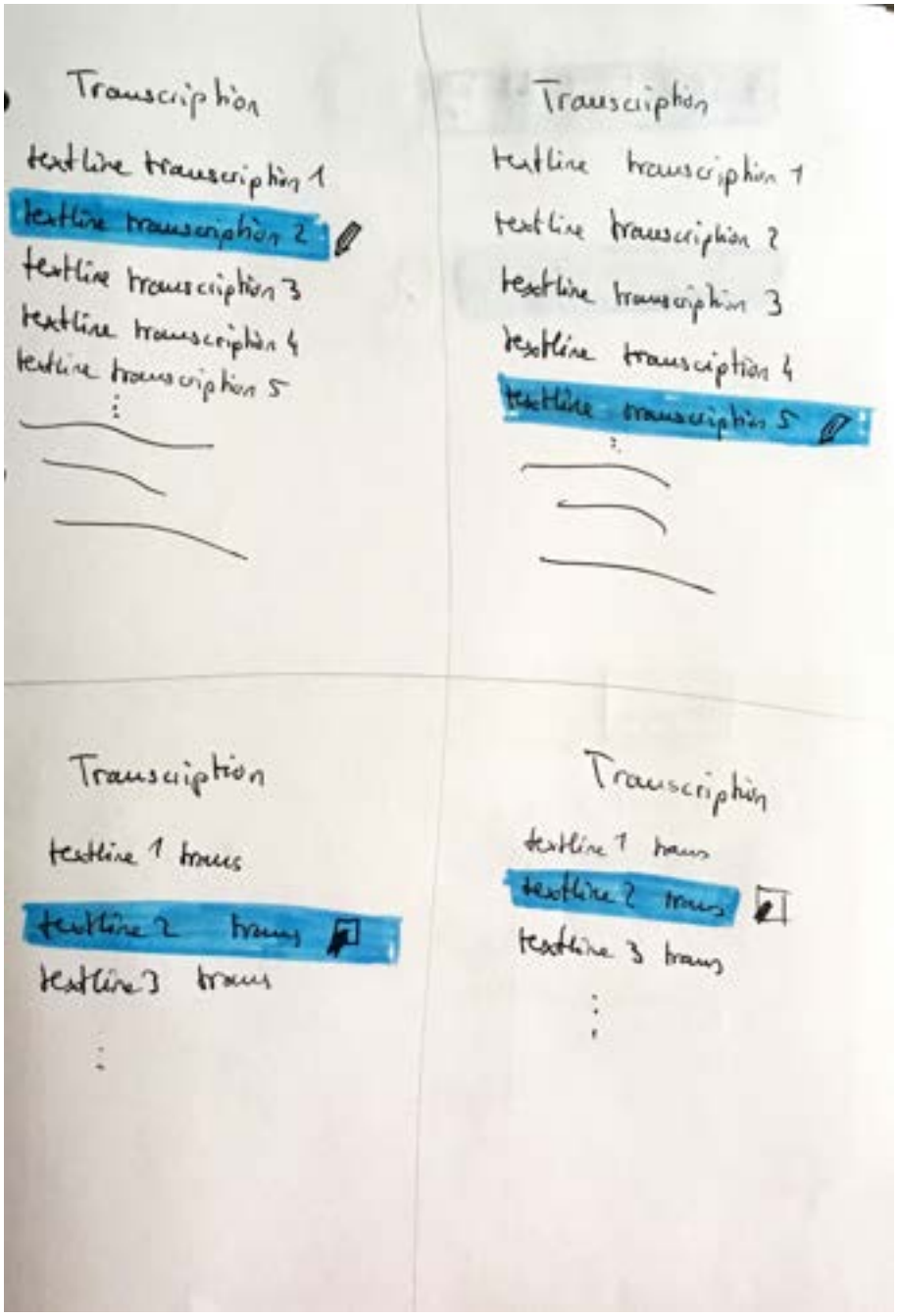
Sketches of how the transcription text should be highlighted.



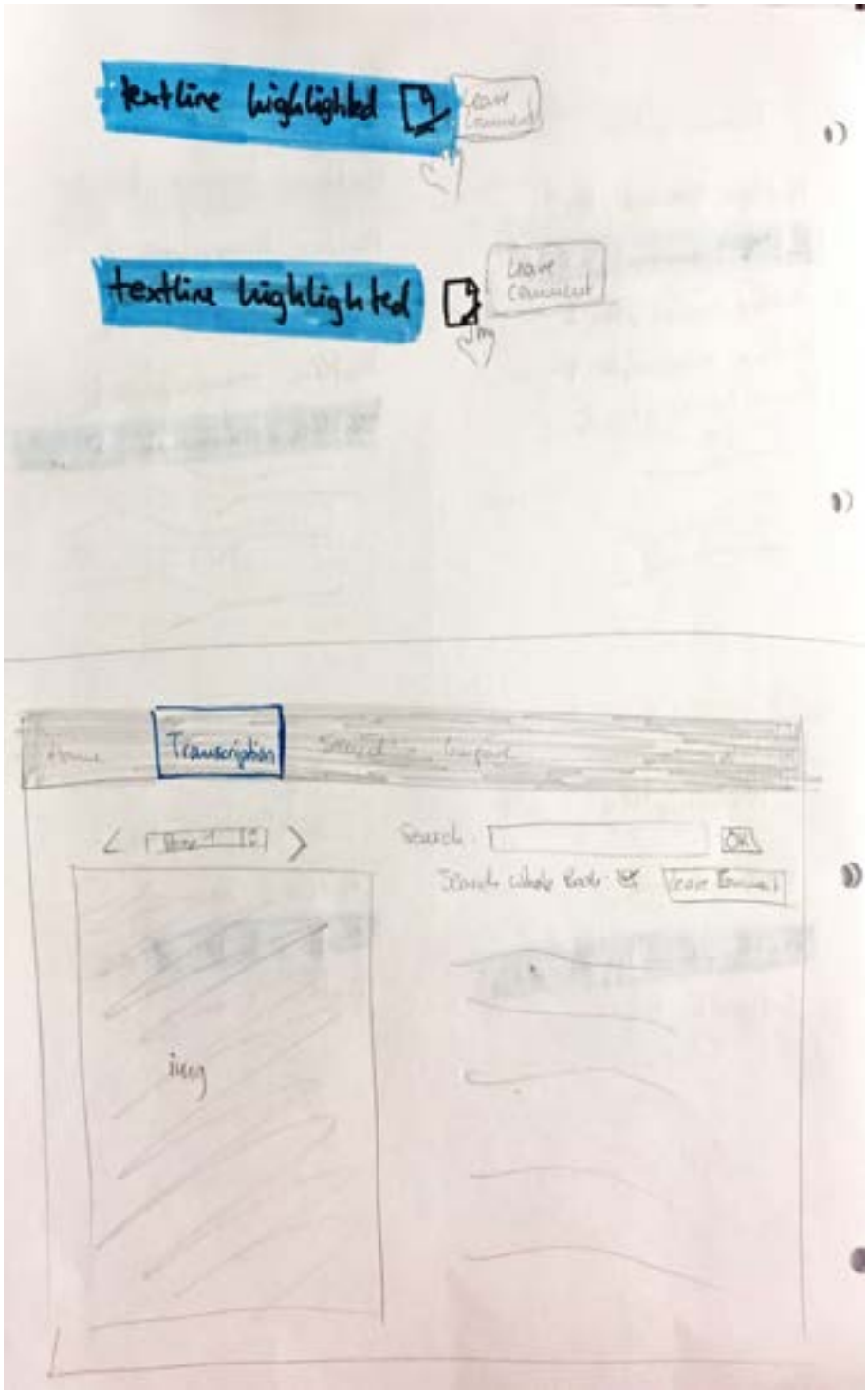
Sketches of how the transcription text should be highlighted.



Sketches of interaction with lines and image.

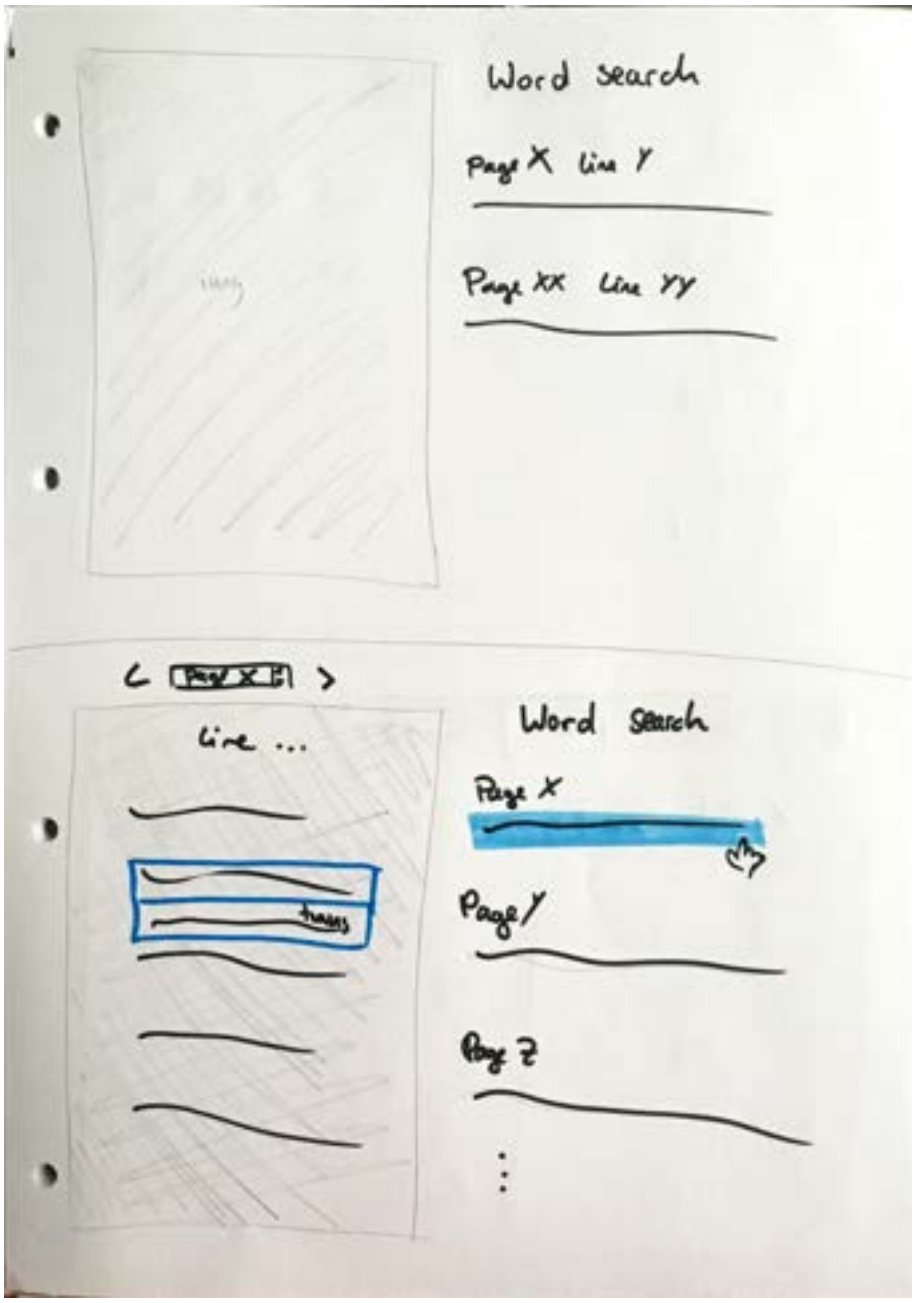


Sketches of form and position of feedback icon.

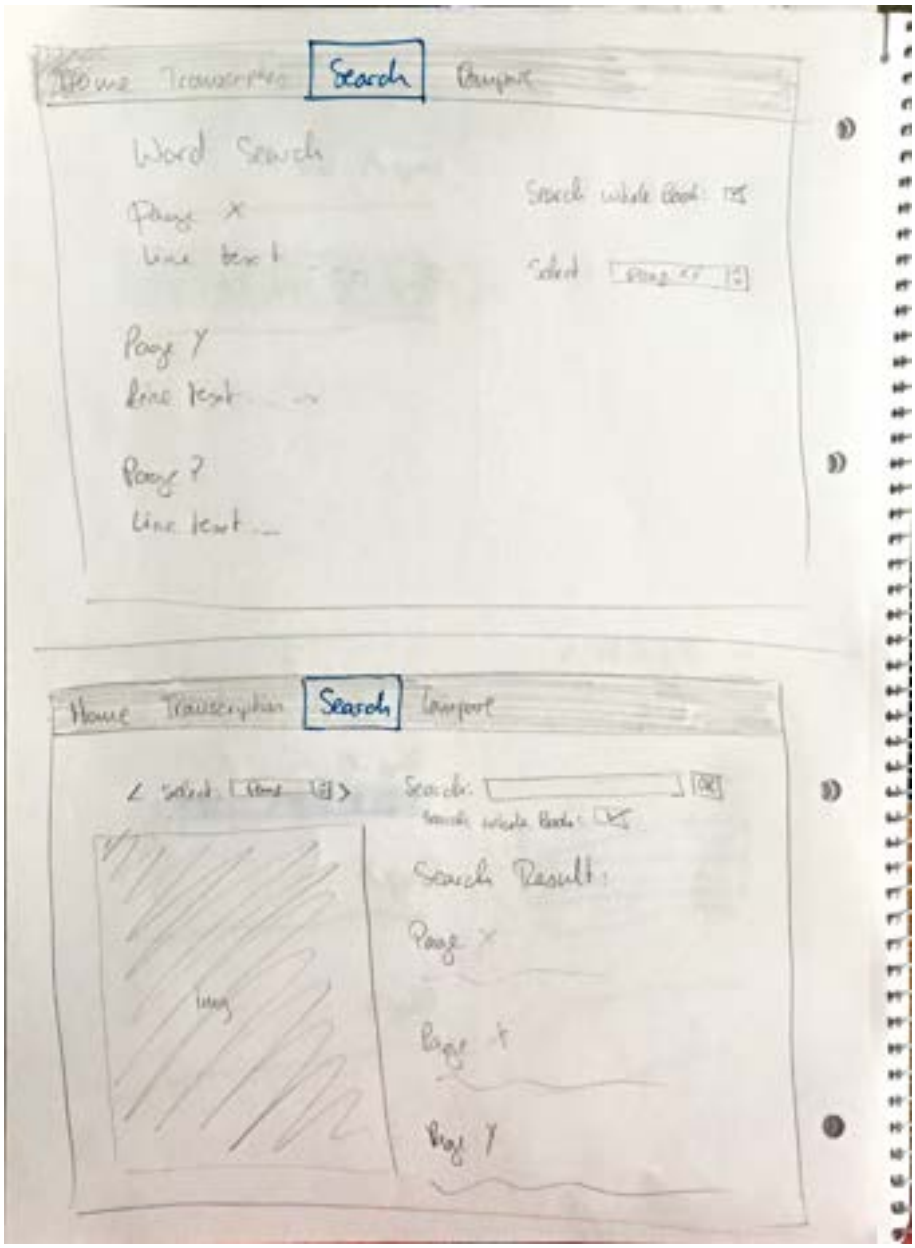


Sketches of form and position of feedback icon plus its tooltip.

APPENDIX A

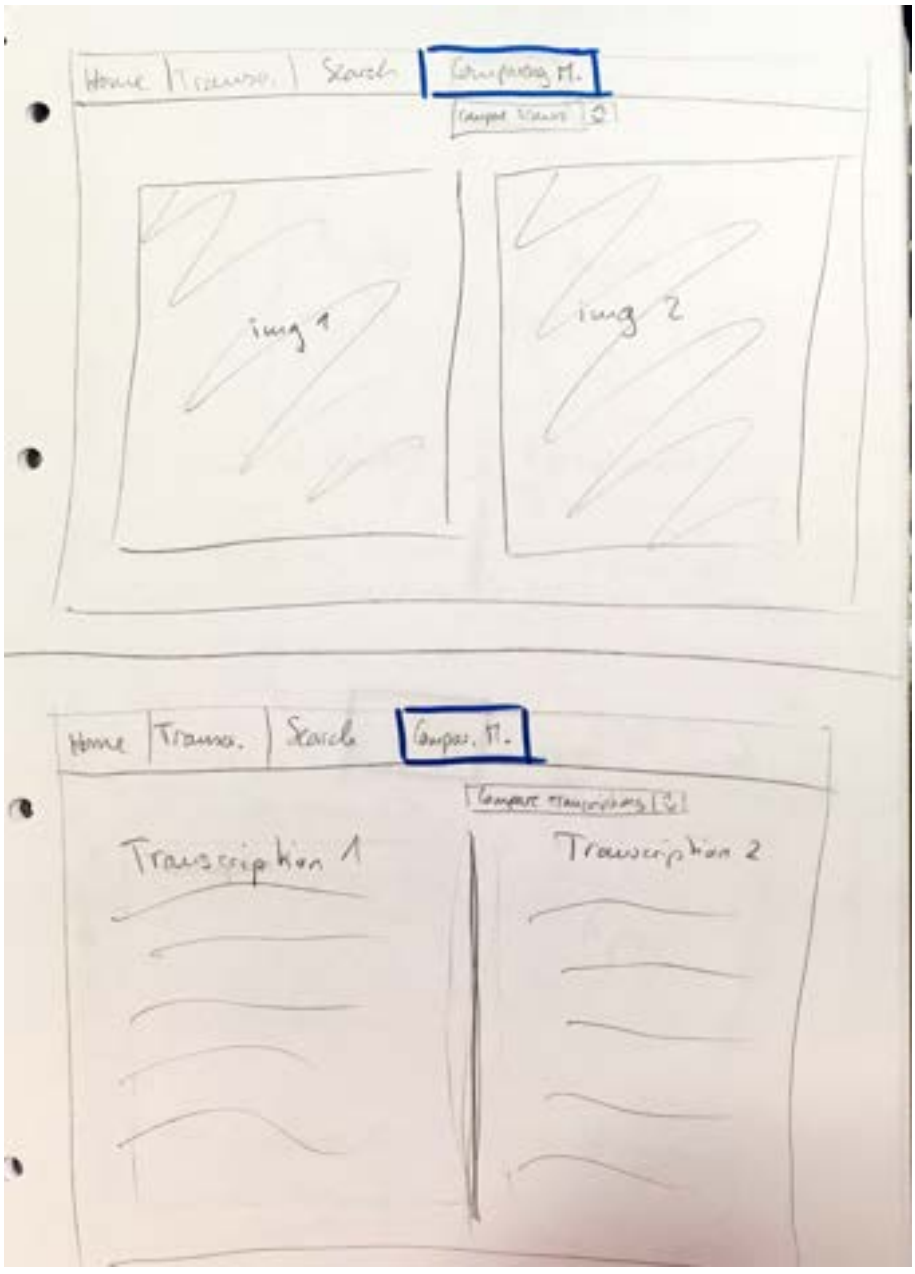


Sketches of the display of the search results and their interactivity with image.

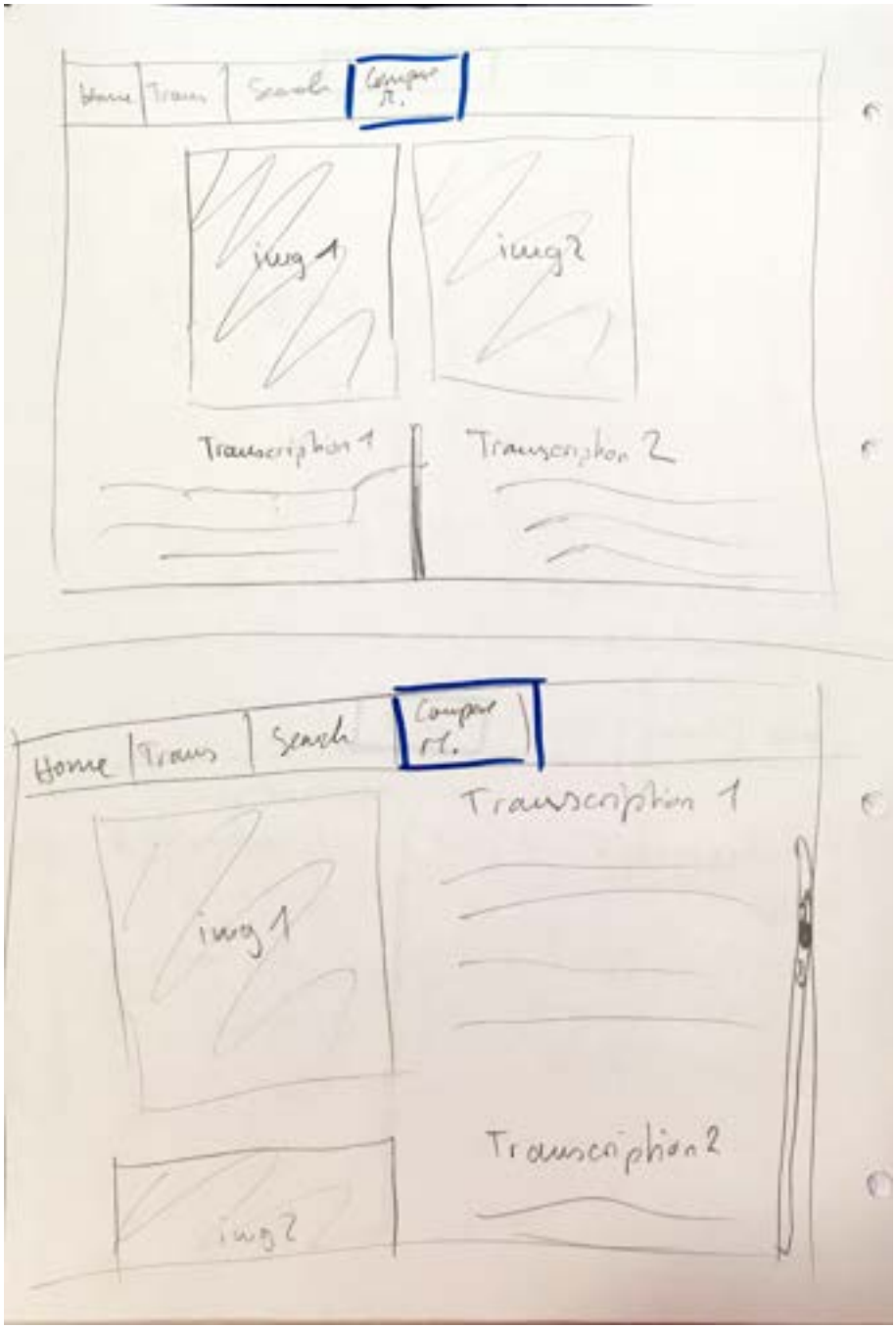


Sketches of search results page.

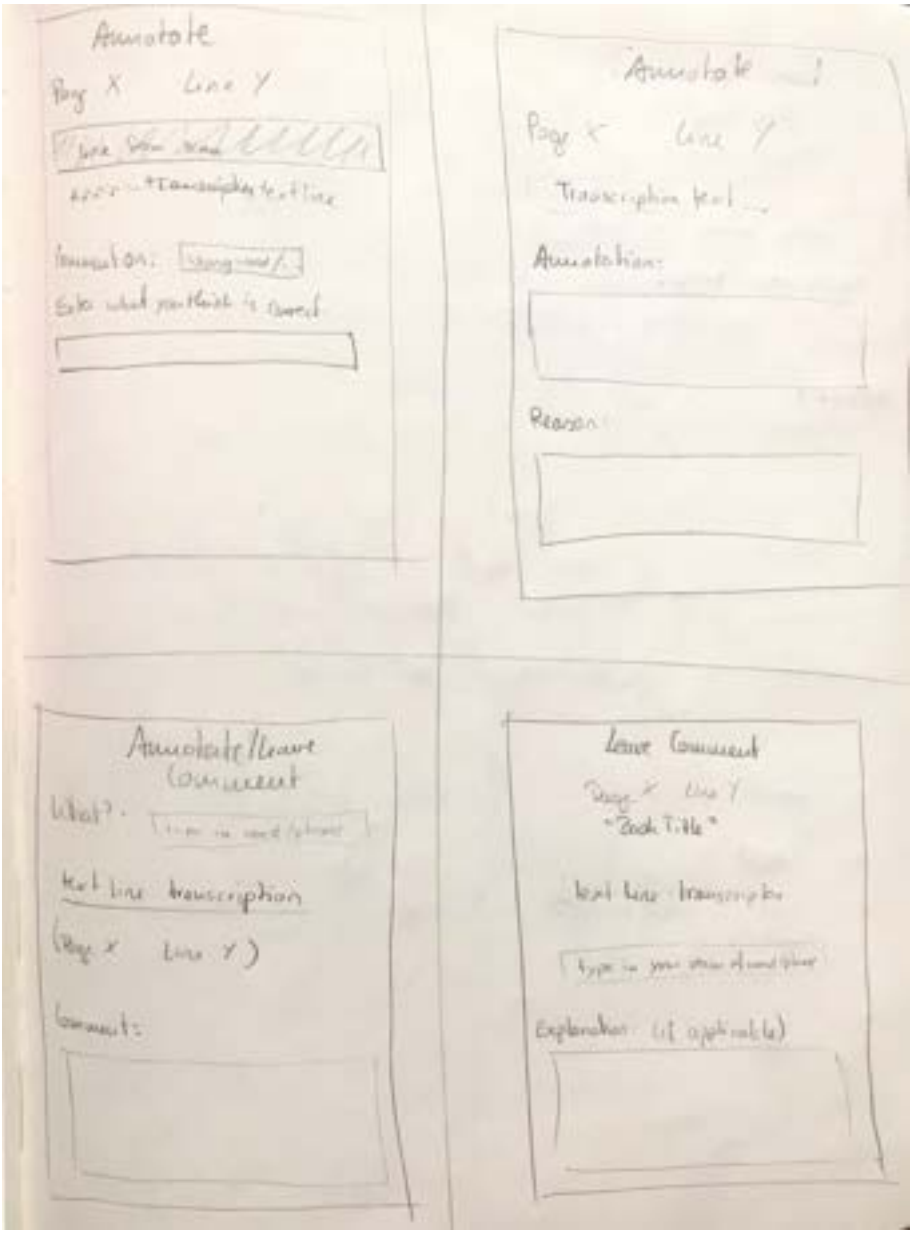
APPENDIX A



Sketches of search page that will allow comparing of manuscripts and/or transcriptions.

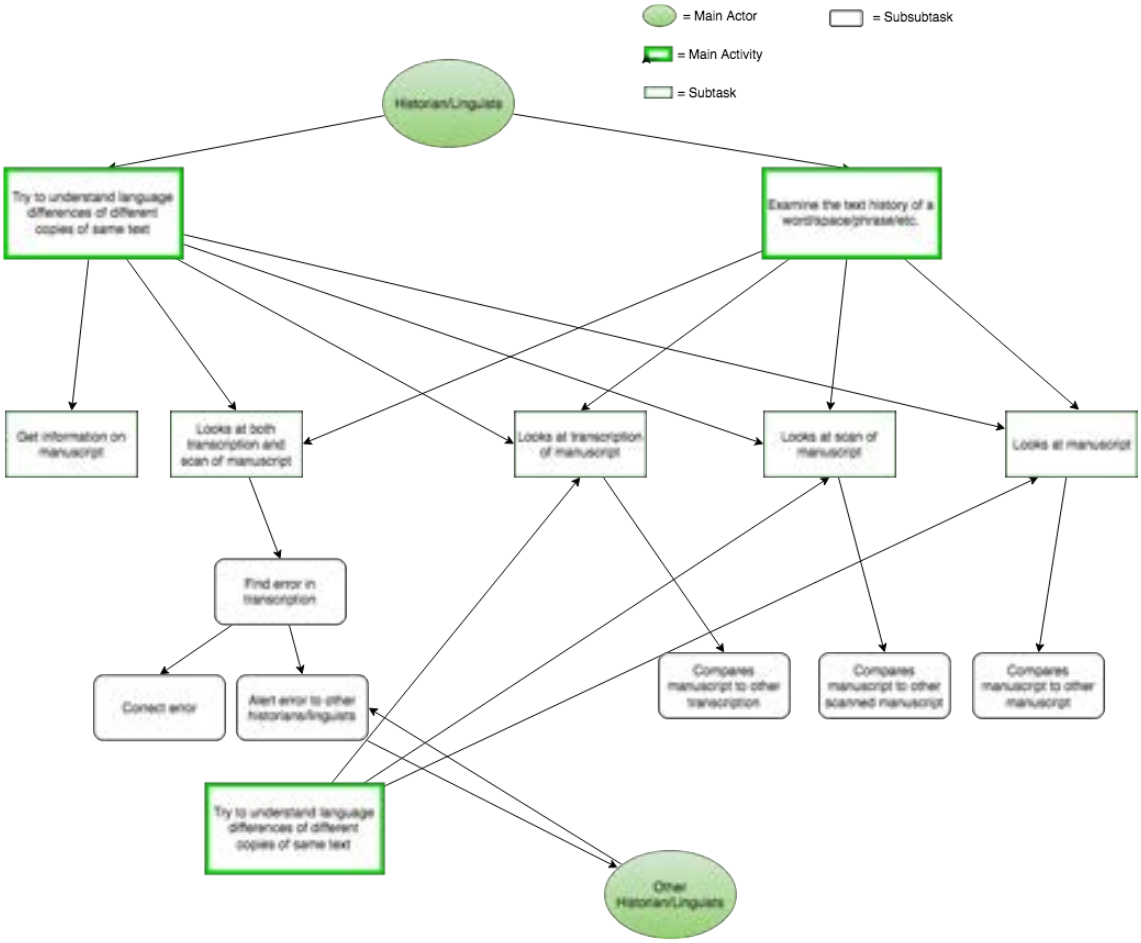


Sketches of search page that will allow comparing of manuscripts and/or transcriptions.

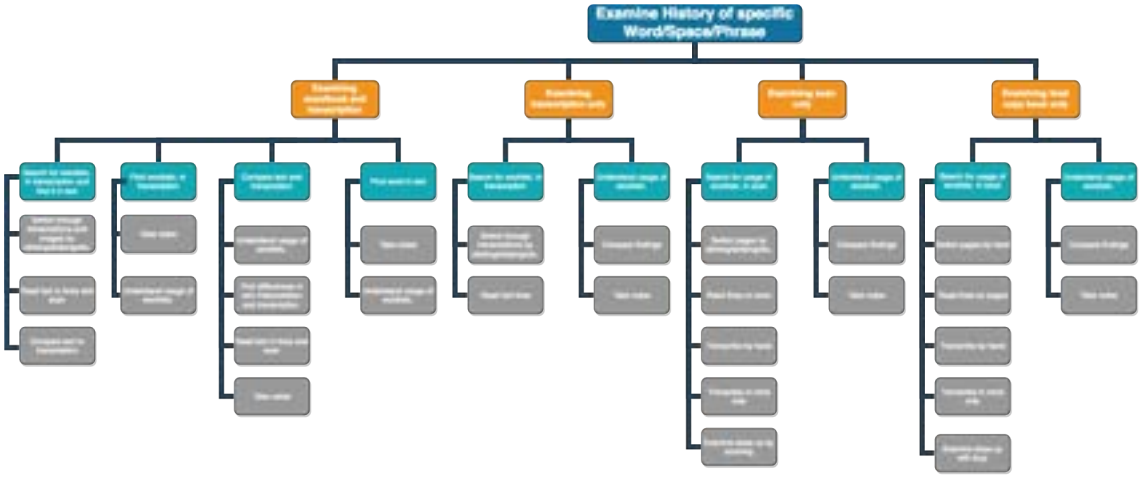


Sketches of popup form to leave a comment about a specific line in the transcription.

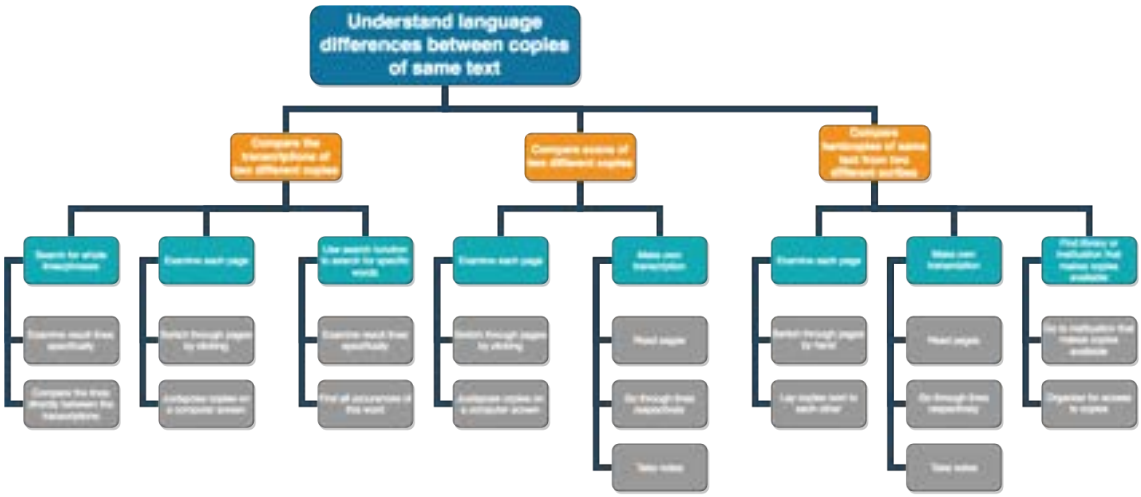
Appendix B - Flow Models



Work Flow Model of how historians/linguists work with historical manuscripts (see [17, ch.6, pp.208-2016]).



Hierarchical task model about the examination of the history of a specific word/character/space/etc. (see [17, ch.6, pp.216-235]).



Hierarchical task model about understanding linguistic differences between copies of same text (see [17, ch.6, pp.216-235]).

Appendix C - User Studies

1. Questions and answers of initial interview with the potential user.

Interview with Potential User – 08.06.2018

1. Introduction

- What is your field of research?
  - Analysis of old documents to find and understand history and development of words

- What is it that you are working on at the moment?
  - Finding the origin of the word “du” rather than “del”

- What kind of work do you perform on historical documents?
  - Understand the language differences of different copies of one text
  - Analyse the text and find usages of specific words or spaces or punctuation

2. Main Questions

- How do you interact with OCR’ed scans?
  - See information of what kind of scan it is, what document etc.
  - See scan and transcription and be able to write correction
  - See transcription of others if applicable

- What work do you perform on ORC scans of historical documents?
  - Search function
  - Patterns of words
  - Different sizes of spaces between words have different meanings and this should be searchable

- Have you ever worked with a tool that presents historical scans?
  - No

- What kind of features do you appreciate in a tool to interact with historical scans?
  - It needs to be absolutely intuitive

- Have you worked with websites before that present OCR’ed documents?
  - No

- In what way have you interacted with them?
  N/A

- What features would you as the user of the website like to see?
  - Maybe in the future be able to compare different scans/documents
  - Have a website that is perfectly intuitive to work with
  - Concording and save that concordance for the next text/scan
  - This concording function would allow you to detect proper names
    - Lemmatisation to simplify the search of words
  - Finding patterns of words
  - See the direct transcription as well as the corrected text to be able to compare and see for yourself how you would interpret the text
  - Search for phrases as words
  - Distinction between phrases and words
  - Extensions of abbreviations
  - Provide guidance on how to search for words/phrases, in order to assure the right
  - Find word endings and where they occur
  - Frequency of occurrence
  - Notify abbreviations so that those who are interested in them will see them and know that it is one, but those who aren't interested in them won't be bothered by them

- Can you think of a feature in particular, that you need to work on the scans when using a tool/website?
  - See the original text and original, direct transcription without correction at all
  - The website should absolutely be usable for many different purposes
  - Navigation and selection of what and how the user wants to work on (thinking of later on, when there is the whole book or multiple books available)

- Open questions/what should be thought of in the future
  - Build website such as to allow easy enhancement of amount of documents

- Besides working with the scans on the website... what information would you want to see?
  - Think of design options of the website
  - The website should absolutely be usable for many different purposes
  - That the website has a whole bible to show

APPENDIX C

2.Questionnaire of the online user study to test the product.

User Tasks

This survey is to evaluate the usability of this website and consists of two parts. First, you will be asked to open the website on a second screen and fulfil a series of tasks. While doing so, there will be questions for you to answer regarding these tasks. These answers are important for me to understand your actions and thoughts behind them in order to then properly assess the website.
Please make sure to open the website in Firefox, Google Chrome or Safari. Please do not use Internet Explorer.
The second part of the survey begins once you have completed all the tasks. It consists of 12 multiple choice questions about your experience.

By starting the survey, you agree that you are aware of what this study consists of and that none of your data will be recorded at any point. You can exit and withdraw from the study at any time without having to give any explanation.

Thank you for your time and participation.

Kind regards,
Caroline

Testing 1

Please open the website: https://cs04.host.cs.st-andrews.ac.uk/Website/index.html

What items can you identify as being links on the initial page, the Home page?

Testing 2

Please go to the transcription feature and try answering following questions:

What page of the manuscript is shown without having to manipulate anything?

What interactions are possible with the image?

What sort of other interactions can you identify (e.g. interactions with the text, etc.) ?

Testing 3

Try to fulfil the necessary tasks to answer following questions:

How many times was the word “femme“ used overall?

What page(s) contain(s) the word “patriarches“ ?

Testing 4

Please look at page 507r of the manuscript and try answering following question.

How many times was the word “gloire“ used on page 507r?

Testing 5

Now please look at page 506r on the transcription page and examine the 4th line of the scan.

Look close at the first word of that line.

Now pretend you disagree with the transcription of a word in that line. Try to inform the website holders about this mistake.

Did you find a way? If so, please explain how you went about it, step by step.

How would you rate the ability to understand how to fill out the feedback form for your purpose?

Features

Which of these features did you identify?

- [ ] Switching through tabs in the navigation bar
- [ ] Zoom on image via mouse scroll
- [ ] Zoom on image via key strokes
- [ ] Moving the image in the window when zoomed in
- [ ] Switching between images with arrows
- [ ] Selecting images via drop down menu
- [ ] Clicking on lines in text
- [ ] Clicking on lines on image
- [ ] Switching through lines with the help of the keyboard (n - next, p - previous)
- [ ] Entering a word in text entry line for word search
- [ ] Changing the word search to only search in the shown page
- [ ] Using the word search on the transcription page
- [ ] Clicking on the "Search" tab to go to the search page and use the word search there
- [ ] Feedback feature by clicking on feedback icon to leave a comment or correction
- [ ] Switching through pages with arrows on keyboard

Which of these features did you use?

- [ ] Switching through tabs in the navigation bar
- [ ] Zoom on image via mouse scroll
- [ ] Zoom on image via key strokes
- [ ] Moving the image in the window when zoomed in
- [ ] Switching between images with arrows
- [ ] Selecting images via drop down menu
- [ ] Clicking on lines in text
- [ ] Clicking on lines on image
- [ ] Switching through lines with the help of the keyboard (n - next, p - previous)
- [ ] Entering a word in text entry line for word search
- [ ] Changing the word search to only search in the shown page
- [ ] Using the word search on the transcription page
- [ ] Clicking on the "Search" tab to go to the search page and use the word search there
- [ ] Feedback feature by clicking on feedback icon to leave a comment or correction
- [ ] Switching through pages with arrows on keyboard

Evaluation of Usability

How difficult was it, to fulfil the tasks/answer the questions you were given?

Extremely easy	Moderately easy	Slightly easy	Neither easy nor difficult	Slightly difficult	Moderately difficult	Extremely difficult
○	○	○	○	○	○	○

How much time did it take you on average, to find the feature in order to fulfil a task?

Extremely fast	Moderately fast	Slightly fast	Average	Slightly long	Moderately long	Extremely long
○	○	○	○	○	○	○

How much time did it take you on avarage to find a feature in order to answer a question?

Extremely fast	Moderately fast	Slightly fast	Average	Slightly slow	Moderately slow	Extremely slow
○	○	○	○	○	○	○

Ease-of-Navigation

Please rate to what extend you agree with these statements:

	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree
On this website, it is simple to accomplish the task I want to accomplish.	○	○	○	○	○	○	○
I find the website easy to use.	○	○	○	○	○	○	○
I found the website unnecessarily complex.	○	○	○	○	○	○	○
It is easy to find the information I need.	○	○	○	○	○	○	○
I found the various functions in this website were well integrated.	○	○	○	○	○	○	○
I thought there was too much inconsistency in this website.	○	○	○	○	○	○	○
I would imagine that most people would learn to use this website very quickly.	○	○	○	○	○	○	○
I was able to complete my tasks in a reasonable amount of time.	○	○	○	○	○	○	○
Performing a task is very straightforward.	○	○	○	○	○	○	○

Statements

Please rate to what extend you agree with these statements:

	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree
The speed in which the computer provided information was fast enough.	○	○	○	○	○	○	○
The rate at which the information was displayed was fast enough.	○	○	○	○	○	○	○
The website loads quickly.	○	○	○	○	○	○	○
The pages download quickly on this website.	○	○	○	○	○	○	○

Please rate to what extend you agree with these statements:

	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree
The website can treat you as a unique person and respond to your specific needs.	○	○	○	○	○	○	○
The website provides content tailored to the individual.	○	○	○	○	○	○	○
The website provides adequate feedback to assess my progression when I perform a task.	○	○	○	○	○	○	○

Please rate to what extend you agree with these statements:

	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree
I am satisfied with the service provided by this website.	○	○	○	○	○	○	○
I feel comfortable in using this website.	○	○	○	○	○	○	○

Interface

Please rate to what extend you agree with these statements:

	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree
This website is visually appealing.	○	○	○	○	○	○	○
It was easy to move from one page to another.	○	○	○	○	○	○	○
The overall organisation of the site is easy to understand	○	○	○	○	○	○	○
Individual pages are well designed.	○	○	○	○	○	○	○
Terminology used in this website is clear.	○	○	○	○	○	○	○
The content of the website met my expectations.	○	○	○	○	○	○	○
I would be likely to use this website in the future.	○	○	○	○	○	○	○
Overall, the website is easy to use.	○	○	○	○	○	○	○

Last questions

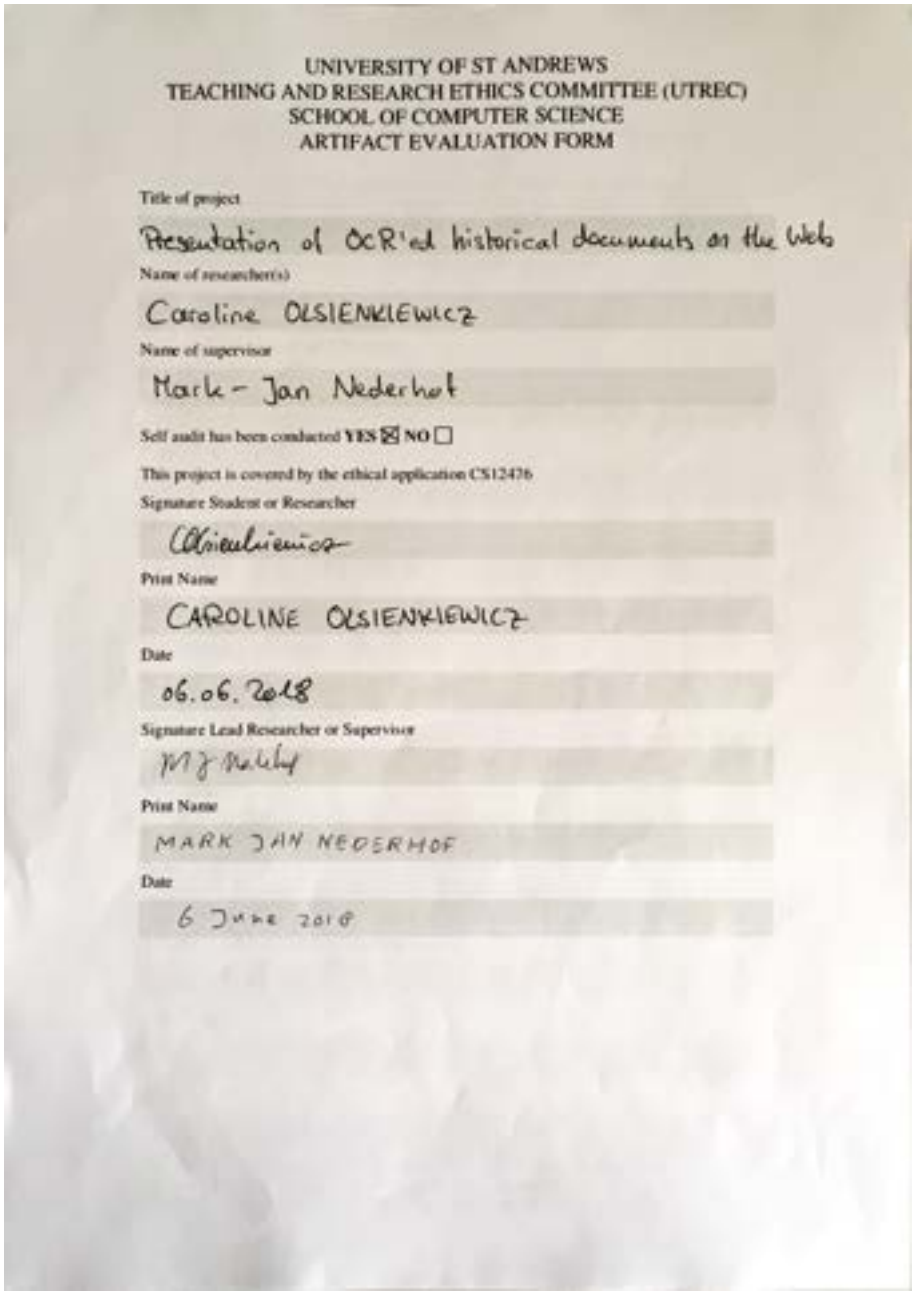
Where would you place yourself on this scale from computer speialist to computer novice?

Computer Specialist	Above average computer afiliated	Average computer user	Below average computer user	Complete computer novice
○	○	○	○	○

- Do you have any further annotations about a specific part or feature of the website, was there something (feature or information) missing? Or do you have any further comments?

Survey Powered By Qualtrics

Other Appendices



UNIVERSITY OF ST ANDREWS
TEACHING AND RESEARCH ETHICS COMMITTEE (UTREC)
SCHOOL OF COMPUTER SCIENCE
ARTIFACT EVALUATION FORM

Title of project

Presentation of OCR'ed historical documents on the Web

Name of researcher(s)

Caroline OLSIENKIEWICZ

Name of supervisor

Mark-Jan Nederhof

Self audit has been conducted YES ☒ NO ☐

This project is covered by the ethical application CS12476

Signature Student or Researcher

Olsienkiewicz

Print Name

CAROLINE OLSIENKIEWICZ

Date

06.06.2018

Signature Lead Researcher or Supervisor

MJ Nederhof

Print Name

MARK JAN NEDERHOF

Date

6 June 2018

Ethical Approval Document

Bibliography

[2] William Albert and Thomas Tullis. *Measuring the user experience: collecting, analyzing, and presenting usability metrics*. Newnes, 2013.

[3] Nigel Bevan. "Guidelines and standards for web usability". In: *Proceedings of HCI International*. Vol. 2005. Lawrence Erlbaum. 2005.

[4] Ofer Biller et al. "Webgt: An interactive web-based system for historical document ground truth generation". In: *Document Analysis and Recognition (ICDAR), 2013 12th International Conference on*. IEEE. 2013, pp. 305–308.

[5] Arianna Ciula, Paul Spence, and José Miguel Vieira. "Expressing complex associations in medieval historical documents: the Henry III Fine Rolls Project". In: *Literary and Linguistic Computing* 23.3 (2008), pp. 311–325.

[8] Floriana Esposito et al. "Machine learning methods for automatically processing historical documents: From paper acquisition to XML transformation". In: *Document Image Analysis for Libraries, 2004. Proceedings. First International Workshop on*. IEEE. 2004, pp. 328–335.

[9] Xristine Faulkner. *Usability Engineering*. Grassroots Series. PALGRAVE, Basingstoke, NY, 2000.

[10] Jennifer Fleming and Richard Koman. *Web navigation: designing the user experience*. 1st. O'reilly Sebastopol, CA, 1998.

[12] Carole A. George. "Usability testing and design of a library website: an iterative approach". In: *OCLC Systems & Services: International digital library perspectives* 21.3 (2005), pp. 167–180.

[17] Rex Hartson and Pardha S. Pyla. *The UX Book: Process and guidelines for ensuring a quality user experience*. Elsevier Inc., Waltham, MA, 2012.

[18] Hans Van der Heijden. "Factors influencing the usage of websites: the case of a generic portal in The Netherlands". In: *Information & management* 40.6 (2003), pp. 541–549.

[19] Ralf Hoffmann and Kirstin Krauss. "A critical evaluation of literature on visual aesthetics for the web". In: *Proceedings of the 2004 annual research conference of the South African institute of computer scientists and information technologists on IT research in developing countries*. South African Institute for Computer Scientists and Information Technologists. 2004, pp. 205–209.

[20] Wonil Hwang and Gavriel Salvendy. "Number of people required for usability evaluation: the 10±2 rule". In: *Communications of the ACM* 53.5 (2010), pp. 130–133.

[21] Nancy Ide and David Woolner. "Exploiting Semantic Web Technologies for Intelligent Access to Historical Documents." In: *LREC*. Citeseer. 2004.

[22] Tomayess Issa and Andrew Turk. "Applying usability and HCI principles in developing marketing websites". In: *International Journal of Computer Information Systems and Industrial Management Applications* 4 (2012), pp. 76–82.

[23] Melody Y. Ivory and Marti A. Hearst. "Improving web site design". In: *IEEE Internet Computing* 2 (2002), pp. 56–63.

[24] Melody Y. Ivory and Marti A. Hearst. "The state of the art in automating usability evaluation of user interfaces". In: *ACM Computing Surveys (CSUR)* 33.4 (2001), pp. 470–516.

[26] Fanny Klett. "Visual Communication in Web-based Learning Environments". In: *Educational Technology & Society* 5 (2002), p. 4.

[27] Tali Lavie and Noam Tractinsky. “Assessing Dimensions of Perceived Visual Aesthetics of Web Sites”. In: ().

[29] Shunji Mori, Ching Y Suen, and Kazuhiko Yamamoto. “Historical review of OCR research and development”. In: *Proceedings of the IEEE* 80.7 (1992), pp. 1029–1058.

[31] Jakob Nielsen. *Designing web usability: The practice of simplicity*. New Riders Publishing, Berkeley, CA, 1999.

[33] Jakob Nielsen. “Usability inspection methods”. In: *Conference companion on Human factors in computing systems*. ACM. 1994, pp. 413–414.

[35] Jakob Nielsen and Hoa Loranger. *Prioritizing web usability*. New Riders Publishing, Berkeley, CA, 2006.

[36] Donald A. Norman. *The design of everyday things*. Basic Books, NY, 2013.

[37] Peter G. Polson et al. “Cognitive walkthroughs: a method for theory-based evaluation of user interfaces”. In: *International Journal of man-machine studies* 36.5 (1992), pp. 741–773.

[38] Mgr Petr Přidal and Petr Žabička. “Tiles as an approach to on-line publishing of scanned old maps, vedute and other historical documents”. In: *e-Perimetron* 3.1 (2008), pp. 10–21.

[40] Roslyn Raward. “Academic library website design principles: development of a checklist”. In: *Australian Academic & Research Libraries* 32.2 (2001), pp. 123–136.

[41] Luz Rello and Ricardo Baeza-Yates. “Good fonts for dyslexia”. In: *Proceedings of the 15th international ACM SIGACCESS conference on computers and accessibility*. ACM. 2013, p. 14.

[42] Jeffrey Rubin and Dana Chisnell. *Handbook of usability testing: how to plan, design and conduct effective tests*. 2nd. John Wiley & Sons, Indianapolis, IN, 2008.

[44] Andrew Sears and Julie A. Jacko. *Human-Computer Interaction Fundamentals*. 2nd. CRC Press, Boca Raton, FL, 2007.

[45] Ben Shneiderman and Catherine Plaisant. *Designing the user interface: strategies for effective human-computer interaction*. 5th. Addison Wesley, Upper Saddle, N.J., 2009.

[47] Jared Spool and Will Schroeder. “Testing web sites: Five users is nowhere near enough”. In: *CHI’01 extended abstracts on Human factors in computing systems*. ACM. 2001, pp. 285–286.

[49] Wei-siong Tan, Dahai Liu, and Ram Bishu. “Web evaluation: Heuristic evaluation vs. user testing”. In: *International Journal of Industrial Ergonomics* 39.4 (2009), pp. 621–627.

[51] Thomas S. Tullis and Jacqueline N. Stetson. “A Comparison of Questionnaires for Assessing Website Usability”. In: ().

[53] Jianfeng Wang and Sylvain Senecal. “Measuring perceived website usability”. In: *Journal of Internet Commerce* 6.4 (2007), pp. 97–112.

[54] Robin Williams. *The non-designer’s design book: Design and typographic principles for the visual novice*. 3rd. Peachpit Press, Berkeley, CA, 2008.

Web Links

[1] University of Aberdeen. *The Aberdeen Bestiary - MS 24*. Viewed on 12.06.2018. URL: https://www.abdn.ac.uk/bestiary/.

[6] University of St. Andrews Dr. Mark-Jan Nederhof. *The stela of Iy*. Viewed on 03.05.2018. URL: https://mjn.host.cs.st-andrews.ac.uk/egyptian/stelae/iy-dundee/.

[7] Dynamit. *POUR Accessibility*. Viewed on 25.07.2018. URL: http://www.dynamit.com/accessibility-principles/.

[11] Bibliothèque nationale de France. *Gallica*. Viewed on 12.06.2018. URL: http://image.ox.ac.uk/show?collection=jesus&manuscript=ms57.

[13] Github. *A Web App for Optical Character Recognition using Tesseract OCR and ImageMagick.*. Viewed on 10.06.2018. URL: https://github.com/pvgupta24/OCR-Web-App.

[14] a9t9 software GmbH. *Free OCR API and Online OCR*. Viewed on 10.06.2018. URL: https://ocr.space/.

[15] Maklabu GmbH. *Free OCR*. Viewed on 10.06.2018. URL: https://www.free-ocr.com/.

[16] Google. *Convert PDF and photo files to text*. Viewed on 10.06.2018. URL: https://support.google.com/drive/answer/176692?co=GENIE.Platform%3DDesktop&hl=en.

[25] jQuery. *jQuery*. Viewed on 10.08.2018. URL: https://jquery.com/.

[28] Hathi Trust Digital Library. *Roman de la Rose, Digital Library*. Viewed on 12.06.2018. URL: https://babel.hathitrust.org/cgi/mb?colltype=updated.

[30] newOCR.com. *Free Online OCR: Convert JPEG, PNG, GIF, BMP, TIFF, PDF, DjVu to Text*. Viewed on 10.06.2018. URL: https://www.newocr.com/.

[32] Jakob Nielsen. *Usability 101: Introduction to Usability*. Viewed on 25.07.2018. URL: https://www.nngroup.com/articles/usability-101-introduction-to-usability/.

[34] Jakob Nielsen. *Why You Only Need to Test with 5 Users*. Viewed on 25.07.2018. URL: https://www.nngroup.com/articles/why-you-only-need-to-test-with-5-users/.

[39] Qualtrics. *Four core experiences of business. Four applications to get them right.* Viewed on 25.07.2018. URL: https://www.qualtrics.com/uk/.

[43] University of Saskatchewan and Innovation.ca. *Textual Communities - Make the edition you want*. Viewed on 10.08.2018. URL: https://textualcommunities.org/app/.

[46] Universität Freiburg Schweitzerische Akademie der Geistes-und Sozialwissenschaften. *e-codices - Virtual Manuscript Library of Switzerland*. Viewed on 12.06.2018. URL: https://www.e-codices.unifr.ch/en.

[48] University of St. Andrews. *University Colour Palette*. Viewed on 03.06.2018. URL: https://digitalcommunications.wp.st-andrews.ac.uk/2018/03/16/colour-palette/.

[50] Bibliothèque Nationale de France The Johns Hopkins University. *Roman de la Rose, Digital Library*. Viewed on 03.08.2018. URL: http://romandelarose.org/.

[52] Oxford University. *Jesus College MS. 57*. Viewed on 15.06.2018. URL: http://image.ox.ac.uk/show?collection=jesus&manuscript=ms57.