Heuristic evaluation of the information architecture of academic library websites

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Declaration

I declare that this master's dissertation, which I hereby submit for the degree MIS (Multimedia) at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at another university.

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Abstract

The main goal of this study was to do a heuristic evaluation of the information architecture (IA) of the recently redesigned academic library website of the University of Pretoria and to provide recommendations for improvement if necessary.

The main problem that is addressed by this study is that there is no comprehensive list of heuristics for the purpose of evaluating the IA of academic library websites. This study used various methods to address this problem and achieve the main goal.

A literature review resulted in a set of integrated usability heuristics that can be used to do a heuristic evaluation of the IA of academic library websites. The set was created based on an integration of existing usability principles from authorities in the field of usability. The integrated set of existing principles was made applicable to academic library websites through the addition of sub-criteria based on a review of twenty related studies.

A multiple-case study method was used for the heuristic evaluation of the library websites of the top three universities in South Africa, i.e., University of Cape Town, University of the Witwatersrand, and Stellenbosch University. The results of the multiple-case study method were used to further adapt the list of principles. The heuristic evaluation method was used in each of the case studies as a data collection method. Another case study was done, using the same method and revised heuristics, to evaluate the usability of the library website of the University of Pretoria and to provide recommendations.

The main outcomes of this study is a list of heuristics that can be used for the heuristic evaluation of the IA of academic library websites, as well as a list of recommendations for the improvement of the newly redesigned library website of the University of Pretoria. The list of heuristics is not limited to academic library websites, however, as it can be adapted and reused for the heuristic evaluation of other types of websites.

Keywords

Academic library websites, information architecture, usability inspection, heuristic evaluation, expert evaluation, user-centred design

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List of Abbreviations

CMS	Content management system
DE	Dialogue element
IA	Information architecture
SU	University of Stellenbosch
UCD	User-centred design
UCT	University of Cape Town
UP	University of Pretoria
WCAG	Web Content Accessibility Guidelines
Wits	University of the Witwatersrand

Chapter 1 – Introduction

Academic institutions need to be aware of the usability problems that can be found on their websites, which can be improved to gain the "advantages of usable educational websites" (Hasan 2013:231). A usability problem is something that is confusing, misleading, or sub-optimal in an interface (Lazar, Feng & Hochheiser 2010:252). The aim of a usability inspection is to find usability problems in an existing user interface design and to use these problems to make recommendations for fixing the problems and improve the usability of the design (Nielsen & Mack 1994:3). According to Sherwin (2016) "universities that prioritize a good user experience leverage the website to contribute to larger institutional goals and see a clear return on investment".

The University of Pretoria has recently gone through the process of redesigning their library website and at the time of this study, has released a partial implementation of the new website. This study goes through the process of compiling a consolidated set of heuristics for the heuristic evaluation of the information architecture (IA) of academic library websites. The process includes case studies in which the library websites of top universities in South Africa are evaluated with the compiled heuristics. At the end of this study, the list of heuristics is used to evaluate the library website of the University of Pretoria and provide recommendations for improvement.

Multiple steps were taken to create an appropriate set of heuristics for this purpose. The steps that were taken include:

- Integrating sets of existing usability principles from Nielsen (1995a), Shneiderman et al. (2016), and ISO (2006);
- Determining what usability problems are commonly found on academic library websites by evaluating related studies and making the integrated set of heuristics applicable to these problems;
- Using this set of heuristics to evaluate the library websites of the top universities in South Africa;
- Supplementing the heuristics with additional sub-criteria based on the findings of the evaluations; and
- Using the set of heuristics for the evaluation of the library website of the University of Pretoria and providing recommendations for improvement.

This study focusses on the evaluation of the IA aspects of websites, rather than the visual design aspects. IA is concerned with the organisation, labelling, navigation, and search

systems of a website. Conversely, visual design is more concerned with the 'look and feel'. IA is a key determiner of the usability of academic library websites (Gullikson et al. 1999:303). The importance of the IA has often been overlooked by website designers in the past, specifically in the context of academic library websites (Duncan & Holliday 2008:302).

This study focusses on library websites of universities in South Africa, specifically the top three universities according to QS rankings (Quacquarelli Symonds 2016a; Quacquarelli Symonds 2016b). These three universities can be seen as the direct competitors of the University of Pretoria, as the University of Pretoria is rated as the fourth best university in South Africa. Therefore, case studies are conducted on the library websites of the top three universities in South Africa to 'test' the consolidated list of heuristics, before using them to conduct a heuristic evaluation on the library website of the University of Pretoria, with the purpose of providing recommendations for improvement.

The following section provides a background to the various aspects mentioned above.

1.1 Background to the study

The background to the study is a contextualisation of the problem within the broader usability environment which provides a rationale for the problem statement.

The following discussion shows that there is a lack of usability studies on academic library websites in South Africa. Additionally, it shows that there is a specific set of problems that a user is faced with when working with academic library websites and that it has evolved since the existence of academic library websites. It also discusses the significance of IA in the context of academic library websites and the methods that can be used to evaluate it.

1.1.1 Usability studies on academic library websites in South Africa

Tim Berners-Lee created the world wide web in 1989 (Greenemeier 2009). Since this time, many usability studies have been done internationally on a wide variety of websites (Mustafa & Al-Zoua'bi 2008:2). The usability of academic library websites has also been a widely researched topic internationally, for example, Hasan (2013), Jasek (2004), Joo (2010), Mustafa and Al-Zoua'bi (2008), and many others that are cited later on in the study. There is, however, a lack of these studies in South Africa and only a limited number could be found, as is evident in the literature review (Chapter 2).

A library website is an important gateway to a university's library services including electronic resource access, online catalogues, and online referencing services. The University of Pretoria (UP) launched a partial implementation of their redesigned academic library website in 2016, and no usability study has been conducted on it yet.

1.1.2 History of academic library website usability

The web has evolved to a great extent since 1989 when it was first invented. Library websites have also evolved drastically over the past ten years "from simple pages with a few links to complex sites that provide direct access to hundreds of different resources" (Duncan & Holliday 2008:301). The evaluation of library websites has attracted a large amount of attention from researchers in the field of library and information sciences (Shukla & Tripathi 2010:404; Joo, Lin & Lu 2011:11; Iqbal & Warraich 2012:2).

Library websites were initially developed to meet the needs of the people who work in the library (Dominguez, Hammill & Brillat 2015:100) and were designed and maintained by library employees, rather than web developers (King & Jannik 2005:236). This resulted in academic library websites that were "filled with too much library jargon, including endless acronyms for names of databases and tools, too much text, and confusing navigation options" (Dougan & Fulton 2009:218). According to Tidal (2012:94), the confusion with terminology is one of the biggest obstacles in library websites (Tidal 2012:94).

Library resources that were made available on the library website were growing at a rapid rate and at that time the focus was more on quantity rather than quality (King & Jannik 2005:236; Duncan & Holliday 2008:301). This resulted in websites that were "cluttered and crowded with information" (Dominguez, Hammill & Brillat 2015:100).

The rapid growth of library websites resulted in websites that were not robust enough to support a large number of resources. These websites were not designed with the users in mind or with a consideration for how it would affect the findability of information. One of the major problems with early academic library websites was that they were designed and redesigned without any consideration for the website IA – the organisation and underlying structure of the website (Duncan & Holliday 2008:302).

Since then, many of these library websites have gone through usability testing and redesigns. Many of the problems that were relevant to websites then, are no longer applicable to modern library websites. For example, many websites have moved to content management systems (CMS) (Dougan & Fulton 2009:219). Therefore, a large number of the studies that were conducted on academic library websites are no longer relevant to current academic library websites or studies.

1.1.3 Aspects of interfaces that contribute to their usability

Various aspects of an interface play an important role in its usability. Two of these aspects that can be evaluated with usability studies are the visual design aspects and IA (Macefield 2012). The visual design focuses on the aesthetic aspects of the website, including colours, font choices, the overall look and feel, the images, and other elements (Usability.gov 2013). IA relates to the structural aspects of the website, i.e., the organisation, navigation, labelling, and search systems (Rosenfeld, Morville & Arango 2015:4).

The IA is essential for the success of an academic library website (Gullikson et al. 1999:293). Academic library websites are large, information-rich systems, which are only useful if the available resources are findable. One of the main focuses in the field of IA is supporting the findability of information (Wodtke & Govella 2009:xvii) and it is regarded by Rosenfeld, Morville and Arango (2015:5) as a "critical success factor" for the overall usability of a website. The visual design of a website is more visible to a user when they first interact with a system, however, if the organisation of the website and its content does not have a good underlying structure, then the visual design will not fix the usability problems (Lynch & Horton 2009:71).

1.1.4 Types of usability studies

Usability evaluation (in the source equated with usability engineering) is a term that is used to describe a "process or activity that aims to improve the ease of use of an interface" (Lazar, Feng & Hochheiser 2010:256). There are three broad categories under usability evaluation that define how usability problems are identified – expert-based evaluation (by expert evaluators), automated testing (with tools), and user-based testing (with end-users) (Zahran et al. 2014:26).

The usability evaluation methods that are conducted by human intervention, i.e. experts or users, assess the external attributes of the website, such as the structure of the contents of the website rather than its internal attributes such as download time or HTML errors, which can be evaluated using tools (Mustafa & Al-Zoua'bi 2008:4).

Expert-based evaluations are usually used together with user-based tests because each can be used to find problems overlooked by the other method (Nielsen 1995c). Expert-based evaluations should always be done first so that the interface flaws that experts can easily detect can be fixed before users interact with the interface (Nielsen 1995c; Lazar, Feng & Hochheiser 2010:256).

Expert-based evaluations, as opposed to user-based tests, are ideal for the evaluation of IA because users are good at performing tasks within an interface, but they are not interface

experts (Lazar, Feng & Hochheiser 2010:256). Users that experience problems while performing tasks with an interface will not necessarily be able to identify the problems that they encounter as a problem with the IA.

1.1.5 Heuristic evaluation of academic library websites

There are various heuristics that apply to generic problems that can exist in large websites. Library websites, a subset of these large websites, have elements that are unique to them. There is no comprehensive set of principles that could be found that are specifically for the evaluation of these websites. An integrated set of heuristics for the evaluation of academic library websites was therefore created in this study.

The gap that has been outlined in the above discussion is addressed by this study. It is outlined in the following problem statement.

1.2 Problem statement

The discussion above leads to the following problem statement:

- There is a lack of usability studies on academic library websites in South Africa.
- A usability study has not yet been conducted on the UP library website.
- There is a lack of usability principles specifically for the heuristic evaluation of the IA of academic library websites.

1.3 Statement of purpose

Due to the lack of usability studies on academic library websites in South Africa, this study focusses on the usability of academic library websites in South Africa. This study also does an in-depth heuristic evaluation on the new UP library website and provides recommendations for improvement. The focus of the evaluations are specifically on the usability of the IA and an integrated set of heuristics is created specifically for this purpose.

1.4 The goal and aims of this study

The goal of this study was to create a set of principles for the evaluation of the usability of the IA of academic library websites, to investigate the usability of the IA of UP's library website using these principles and, if necessary, to provide recommendations on how to improve it.

This goal can be achieved through the following steps:

1. Establish the IA components of which academic library websites should consist.
2. Identify heuristics that can be used to evaluate the usability of these components.
3. Conduct a multiple case study to test and refine the heuristics.
4. Apply the set of heuristics to evaluate the library website of the University of Pretoria.

1.5 Research questions

The goal of this study was achieved by answering the following research questions.

1.5.1 Main research question

This study has attempted to answer the main research question: *To what extent does the library website of the University of Pretoria comply with an integrated set of usability heuristics, compiled specifically for the evaluation of the IA of academic library websites?* The answer of the main question is summarised in the conclusion of this study, Chapter 6.

1.5.2 Sub-questions

The main research question is answered through the following sub-questions. Table 1.5-1 indicates the sections of the study in which each of the sub-questions is answered. The answers of each of the sub-questions are summarised in Chapter 6.

	Question	Section
1	What is usability?	Chapter 2: Literature review, part 1
2	How can usability be evaluated?	
3	What is IA and how can it be evaluated?	
4	What usability principles are appropriate for evaluating the usability of the IA aspects of academic library websites?	Chapter 2: Literature review, part 2
5	To what extent are the library websites of the top universities in South Africa usable?	Chapter 4: Case studies
6	How can the integrated list of heuristics be improved?	
7	What recommendations can be made to improve the usability of the library website of the University of Pretoria?	Chapter 5: Evaluation and analysis of the UP library website

Table 1.5-1: Sections of the study where each of the sub-questions is answered

1.6 Methodology overview

The methodology used in this study consists of three main qualitative research methods (literature review, case study, and heuristic evaluation), therefore, the methodology chapter consists of three parts.

The first part describes the literature review, which was used to determine the usability principles that were used in the empirical study. The second part describes the case study method. Three case studies were conducted on the library websites of the top universities in South Africa in Chapter 4. A fourth case study was conducted on the library website of the University of Pretoria in Chapter 5. Each website was evaluated by using the usability inspection method called heuristic evaluation, which is described in the third part of the methodology chapter. These methods are discussed in more detail below.

1.6.1 Literature review

The literature review was divided into two parts. Part one was used to get the background of the study and part two was used to devise an integrated set of heuristics that was used in the empirical study.

Part one consists of a discussion of the main terms used in this study, i.e., usability and usability evaluation, and IA. The discussion of IA contributed to the framework that was used to divide each of the websites into six dialogue elements.

Part two consists of an integration of existing lists of usability principles. The integration resulted in a list of fourteen heuristics with sub-criteria that are based on the discussions of the existing lists of principles. After the integration, related studies were analysed to find out what problems were commonly found on other academic library websites with reference to the fourteen heuristics. The results of the analysis were a list of recommendations that the integrated list of heuristics was supplemented with.

1.6.2 Case studies

The case study method is a qualitative research method in which a certain phenomenon is investigated in order to gain an in-depth understanding of the specific case (Leedy & Ormrod 2014:143). A better understanding of a specific phenomenon can be gained through an investigation of the phenomenon across multiple cases (Blatter 2008). These cases should be selected based on the assumption that they are information-rich sources (Patton 2014).

Three websites were chosen and analysed as three separate cases in a multiple case study. The first three case studies were selected based on the assumption that these websites are information-rich sources that can be used to learn about the important aspects of the phenomenon being investigated. Therefore, the websites of the top three universities in South Africa, according to the QS World University rankings and the QS University Rankings: BRICS 2016 (Quacquarelli Symonds 2016a; Quacquarelli Symonds 2016b) were chosen.

These websites were evaluated using the heuristics compiled in the literature review. Additional sub-criteria was added based on the results of these case studies. A final case study

was conducted on the library website of the University of Pretoria, with the purpose of providing recommendations for improvement.

1.6.3 Heuristic evaluation

A heuristic evaluation was performed on each of the websites in the case studies.

Heuristic evaluation is a usability inspection method that involves experts evaluating an interface to see if it complies with a set of established usability principles (Nielsen & Mack 1994:5). The heuristic evaluation method is relatively easy to learn and to apply and it is effective compared to other usability inspection methods (Nielsen & Mack 1994:12).

A heuristic evaluation can be conducted using any set of principles that are appropriate for the evaluation of the specific interface. Therefore, a unique set of heuristics was compiled in the literature review for the specific purpose set out by this study.

The integrated set of heuristics that was compiled in the literature review was used for the usability evaluations in the first three case studies, in which the library websites of the top three universities in South Africa were evaluated. Additional sub-criteria were then added based on the results of the case studies. This final set of heuristics with sub-criteria was used for the fourth and final case study in which the library website of the University of Pretoria was evaluated.

1.7 Limitations

Certain aspects of the library websites were not evaluated in this study as discussed below.

1.7.1 Website subdomains

Each of the library websites that was evaluated in this study also had main library content on subdomains. The content on the subdomains had different structures to the main library website that was being evaluated. Therefore, the content on the subdomains were excluded from this study, as the IA of the (main) academic library website was the focus of the study. The only aspects of the subdomains that were discussed was the negative impact that the different structure of these webpages had on the usability of the main library website. The only exception to this limitation is the evaluation of forms, which are standard features of academic library websites, but not necessarily on the main library domain. The sub-domains that were excluded are specified in the introductory section of each of the case studies.

1.7.2 Restricted access

There are aspects of academic library websites that require users to log in to the system to gain access to information. These aspects were not evaluated because the researcher is not a

student or staff member at the various universities and therefore does not have a user account for these websites. However, the researcher was able to evaluate some of the forms that a user is presented with *before* the limited content is reached. Therefore, some of the functionality of the interactive forms were evaluated, right up to where access is restricted.

1.7.3 Partial implementation of UP's academic library website

At the time of this study, the redesign of the library website of the University of Pretoria has only been implemented partially. Some of the pages consisted of the new design and some of the pages still had the old design. The evaluation of the UP library website was only done on the new pages because the old ones would inevitably be replaced.

1.7.4 Accessibility

An important aspect of website usability is accessibility. Accessibility refers to how user-friendly the interface is for disabled persons. For example, people who are visually impaired need colour blindness support or larger font sizes. These aspects are dependent on the usability of the visual design aspects of an interface and therefore it is excluded from this study, since the focus of the study is only on the IA.

1.7.5 Visual design

The focus of this study is on the IA aspects of the library websites as opposed to the visual design aspects, as motivated in Section 1.1.3.

1.7.6 Single expert evaluator

The researcher was the sole expert evaluator in this study, therefore, the simplest form of a heuristic evaluation was performed, i.e., it involved one expert only. This contributes to the method's cost-effectiveness, which is often referred to as a "discount usability engineering" solution (Nielsen & Mack 1994:19, 173).

1.8 Outline of chapters

This section provides a brief summary of the chapters in this study. Each of the chapters plays a key role in achieving the goal of the study.

1.8.1 Chapter 1 – Introduction

The introduction presents the rationale for the study, an overview of the literature, and a summary of the methodology. It also presents the aims and goals of this study, and the research questions that help to achieve these goals. It contains references to the sections in the study where each of the research questions is answered.

1.8.2 Chapter 2 – Literature review

The literature review consists of two parts. The first part describes the three main topics of this study, namely, usability, usability evaluation, and IA. The second part analyses sets of established usability principles, as well as related studies that have been done in order to compose a set of heuristics that are used in the empirical study.

The established usability principles that are analysed are the sets of principles from the pioneers in the field of usability, Ben Shneiderman (Shneiderman 1986; Shneiderman et al. 2016) and Jakob Nielsen (1995a), as well as a published standard from ISO (2006).

The related studies that are analysed are the most widely cited peer-reviewed articles from 2005 to 2016. Only related studies of the past 11 years were used based on the fact the problems that were found in older related studies are no longer applicable to modern websites (due to the rapid evolution of academic library websites, as discussed in Section 1.1.2). The related studies are analysed in order to find out what usability problems are commonly found in usability studies that are performed on academic library websites.

The result of the literature review is a list of heuristics with sub-criteria and recommendations that focus specifically on the usability of the IA aspects of academic library websites.

1.8.3 Chapter 3 – Methodology

The methodology explains the research methods that were used in the study and how they were implemented.

The first part describes the literature review as a method. In this study, in addition to providing the background of the study, the literature review is used to compose a set of heuristics that can be used to evaluate academic library websites.

The second part of the methodology chapter describes the case study method and how it was applied in this study.

The final part of the methodology chapter describes the usability inspection method (heuristic evaluation) that is used in each of the case studies as a data collection method.

1.8.4 Chapter 4 – Case studies

This chapter provides a description of the usability problems that were found on the three selected websites using the heuristic evaluation method.

After the evaluation of the three websites, the heuristics are supplemented with additional sub-criteria based on problems that were common in the case studies, but not directly addressed by the heuristics.

1.8.5 Chapter 5 – Evaluation and analysis of the UP library website

This chapter provides a description of the usability problems that were found on the UP library website using the heuristic evaluation method using the revised set of heuristics from Chapter 4. For each of the problems, recommendations for improvement are also provided.

1.8.6 Chapter 6 – Conclusion

This chapter provides the conclusion of the study. In the conclusion, the researcher discusses each of the sub-questions of the study and how it contributed to answering the main research question. Recommendations for future research are also provided.

1.9 Chapter 1 summary

This chapter provided an overview of the study, which includes the background to the study, the goal and aims, the research questions, the overview of the methodology, and the outline of the chapters.

Each of the following chapters contributes to answering the research questions of this study with the aim of achieving the goal of the study.

The next chapter consists of the literature review, which provides definitions of the key terms used in the study as well as all the steps that were taken to create the list of heuristics that are used in the case studies (Chapter 4) and evaluation and analysis of the UP library website (Chapter 5).

Chapter 2 – Literature review

The literature review consists of two parts. Part one provides the context and the background of the current knowledge of the topic by summarising and analysing the key concepts used in the study, i.e., usability and usability evaluation, and IA. This establishes the definition of usability that is followed in this study and how it can be evaluated, as well as a summary of the IA components that can be identified in large websites, specifically academic library websites.

Part two is an analysis of well-known sets of established usability principles as well as related studies that have been done. The purpose of this analysis is to combine it with the findings of part one to compose a set of heuristics that were used in the empirical study (Chapter 4 and Chapter 5).

Therefore, the result of the literature review is a list of heuristics that focus specifically on the usability of the IA aspects of academic library websites based on the findings of the two parts of the literature review.

2.1 Part one: Background to the study

The three main topics of this study (usability, usability evaluation, and IA) are described in this section. According to Krug (2014:183), the two terms "Usability" and "Information Architecture" were known as the two "professions" that focussed on *making websites more usable* in the late 1990s. Krug (2014:183) defines usability as the practice of designing interfaces in a way that enables users to use them successfully and IA as the practice of organising content to allow users to find what they need. King and Jannik (2005:235) confirm that these two terms are major concepts that apply when designing or redesigning library websites. Usability evaluation is also discussed, as it is the fourth and final step of the user-centred design (UCD) process, and its goal is to make a product usable.

2.1.1 Usability

According to Nielsen (2012), *usability* is a quality attribute that determines whether a product is easy to use. Nielsen (2012), together with other prolific authorities in the field (as discussed below), uses various overlapping collections of descriptive usability terms to define usability. Such terms can be used to describe or measure the usability of a system (Preece, Rogers & Sharp 2015:19). Many definitions of usability that can be found on the web are derived from these collections of usability terms or definitions, as they are the most widely cited sources for usability. These various collections of terms are presented below and consolidated in Section 2.1.1.1 to create an integrated definition of usability.

Nielsen (2012) defines usability by the five *quality components*:

" • Learnability
• Efficiency
• Memorability
• Errors
• Satisfaction"

ISO 9241-11 (1998) defines usability as "the extent to which a product can be used by specified users to achieve specified goals" in "a specified context of use" with the *usability measures*:

" • Effectiveness
• Efficiency
• Satisfaction"

Preece, Rogers and Sharp (2015:19) break usability down into the following *usability goals*:

" • Effective to use (effectiveness)
• Efficient to use (efficiency)
• Safe to use (safety)
• Having good utility (utility)
• Easy to learn (learnability)
• Easy to remember how to use (memorability)"

Shneiderman et al. (2016) present the following five measurable *human factors* that are central to evaluation:

" • Time to learn
• Speed of performance
• Rate of errors by users
• Retention over time
• Subjective satisfaction"

Each of the authorities referenced above refer to their collections of terms using different titles, i.e.: *quality components* (Nielsen 2012), *usability measures* (ISO 9241-11 1998), *usability goals* (Preece, Rogers & Sharp 2015:19), and *human factors* (Shneiderman et al. 2016). The book section in which Shneiderman et al. (2016) address these "human factors" is titled "usability goals and measures" which also corresponds to the other authorities' titles. These terms are referred to as *usability measures* hereafter because it is the most descriptive of the purpose of the terms.

It is to be noted that Shneiderman's human factors were published in 1986, in the first edition of "Designing the User Interface: Strategies for Effective Human-Computer

Interaction" by Ben Shneiderman as the sole author (1986). Therefore, this list is referred to as Shneiderman's "human factors", despite the fact that the latest version of the book has five co-authors. This same issue also applies to Shneiderman's "golden rules" (discussed in Section 2.2.1.3), which were also published in the same book.

2.1.1.1 Usability measures

The terms effectiveness, efficiency, learnability, memorability, safety, satisfaction, and utility are used as a foundation for the discussion of the usability measures below since various definitions use different terms to refer to the same concept. For example, Shneiderman et al. (2016) use "speed of performance" to refer to "efficiency". The detailed discussion is summarised in Table 2.1-1 at the end of the section that shows how the usability measures from various definitions correspond to each other.

2.1.1.1.1 Effectiveness

Effectiveness refers to "how good a product is at doing what it is supposed to do" (Preece, Rogers & Sharp 2015:19). ISO 9241-11 (1998) defines it as "accuracy and completeness with which users achieve specified goals (the intended outcome)". Preece, Rogers and Sharp (2015:19) define usability goals from the product's perspective while ISO 9241-11 (1998) defines usability measures from the user's perspective. The effectiveness of a product is fundamental because it is about achieving an intended goal.

2.1.1.1.2 Efficiency

Efficiency refers to "the way a product supports users in carrying out their tasks" (Preece, Rogers & Sharp 2015:19). ISO 9241-11 (1998) defines it as "resources (time of usage, financial cost of usage, and human effort of usage) expended in relation to the accuracy and completeness with which users achieve goals". It is therefore about the fundamental resources that a user needs to expend to achieve a goal. Efficiency is listed as one of the quality components as part of Nielsen's definition and is defined by how quickly users can perform their tasks, once they have learned the design (Nielsen 2012). Shneiderman's (2016) equivalent measure for efficiency is "speed of performance" and it is defined as the amount of time that it takes users to carry out the benchmark tasks.

2.1.1.1.3 Learnability

Learnability refers to "how easy a system is to learn to use" (Preece, Rogers & Sharp 2015:21). The users of websites are not given a manual before using the website, therefore, it is important that it is easy to learn how to use a system by interacting with it (Nielsen 2012). Nielsen (2012) defines it as the ease with which users accomplish basic tasks the first time they interact with the design. Shneiderman's equivalent measure for learnability is "time to

learn" and it is defined as the amount of time it takes for typical users to learn how to use commands relevant to a set of tasks (Shneiderman et al. 2016).

2.1.1.1.4 Memorability

Memorability refers to "how easy a product is to remember how to use, once learned" (Preece, Rogers & Sharp 2015:21). This usability goal is used to establish if it is easy to remember how to use a system, especially when users return to the design after not using it for a period of time (Nielsen 2012; Preece, Rogers & Sharp 2015:21). Shneiderman's equivalent measure for memorability is "retention over time" and is defined by how well a user maintains their knowledge after more than an hour (Shneiderman et al. 2016).

2.1.1.1.5 Safety

Safety involves "protecting the user from dangerous conditions and undesirable situations" (Preece, Rogers & Sharp 2015:19). The first aspect (dangerous conditions) refers to external conditions that are applicable to where people work. In this case it is not relevant to the usability of websites. The second aspect, undesirable situations, refers to "helping any kind of user in any kind of situation avoid the dangers of carrying out unwanted actions accidentally". In websites, this attribute involves reducing the risk of the user mistakenly activating the wrong buttons or links. Nielsen (2012) refers to this issue under the quality components as "errors" while Shneiderman refers to this issue as "rate of errors" and it is defined as the number of errors users make (Shneiderman et al. 2016). It also includes the severity of the errors and how easily they can recover from the errors (Nielsen 2012) as well as the types of errors (Shneiderman et al. 2016).

2.1.1.1.6 Satisfaction

User satisfaction is the "freedom from discomfort and positive attitudes towards the use of the product" (ISO 9241-11 1998). It is, therefore, the perceived success, trust, emotional, and physical experience when using a system to achieve specified goals. Nielsen (2012) defines satisfaction as how pleasant it is to use the interface. Satisfaction is not included by Preece, Rogers and Sharp (2015:22) as a usability goal, but rather as a *user experience goal* as one of the many desirable aspects of an interface. It is excluded as a usability goal since it is concerned with "how a system feels to a user" rather than "how useful or productive a system is from its own perspective" (Preece, Rogers & Sharp 2015:23). Therefore, Preece, Rogers and Sharp (2015:23) classify it as a subjective rather than objective quality of an interface. Shneiderman et al. (2016) refer to this issue as "subjective satisfaction" and define it as how much users like using various aspects of the system. This can be determined by asking the user relevant questions via interviews or surveys (Shneiderman et al. 2016). User satisfaction

can also be the result of a system with a high level of effectiveness and efficiency (Joo, Lin & Lu 2011).

2.1.1.1.7 Utility

Utility refers to a design's functionality (Nielsen 2012) and is defined as "the extent to which the product provides the right kind of functionality so that users can do what they need or want to do" (Preece, Rogers & Sharp 2015:20). It is not listed as a quality component of usability by Nielsen (2012) but rather as another quality attribute (of something that is useful), that is equally as important as the usability of a system. Utility is about having a system that can "do what you want" while usability is about how easy it is for you to do what you want (Nielsen 2012). It is defined as doing what users need as well as providing the features that they need (Nielsen 2012). Even though it is not listed by Nielsen (2012) as a quality component of usability, it is still relevant to include it as an essential measurement of usability because a system that does not have the required functionality can be perceived as being less usable. According to Nielsen (2012), the same user research methods that can be used to improve *usability* can be used to improve *utility*. In this study, part of the evaluation includes determining if the websites have the required functionality.

The preceding discussion is summarised in the following table (Table 2.1-1). The terms in the first column are the terms that are used to refer to the concepts that are listed in the other columns, that contain the terms that each of the authors used for the concepts.

Term	Nielsen (2012) Quality components	Preece, Rogers and Sharp (2015) Usability goals	Shneiderman et al. (2016) Human factors	ISO (1998) Usability measures
Effectiveness	-	Effectiveness	-	Effectiveness
Efficiency	Efficiency	Efficiency	Speed of performance	Efficiency
Learnability	Learnability	Learnability	Time to learn	-
Memorability	Memorability	Memorability	Retention over time	-
Safety	Errors	Safety	Rate of errors by users	-
Satisfaction	Satisfaction	-	Subjective satisfaction	Satisfaction
Utility	-	Utility	-	-

Table 2.1-1: Usability measures used in various usability definitions and goals of usability

According to the discussion above, usability can be defined as the degree to which an interface can be considered usable with regards to the seven *usability measures:*

- Effectiveness
- Efficiency
- Learnability
- Memorability
- Safety
- Satisfaction
- Utility

These usability measures can be seen as the goals that a user interface expert wants to achieve when designing or evaluating a user interface.

The interface expert might not be able to succeed in every measure as there can be forced trade-offs based on the type of application (Shneiderman et al. 2016). Some of the usability measures will not be relevant to the product being designed or evaluated and some of them might even be incompatible with each other (Preece, Rogers & Sharp 2015:25). For example, the speed of performance may need to be sacrificed if it is very important to keep the rate of errors low (Shneiderman et al. 2016). In different applications, different usability attributes can determine the success of the application; therefore, it is important to determine the goal of a specific user interface in order to find out which usability measures are the primary goals for the type of user interface.

2.1.2 Usability evaluation

According to Burmester and Machate (2003:45), there is a consensus in the international community of usability experts that usability can be achieved through the UCD process. The UCD process is an iterative design cycle where the user is the centre of focus (Rubin, Chisnell & Spool 2008:12). The process consist of iterative cycles, phases or activities involving design, prototyping, and evaluation of the user interface (Burmester & Machate 2003:45; Dix et al. 2004; Petrie & Bevan 2009:7). Preece, Rogers, and Sharp (2015:15) refer to it as the process of interaction design and state that these activities should inform one another and should be performed repeatedly in order to design a successful product (Preece, Rogers & Sharp 2015:15).

According to Petrie and Bevan (2009:7) and Preece, Rogers and Sharp (2015:15) the evaluation phase is at the heart of the process.

2.1.2.1 Categorisation of usability evaluation methods

Usability evaluation methods can be categorised into methods that involve users (user-based methods) and methods that do not involve users (expert-based methods) (Petrie & Bevan 2009:7).

The term *usability testing* is reserved for methods that involve users (Lazar, Feng & Hochheiser 2010). Typically, usability tests require users to perform a set of tasks and require users and evaluators to have an understanding of the tasks that will be performed in the interface. Empirical methods involving users are the most commonly used method of evaluating user interfaces. However, the drawback of using real users is that it can be difficult or expensive to find enough users to test all aspects of all the versions of an evolving design (Nielsen & Mack 1994:2). Another problem is that project schedules or budgets sometimes make it difficult to involve users. This makes methods that do not involve users desirable as a "discount usability engineering" solution because they are cost-effective and do not require special equipment or lab facilities (Nielsen & Mack 1994:19, 173).

Expert-based evaluations are defined as "structured inspections by interface experts" (Lazar, Feng & Hochheiser 2010:256). The method of having expert evaluators identify usability problems is referred to as a *usability inspection* (Nielsen & Mack 1994:1; Lazar, Feng & Hochheiser 2010:257). According to Nielsen & Mack (1994:2), "Several studies of usability inspection methods have discovered that many usability problems are overlooked by user testing, but that user testing also finds problems that are overlooked by inspection". Therefore, the best results can be achieved by combining user-based and expert-based methods. Ideally, a usability inspection method should be used first to "clean up" the interface and to uncover obvious interface flaws. Improvements should be suggested even before user-based testing starts so that user testing can be applied to the revised design (Nielsen & Mack 1994:19; Lazar, Feng & Hochheiser 2010:256). This way, experts can find the interface flaws, and users can focus on finding task-related flaws, without being distracted by interface flaws (Lazar, Feng & Hochheiser 2010:256).

The usability inspection method that is used in this study is *heuristic evaluation*. The heuristic evaluation method is discussed in more detail in Section 3.3.1.

2.1.2.2 Why heuristic evaluation is applicable to this study

Heuristic evaluation (as opposed to usability testing involving users) is more appropriate for evaluating the IA of a product. User testing typically consists of tests that require users to perform a set of tasks whereas heuristic evaluation does not require the expert to perform tasks.

Interface experts are experts in interfaces and not typically in the tasks to be performed within an interface, while users are experts in performing the tasks within an interface but not experts in interface design (Lazar, Feng & Hochheiser 2010:256). Some portion of the interface functionality can be understood and improved without having an understanding of the tasks that will be performed in the interface (Lazar, Feng & Hochheiser 2010:256).

Therefore, heuristic evaluation is appropriate for the evaluation of IA because users might struggle to perform tasks, yet might not know that it is because of a problem with the IA.

2.1.2.3 Characteristics of an "expert"

At its simplest form, the heuristic evaluation of an IA can involve one expert that reviews the information environment and identifies problems together with recommendations for improvement (Rosenfeld, Morville & Arango 2015:240).

The expert that performs the usability inspection should be someone who was not part of the development of the interface that is being inspected and who is not familiar with the interface (Lazar, Feng & Hochheiser 2010:256).

An expert is someone who possesses "an unwritten set of assumptions about what does and doesn't work", based on experience in the field (Rosenfeld, Morville & Arango 2015:240). The expert is allowed to "make an educated guess about what the problem is and its most appropriate solution". Although these "guesses" are not always right, a single-expert model such as this can provide a good balance between cost and quality (Rosenfeld, Morville & Arango 2015:240).

2.1.3 Information architecture

One of the main focuses in the field of IA is supporting the findability of information (Wodtke & Govella 2009:xvii). Educational websites are mainly concerned with the two major questions: can the information that the user is looking for be found easily on the website and can the information be found in a timely manner? (Mustafa & Al-Zoua'bi 2008:2). Rosenfeld, Morville and Arango (2015:5) regard findability as a "critical success factor" for the overall usability of a website: "if users can't find what they need through some combination of browsing, searching, and asking, then the site fails" (Rosenfeld, Morville & Arango 2015:5). Findability is referred to as the sister of usability because one cannot *use* something if one cannot *find* it first (Wodtke & Govella 2009:xvii).

The main focus of this study is the IA of large, information-rich websites. The following section is used to identify the IA components in large, complex websites, such as academic library websites. The identified IA components of specific academic library websites were evaluated in the empirical study in Chapter 4.

2.1.3.1 Definitions of IA

Rosenfeld, Morville and Arango (2015:4) define IA as follows:

" 1. The structural design of shared information environments;
2. The synthesis of organization, labeling, search, and navigation systems within digital, physical, and cross-channel ecosystems;
3. The art and science of shaping information products and experiences to support usability, findability, and understanding;
4. An emerging discipline and community of practice focused on bringing principles of design and architecture to the digital landscape."

The Information Architecture Institute (2013) defines it as "the practice of deciding how to arrange the parts of something to be understandable". IA is defined by Krug (2014:183) as "making sure the content is organized in a way that allows people to find what they need". Brinck, Gergle and Wood (2001:120) define it as the organisation or structure of a website and how the pages in the website relate to each other. According to Garrett (2011:30), IA is the structure of information resources and it is defined as "the arrangement of content elements to facilitate human understanding". Lynch and Horton (2009:71) define it as "the overall conceptual models and general designs used to plan, structure, and assemble a site". All of the above definitions are similar in that they have to do with the arrangement, organising, structuring, or planning of content.

The *purpose* of having a website with a good IA is to help users answer the three questions of: where they are, where they have been, and where they can go (Wodtke & Govella 2009:2; Rosenfeld, Morville & Arango 2015:48). According to Wodtke and Govella (2009:2), this is the first principle of IA: designing for wayfinding. Nielsen (1999:188) states that navigation systems are responsible for helping users answer these three fundamental questions of navigation, the most important one being "where am I?", since users will not be able to understand a website's structure if they do not understand where they are.

The IA of a website can be both visible and invisible. It is visible if the user interacting with the website knows what to look for (Rosenfeld, Morville & Arango 2015:48). Usually, it goes unnoticed to the inexperienced user, and they will only notice it when it is not well designed, but they will probably not be aware that the problem is with the IA (Rosenfeld, Morville & Arango 2015:41). Therefore it can be difficult to know what components make up an IA. Users can interact directly with some components while others are so unnoticeable that users are not aware of their existence (Rosenfeld, Morville & Arango 2015). Therefore, it is appropriate to use expert evaluation to measure the usability of the IA explicitly, as motivated in Section 2.1.2.2.

2.1.3.2 IA component categories: The anatomy of IA

Overall website IA comprises the following four systems – organisation, labelling, search, and navigation (Rosenfeld, Morville & Arango 2015:39). These four systems are shared by most interactive information environments (Rosenfeld, Morville & Arango 2015:39).

This section focusses on identifying the IA components in the context of large, information-rich websites.

2.1.3.2.1 Organisation systems

"*How we categorize information*" (Rosenfeld, Morville & Arango 2015:49).

There are various ways to organise a website's information. A successful organisation system is one that supports a user's tasks (Nielsen 1999:198; Brinck, Gergle & Wood 2001:120).

The information organisation systems in the context of website development are very closely related to the navigation and labelling systems. The hierarchical organisation structures of websites are the primary way of *navigating* the system and the *labels* of categories help define the contents of those categories. The organisation system, however, focuses specifically on the *classification* and *logical grouping* of information. Therefore, it is relevant to isolate the design of the organisation system (Rosenfeld, Morville & Arango 2015:58).

An organisation system consists of *organisation schemes* and *organisation structures* (Rosenfeld, Morville & Arango 2015:58). An *organisation scheme* is used to determine the characteristics that are shared by content items and this influences the logical grouping and sorting of those items (Rosenfeld, Morville & Arango 2015:58). There are various methods for sorting information, for example, alphabetical, chronological, or topical (Rosenfeld, Morville & Arango 2015:58). Alphabetical and chronological sorting are more appropriate for known item searching, for example, when a user is looking for a book and they know the title of the book or the date on which the book was published. Sorting by topic is more appropriate when users are not sure what they are looking for, for example, when they are looking for books on a specific topic, they might not necessarily know the name of the book, the author, or the date on which the book was published. Sorting by topic usually makes more sense and is more common in website development, but it is more difficult to implement.

The grouping of information is concerned with how well similar pieces of content are grouped together, how much the groups overlap with each other, and how well child content objects represent parent content objects (Toub 2000:18). This means that items that are classified together should fit together, there should not be a high degree of overlap between categories, and categorised items must fit into their chosen categories. Even though the *labelling* of categories helps define the contents of those categories, the focus in the context of

organisation systems is not the effectiveness of the labels, but rather on the grouping of information and the similarity of concepts.

An *organisation structure* "defines the types of relationships between content items and groups" (Rosenfeld, Morville & Arango 2015:58). Organising the website content into taxonomies and hierarchies of information is one of the primary aims of IA (Lynch & Horton 2009:71). The most common organisation structure (also referred to as a topology) used in websites is the hierarchical structure (Nielsen 1999:198; Brinck, Gergle & Wood 2001:146; Rosenfeld, Morville & Arango 2015:58). Users usually understand and can easily learn how to use websites with hierarchical organisation structures since hierarchies are simple and familiar (Rosenfeld, Morville & Arango 2015:69). A hierarchical structure is represented as a tree that can be traversed by starting at the root node and moving down the branches (Rosenfeld, Morville & Arango 2015:69). Large websites usually require a combination of structures but, at the top level, will typically consist of a hierarchical structure (Rosenfeld, Morville & Arango 2015:77). A hierarchical structure can be complemented with a hypertext structure — a structure that can have nodes that branch from anywhere to anywhere regardless of the order of the nodes (Rosenfeld, Morville & Arango 2015:75). The organisation structure of a website defines the primary ways in which users can navigate a website (Rosenfeld, Morville & Arango 2015:69).

When analysing hierarchical structures, it is important to consider the balance between exclusivity and inclusivity of categories in a hierarchy (Rosenfeld, Morville & Arango 2015:70). Categories in hierarchical structures are typically mutually exclusive. However, when working with the structures of websites, it can be difficult to divide content into mutually exclusive categories. Therefore, some items may be cross-listed by placing them under two or more categories to improve the findability of these items. When taxonomies allow this cross-listing of items, it is referred to as a polyhierarchical structure (Rosenfeld, Morville & Arango 2015:70). When an information item can be found under various categories because it has multiple characteristics, it is referred to as a faceted classification. This increases the users' chance of finding what they are looking for, but it is also more difficult to implement (Wodtke & Govella 2009:57).

Another important aspect to consider, when analysing hierarchical structures, is the breadth versus the depth of the hierarchical structure. The breadth is the number of nodes at each level of the hierarchy and the depth is the number of levels (Rosenfeld, Morville & Arango 2015:70). It can either be broad and shallow with many links on each page, or narrow and deep with few links on each page (Brinck, Gergle & Wood 2001:148). A common navigation

design that emphasises the breadth of the design, is to list all the top levels of the design in the form of a navigation bar (Nielsen 1999:203).

When choosing between breadth and depth, it is important to consider the cost trade-off when looking at how people navigate websites. This cost trade-off affects how many links are displayed on a given page. If there are too many links on one page, users might not read all the options. If there are too few, users are more likely to make an error in their selection because the labels might be "less informative and specific" (Brinck, Gergle & Wood 2001:125).

2.1.3.2.2 Labelling systems

"*How we represent information*" (Rosenfeld, Morville & Arango 2015:49).

Labels are used to represent larger pieces of information in websites. Examples of textual labels on websites include page titles (the text that is displayed in the browser tab), the names of the links (to other pages or locations on the same page) and the headings on a webpage (Toub 2000:23; Rosenfeld, Morville & Arango 2015:82). Examples of visual labels include icons or buttons. Labels should be descriptive of the content they represent and should use language that is meaningful to the target users of the website (Rosenfeld, Morville & Arango 2015:82).

Link labels need to be useful cues for the information they lead to (Brinck, Gergle & Wood 2001:122). When the website organisation is logically and consistently named, it allows a user to successfully predict where to find information (Lynch & Horton 2009:121). Many different labels can be used to represent a single chunk of information. The goal is to establish how well a label tells users more about the represented information (Toub 2000:23). A good label must be obvious or "dull as dirt", i.e., users should know exactly what it refers to without having to think about it (Wodtke & Govella 2009:61). Link labels should be short containing single descriptive words instead of phrases (Duckett 2011:472).

2.1.3.2.3 Navigation systems

"*How we browse or move through information*" (Rosenfeld, Morville & Arango 2015:49).

Navigation systems are closely related to search systems since they both help users to move through the website (Rosenfeld, Morville & Arango 2015:43). In this context, the focus is on systems that support browsing.

Successful navigation systems depend greatly on the visual design aspect of usability engineering since they are also concerned with, for example, the colours of links, or the layout and position of links. From an information architect's perspective, however, it refers to giving

users context and allowing users to navigate laterally and vertically between branches in a hierarchical navigation system so that they can get to anywhere from anywhere (Rosenfeld, Morville & Arango 2015:177). Visual design aspects assist with providing context, for example, users' location within a website can be indicated in navigation bars by changing the style of the current link, i.e., the link that links to the current page.

By giving users context, i.e., showing users their current location in the website, the system helps them answer the most important fundamental question of navigation, "where am I" (Nielsen 1999:188). This can be done at two levels: their position relative to the web as a whole and their position relative to the website's structure (Nielsen 1999:189).

Showing a user where they are relative to the web as a whole includes identifying the website on all of the pages. According to Nielsen (1999:189), this is "navigation rule number one" because users who do not enter the website from the homepage should know what website they have landed on as well as where they are within the website. This can be done with the page title (that appears in the browser tab) and by having the website name or logo placed consistently at the same position at the top of all pages. It is a convention that the page title should consist of a keyword phrase that identifies the current page as well as the website or company (Mifsud 2011; Fernando 2014). According to Nielsen, the homepage title must start with the website or company name followed by a brief description of the site (Nielsen 2011). The logo must be a hypertext link to the homepage so that users can navigate back to the homepage from any page (Nielsen 1999:191). The website layout must also be consistent on all pages. This also helps the user know that they are still on the same website when they navigate around, thus it also gives them context.

Showing a user their location relative to the website structure can be done by showing them parts of the website structure, for example, in the main navigation bar, and then highlighting the part where the current page is located (Nielsen 1999:191). Context in a navigation bar is provided using visual design elements, i.e., by changing the colour of the link of the current page or by adding a marker to it (Duckett 2011:472). This is where the visual design aspects can be taken into consideration in the context of IA. It is also important to have main headings on all pages that identify the main content of the page. This should not be confused with the purpose of the labelling system, which is more concerned with the language that is used to represent the content.

Another way of telling users where they are within a website is through the use of *breadcrumbs*. Breadcrumbs is a term that is used for an indicator on a page that shows a user where they are in a hierarchy of webpages (Wodtke & Govella 2009:4). According to Nielsen (1999:206), it is named after the fairy tale, Hansel and Gretel. Breadcrumbs typically

emphasise the depth of a website, as opposed to the breadth (Nielsen 1999:203). Including a breadcrumb list in a design is simple to implement and takes up only a small amount of space. It is, however, only useful for hierarchical navigation structures (Nielsen 1999:206). Breadcrumbs are also useful for allowing users to return to higher-level pages in a hierarchy without using the browser's "back" button and with less clicks, as breadcrumbs should be interactive links (Gube 2009).

Generally, large websites include the following three embedded navigation systems (allowing users to navigate laterally and vertically between branches in a hierarchical navigation system): global, local, and contextual navigation (Rosenfeld, Morville & Arango 2015:122). The global navigation system refers to the hyperlinks that should consistently be present on all webpages in the form of a navigation bar to allow direct access to important pieces of information (Wodtke & Govella 2009:5; Rosenfeld, Morville & Arango 2015:122). This is also referred to as the primary navigation (Duckett 2011:472). It is convention to put the main (global) navigation bar at the top of the page (Rosenfeld, Morville & Arango 2015:129). Important links include links to the homepage or to the search function of the website. The links in the main navigation bar should be limited to eight links that link to the homepages of main sections of the website and then local navigation menus should be provided that allow users to explore pages within each of the sections (Duckett 2011:472). Local navigation systems let users explore links that are relevant to the information being displayed on the current page and can typically be found on the side of a page in the form of a sidebar. This is also referred to as the secondary navigation (Duckett 2011:472). Contextual navigation links are links that are specific to a particular page, document, or object (Rosenfeld, Morville & Arango 2015:122) and can typically be found within bodies of text, for example, within paragraphs. Contextual navigation links are usually represented as blue and underlined text (Nielsen 1999:195).

In addition to embedded navigation systems, there are also supplemental navigation systems. These systems refer to sitemaps, indexes, and guides that provide complementary ways of finding information. Supplemental navigation systems allow users to navigate using *mental maps,* "an idea the user has of how the overall web site is structured" (Brinck, Gergle & Wood 2001:122). According to Rosenfeld, Morville, and Arango (2015:131), these navigation systems can be critical within large websites, such as academic library websites, to ensure usability and findability.

2.1.3.2.4 Search systems

"*How we search information*" (Rosenfeld, Morville & Arango 2015:49).

Search systems help the user find information when there is too much information to browse. In large websites, search systems are the only efficient means to find specific content pages or all the pages that mention a specific keyword or phrase (Lynch & Horton 2009).

According to Nielsen (1999:224; 2013), the majority of users are still search-dominant, which means that they will immediately start using the search box when they land on a website, instead of following links in order to navigate through the website. These users know what they want and want to find specific information as quickly as possible.

Users who use a search option to find information still need structure to understand where the information that they have found fits in relative to the rest of the website and to move on to other related pages (Nielsen 1999:255). Therefore, a good search feature does not negate the importance of good organisation and navigation systems.

A search system usually consists of a text box that allows a user to enter a search query and a submit button to send the query. The search results page where the user is directed after sending the query is also an important aspect of the search system. A search box should be available at the same position on every page of a website, usually as part of the global navigation structure (Nielsen 1999:225). According to Rosenfeld, Morville, and Arango (2015:154), an information architect is typically concerned with factors that affect retrieval performance and must help determine aspects such as:

- whether the website needs a search system,
- the basic anatomy of a search system,
- what to make searchable,
- a basic understanding of retrieval algorithms,
- how to present retrieval results, and
- the search interface design.

A search engine should not necessarily search the entire website, as this can result in poor retrieval performance and the entire website's content is not necessarily relevant to the user's search query. A search engine can be set up to search certain subsets of a website which can be parts of a website that are indexed separately from the rest of the website's content. A system can detect which search zones users are interested in by looking at the context of the task the users are engaged in. This is referred to by Wodtke and Govella (2009:110) as "vertical search". Vertical search is when a system explicitly searches for something in a specific subset of the content being searched (Wodtke & Govella 2009:110). Rosenfeld,

Morville, and Arango (2015:155) refer to the separately indexed subsets of a website as "search zones". Searching within specified search zones can contribute to retrieval performance since it limits the amount of content that has to be searched to the subset of the website that the user is searching in (Rosenfeld, Morville & Arango 2015:151). It also eliminates content that is irrelevant, therefore helping users retrieve more specific or precise search results (Rosenfeld, Morville & Arango 2015:155). If the areas of the website are sufficiently distinct to justify a scoped search, it is important to make it very clear to the user that they are not searching the entire website and to specifically tell them what part of the website they are searching. They must also be given the option to search different search zones if they cannot find what they are looking for in the specific search zone (Nielsen 1999:225).

Users can also have the option *specifying* the search zone where they want to search through the use of an "Advanced Search" option where the user can choose the search zones. This allows users to explicitly narrow down their search results. Rosenfeld, Morville, and Arango (2015:185) and Nielsen (1999:227) advise that great effort must still go into the design of a simple search feature as novice users should not be forced to use an advanced search due to a poorly implemented simple search feature. Users should only feel the need to use the advanced search feature if it is their preference. Nielsen (1999:227) also recommends that the advanced search option should be provided on a separate page.

A website's organisation schemes can help determine search zones for a search engine (Rosenfeld, Morville & Arango 2015:152). Therefore, popular examples of search zones include content type, audience, role, subject/topic, geography, chronology, author, department/business unit, recent content etc. (Rosenfeld, Morville & Arango 2015:152).

Query builders are tools that can be used to improve the outcome of a search query (Rosenfeld, Morville & Arango 2015:161). The most common example is a spell-checker. It allows a user to misspell a term and still get the right results, by automatically correcting the mistake before performing the search (Rosenfeld, Morville & Arango 2015:161). A good search system should perform spelling checks for both the user's search terms as well as the documents being searched (Nielsen 1999:227). Other examples of query builders include features that check for synonyms so that users are not required to submit different queries themselves using synonyms of their search terms (Nielsen 1999:227; Rosenfeld, Morville & Arango 2015:162).

Search system results are judged by two core values, namely recall and precision. Recall refers to how good the system is at finding everything that the user searched for while precision

refers to how good it is at organising the search results by relevance (Wodtke & Govella 2009:999).

The search output of a search query is a page that provides a list of results that match the query (Nielsen 1999:231). The results page should display a sorted list of search results with the most important results at the top. The search system should recognise both the relevance and the quality of the results and should not include duplicate occurrences of the same page (Nielsen 1999:231).

The two most common methods for listing retrieval results are by sorting or ranking (Rosenfeld, Morville & Arango 2015:168). Sorting is relevant to users who know what they are looking for and are looking to make a decision or take action, for example, users would like to sort products in an online store according to price if they are interested in finding the most inexpensive product. Examples of types of sorting include alphabetical and chronological.

Ranking is more relevant when the user is interested in learning or understanding information (Rosenfeld, Morville & Arango 2015:168). It typically describes the documents' relevance, from most relevant to least relevant. Users want to learn from documents that are the most relevant. Examples of ranking methods include relevance, popularity, and users' or experts' ratings. No single approach is perfect as it depends mainly on the user's task. Hybrid approaches can also be successful.

When deciding how many results to display, it is always safest to keep it simple by showing a small number of results on a page, and if there are multiple pages, the user should be provided with a results navigation system (Rosenfeld, Morville & Arango 2015:166). It is also recommended to display a number that reveals the total number of retrieved results (Rosenfeld, Morville & Arango 2015:176).

2.1.3.3 Summary of IA components

The discussion of IA components above can be summarised in the following table.

Categories	Components
1 Organisation	1.1 Organisation schemes Defines the shared characteristics of content items - Grouping of content items - Sorting of content items 1.2 Organisation structures Defines the types of relationships between items and groups - Hierarchical structure - Hypertext structure

2 Labelling	2.1 Textual labels - Link text - Heading text - Title text 2.2 Visual labels - Icons - Buttons
3 Navigation	3.1 Giving context - User's location relative to the web - User's location relative to the website structure 3.2 Allowing lateral and vertical navigation - Embedded navigation systems - Supplemental navigation systems
4 Search	4.1 Retrieval performance - Vertical search (searching within search zones) - Advanced search 4.2 Query builders - Spell checker - Synonym checker 4.3 Search results page - Recall and precision - Results navigation

Table 2.1-2: Summary of IA components

The discussion of the IA components in this section contributed to the discussion in Chapter 3 that determines how the IA of academic library websites can be evaluated.

2.2 Part two: Analysis of established usability principles and related studies

This part of the literature review consists of an analysis of established lists of usability principles as well as related studies. The established usability principles are discussed and integrated in Section 2.2.1 to compose an integrated set of heuristics with sub-criteria. The related studies are reviewed in Section 2.2.2 to establish how usability problems were evaluated with reference to the integrated set of heuristics. The results of the integration of the related studies are also used to supplement the new set of heuristics with recommendations that are relevant specifically to academic library websites. The final set of integrated heuristics is listed at the end of the chapter in Section 2.2.3.

2.2.1 Established principles for evaluating websites

An integrated set of heuristics is compiled in this section based on established usability principles. The resulting list of heuristics is based on Nielsen's ten heuristics (Nielsen 1995a) that are supplemented with Shneiderman's eight golden rules (2016) and ISO 9241-110's seven dialogue principles (2006). Integrating these three lists of principles results in a list of general heuristics.

Using well-established usability principles usually results in evaluations that are objective rather than opinion-based (Macefield 2014). Therefore, a combination of widely-cited sets of well-established general usability principles is used to create an integrated set of heuristics. The use of established principles also helps to establish a well-researched foundation for the integrated heuristics.

Nielsen describes heuristics as "general rules that seem to describe common properties of usable interfaces" (Nielsen 1995b). The terms guidelines, principles, and heuristics are sometimes used interchangeably, even though they all have slightly different meanings in different contexts. According to Burmester and Machate (2003:43), a principle is a subcategory of a guideline, if the guidelines are categorised according to the degree of the precision when guiding the design and the degree of freedom of interpretation. The three lists of principles that are used for the integration fall under the same category of guidelines, i.e., principles or heuristics. These principles are not specific to a particular interface, and the meaning of each depends on the interpretation of the evaluator (Burmester & Machate 2003:44). Even though principles and heuristics fall under the same category of guidelines, there is also a difference between the two terms. Principles are abstract and widely applicable (Dix et al. 2004:259). Principles are called heuristics when they are used for heuristic evaluations (Nielsen 1994a:152; Nielsen 1994b:28).

The following lists of principles are analysed:

- Ten usability heuristics for user interface design (Nielsen 1994b:30)
- Eight golden rules of interface design (Shneiderman et al. 2016)
- ISO 9241 Part 110: 7 dialogue principles (ISO 9241-110 2006)

Each of the lists of principles has a different label to refer to the principles, i.e., heuristics, golden rules, and dialogue principles. In Section 2.2, these labels are used when referring to the specific principles in the respective lists.

2.2.1.1 How the lists of principles were chosen

These lists of principles were selected as the top three due to their credibility, the fact that they are widely cited, and their applicability to this study and heuristic evaluation in general.

They are credible because the first two lists were created by authorities in the field of usability engineering (Macefield 2014) and the third one is a published ISO standard. Standards are defined as "formal documents that are developed through some form of consensus and formal voting process and published by standard making bodies" (Stewart & Travis 2003:992).

In the search for lists of principles, Nielsen's heuristics (1995a) and Shneiderman's golden rules (2016) were the most commonly listed, so it can be deduced that these are the two most commonly used lists of principles.

Other lists of principles that were found were not applicable to the scope of this study and were therefore eliminated. For example, Tognazzini's first principles of interaction design (Tognazzini 2014) has a strong focus on the evaluation of the usability of the visual design aspects of an interface, and this study will not focus on visual design. Lists of principles that have a strong focus on accessibility, for example, the Web Content Accessibility Guidelines (WCAG) (Henry 2012) were also not considered because the accessibility aspects of websites are beyond the scope of this study.

Heuristic evaluations are usually conducted by using a small set of general usability principles (Nielsen 1994b:28). These principles can then be adapted to apply to any interface such as websites (Preece, Rogers & Sharp 2015:405). The three lists that were chosen are general enough so that they can be adapted and applied to any user interface. According to Nielsen (1994b:28), his heuristics are "general rules that seem to describe common properties of usable interfaces" and the evaluator can add any additional principles that apply to specific dialogue elements. Shneiderman (2016) states that his principles are widely applicable and must, therefore, be adapted based on the environment, but that "they provide a good starting point for web designers" (Shneiderman et al. 2016). ISO 9241 Part 110: 7 dialogue principles are designed to be general and are "presented without reference to situations of use, application, environment or technology" (ISO 9241-110 2006:1). They are applicable in the analysis, design, and evaluation of interactive systems (ISO 9241-110 2006).

2.2.1.2 Ten usability heuristics for user interface design (Nielsen 1995)

According to Preece, Rogers, and Sharp (2015:501), the original (and most well-known) set of heuristics is Nielsen's ten usability heuristics for user interface design. This list was originally developed by Jakob Nielsen and Rolf Molich in 1990 (Nielsen 1994b:30; Nielsen 1995a). It has since been revised and updated by Nielsen and published online in 1995 (Nielsen 1995a).

The ten heuristics are listed below and are discussed together with the other lists of principles in Section 2.2.1.5. It is to be noted that the list provided below (as well as other lists provided in this dissertation) is placed in quotation marks because it is a direct quotation from the source and therefore indicated as such.

" • Visibility of system status
• Match between system and the real world
• User control and freedom
• Consistency and standards
• Error prevention
• Recognition rather than recall
• Flexibility and efficiency of use
• Aesthetic and minimalist design
• Help users recognize, diagnose, and recover from errors
• Help and documentation"

2.2.1.3 Eight golden rules of interface design (Shneiderman et al. 2016)

This list was published in 1986 in the first edition of "Designing the User Interface: Strategies for Effective Human-Computer Interaction" by Ben Shneiderman as the sole author (1986). Therefore, this list is referred to as Shneiderman's golden rules, despite the fact that the latest version of the book has five co-authors. This list is not to be confused with Shneiderman's list of "human factors" (discussed in Section 2.1.1), which was also published in the same book.

According to Shneiderman et al. (2016), these principles apply to most interactive systems. The list below is a revised version of the original list as printed in the sixth edition of the book:

" 1. Strive for consistency.
2. Seek universal usability.
3. Offer informative feedback.
4. Design dialogs to yield closure.
5. Prevent errors.
6. Permit easy reversal of actions.
7. Keep users in control.
8. Reduce short-term memory load."

2.2.1.4 ISO 9241 Part 110: 7 Dialogue principles (ISO 9241-110 2006)

The original version of the dialogue principles, ISO 9241-10, was published in 1996. The list has since been revised and was republished in 2006. Examples of possible usability problems listed by ISO 9241-110 (2006) that can be prevented by using these principles include:

" • additional unnecessary steps not required as part of the task,

- misleading information,
- insufficient and poor information on the user interface,
- unexpected response of the interactive system,
- navigational limitations during use, and
- inefficient error recovery."

The following list is the seven dialogue principles as they are presented in ISO 9241 Part 110 (2006).

"
- Suitability for the task,
- Self-descriptiveness,
- Conformity with user expectations,
- Suitability for learning,
- Controllability,
- Error tolerance,
- Suitability for individualization."

Each dialogue principle comes with a "non-exhaustive" list of between seven and ten corresponding recommendations (ISO 9241-110 2006:3). Each of the recommendations is dependent on a specific type of interface, which determines if the recommendations are applicable. Therefore, not every recommendation is applicable. Some dialogue principles and their recommendations correspond directly to other heuristics or golden rules. Some dialogue principles do not correspond directly, but they do contain recommendations that apply to some of the other heuristics or golden rules, as revealed in the discussion below.

2.2.1.5 Integration of existing principles based on Nielsen's heuristics

The following discussion presents Nielsen's (1995a) heuristics and shows which of Shneiderman's (2016) golden rules and ISO 9241's (2006) dialogue principles correspond with the heuristics. The golden rules that do not overlap with any of the heuristics are presented in the next section together with ISO 9241's (2006) dialogue principles that correspond with them. There are no unique dialogue principles, i.e., principles that do not correspond with any of Nielsen's heuristics or Shneiderman's golden rules.

Nielsen (1994a:153) states that the labels that were chosen to describe his heuristics are his subjective attempt to abstract the main usability issue, but that it is possible to use other labels instead. For each heuristic that is derived from the existing lists of principles, a descriptive label is identified based on the description of the existing principles and the researcher's subjective interpretation. These identified labels are used in Table 2.2-1 at the end of the section as a guide to show what existing principles the new heuristics are derived from. The table also shows what principles from different lists correspond to each other and which

principles are unique. Each heuristic is referred to by the identified label after the integration, and the list of heuristics will hereafter be referred to as the integrated heuristics. Each of the integrated heuristics is expanded with sub-criteria in Section 2.2.3 that are derived from each of the discussions below.

2.2.1.5.1 Heuristic 1: Visibility of system status (Nielsen 1995a)

This principle states that the system must provide appropriate feedback within a reasonable period of time so that the user is always informed about what is going on (Nielsen 1995). Nielsen (1994a:156) previously identified this principle by the label "feedback". The goal of this principle is to find out if the system clearly communicates with the user to "reveal what is happening in the system" (Nielsen 1994a:154), which includes providing status information and showing that input has been received (Nielsen 1994a:153).

This principle is similar to Shneiderman's third golden rule: "offer informative feedback", which states that there should be feedback for every action that a user takes when using an interface (Shneiderman et al. 2016). It also specifies that the feedback can range from modest to substantial, based on the severity of the action taken by the user, which expands on Nielsen's requirement that the feedback should be appropriate.

There is no equivalent dialogue principle in ISO 9241's seven dialogue principles, but "feedback" features in recommendations from the dialogue principles "conformity with user expectations" and "suitability for learning" (ISO 9241-110 2006).

The recommendation under "conformity with user expectations" specifies that suitable feedback should be provided for user input and actions immediately where users expect it, that the type and length of feedback depend on user needs, and that the feedback should be constructive (ISO 9241-110 2006:8). The recommendation under "suitability for learning" specifies that feedback should help the user gain an understanding of the system and that feedback should provide users with a result that indicates if activities have been accomplished successfully (ISO 9241-110 2006:10). Therefore, good feedback can improve the self-descriptiveness of the system, help the system conform to user expectations, and increase the system's suitability for learning.

The label used for this heuristic in this study is "Feedback".

2.2.1.5.2 Heuristic 2: Match between system and the real world (Nielsen 1995a)

This principle states that the system should use terminology and concepts that the intended user is familiar with and avoid the use of system-oriented terms (Nielsen 1995a). Nielsen (1994a:156) previously identified this principle by the label "speak the user's language". In the context of academic library websites, a system-oriented term is, for example, the name of

the catalogue system that the library uses, which might not be a term that novice users are familiar with.

This principle also states that information should "appear in a natural and logical order" by following real-world conventions (Nielsen 1995a). This concept is distinct from the first part of the description of the principle, which is concerned with the language that is used in the system. These two concepts are different enough to split them into two separate principles since the first one deals with IA labelling systems and the second one deals with IA organisation systems.

The concepts covered in these principles are not equivalent to any of Shneiderman's golden rules or ISO 9241's dialogue principles. There is, however, a recommendation under dialogue principle 2: "Self-descriptiveness", which states that the intended users should immediately be able to comprehend the terminology that is used in a dialogue (ISO 9241-110 2006:7). There is also a recommendation under dialogue principle 3: "Conformity with user expectations" which states that the vocabulary that is used in the system should be based on the user's existing knowledge. It also specifies that it should be familiar to the user in the context of the task, but that it does not "prohibit improvements of established vocabulary to make it better suited for the task". Both of these recommendations directly correspond to Nielsen's (1995a) description of the heuristic.

These aspects of usability correspond directly to the IA component categories, labelling systems and organisation systems as defined in Section 2.1.3.2. Therefore, the two labels used in this study for these two heuristics are "Labelling" and "Organisation".

2.2.1.5.3 Heuristic 3: User control and freedom (Nielsen 1995a)

This principle states that the system must have a simple and efficient way to allow a user to go back to where they came from in a situation where they have made a mistake or have navigated somewhere where they did not intend to go (Nielsen 1995a). It is further explained as making the user feel that they are not trapped in a state from which they cannot escape (Nielsen 1994a:154). This is also referred to as allowing "undo and redo" features (Nielsen 1995a). The system must support an easy way for a user to fix errors without having to go through additional or unnecessary steps (Nielsen 1995). Nielsen (1994a:156) previously identified this principle by the label "clearly marked exits".

This principle is similar to Shneiderman's sixth golden rule: "Permit easy reversal of actions". This principle states that actions taken by a user should be reversible. When a user knows that they are allowed to undo errors, this feature relieves anxiety and encourages them to explore the system (Shneiderman et al. 2016).

This principle is similar to ISO 9241's fifth dialogue principle: "Controllability", which states that the user must have control over the pace and sequence of the interaction (ISO 9241-110 2006:11; Travis 2012:45). A dialogue is considered controllable if it allows the user to initiate and control the direction and the pace of the interaction until the user has reached their goal (ISO 9241-110 2006:11). Recommendations include that it should be possible to undo at least the last step when the specific interface has operations that are reversible.

The label used in this study for this heuristic is "Controllability".

2.2.1.5.4 Heuristic 4: Consistency and standards (Nielsen 1995a)

This principle states that users should never be confused as to whether a different word, action, or situation means the same thing. Therefore, the system has to follow the same conventions across the platform (Nielsen 1995). Nielsen also equates this principle to other principles that state that the same thing should be expressed the same way and should be displayed in the same position of every screen (Nielsen 1994a:153).

This principle is equivalent to Shneiderman's first golden rule: "Strive for consistency", which states that situations that are similar should require similar sequences of actions (Shneiderman et al. 2016). Therefore, the developer must use the same conventions, for example, in terminology, colours, layout, letter case, and fonts throughout the interface.

There is no directly equivalent dialogue principle in ISO 9241's seven dialogue principles, but "consistency" features in a recommendation under the dialogue principle: "Conformity with user expectations", which states that the behaviour and the appearance of the dialogue "should be consistent within tasks and across similar tasks". Its motivation is that consistency can increase the predictability of an interface (ISO 9241-110 2006:8).

The label used in this study for this heuristic is "Consistency".

2.2.1.5.5 Heuristic 5: Error prevention (Nielsen 1995a)

This principle states that the best designs do not only have good error recovery but also prevent users from making those errors in the first place. A system must always eliminate conditions where users are likely to make errors or warn a user through a "confirmation option" about what might happen in situations before they take action (Nielsen 1995a).

This principle is similar to Shneiderman's fifth golden rule: "Prevent errors", which states that the system should prevent users from making serious errors (Shneiderman et al. 2016). For example, links that are not appropriate to a user should be "greyed out" so that users are prevented from clicking on them. Shneiderman's principle also addresses *error recovery*. Nielsen (1995a) discusses error recovery in a separate heuristic, heuristic 9: "help users

recognise, diagnose, and recover from errors". In this study, they will also be divided into two separate principles since they are implemented in vastly different ways. Error recovery is covered in Section 2.2.1.5.9.

The label used in this study for this heuristic is "Error prevention".

2.2.1.5.6 Heuristic 6: Recognition rather than recall (Nielsen 1995a)

This principle states that objects, actions, and options must be made more visible so that users are not required to remember information between different dialogues, thus minimising the user's memory load during the interaction. A user should also be able to access instructions for using the system anytime, when needed (Nielsen 1995a). Nielsen (1994a:156) previously identified this principle by the label "minimize memory load". A good example in websites is when a user is provided with a list of options in a drop-down menu rather than expecting them to enter it into a text field, which would require of them to know what the options (and format of these options) are.

This principle is equivalent to Shneiderman's eighth golden rule: "Reduce short-term memory load". This principle states that the system should not require a user to remember aspects of the system to complete a task because they have a "limited capacity for information processing in short-term memory". The system must not require a user to remember information from one screen to use it on a different screen (Shneiderman et al. 2016).

This problem is directly addressed by ISO 9241's first dialogue principle: "Suitability for the task". A dialogue is suitable for a task if it helps the user to complete the task effectively and efficiently. It also specifies that the user should be able to focus on the task and not the technology used to perform the task (ISO 9241-110 2006:5). The first recommendation states that the user should be presented with all the information that is needed for the successful completion of the task (ISO 9241-110 2006:5), which corresponds with Nielsen's (1995a) description of heuristic 6. Other recommendations include that the "format of input and output should be appropriate to the task" or that default values should be provided where typical input values are required (ISO 9241-110 2006:8). One of the recommendations from ISO's second dialogue principle: "Self-descriptiveness" is also relevant in this context. The recommendation specifies that the information that a user is presented with at any step should guide a user in completing a task (ISO 9241-110 2006:7).

The label used in this study for this heuristic is "Task completion support".

2.2.1.5.7 Heuristic 7: Flexibility and efficiency of use (Nielsen 1995a)

This principle states that a system should incorporate ways for the expert user to speed up the interaction, which in turn must not affect novice users (Nielsen 1995a). Nielsen (1994a:156)

previously identified this principle by the label "shortcuts". This means that it must allow the expert user to navigate faster with less frequent actions. Nielsen explains it further as "allowing the user additional options to sidestep the regular interaction techniques" (Nielsen 1994a:154). This principle also states that expert users must be allowed to tailor frequent actions (Nielsen 1995a).

This principle is equivalent to Shneiderman's second golden rule: "Seek universal usability", which states that the design must cater for various users regarding aspects such as experience in computer use, age, and disabilities. A developer can easily add features for novice users that make the interface easier to use, such as additional explanations, as well as adding features for expert users such as shortcuts that enable them to work faster (Shneiderman et al. 2016).

Shneiderman's golden rule describes features for novice users and features for expert users. Nielsen's heuristic (Nielsen 1995a) does not specifically address features for novice users. It only focusses on features for expert users such as shortcuts and customisation. Features for novice users are distinct in that the aim is to provide guidance such as additional explanations (Shneiderman et al. 2016), whereas features for expert users aim to provide shortcuts and customisation options (Nielsen 1995a). These features are not necessarily only relevant to expert users, as novice users might also prefer to use them.

Dialogue principle 4: "Suitability for learning", is applicable to features that support novice users. A dialogue is suitable for learning if it "supports and guides the user in learning how to use the system" (ISO 9241-110 2006). The recommendations of this dialogue principle include that "appropriate support" should be provided for new or infrequent users in learning or relearning how to use the system. It also specifies that rules, underlying concepts, and additional explanations which are useful for learning and which "assist the user in gaining a conceptual understanding of the interactive system" should be made available (ISO 9241-110 2006:10).

Dialogue principle 7: "Suitability for individualisation", is applicable to the feature that Nielsen (1995a) mentioned as an example of features that support "flexibility and efficiency". A dialogue is suitable for individualization if the interaction and presentation can be customised or modified to suit the user's individual capabilities and needs (ISO 9241-110 2006:14; Travis 2012:45).

The features discussed in this section are divided into two separate principles labelled: "Novice user guidance" and "Efficiency features". The principle: "Novice user guidance" includes the features mentioned by golden rule 2 and dialogue principle 4. These features provide users with guidance to help them learn how to use the system, such as additional

explanations. The principle: "Efficiency features" includes all the features as mentioned in heuristic 7, golden rule 2, and dialogue principle 7. These features, applicable to both novice and expert users, provide them with shortcuts or customisation features in order to use the system more efficiently.

The labels that are used in this study for these heuristics are "Novice user guidance" and "Efficiency features".

2.2.1.5.8 Heuristic 8: Aesthetic and minimalist design (Nielsen 1995a)

This principle states that dialogues should not contain irrelevant information that might take the user's attention away from important pieces of information. Excluding irrelevant information ensures that the system is aesthetically pleasant and efficiently composed. Nielsen (1994a:156) previously identified this principle by the label "simple and natural dialogue".

There is no equivalent golden rule or dialogue principle. There are, however, two recommendations under ISO 9241's first dialogue principle: "Suitability for the task" that apply to this issue. The recommendations specify that the dialogue should not present the user with information that is not needed for the successful completion of tasks (ISO 9241-110 2006:10).

The label used in this study for this heuristic is "Clutter".

2.2.1.5.9 Heuristic 9: Help users recognize, diagnose, and recover from errors (Nielsen 1995a)

This principle states that all error messages should be expressed in plain language and must clearly indicate what the problem is. It must allow the user to solve the problem by suggesting an appropriate solution (Nielsen 1995a).

This principle is equivalent to the second part of Shneiderman's fifth golden rule: "Prevent errors", as mentioned in Section 2.2.1.5.5. It states that a system should allow a user to recover easily when they have made an error, by detecting that they have made an error and by providing clear instructions to a simple solution (Shneiderman et al. 2016). For example, when users submit a form and the system detects that they have entered incorrect information, users should not be required to enter all the information again when only a single field had invalid data, and it should be clear to users which field contains the incorrect data.

This principle is also equivalent to ISO 9241's sixth dialogue principle: "Error tolerance", which states that the interaction should be forgiving when users make errors (Travis 2012:45).

A dialogue is error-tolerant if a user can easily correct their mistakes and still complete their task (ISO 9241-110 2006:12). Recommendations include that the user should be assisted with detecting and avoiding errors in input, and be provided with explanations to help correct errors. The system must also validate input before processing it, and it should be able to correct errors automatically, if possible. A good example of automatic error recovery in websites is where there is a search feature that autocorrects incorrect search terms before executing the search. When the system corrects errors automatically, it should inform the user of the correction and provide the user with an opportunity to override the correction (ISO 9241-110 2006:12).

The label used for the heuristic in this study is "Error recovery".

2.2.1.5.10 Heuristic 10: Help and documentation (Nielsen 1995a)

This principle states that, even though a user should be able to use the system without documentation, it is still a good idea to provide help. A user should be able to find documentation easily when the need arises. The help and documentation should be easy to search and easy to use without containing too much information. This heuristic was not included in earlier versions of the list of heuristics, and there is no equivalent golden rule or dialogue principle.

The label used in this study is "Help documentation".

2.2.1.6 Other golden rules

Some of Shneiderman's golden rules and ISO 9241's dialogue principles do not correspond with any of Nielsen's ten heuristics; therefore, the remaining golden rules (together with dialogue principles that correspond to them) are discussed separately below.

2.2.1.6.1 Golden rule 4: Design dialogues to yield closure (Shneiderman et al. 2016)

This principle states that a user should know exactly where they are when completing a sequence of actions, for example, at the beginning, middle, or end. This gives a user a sense of accomplishment when they can see that they have reached the end of a sequence (Shneiderman et al. 2016). For example, when a user is reading an article that consists of multiple pages, it is important to indicate on what page they are out of how many pages. This would clearly indicate their reading progress.

This principle is similar to ISO 9241's second dialogue principle: "Self-descriptiveness", which states that it should be clear to the user "where they are within the dialogue" and what they can do within the dialogue (ISO 9241-110 2006:7). Recommendations specify that users should not be required to consult help documentation during interaction, and that the steps that can be taken should be clear (ISO 9241-110 2006:7).

The goal of this principle is essential to help the user answer the core questions of navigation, "where am I?", "where have I been", and "where can I go?" (Nielsen 1999:188).

The label used in this study for this heuristic is "Context".

2.2.1.6.2 Golden rule 7: Keep users in control (Shneiderman et al. 2016)

This principle states that users should feel like they are in control at all times. This can easily be done by not changing familiar behaviour and by responding to their actions in the way that they expect the system to respond (Shneiderman et al. 2016).

This principle is equivalent to ISO 9241's third dialogue principle: "Conformity with user expectations". A dialogue conforms with user expectations when it corresponds to the user's predictions in the context of the interaction and uses commonly accepted conventions (ISO 9241-110 2006:8). Recommendations include that "formats should follow appropriate cultural and linguistic conventions".

The label used in this study is "Predictable behaviour".

2.2.1.7 Summary of integration of heuristics

The following table summarises the integration of the heuristics by indicating what principles from different lists correspond to each other and which principles are unique. The terms in the left column are the terms that were identified as the labels that are used in this study to refer to each of the heuristics. The heuristics are listed in the order that they were discussed in the previous section (Section 2.2.1.5).

Labels	Heuristics (Nielsen 1995a)	Golden rules (Shneiderman et al. 2016)	Dialogue principles and recommendations (ISO 9241-110 2006)
Feedback	Heuristic 1: Visibility of system status	Golden rule 3: Offer informative feedback	Recommendations from dialogue principles 3: Conformity with user expectations, and 4: Suitability for learning.
Labelling	Heuristic 2: Match between system and the real world		Recommendations from dialogue principles 2: Self-descriptiveness, and 3: Conformity with user expectations

Organisation	Heuristic 2: Match between system and the real world		
Controllability	Heuristic 3: User control and freedom	Golden rule 6: Permit easy reversal of actions	Dialogue principle 5: Controllability
Consistency	Heuristic 4: Consistency and standards	Golden rule 1: Strive for consistency	Recommendation from dialogue principle 3: Conformity with user expectations.
Error prevention	Heuristic 5: Error prevention	Golden rule 5: Prevent errors	
Task completion support	Heuristic 6: Recognition rather than recall	Golden rule 8: Reduce short-term memory load	Dialogue principle 1: Suitability for the task and a recommendation from dialogue principle 2: Self-descriptiveness
Efficiency features	Heuristic 7: Flexibility and efficiency of use	Golden rule 2: Seek universal usability	Dialogue principle 7: Suitability for individualization
Novice user guidance		Golden rule 2: Seek universal usability	Dialogue principle 4: Suitability for learning
Clutter	Heuristic 8: Aesthetic and minimalist design		Recommendation(s) from dialogue principle 1: Suitability for the task
Error recovery	Heuristic 9: Help users recognize, diagnose, and recover from errors	Golden rule 5: Prevent errors	Dialogue principle 6: Error tolerance
Help documentation	Heuristic 10: Help and documentation		
Context		Golden rule 4: Design dialogues to yield closure	Dialogue principle 2: Self-descriptiveness
Predictable behaviour		Golden rule 7: Keep users in control	Dialogue principle 3: Conformity with user expectations

Table 2.2-1: Integrated heuristics with identified labels

2.2.2 Related studies: Case studies of academic library website usability

The aim of analysing related studies is to find out how others have conducted usability studies on academic library websites and what their results were in the context of the 14 integrated heuristics presented in Section 2.2.1.7.

Studies were analysed to find out what problems were found with the various methods that the studies used, as well as what recommendations were made or what changes were implemented to solve the problems.

The recommendations from the related studies are used to supplement the heuristics so that they apply specifically to academic library websites. Appropriate recommendations are added to each of the new heuristics listed in Section 2.2.3, except the heuristic "feedback" because none of the studies addressed feedback issues.

2.2.2.1 How related studies were chosen

The related studies were selected based on the following criteria:

- Is it a usability study?
- Does the study focus on an academic library website?
- Was the article published in a peer-reviewed journal?
- Was the study published in the last ten years (from 2006 – 2016)?

Older studies were avoided since library websites have undergone various redesigns in the past decade to improve usability or to keep up with recent technologies. Websites that have gone through major redesigns are referred to as newer generation websites (Duncan & Holliday 2008). The evaluation of older generation websites will not be helpful in this study because the results are not necessarily relevant to new generation websites anymore, as discussed in Section 1.1.2. Usability problems that were found in older generation websites have in most cases been resolved in the past ten years. Three studies from 2005 were, however, also included because a large number of articles were published in 2005, three of which were widely cited and still relevant. Therefore the following additional criterion was added:

- Is it a widely cited and relevant article that was published in 2005?

2.2.2.2 Overview of related studies

This section presents twenty related studies in chronological order. They are summarised here to provide a broader context, then analysed and integrated in Section 2.2.2.3.

2.2.2.2.1 Study 1: Usability testing and design of a library website: an iterative approach (George 2005)

This case study reports on the usability studies that were conducted at the Carnegie Mellon University Libraries throughout the iterative redesign process of their website (George 2005). Various methods were used to get user input including a web-based survey and a task-based usability test using the think-aloud protocol (a method where users are required to say what they are thinking while they are completing tasks). A prototype design was created after the web-based survey, and a final design was created and tested after feedback on the prototype was received. Several weaknesses with the usability and IA were discovered and improved during the process. The processes resulted in a website that is more usable and that will continually be improved.

2.2.2.2.2 Study 2: Redesigning for usability: Information architecture and usability testing for Georgia Tech Library's website (King & Jannik 2005)

This study describes how the Georgia Institute of Technology used in-house and outsourced user testing to redesign their library website to keep the website relevant and current. Their goal is to have "a successful library website that features a solid, sensible information architecture, and is highly usable to non-expert users" (King & Jannik 2005:236). The paper describes the two major redesigns that the website has undergone. The first redesign was to create a well-planned IA by creating pages "from scratch" (King & Jannik 2005:237). The second redesign was done to focus on usability for non-expert users. They used a variety of methods to get user input, including user surveys and formal usability testing using the "talk aloud method" with non-expert users. A small number of usability problems were found on the website because it has been through various tests and redesigns. The main issue that was found on the website is that it is not good at guiding users to appropriate search interfaces such as the catalogue, databases, and e-journals.

2.2.2.2.3 Study 3: Usability testing for web redesign: a UCLA case study (Turnbow et al. 2005)

This study used a variety of usability methods, including user surveys, card sorting, and the think aloud protocol, with the goal of developing a new website for the University of California, Los Angeles (UCLA) Library. From the studies that were conducted, enough information was gathered to meet the goals of the redesign. The goals of the redesign were to create a clear website organisation and navigation, use user-centred library terminology, ensure easy access to information that is relevant to the entire user population from the homepage, develop a consistent visual identity throughout the site, and to use a content management system.

2.2.2.2.4 Study 4: Web site redesign: the University of Washington Libraries' experience (Ward 2006)

The purpose of this study was to do a case study on the redesign of the University of Washington (UW) library website. The case study included the following methods to gain user feedback: an online survey, focus groups, a parallel design process to generate the first round of prototypes, low fidelity prototyping, card sorting, high fidelity prototyping, and usability testing. All of the results were carefully analysed to find out where the website could be improved and to see how users use the website.

2.2.2.2.5 Study 5: User-centered design of a web site for library and information science students: heuristic evaluation and usability testing (Manzari & Trinidad-Christensen 2006)

The purpose of this study was to do a usability study on the Library and Information Science (LIS) library website of the C.W. Post Campus of Long Island University (LIU Post) during a redesign process. The usability study included a heuristic evaluation and usability testing. Useful suggestions were made and implemented based on the results of the evaluations. It was confirmed after the redesign that the website was well-designed through an online survey that was added to the final design.

2.2.2.2.6 Study 6: Getting everyone on the same page: A staff focus group study for library web site redesign (MacMillan, McKee & Sadler 2007)

The purpose of this study was to include staff in the usability study for redesigning the University of Calgary library website. The study consisted of a case study with a series of five focus group interviews with library staff. Recommendations were made on how to redesign a library website to focus on the unique needs of library staff.

2.2.2.2.7 Study 7: The role of information architecture in designing a third-generation library web site (Duncan & Holliday 2008)

The purpose of this study was to use IA to redesign the third-generation library website of the Utah State University (USU). Various data collection methods were used to determine the required functionality of the website. Methods included a web-based survey and library staff interviews to find out what users want to achieve when using the website. During the iterative testing of the website, card sorting and usability tests with paper prototypes were used. The result of the study was a library website that was more usable and that meets the needs of a broad range of users.

2.2.2.2.8 Study 8: Making sense of an academic library web site: toward a more usable interface for university researchers (Kitalong, Hoeppner & Scharf 2008)

The purpose of this study was to redesign the library website at the University of Central Florida (UCP). A variety of methods were used to get a better understanding of what is

expected from a library and how users use a library, including usability testing, card sorting, and affinity mapping. The goal of the study was to find out how users understand the website's content and organisation, to identify more logical organisation alternatives that users find more intuitive, to determine what content on the website is considered to be the most important, and to create new labels that users find more logical and intuitive.

2.2.2.2.9 Study 9: An evaluation of the information architecture of the UCT Library web site (Mvungi, De Jager & Underwood 2008)

The purpose of this study was to demonstrate the importance of a well-organised IA of an academic library website at the University of Cape Town (UCT). This study consisted of a formal usability test to find out what the required website structure is and to identify possible problems with the usability of the site, as well as a closed card sort analysis to determine what the required site structure and terminology for the potential website re-design should be. A post-test questionnaire was also included to get a satisfaction rating from the users. The study provides recommendations on how to handle the problems that were found. There were a few problems with labelling and navigation design, as well as issues with identifying specific information, but overall it had a usable IA.

2.2.2.2.10 Study 10: Focus groups and usability testing in redesigning an academic library's web site (Oldham 2008)

This study collected user perceptions using focus groups and usability testing before undertaking a redesign of the University of Scranton's Weinberg Memorial Library website. The results from the focus groups and usability tests concluded that the website was not working as intended and that the homepage was cluttered. One of the main issues discovered by the focus groups was that the process of accessing the library databases from off campus was too complicated since it took too many steps. Additionally, the sign in process was too complicated since it required a unique username and password that was difficult to remember. After the redesign, the users who participated were surveyed about the redesigned website and the majority of users indicated that the website was less confusing, more intuitive, and easier to use. There were a large number of style concerns in the study that are not applicable to this study and are therefore excluded from the analysis.

2.2.2.2.11 Study 11: Side by side: what a comparative usability study told us about a web site redesign (Dougan & Fulton 2009)

The purpose of this study was to compare users' use of the old Music and Performing Arts Library (MPAL) website at the University of Illinois Urbana-Campaign to the use of the new version of the website, in order to determine if user performance was improved after the redesign. Usability testing involved users performing library-related tasks on the old and new

websites using a think-aloud protocol. A survey was used at the end of the test to determine the users' satisfaction with the ease of use and navigation with both websites. Results showed that users performed better on the new website and that they preferred the new website, seeing it as a vast improvement to the old website.

2.2.2.2.12 Study 12: Testing an academic library website for usability with faculty and graduate students (Emde, Morris & Claassen-Wilson 2009)

The purpose of this study was to find out how faculty and graduate students reacted to the redesigned library website of the University of Kansas. The study also reported how these users use the website to locate and retrieve information. The study consisted of a usability test where faculty and graduate students were required to answer interview questions regarding their opinions of the new features of the website. The study also used data from observational analysis software. One of the main features of the redesigned website was a federated search tool that provides search results from four different databases. One of the main comments on the newly implemented federated search tool was that users were able to access databases that they were unable to access before and that it is a good starting place for undergraduate students who are new to the field of research. Most of the users avoided using the new features since most of the links that they are familiar with were still available and were used to complete tasks. The results showed that users preferred to use the tools on the website that they were familiar with, but that the new features would appeal to new users. Some problems with the navigation system were reported, including ambiguous terminology and unclear icons that are meant to expand subject heading lists.

2.2.2.2.13 Study 13: Usability analysis for redesign of a Caribbean academic library web site: a case study (Rogers & Preston 2009)

The purpose of this study was to identify the strengths and weaknesses of the St Augustine Campus of the University of the West Indies (UWI) library website. The analysis resulted in a redesign based on the results and feedback from participants. The study employed a variety of methods, including survey questionnaires, focus groups, formal usability testing, and card sorting. The main problems that were found were problems related to the labelling and organisation systems of the IA and the interface design.

2.2.2.2.14 Study 14: Why we are not Google: lessons from a library web site usability study (Swanson & Green 2011)

Two usability studies were conducted in this study, one on the current Moraine Valley community college library website (where the main search tool is on a secondary page) and one on a mock-up version of their website with a centralised search box on the homepage. The purpose of the study was to find out which version users found more usable. The

usability study consisted of fourteen task-based questions and three open-ended opinion-based questions. Participants were required to use the "talk-aloud" protocol while performing the tasks. Eight students performed the questions on the current website, and eight (different) students performed the tasks on the mock-up website. The general finding was that the current design of the website is more successful than the mock-up version since it "presents a clear view of the site's content, an organisational structure within the site, and an understanding of the site's navigation". The results show that the current design is still effective.

2.2.2.2.15 Study 15: Creating a user-centered library homepage: a case study (Tidal 2012)

The purpose of this article was to describe the case study of the redesign of the Ursula C. Schwerin Library website of the New York City College of Technology (City Tech) of the City University of New York (CUNY), in order to create a user-centred homepage. The methods that were used to get user feedback included a survey and a usability test. The results of the study include recommendations on how to improve the usability of the homepage.

2.2.2.2.16 Study 16: Modeling a library website redesign process: developing a user-centered website through usability testing (Becker & Yannotta 2013)

The purpose of this study was to do usability testing throughout the course of a redesign of the Hunter College's library website. Four usability tests were conducted during various stages of the redesign that consisted of users performing typical library tasks using the "talk-aloud" protocol. The web committee developed guiding principles that endorsed a "solid information architecture, clear navigation systems, strong visual appeal, understandable terminology, and user-centred design" that provided a framework for the development of the new website. The results show that usability testing throughout the design process is an effective way to build a user-centred website.

2.2.2.2.17 Study 17: Toward a usable academic library web site: a case study of tried and tested usability practices (Dominguez, Hammill & Brillat 2015)

This study reports on the iterative design process that the Florida International University Libraries has gone through over the years since their website was first developed in 2001. The usability studies included a wide variety of methods such as task-based usability testing with think aloud protocol, card sorting, and interviews. Users did not like the use of library jargon, lack of functionality and findability, overall layout, and absence of photos.

2.2.2.2.18 Study 18: Usability evaluation of an academic library website: Experience with the Central Science Library, University of Delhi (Pant 2015)

This study describes the usability evaluation methods conducted on the Central Science Library (CSL) website at the University of Delhi. Data was collected using a standard checklist

and questionnaire survey. Usability aspects were categorised under the usability attributes: "usefulness, efficiency, effectiveness, learnability, satisfaction, and accessibility", the biggest problems being with efficiency, effectiveness, and learnability. Objectives involved identifying and understanding the IA structure of the website, testing the usability using a standard checklist, conducting a survey with library users using a questionnaire, and providing recommendations for improving the usability of the website.

2.2.2.2.19 Study 19: The perfect storm: examining user experience and conducting a usability test to investigate a disruptive academic library web site redevelopment (Chase, Trapasso & Tolliver 2016)

The perfect storm in the title refers to the three drastic changes that were made to the academic library website at the Stony Brook University (SBU). This was a usability study that evaluated the website after the changes were implemented. The libraries at the Stony Brook University (SBU) conducted a usability test to test the effectiveness of the redesigned website. The redesign included the implementation of the following: an EBSCO Discovery service (EDS), EBSCO Electronic Resource Management System (ERMS), and a complete redesign with the WordPress Content Management System (CMS). The EDS featured an index that included two separate online library catalogues. The goal of the usability study was to evaluate the search interface, the search results, and the impact of discovery tools.

2.2.2.2.20 Study 20: Website redesign: a case study (Wu & Brown 2016)

This study describes the processes that the University of Southern California (USC) Norris Medical Library followed to redesign their website. The study used a variety of usability methods, including, usability testing, and card sorting. According to staff, the new website provides users with a good experience, but further usability tests will need to be conducted to confirm it.

2.2.2.3 Integration of related studies' findings

The discussion below shows how the usability was measured in comparison with the integrated set of heuristics. Usability problems that relate to the visual design aspects of websites were not addressed.

Each of the usability problems and recommendations (that were made by the researchers) was analysed and categorised under the heuristics where they are the most applicable. Some of the issues applied to more than one heuristic and were subsequently categorised and discussed under more than one heuristic. Some of the issues were divided into heuristics according to the recommendations that were provided for solving them.

Heuristic headings are sorted from most prevalent to least prevalent. This refers to how many studies addressed the issue. Language problems were the most prevalent, error recovery and error prevention were the least prevalent, and feedback was not addressed at all.

Many of the studies are incomplete in that they do not provide recommendations for all the problems or report on improvements after problems had been fixed.

2.2.2.3.1 Labelling

Based on the discussion of existing usability principles in Section 2.2.1.5.2, the following sub-criteria apply to the "Labelling" heuristic:

- The system uses comprehensible terminology and concepts that the intended user is familiar with (based on the user's existing knowledge).
- The system avoids using system-oriented terms but the terms are familiar within the context of the task.

Additionally, the following sub-criteria can be added based on the IA labelling system component category in Section 2.1.3.2.2:

- Terminology in labels corresponds to the content it represents.
- The page title contains information about the current page and the website.

The following discussions of related studies apply to this heuristic. The problems that were found and recommendations that were made relating to this heuristic are integrated and summarised at the end of this section, Section 2.2.2.3.1.19.

2.2.2.3.1.1 Study 1

Some users reported in the web-based user survey that the labelling was unclear and that the labels on the homepage did not make sense (George 2005:168). This indicated to the researchers that the labels in the new design should be changed to be more clear and consistent. The team that lead the redesign project focussed on relabelling in the prototype design phase by using terminology that is more common.

The label of the libraries' catalogue in the prototype was "Cameo" (the name of the catalogue) which proved to be an unfamiliar term to new and infrequent users. The label was subsequently changed to "Library Catalogue" (George 2005:172).

There were no reports of user complaints about the labelling during the final usability test after the changes that were made in the prototype phase were implemented in the final design.

2.2.2.3.1.2 Study 2

The library, together with an outsourced company, ran user surveys to learn more about library terminology and jargon before their first redesign which focussed on improving the website's IA. Using the user feedback, a wireframe was developed that everyone involved in the process was satisfied with (King & Jannik 2005:237). Specific details were not reported, but it is clear from this study that library terminology and jargon causes problems.

2.2.2.3.1.3 Study 3

A structured analysis of the inventory of the old version of the library website showed that library terminology made heavy use of library jargon (Turnbow et al. 2005:227). Surveys and user testing were used to ensure that the redesigned website will use terminology and labels that are familiar to the majority of library users (Turnbow et al. 2005:228).

2.2.2.3.1.4 Study 4

One of the main goals of the redesign was to reduce jargon — especially on the homepage of the library website (Ward 2006:208). Users were confused about the terminology on the website during the first round of usability testing.

The main confusion that was experienced was caused by terms that are unique to the UW library. For example, the term "UWorld Express" is the name of the interlibrary lending/borrowing office, and "Information Gateway" was the original name of the website. It was suggested that users would not know what the term "UWorld Express" means unless they had used the service before, so the recommendation was to use a descriptive term such as "interlibrary loan" instead. The name "Information Gateway" was found to be meaningless to users and was therefore removed (Ward 2006:211).

More problems that were found with language during the second round of usability tests resulted in changes to wording and formatting. For example, "Contact us" was changed to "Ask us" (Ward 2006:212).

2.2.2.3.1.5 Study 5

All heuristic evaluators agreed that the language that was used in the website was appropriate for LIS students (Manzari & Trinidad-Christensen 2006:164).

Heuristic evaluators commented that using the name of the university's online catalogue "LIUCAT" in the link text might be a problem since users might not be familiar with the term. The recommendation to improve the problem was to change the link text (label) to "LIUCAT (library catalog)".

2.2.2.3.1.6 Study 6

This study was the only one where library jargon was not a problem. The reason for this was that the participants consisted exclusively of library staff. Users, however, still commented that the terminology "should be simple" (MacMillan, McKee & Sadler 2007:431).

2.2.2.3.1.7 Study 7

Users were not able to make a clear distinction between the categories "Help with the Research Process" and "Help Using the Library". The suggestion for improving this problem was to collapse them into a single category (Duncan & Holliday 2008:312).

Usability testing proved that the label "Services" (which is considered library jargon) was ineffective and did not bear much meaning to users. "Services" was replaced with "Quick Links" (Duncan & Holliday 2008:312).

2.2.2.3.1.8 Study 9

Users did not understand terms that are unique to the UCT library, i.e., "EZProxy" (protocol for off-campus use), and "SFX" (protocol for access to other university resources). Recommendations for improving these issues were either providing "roll-over text" that further explains the term (discussed in Section 2.2.2.3.4.3 where additional explanations are discussed), or renaming the link labels to be more meaningful and to explain what the links are for. For example, "EZProxy" must be changed to "Access from home" and "SFX" must be changed to "CALICO institutions catalogue" (Mvungi, de Jager & Underwood 2008:181).

The label "Access from home" is preferred over "Off-campus access" because one user had difficulty understanding the meaning of "Off-campus access" and the alternative label better explains what the link is for (Mvungi, de Jager & Underwood 2008:178).

Users were confused about the difference between the terms "Electronic journals" and "Print journals" under the "Field to search" options when doing a basic catalogue search; they expected a "Journals" option instead. The recommendation to improve this problem was to provide a "Journals" option under the "Field to search" options (Mvungi, de Jager & Underwood 2008:178).

When performing an online database search, the users avoided using the "Databases by platform" link since they were not familiar with the term. They used a link called "Databases" instead. The researchers recommended that the link named "Databases by platform" should be changed to "Online databases" (Mvungi, de Jager & Underwood 2008:178).

2.2.2.3.1.9 Study 10

One of the goals of the redesign of the website included eliminating jargon as much as possible. To achieve this goal, users were required to write down all the unfamiliar terms that they encountered on the website during the usability test (Oldham 2008:230). The study did not reveal specific problematic terms.

2.2.2.3.1.10 Study 11

Users did not know what tools to use for finding specific resources because the names of the tools had little meaning to them. Evaluators commented that link labels did not make it clear where they linked to (Dougan & Fulton 2009:235). This problem can easily be solved by providing guidance (see Section 2.2.2.3.4.4).

Users did not know what "Class Guides" were when they had to find them in a task; they assumed "Class Guides" were equivalent to either e-reserves or course descriptions. All participants needed a definition for "Class Guide" (Dougan & Fulton 2009:225).

Users found the library jargon to be confusing, and evaluators commented that some of the words were difficult to understand or misleading. Some terms, for example, "Reference Help" and "Reference Tools" might seem redundant to users (Dougan & Fulton 2009:234). Evaluators also commented that it is difficult to find terms that communicate effectively to a diverse audience with a different range of experience. This problem can be solved by including novice user guidance. In the redesign, a few words were deleted or substituted.

Users failed to locate a link labelled "Music and Performing Arts Library Maps" when they were looking for maps on the correct page. The evaluators suggested that this might be because they were "scanning" instead of reading and were just looking for a link labelled "Maps". Therefore, they suggested that the link text should start with the keyword "Maps" instead of end with it (Dougan & Fulton 2009:233).

2.2.2.3.1.11 Study 12

The following links were recognisable to the users, but only because they were familiar with the website or they were staff: "Articles & Databases", "Catalog", and "Request Materials" (Emde, Morris & Claassen-Wilson 2009:32). This finding does not correspond with most of the other studies, but it is mainly because the other studies involved novice users.

Users identified problems with the labelling and help links in the navigation tabs, specifically that the links consist of "unclear library verbiage" (Emde, Morris & Claassen-Wilson 2009:30). They commented that the terminology must be comprehensible and unambiguous (Emde, Morris & Claassen-Wilson 2009:31).

2.2.2.3.1.12 Study 13

Users found the vocabulary ambiguous and misleading. Recommendations included the revising of labels to bring it in line with the content and clarification of labels to increase findability (Rogers & Preston 2009:207).

2.2.2.3.1.13 Study 14

Users' input on terminology was gathered using questions that explicitly asked them about their feelings about the terminology that was used. Users had difficulty distinguishing between databases, catalogues, and other tools (Swanson & Green 2011:227). This problem is addressed in "Novice user guidance" (Section 2.2.2.3.4.6) where the recommendation is to provide guidance.

2.2.2.3.1.14 Study 15

Users were confused by the terminology used on the website. The words that were discussed the most included "catalog", "database", "instructional support", and "library instruction" (Tidal 2012:94). The recommendation for improving this problem is to alter the terminology by using common everyday language (Tidal 2012:97).

2.2.2.3.1.15 Study 16

One of the main goals was to simplify the language used to describe resources, tools, and services and to eliminate library jargon from the navigational system by making use of concise language (Becker & Yannotta 2013:7).

Users had difficulty finding a journal article on a topic because they tried locating it by clicking on "Journal Title List" instead of "Databases" which would have been more appropriate if they did not have the journal title. The "Databases" link was changed to "Databases/Articles" to clarify what resources would be found if users clicked on it (Becker & Yannotta 2013:13) and "Journal Title List" was changed to "List of Journals and Magazines" (Becker & Yannotta 2013:14). This change resulted in participants experiencing greater success with the terminology.

Users had difficulty finding reference materials because it was categorised under the heading "Subject Guides" and students avoided using the link. Evaluators recommended changing the link to "Topic Guides". The new link was still being avoided after the renaming; therefore, it was changed again to "Research Guides", as was suggested by users (Becker & Yannotta 2013:13).

Users had difficulty locating circulation policies because they did not use the link labelled "Library Policies". The link label was changed to "Checkout Policies" after a redesign since it

uses terminology that users are familiar with, i.e., users use the checkout desk to check out books from the library (Becker & Yannotta 2013:14).

2.2.2.3.1.16 Study 17

During the discovery phase of the redesign process, researchers discovered that users do not like the use of library jargon (Dominguez, Hammill & Brillat 2015:109). This feedback was not surprising, but researchers were surprised that users did not understand the phrase "renew materials" (Dominguez, Hammill & Brillat 2015:110). Researchers performed another round of usability testing during the development phase, which was valuable for determining terminology. The phrase "interlibrary loan" was changed to "borrow from other libraries" and "library catalogue" was changed to "books & more" (Dominguez, Hammill & Brillat 2015:110).

2.2.2.3.1.17 Study 18

It was evident that the homepage consisted of vague headings that were not descriptive of the purpose of main categories — headings such as "Federated/Common Search Engines", "Public Search Engines", and "Clientele" (Pant 2015:903). Recommendations included that the overall IA needs to be restructured by renaming navigation labels and content headings (Pant 2015:911). It was recommended that navigation labels and headings should use terminology that users are familiar with, must be explicitly related to the content they represent, be distinct, and easily understandable (Pant 2015:912).

2.2.2.3.1.18 Study 20

Usability tests confirmed that the website used jargon, for example, DocRetriever, HELIX, and NML specific terms that users did not understand (Wu & Brown 2016:161). Improvements relating to the problems that were found were not discussed.

2.2.2.3.1.19 Summary of "Labelling" recommendations from related studies

Issues with labelling were the most prevalent problem in the related studies.

The main problems that were found with labelling in academic library websites were either problems with basic library terms (for example, catalogue, database, and interlibrary loan) or names of the systems used that are unique to each of the library websites (for example, ALEPH, CAMEO, and LIUCAT).

Problems were mainly found in cases where *novice* users were involved in the testing. Results prove that users experienced greater success after labels were changed. It was appropriate to change the terminology where terms specific to that library were changed. For example, "UWorld Express" was changed to "Interlibrary loan" in study 4.

In study 17, however, popular library terms such as "Interlibrary loan" were changed to "borrow from other libraries", which is a description of the term that aims to provide guidance. This indicates that the problems that were found might have been due to a lack of guidance. Since the majority of problems were found where novice users were involved, a better solution, in that case, would have been to provide guidance, instead of changing some of the common library labels, such as "catalogue", and "databases". This concept is further explained by the heuristic "novice user guidance" in Section 2.2.2.3.4. Guidance can explain what basic library resources can be used to complete which tasks. There should be a balance between keeping library jargon that is popular across libraries (familiar in the context of the task) and library jargon that is only relevant to a specific library.

These studies contributed the following library website-related recommendations to the "Labelling" heuristic:

- The use of library jargon that is specific to the library should be avoided (for example, the name of the library's catalogue).
- Common everyday language that users are likely to be familiar with, should be used where possible and additional explanations should be provided in the form of tooltips where necessary, according to the "Novice user guidance" heuristic.
- The language used in labels should be clear, concise, comprehensible, and meaningful.
- Terms that are ambiguous, vague, redundant, or misleading should be avoided.
- Long labels should start with an identifying keyword.
- Different labels that overlap in meaning should be renamed to be more distinguishable.

These recommendations were added to the sub-criteria of the "Labelling" heuristic in Section 2.2.3.1.1.

2.2.2.3.2 Organisation

Based on the discussion of existing usability principles in Section 2.2.1.5.2, the following sub-criterion applies to the "Organisation" heuristic:

- Information appears in a natural and logical order.

The usability problems listed in this section were categorised under organisation because this heuristic was the most applicable. It is, however, not clearly defined in the discussion of the established principles. Therefore, it was expanded to have a broader focus, including factors such as categorisation, grouping, sorting, and layout as discussed in Section 2.1.3.2.1 (Organisation systems):

- Information is grouped and classified logically.
- Documents or categories that are grouped together fit well with each other.
- The degree of overlap between categories is low.
- Child content objects represent parent content objects.

The following discussions of related studies apply to this heuristic. The problems that were found and recommendations that were made relating to this heuristic are integrated and summarised at the end of this section, Section 2.2.2.3.2.15.

2.2.2.3.2.1 Study 1

User feedback revealed that students had difficulty navigating the website due to the disorganised categorisation, where items in lists were sometimes unrelated, resulting in confusion (George 2005:168). The results of the web-based user survey indicated that links should be reorganised with a focus on the reference areas. Design indications also included that links should be re-categorised. The team that lead the redesign project focussed on re-categorisation in the prototype design phase. They tested a variety of different navigation bars and organisational links to create the final prototype design. After the redesign, users commented that the new website is cleaner, clearer, and more organised (George 2005:177).

Users had difficulty finding the link to the libraries' catalogue and the link to other library catalogues during the task-based usability test. This problem indicated that the catalogue should be made more obvious for new and infrequent users, and it was subsequently placed at the top of the homepage in the final version (George 2005:171). After the usability test, some users still had problems finding the link and commented that it was not noticeable at the top of the banner (George 2005:177).

During the task-based usability test, users had difficulty finding the correct page for account information and had to use the sitemap to find it (George 2005:173). Users suggested that the link called "User Services", which links to account information, should be directly accessible from the homepage because it was on the "Borrow and Renew" page. As a result, the links on the "Borrow and Renew" page were rearranged so that the most important links, including "Manage your library account", appear in the main section and that supplemental links appear in the "Buckets" (separate containers in the right sidebar for supplemental or short-term information). The "Manage your library account" link now appears first in the main section. For a future redesign, they will consider placing the link on the homepage in the main section, as users suggested (George 2005:173).

One of the major findings was that users navigate from top to bottom and left to right (George 2005:178). Users expect to find common links, such as the sitemap and logo, in the

header, but they do not look in the header for links that are unique to the library, for example, "Ask a Librarian" (George 2005:175). This finding indicates that the most frequently used links should be listed first.

2.2.2.3.2.2 Study 3

One of the problems that were found in the old version of the library website was that it was not organised to reflect the way users look for information. Instead, it was organised according to the physical library buildings, i.e., the individual departments or the unit of the library that is responsible for maintaining their part of the website (Turnbow et al. 2005:227). A structured analysis of the inventory of the pages of the old website showed inconsistencies in the organisation of links (Turnbow et al. 2005:228). Surveys and user testing were used to ensure that the redesigned website will be organised to anticipate users' questions (Turnbow et al. 2005:228). The resulting website used five main navigational categories that had corresponding drop-down menus, and users liked it (Turnbow et al. 2005:232).

2.2.2.3.2.3 Study 4

During the survey, it was discovered that users were confused about the navigation on the old website. During the prototype phase, users were asked to provide feedback on different layout options and to choose one that will help them find what they need quickly. There was a consensus about which combination of layouts would be the most effective, and a combination of two layouts was subsequently used for the design of the new homepage (Ward 2006:210).

2.2.2.3.2.4 Study 5

The heuristic evaluators found that the menu options were arranged in order of anticipated use, which is not ideal. The recommendation to improve this problem was to put the link to the homepage first. This would provide an "emergency exit" for when users get lost on the website. A specific ordering scheme should then be used for the rest of the links and it should stay consistent on all the pages (Manzari & Trinidad-Christensen 2006:165).

2.2.2.3.2.5 Study 7

Usability testing suggested that users do not make use of clear navigation patterns when searching for certain types of information. For example, users either used "About" or "Services" to search for circulation information or group study rooms. Some users (specifically faculty members) looked for "Interlibrary Loan" under the category "Find", rather than "Services", which suggested that the link should be placed under both categories. The researchers commented that there is "no such thing as a 'typical' user following consistent paths to specific information items" (Duncan & Holliday 2008:314). Therefore a

design should have built-in redundancy that includes multiple pathways to general content areas (Duncan & Holliday 2008:312).

2.2.2.3.2.6 Study 9

Most users were not able to locate the tutorial for the online catalogue. One user expected to find it by clicking on the "Help" link. Therefore one of the recommendations was to make it accessible by clicking on the "Help" link. The "Help" link must also be more prominent and should be accessible from the homepage as well as the main search page (Mvungi, De Jager & Underwood 2008:179).

Users had difficulty finding the location of links to access resources from other universities' libraries. They recommended that there must be links to other universities' resources available on the homepage of the library website (Mvungi, de Jager & Underwood 2008:178).

2.2.2.3.2.7 Study 11

Users experienced problems with the categorisation and organisation of the website. When users were looking for a link for help with citations on the "Services & Research Assistance" page, they could not find it because it was under the "Services" heading and they did not think it would be there (Dougan & Fulton 2009:228). In the redesign of the website, content was rearranged to make the website easier to navigate (Dougan & Fulton 2009:236).

2.2.2.3.2.8 Study 12

When searching for a journal article, the users completed the task using various paths. Some users used the "E-journals" link, while others searched for the title using the "Articles & Databases Quick Search" link (Emde, Morris & Claassen-Wilson 2009:30).

2.2.2.3.2.9 Study 13

In the survey questionnaire, users selected unstructured content as the website's worst feature (Rogers & Preston 2009:205). Users struggled with labels that were grouped incorrectly and placed under the wrong main heading. For example, "Divisions" was found to be a misunderstood label for grouping labels such as "Humanities and Education" and "Engineering and Physical Sciences" together. This resulted in users wasting time (Rogers & Preston 2009:207). The evaluators suggested that the labels do not represent possible user goals. For example, users are not likely to search for information on a library website by faculty divisions. The recommendation was to review the content and bring it in line with labels, or revising and clarifying the labels.

2.2.2.3.2.10 Study 15

Users reported in the survey that the website is hard to navigate and that they felt lost in the library (Tidal 2012:93). There was no main navigation bar on the homepage. The main navigation bar was added after the first usability study (Tidal 2012:94).

2.2.2.3.2.11 Study 16

Users rarely used the online chat client labelled "Ask a librarian" because the link to it could not be found easily. In a redesign, it was prominently featured on the top of the screen and, as a result, the use of the chat client has doubled (Becker & Yannotta 2013:13).

To improve the organisation of the contents of the website, four main headings "About, "Find", "Services", and "Help" were created on the homepage and all content headings were divided among these headings. Users commented that these menu options break down the information easily (Becker & Yannotta 2013:15). The new links "Databases/Articles" and "List of Journals and Magazines" were placed under the heading "Find" after being renamed for clarification (see Section 2.2.2.3.1.15) (Becker & Yannotta 2013:13).

2.2.2.3.2.12 Study 17

A large number of users commented that it was extremely difficult for them to find contact information for librarians, library departments, and hours (Dominguez, Hammill & Brillat 2015:110). This is most likely due to an unorganised system.

The third redesign of the website included a navigation bar with the following links: "Catalog, Research, Ask Us, About Us, and Home". Each link served as a major category under which content was organised (Dominguez, Hammill & Brillat 2015:112).

2.2.2.3.2.13 Study 18

Main navigation links were not organised properly into the six (vague) main categories, for example, the links "Staff", "Suggest-a-book, and "Contact" appeared under the category "Clientele" (Pant 2015:903). The overall IA was unstructured and misleading, resulting in poor learnability. Recommendations included that the overall IA needs to be restructured by reorganising information and restructuring the navigation menu (Pant 2015:911).

2.2.2.3.2.14 Study 20

Finding library hours information was more complicated than necessary because it required too many clicks (Wu & Brown 2016:161). The collected data confirmed that library hours is an important element for the homepage (Wu & Brown 2016:164).

2.2.2.3.2.15 Summary of "Organisation" recommendations from related studies

These studies contributed the following library website-related recommendations to the "Organisation" heuristic:

- The system should be organised to reflect the way users look for information.
    - Important links should appear in noticeable locations or main sections.
    - Important information should be accessible from the homepage.
    - A link to the homepage should be easy to find and listed first if it is in a list of links.
    - Help links should be prominent and easily accessible.
- The website should use clear organisation and categorisation.
    - A small number of main navigational categories should subdivide information into logical sections.
    - Multiple pathways to general content areas should be provided.
    - Content should be structured and grouped correctly.
    - Content should be sorted according to possible user goals.
- The layout and navigation should be simple.
    - The website should be easy to navigate.
    - The layout structure should be intuitive.

These recommendations were added to the sub-criteria of the "Organisation" heuristic in Section 2.2.3.1.2.

2.2.2.3.3 Clutter

Based on the discussion of existing usability principles in Section 2.2.1.5.2, the following sub-criteria apply to the "Clutter" heuristic:

- The system does not provide the user with irrelevant information or information that is not needed for the successful completion of tasks.
- There is nothing that takes the user's attention away from important information.

Additionally, the following sub-criterion can be added based on the IA navigation system component category in Section 2.1.3.2.3:

- Links in main navigation bars are limited to eight links.

The following discussions of related studies apply to this heuristic. The problems that were found and recommendations that were made relating to this heuristic are summarised at the end of this section, Section 2.2.2.3.3.13.

2.2.2.3.3.1 Study 1

The results of the web-based user survey indicated that the homepage of the new design should be simplified and decluttered (George 2005:168). One of the design team's strategies for reducing clutter on the homepage was to include "blocks of information in the right sidebar for short bits of supplemental and sometimes short-term information such as features and news" which they refer to as "buckets" (George 2005:169). These buckets were created for information that is constantly changing, for example, news. After the task-based usability test of the redesigned website, users commented that the visual display and screen design looked less cluttered and appeared to be more user-friendly (George 2005:171). However, even though these buckets were created to reduce clutter, some users disliked them and commented that the buckets were cluttered and difficult to scan (George 2005:177).

2.2.2.3.3.2 Study 2

The "Quick Links" caused clutter and distracted users. According to the researchers, the "Quick Links" is mainly used by librarians. Therefore it was featured in a drop-down menu instead, to reduce the distraction to users (King & Jannik 2005:240).

2.2.2.3.3.3 Study 4

One of the main goals of the study was to eliminate redundancy, especially on the homepage of the library website (Ward 2006:208).

2.2.2.3.3.4 Study 5

The heuristic evaluators agreed that the website was free of clutter based on the comments that they received. Comments included that the pages were uncluttered and clean, that the website was not "over designed", and that unnecessary or irrelevant information was limited (Manzari & Trinidad-Christensen 2006:164). The only issue that was encountered in this regard was that the subject list of journals was too long, but no suggestions were made to improve it.

Users that were included in the usability test also called the website "uncluttered" and they liked it because of that (Manzari & Trinidad-Christensen 2006:167). Based on the comments of the heuristic evaluation and usability test, having an "uncluttered" website seems like a critical aspect.

2.2.2.3.3.5 Study 8

Students appeared to be impatient with long lists of search results because they did not wait for all of the search results to load. They only used the results that were returned first (Kitalong, Hoeppner & Scharf 2008:193).

2.2.2.3.3.6 Study 10

Recommendations from focus groups indicated that the library homepage was cluttered, mainly because a picture, as well as information about the library took up too much space on the page (Oldham 2008:219).

One of the goals of the redesign of the website was to eliminate scrolling as much as possible (Oldham 2008:232). A website that requires too much scrolling is usually a result of an imbalance between the width and the breadth, i.e., it is wider than it is deep.

2.2.2.3.3.7 Study 11

The website's layout was overcrowded and confusing before the redesign. Screen real estate was taken up by announcements and news that users did not use (Dougan & Fulton 2009:219).

There were 77 links on the main page, which is too many, and it consisted of two navigation bars which caused confusion (Dougan & Fulton 2009:219). On the new website, the number of clicks needed to find a resource was increased, resulting in fewer links on the homepage, i.e., the depth was increased. Users stated that "they would rather click more to find what they need as long as they could understand the general structure of how the information is being presented" (Dougan & Fulton 2009:229).

2.2.2.3.3.8 Study 13

The variety of data collection methods confirmed that users found the website to be cluttered (Rogers & Preston 2009:205). The homepage consisted of labels that were never used: 36.8% of headings on the homepage were never used by 50% of the participants in the card sort. Labels such as "Caribbean Resources" and "24/7 service" were unclear to the users and subsequently underutilised. The evaluators suggested that the labels could be removed completely or could be included under subheadings that provide context (Rogers & Preston 2009:207).

2.2.2.3.3.9 Study 14

Researchers commented that the homepage's real estate is a limited resource since more items are constantly being added to it. According to them, the more items there are, the less findable they are, therefore the real estate needs of different resources need to be balanced in the next redesign (Swanson & Green 2011:227).

2.2.2.3.3.10 Study 15

Users commented on the abundance of links and text on the homepage and reported that the website was "jumbled" and "too busy" (Tidal 2012:93). Users also described it as "crowded" and "overwhelming" and said that it causes confusion and a sense of being lost (Tidal

2012:94). The number of links and the amount of text were reduced after the first usability test. Six links were removed (Tidal 2012:95).

2.2.2.3.3.11 Study 17

Feedback from card sorting and focus groups indicated that there were too many links on the website and that the links contained too many words. Eighty links were identified on the library homepage (Dominguez, Hammill & Brillat 2015:118). The main complaint was that this resulted in users experiencing difficulty when trying to find information (Dominguez, Hammill & Brillat 2015:115).

2.2.2.3.3.12 Study 20

One of the features that the web committee wanted to add to the homepage was "mega-menus" that display the entire navigation structure of the website. They were advised against such a feature because users might struggle to navigate the website when they are presented with too much information at once (Wu & Brown 2016:165). The web committee was confident that the new website meets the goal of providing more links on the homepage — but not too many — enabling users to find what they need quickly (Wu & Brown 2016:168).

2.2.2.3.3.13 Summary of "Clutter" recommendations from related studies

The analysis shows that clutter has a negative effect on users' productivity with the website. The more items there are, the less findable they become. The breadth versus depth issue has a significant impact on clutter. Studies have reported that users prefer a website with a deeper organisational structure as long as it makes the general structure of information more understandable (Dougan & Fulton 2009:229). Many studies aimed to decrease the number of links on the homepage of the website.

These studies contributed the following library website-related recommendations to the "Clutter" heuristic:

- All pages should have simple layouts and should be clutter free.
- Pages should not contain too many links.
- Links should not contain too many words.
- Duplication of information on a page should be eliminated.
- Non-essential information should not appear in multiple locations on a page.
- There should be a good balance between breadth and depth.
- Pages should not be too long, requiring users to scroll too much.
- The system should not make a user feel lost.

These recommendations were added to the sub-criteria of the "Clutter" heuristic in Section 2.1.3.2.3.

2.2.2.3.4 Novice user guidance

Based on the discussion of existing usability principles in Section 2.2.1.5.7, the following sub-criteria apply to the "Novice user guidance" heuristic:

- Additional explanations, rules, and underlying concepts that assist the user in gaining a conceptual understanding of the interactive system are provided.
- Guidance and support are provided to help the user learn how to use the system.

The following discussions of related studies apply to this heuristic. The problems that were found and recommendations that were made relating to this heuristic are integrated and summarised at the end of this section, Section 2.2.2.3.4.10.

2.2.2.3.4.1 Study 2

The formal usability test showed that users did not know why they should choose to use one resource or interface over another, for example, catalogue, databases, and e-journals (King & Jannik 2005:240). This indicated that the researchers should focus on ways to guide new users to the right sources on the website. The outsourced design team provided the library with design recommendations to provide users with clear navigational choices and screen-to-screen learning to guide them. They also commented that the redesigns would make use of consistent design that would assist the users to make informed decisions.

A page called "Search and Locate" was recommended as a landing page that highlights the primary ways to locate resources. This page featured a section called "3 ways to find what you are looking for" as a way to guide novice users (King & Jannik 2005:240).

2.2.2.3.4.2 Study 5

Heuristic evaluators commented that the term "JAKE" (the library tool for accessing full text) might not be clear to users, but that there was a sufficient explanation for the term. They did, however, suggest that the description, "Find periodicals in online databases", should be added to the link for clarification (Manzari & Trinidad-Christensen 2006:164).

Heuristic evaluators commented that many of the menu options (for example, "databases", "journals", "LIUCAT", "Other web sites", "Palmer school", and "staff") were unclear and that they needed clarification. The recommendation to improve the problem was to add additional text "for clarity at the expense of brevity" (Manzari & Trinidad-Christensen 2006:164).

Novice users had difficulty understanding some "basic library concepts", for example, "Refereed journals" and the difference between "Journals" and "Index databases" and suggested that explanations of terms that they are not familiar with should be provided. Test

facilitators commented that descriptions of these terms were available, but that they were ignored (Manzari & Trinidad-Christensen 2006:186).

2.2.2.3.4.3 Study 9

Users avoided using the link named "Catalogue (ALEPH)" to perform a catalogue search. It was suggested that users might not have been familiar with the term "ALEPH", but it was also suggested that all users do not understand the term "catalogue" (Mvungi, De Jager & Underwood 2008:177). The recommendation to improve this problem was to provide "roll-over" text that explains what "Catalogue (ALEPH)" means, as well as other categories on the main navigation bar. This will help users to know where a link will take them when they hover over the link text (Mvungi, de Jager & Underwood 2008:178).

2.2.2.3.4.4 Study 11

Users had difficulty finding journal articles because they did not know what tools to use. The names of some tools had little or no meaning to them. They had trouble with deciding what tool to use, but even if they found the right tool, they did not know what to do with it (Dougan & Fulton 2009:234). They tried to use the library catalogue to locate them, which resulted in failure (Dougan & Fulton 2009:235). This problem proved that there was a lack of guidance for novice users.

2.2.2.3.4.5 Study 12

One user had difficulty understanding the link "Articles & Databases Quick Search" since it does not state which databases are included in the search (Emde, Morris & Claassen-Wilson 2009:29). Additional explanations that explain what databases are used would be useful in this case.

2.2.2.3.4.6 Study 14

Users had difficulty with choosing the correct database when they had to perform a search for periodicals because the website requires users to "make several decisions about where to search before they even need to consider how to search" (Swanson & Green 2011:226). The website did not provide sufficient guidance on choosing what subscription database to search (Swanson & Green 2011:226).

The different search boxes on the website were indistinguishable to students. Students were confused between the library's primary search tools such as the catalogue and periodical database pages and additional tools such as WorldCat or the regional library systems catalogue. According to the researchers, the website's primary search tools such as links to the library's catalogue and periodicals database page must be emphasised so that users can distinguish between them and outside tools (Swanson & Green 2011:226).

The researchers commented that the "users do not appear to be very aware of the differences between databases, catalogs, and other tools" (Swanson & Green 2011:227). Users also had difficulty interpreting search results, especially with distinguishing between different *types* of results, for example, if it was a list of subjects, article titles, or keyword results (Swanson & Green 2011:266). This shows that there is a lack of guidance in the search results. The researchers suggested that the type of result should be clearly indicated to increase the user's ability to recognise the differences between results, and that clear guidance for search tools should be provided that indicates the types of results that the tools would provide (Swanson & Green 2011:227).

2.2.2.3.4.7 Study 18

Web forms were identified as a useful feature that allows users to communicate with library staff to save the user time and effort (Pant 2015:903). One of the recommendations was to provide users with web forms that they can use to send queries or get help (Pant 2015:912).

2.2.2.3.4.8 Study 19

Undergraduate students had difficulty differentiating between different resources (for example, e-journals collections and specific databases) and how to locate them. The researchers argue that this problem is due to a lack of training in using library resources (Chase, Trapasso & Tolliver 2016:36). The researchers identified a need for online research support and information literacy instruction (Chase, Trapasso & Tolliver 2016:37) and mention that "undergraduates require training in information literacy practise" (Chase, Trapasso & Tolliver 2016:38). However, users should not be required to go for training before they can use the library website. Therefore, in addition to recommending information literacy instruction courses, information literacy principles should be built into the library website design and development (Chase, Trapasso & Tolliver 2016:39).

2.2.2.3.4.9 Study 20

Users did not know what the use of specific resources were, for example, "Pubget" and "Web of Science" (Wu & Brown 2016:161), which shows that there is a lack of guidance. Users also did not know what content they were searching when using the search box with the caption "search the NML website". The researchers identified that there is a need for "clear instructions on how to quickly access resources" (Wu & Brown 2016:161).

2.2.2.3.4.10 Summary of "Novice user guidance" recommendations from related studies

It is very evident that the lack of guidance is a common problem on academic library websites. As mentioned in Section 2.2.2.3.1.19, many of the usability problems relating to language can be solved by providing users with guidance.

A simple way to provide users with additional explanations of unfamiliar terms is through the use of tooltips. A tooltip is a message that appears when a cursor is positioned over an element such as an icon, image, or hyperlink in a graphical user interface (Nielsen 2016). When a tooltip is added to a link, its goal is to help users predict what will happen if they follow the link (Nielsen 2016).

These studies contributed the following library website-related recommendations to the "Novice user guidance" heuristic:

- Descriptions for unfamiliar terms should be provided for clarification.
- Additional explanations should be provided for basic library terms (instead of changing the labels).
- Tooltips should be used to reveal additional explanations for terms or the target destination of links.
- New users should be provided with clear navigational choices that guide them to the right resources.
- Information about expected search results as well of the scope of a search box should be provided so that users will know what search boxes to use.
- Primary search tools should be emphasised.
- Search results should be annotated automatically to help users distinguish between the different types of results.
- Novice users should be provided with web forms that allow them to communicate with library staff.
- Users should be able to differentiate between different resources.

These recommendations were added to the sub-criteria of the "Novice user guidance" heuristic in Section 2.2.3.1.4.

2.2.2.3.5 Help documentation

Based on the discussion of existing usability principles in Section 2.2.1.5.10, the following sub-criteria apply to the "Help documentation" heuristic:

- Help documentation is provided.
- Help documentation can be located easily when the need arises.
- Help documentation is searchable.
- Help documentation is easy to use.
- Help documentation does not contain too much information.

The following discussions of related studies apply to this heuristic. The problems that were found and recommendations that were made relating to this heuristic are integrated and summarised at the end of this section, Section 2.2.2.3.5.10.

2.2.2.3.5.1 Study 1

Results from the web-based user survey indicated a need for help documentation, including:

- a sitemap,
- librarian e-help throughout the website,
- a guide on using the databases and the library's other references resources, and
- a site search option (George 2005:168).

The team that lead the redesign project strove to provide easy access to electronic help in the prototype design phase.

2.2.2.3.5.2 Study 5

Users suggested that more explanations of terms that they are not familiar with should be provided. Evaluators commented that this might clutter the website, so instead, a better solution might be to provide a glossary page that explains these terms (Manzari & Trinidad-Christensen 2006:168).

2.2.2.3.5.3 Study 7

Users had difficulty finding and accessing library resources and were seeking help on the library website to assist with this. Interviews with stakeholders also suggested that the website should provide help and instructions on using library resources and services. The following items ranked the highest of library services that users needed assistance with:

- remote access,
- information on how to get help from a librarian, and
- contacting a subject librarian (Duncan & Holliday 2008:307).

2.2.2.3.5.4 Study 9

Users had difficulty finding the location of links to access resources from other universities' libraries. In addition to other recommendations to rename the link, the researchers also recommended that instructional help should be provided on how to search for other libraries' resources (Mvungi, de Jager & Underwood 2008:178).

One of the tasks involved locating a tutorial on how to use the university's "ALEPH" catalogue. Most participants could not locate the tutorial, and they suggested that it should also be accessible from a "Help" link and that it must be made more prominent so that it is easy to find (Mvungi, de Jager & Underwood 2008:179). The researchers concluded that more

visible help features will improve the ease of finding specific information, which was an issue that was discovered in a post-test questionnaire (Mvungi, de Jager & Underwood 2008:180).

2.2.2.3.5.5 Study 13

Users had a problem with the absence of a sitemap (Rogers & Preston 2009:205). One of the recommendations was to develop a sitemap to assist users who navigate by browsing (Rogers & Preston 2009:207).

2.2.2.3.5.6 Study 14

Help features in this study included a "site search" and "FAQ page". Students rarely used these features. Students who used the FAQ page were not successful, but students who used the site search feature were successful. When students struggled, their default answer was that they would use the "Ask a librarian" feature (Swanson & Green 2011:226).

2.2.2.3.5.7 Study 18

Users indicated a need for FAQs and user guides (Pant 2015:911). One of the recommendations included that help should be provided for the resources that are available on the website (Pant 2015:9012).

2.2.2.3.5.8 Study 19

Users had difficulty with locating research help and help features on the website. Researchers noted that more help options and more prevalent links are needed to assist users (Chase, Trapasso & Tolliver 2016:37).

2.2.2.3.5.9 Study 20

The help page was not useful because it did not aim to provide assistance. Instead, it offered contact information for the library (Wu & Brown 2016:161).

2.2.2.3.5.10 Summary of "Help documentation" recommendations from related studies

Many studies mention that there is a need for help documentation on academic library websites to assist users with the available resources.

These studies contributed the following library website-related recommendations to the "Help documentation" heuristic:

- Help documentation should provide help and instructions on using library resources and services.
- Instructional help should be provided on how to search for other libraries' resources.
- Tutorials should be accessible from a "Help" link.
- A sitemap should be included as a supplemental navigation system.

These recommendations were added to the sub-criteria of the "Help documentation" heuristic in Section 2.2.3.1.5.

2.2.2.3.6 Efficiency features

Based on the discussion of existing usability principles in Section 2.2.1.5.7, the following sub-criteria apply to the "Efficiency features" heuristic:

- Shortcuts are available that enable users to speed up the interaction with less frequent actions.
- Frequent actions are customisable.
- The user can modify their interaction with and the presentation of information.

The following discussions of related studies apply to this heuristic. The problems that were found and recommendations that were made relating to this heuristic are integrated and summarised at the end of this section, Section 2.2.2.3.6.9.

2.2.2.3.6.1 Study 1

The web-based user survey indicated that users are interested in having a customisable library website, but this need was not addressed in the study (George 2005:168).

2.2.2.3.6.2 Study 5

Users suggested that a search box should be provided for users who prefer not to use links to navigate by browsing the website. The recommendation for this problem was that a search engine might be worth including, even though the website does not have a large number of pages (Manzari & Trinidad-Christensen 2006:167).

2.2.2.3.6.3 Study 6

An unexpected response that was unique to the staff focus group was that users should be able to personalise their library accounts (MacMillan, McKee & Sadler 2007:432).

2.2.2.3.6.4 Study 9

When performing a basic search using the online catalogue, users did not realise that they could limit their search results by changing a "Field to search" option from "All fields" to "Title". Most users just left it on the default "All fields" option (Mvungi, de Jager & Underwood 2008:178). Limiting the search result would lead to getting results faster and getting more appropriate search results.

Users found it difficult to find an online newspaper title on the newspaper page since the titles were not sorted alphabetically and no search box was provided. The only way of finding an online newspaper title was to scan through the entire list of titles. This affects efficiency negatively since it takes a user longer to achieve a basic goal. The recommendation was that a

search box should be provided at the top of the "Online newspaper and news sites" webpage (Mvungi, de Jager & Underwood 2008:178).

2.2.2.3.6.5 Study 10

Goals for the redesign of the library website included that a search box should be provided for searching the library catalogue (and it should be placed in a prominent position) (Oldham 2008:232).

The researchers mentioned in the conclusion that the library is considering creating a customised library page since many library websites lack the high-level personalisation and customisation that users expect (Oldham 2008:238).

2.2.2.3.6.6 Study 12

When users were asked to find an article using a citation, most of them (including faculty) searched for it by using the title or author, rather than the journal title (as expected), which suggests that users see articles as separate entities from the journals in which they are published. This suggests that tools that force users to navigate to an article by locating the journal first may present a challenge (Emde, Morris & Claassen-Wilson 2009:30).

This is a shorter way of finding articles, and the system should make provisions that allow users to find articles using this method.

2.2.2.3.6.7 Study 13

Users had a problem with the absence of a search facility (Rogers & Preston 2009:205). Recommendations included that a website search facility should be provided for users who prefer to find information by searching for keywords instead of browsing.

2.2.2.3.6.8 Study *18*

Users identified a need for a site search facility, and recommendations included that "a good site search facility will enhance the efficiency and the effectiveness of the website" (Pant 2015:912).

2.2.2.3.6.9 Summary of "Efficiency features" recommendations from related studies

Features for expert users include shortcuts, site search features, advanced search, and customisation. Customisation is a feature that is difficult to evaluate because it is only applicable to systems where the user has access to a user account. Sometimes minor customisation can apply without a user account, for example, changing the display language, but the change will in that case not be persistent.

These studies contributed the following library website-related recommendations to the "Efficiency features" heuristic:

- A site search feature should be provided for users who prefer not to navigate through browsing.
- Search tools should support the ways users search for information, i.e., if they prefer to search for journal articles directly, the system should allow it.

These recommendations were added to the sub-criteria of the "Efficiency features" heuristic in Section 2.2.3.1.6.

2.2.2.3.7 Consistency

Based on the discussion of existing usability principles in Section 2.2.1.5.4, the following sub-criteria apply to the "Consistency" heuristic:

- Situations that are similar should require similar sequences of actions.
- The same conventions (for example, terminology, and layout) should be followed throughout the interface.
- The system should behave consistently within tasks and across similar tasks.

The following discussions of related studies apply to this heuristic. The problems that were found and recommendations that were made relating to this heuristic are integrated and summarised at the end of this section, Section 2.2.2.3.7.9.

2.2.2.3.7.1 Study 1

Design indications after the web-based user survey included that a global navigation structure should be provided for a cohesive look (George 2005:168). As a result, the team that lead the redesign project focussed on creating a persistent global navigation structure using headers and footers. A global template was created for the "interior pages" in the prototype design phase (George 2005:169).

One of the main goals of the redesign was to strive for consistency of the labels and the placement of links (George 2005:174). One of the major findings of the study was that consistency in the layout, header, and footer, and labelling decreases the learning curve, which has a direct positive influence on the usability of the website (George 2005:178).

2.2.2.3.7.2 Study 2

The university asked all their departments to "keep their pages consistent with the university's main site". The library used the same company that the university hired to help them create a new IA that uses the new website template as a design guide (King & Jannik

2005:237). The design of the new homepage used the Georgia Tech campus branding and used consistent content columns (King & Jannik 2005:240).

2.2.2.3.7.3 Study 3

One of the problems with the old version of the library website was the lack of consistency in the placement and labelling of navigational elements as well as differences in layout across different pages. This happened because different people were responsible for different parts of the website, no centralised body was responsible for the planning and management, and there was a lack of coordination among individual library units (Turnbow et al. 2005:227). This problem was solved because the redesign team developed a new website with a consistent layout and navigation structure (Turnbow et al. 2005:226).

2.2.2.3.7.4 Study 4

During the redesign of the UW library website, great effort was made to keep the layout and page format consistent across platforms (Ward 2006:209).

2.2.2.3.7.5 Study 5

The heuristic evaluators found that the order of the links on the main navigation bar varied from page to page. The evaluators' proposal to fix this problem was to make the links stay the same on every page (Manzari & Trinidad-Christensen 2006:165).

2.2.2.3.7.6 Study 6

Responses from the focus group included that terminology should be consistent throughout the website, and the search box should stay in the same location on each of the webpages (MacMillan, McKee & Sadler 2007:431).

2.2.2.3.7.7 Study 11

This study does not give any detail, but they do mention that the researchers paid special attention to creating a layout with consistent navigation during the redesign (Dougan & Fulton 2009:220).

2.2.2.3.7.8 Study 17

During the discovery phase (phase one) of the six-phase website redesign process in 2008, users commented that there is a need for consistency across the website (Dominguez, Hammill & Brillat 2015:109).

2.2.2.3.7.9 Summary of "Consistency" recommendations from related studies

There is a consensus in all the related studies that there should be consistency in navigation, labelling, and layout throughout the website.

These studies contributed the following library website-related recommendations to the "Consistency" heuristic:

- The website should have a consistent global navigation structure.
- There should be consistency in the placement and labelling of navigational elements.
- The order of links should stay the same on every page.
- Terminology should be consistent throughout the website.
- The search box should stay in the same location on each of the webpages.

These recommendations were added to the sub-criteria of the "Consistency" heuristic in Section 2.2.3.1.7.

2.2.2.3.8 Predictable behaviour

Based on the discussion of existing usability principles in Section 2.2.1.6.2, the following sub-criteria apply to the "Predictable behaviour" heuristic:

- The system makes the user feel as if they are in control at all times.
- The system responds how the user expects it to respond.
- The system does not change familiar behaviour.
- The system uses commonly accepted conventions from related systems.
- Formats follow appropriate cultural and linguistic conventions.

The following discussions of related studies apply to this heuristic. The problems that were found and recommendations that were made relating to this heuristic are integrated and summarised at the end of this section, Section 2.2.2.3.8.9.

2.2.2.3.8.1 Study 2

Users treated the "Quick Catalogue Search" link like Google's search interface (thinking that they can find anything by simply using the search box), which resulted in failed searches. As a result, the "Quick Catalogue Search" link was removed from the homepage (King & Jannik 2005:240).

2.2.2.3.8.2 Study 8

The study indicated that students prefer to use search boxes rather than browsing through lists. However, users find the search features on library websites intimidating because it is less familiar compared to Google's search interface (Kitalong, Hoeppner & Scharf 2008:178,193).

2.2.2.3.8.3 Study 10

Goals of the website redesign included that the library's address and telephone number, as well as a library calendar, must be included in the website (Oldham 2008:232). This goal is based on the findings of a literature review, which showed that basic information about the

library itself — features that users expect to find on a library website — are lacking in a large number of library homepages (Oldham 2008:221).

2.2.2.3.8.4 Study 12

Results from interviews with users indicated that the icons that were meant to expand subject heading lists were unclear (Emde, Morris & Claassen-Wilson 2009:25). Icons with plus symbols were used to indicate that users can expand subject headings (Emde, Morris & Claassen-Wilson 2009:31). This was not intuitive for the majority of users and resulted in users having difficulty with the navigation of the website (Emde, Morris & Claassen-Wilson 2009:25).

Users commented that the results from the federated search tool (that searches across four pre-selected databases) were unrelated or too broad, but that it also made them discover databases that they had not previously thought of using. They suggested that the federated search tool is useful for novice or undergraduates as a good place to begin their research, but that it is less useful for experienced users (Emde, Morris & Claassen-Wilson 2009:29).

The website had a subject-specific federated search tool for some subject areas to allow users to search databases selected by a subject librarian. This proved to be a very useful tool since users discovered useful databases that they were not aware of (Emde, Morris & Claassen-Wilson 2009:29).

2.2.2.3.8.5 Study 14

The centralised search box in the mock-up version of the Moraine Valley Library website was a problem when users had to search for anything that is not a book or an article. The search box was seen as an "all-encompassing search for the entire site" (Swanson & Green 2011:227). Students tried to use it to find administrative information, research guides, and podcasts, although this was not the purpose of the search box. Swanson and Green (2011:277) suggest that this might not have been a problem if the search box was on a secondary page: it requires more clicks, but it is more usable (as proven in the usability study of their existing website). According to them, the search box made users ignore all other links on the page, thinking that they can just find what they want by using the search box. The search box prevented the students from taking the time to try to understand the website architecture, and this prevented them from looking for appropriate links on the homepage instead of typing a query into the search box.

2.2.2.3.8.6 Study 18

The following features were indicated as being the most sought after:

- notice board,

- site search facility,
- list of services,
- FAQ, and
- user guides (Pant 2015:911).

Recommendations included that these preferred features should be provided as a priority (Pant 2015:912).

2.2.2.3.8.7 Study 19

Users commented that the single-search box (EDS) might be more useful to users who are only starting to learn how to use library resources. It was found that undergraduate researchers prefer a convenient "Google-like" search box interface and are more likely to perform effective research using one (Chase, Trapasso & Tolliver 2016:37). Users complained that the singular search option (EDS) returned a large number of search results which results in users taking longer to sift through the search results (Chase, Trapasso & Tolliver 2016:37). Therefore, they can benefit from having additional information added to the search results that indicate what each of the results is.

2.2.2.3.8.8 Study 20

Data from the usability studies identified that there are some essential elements that should be on the homepage, including:

- a search box,
- library hours,
- events and calendar,
- library news,
- help,
- quick links,
- portals,
- citation tools,
- interlibrary loan, and
- e-journals (Wu & Brown 2016:164).

These items can be seen as features that users expect to find on academic library websites. The study reported that users want a single search box that gives federated search results that can be filtered by availability, date, and relevance (Wu & Brown 2016:161). The usability tests and the collected data confirmed that the old search box caused confusion and was not used properly and that an important element for the homepage is a "Google-like" search box (Wu & Brown 2016:162, 163).

2.2.2.3.8.9 Summary of "Predictable behaviour" recommendations from related studies

Studies suggest that a federated search tool might be useful for novice users who are starting out with research. This claim has, however, not been tested. There is evidence that a federated search tool can lead to failure since it behaves unexpectedly and returns too many search results to filter through.

According to Swanson and Green (2011:227), users treated the federated search box as an "all-encompassing search for the entire site" which is a problem because none of the search boxes had that type of functionality, which leads to unsuccessful searches. One of the suggested solutions for this problem with federated search tools is to remove it from the homepage and make it available on a secondary page, which contradicts the advice by Wu and Brown (2016) to include a "Google-like" search box on the homepage.

There has been no evidence so far of a successful federated search tool on library websites. Therefore, the use of a federated search tool should only be considered if it is implemented properly and has been tested thoroughly.

Some features that are typical of library websites were missing from some of the websites, including library contact information.

These studies contributed the following library website-related recommendations to the "Predictable behaviour" heuristic:

- Users should know how search boxes will behave before they use them.
- Search boxes should not cause confusion.
- Search boxes should make use of web searching conventions.
- Information that users expect to find on an academic library website, such as the library's address, telephone number, and library calendar, should be provided.
- Intuitive icons should be used.

These recommendations were added to the sub-criteria of the "Predictable behaviour" heuristic in Section 2.2.3.1.8.

2.2.2.3.9 Context

Based on the discussion of existing usability principles in Section 2.2.1.6.1, the following sub-criteria apply to the "Context" heuristic:

- The system informs the user of where they are in a dialogue.
- Users always know what they can do next.
- In a dialogue that consists of a range of steps/sub-pages, users' progress is indicated, i.e., they know where they are, and how many steps they are away from the end.

Additionally, the following sub-criterion can be added based on the IA navigation system component category in Section 2.1.3.2.3:

- A user's context within the web and the website is indicated.

The following discussions of related studies apply to this heuristic. The problems that were found and recommendations that were made relating to this heuristic are integrated and summarised at the end of this section, Section 2.2.2.3.9.6.

2.2.2.3.9.1 Study 1

User feedback revealed that infrequent users might have difficulty with finding information and answering the core questions of navigation, "where have I been?" and "where can I go?" (George 2005:168). Some users even reported that they "get stuck in a loop". This problem was not directly addressed in the usability study, but the problem can be addressed by providing the user with context, such as changing the colour of visited links and highlighting the current link in navigation elements.

2.2.2.3.9.2 Study 2

The "Search and Locate" page utilised a breadcrumb trail to assist users with navigation by presenting them with a visual hierarchy, thus giving them context (King & Jannik 2005:240).

2.2.2.3.9.3 Study 7

During the card sort, users were allowed to refine the predetermined broad categories by placing cards in labelled subcategories, and this resulted in grouping being more consistent. This confirmed that context is a crucial factor in enabling users to recognise what a label might mean (Duncan & Holliday 2008:309).

2.2.2.3.9.4 Study 9

Users were not very satisfied with the navigation logic and their overall productivity with the website. The recommendation for improving this problem was to use more navigation elements (for example, breadcrumbs) to make the user aware of their current position within the website (Mvungi, de Jager & Underwood 2008:180).

2.2.2.3.9.5 Study 13

Labels such as "Caribbean Resources" and "24/7 service" were unclear to the users and subsequently underutilised. The evaluators suggested that the labels could be removed completely or could be included as subheadings since subheadings can provide users with the necessary context (Rogers & Preston 2009:207).

2.2.2.3.9.6 Summary of "Context" recommendations from related studies

Elements that provide context help users answer the main question of navigation, i.e., "where am I?".

These studies contributed the following library website-related recommendations to the "Context" heuristic:

- Breadcrumb trails should be provided to assist users with navigation and context.
- Labels should be grouped under subcategories if main categories are too broad.

These recommendations were added to the sub-criteria of the "Context" heuristic in Section 2.2.3.1.9.

2.2.2.3.10 Task completion support

Based on the discussion of existing usability principles in Section 2.2.1.5.6, the following sub-criteria apply to the "Task completion support" heuristic:

- Simple tasks require simple interactions.
- All objects, actions, and options are visible.
- All the information that a user needs to perform a task is visible.
- The system does not require a user to remember information from one screen to use it on a different screen.
- The system helps the user to complete the task effectively and efficiently.
- The technology used to perform the task does not distract the user.
- The system does not require a user to re-enter information that was entered previously.
- The system provides default values where applicable, for example, where typical input values are required.

The following discussions of related studies apply to this heuristic. The problems that were found and recommendations that were made relating to this heuristic are integrated and summarised at the end of this section, Section 2.2.2.3.10.4.

2.2.2.3.10.1 Study 6

Responses from the focus group included that the authentication process and the display of the authentication process should be simplified (MacMillan, McKee & Sadler 2007:432).

2.2.2.3.10.2 Study 8

Findings from the usability study include that security or login processes can negatively influence searching or discourage users from even trying, even though the security processes are simple when understood (Kitalong, Hoeppner & Scharf 2008:193).

2.2.2.3.10.3 Study 10

Responses from the online user-satisfaction survey indicated that the users had difficulty accessing journals from off campus because the process was too complicated. Users commented that there were too many steps in the process (Oldham 2008:227)

The complicated sign-in process for accessing databases from off campus was simplified by implementing a single sign-on and allowing users to use the same username and password that they use for the university's web portal (Oldham 2008:235).

2.2.2.3.10.4 Summary of "Task completion support" recommendations from related studies

The most prevalent problem relating to this heuristic was complicated authentication processes that required too many steps or expected users to memorise a complicated password.

These studies contributed the following library website-related recommendation to the "Task completion support" heuristic:

- The authentication system should be simplified with a single sign-on feature so that users are not required to use a different password to access different parts of the same system.

This recommendation was added to the sub-criteria of the "Task completion support" heuristic in Section 2.2.3.1.10.

2.2.2.3.11 Controllability

Based on the discussion of existing usability principles in Section 2.2.1.5.3, the following sub-criteria apply to the "Controllability" heuristic:

- The system provides the user with a simple and efficient way to go back to where they came from if they landed in an unwanted situation.
- Users have control over the sequence of their interaction with the system.

The following discussions of related studies apply to this heuristic. The problems that were found and recommendations that were made relating to this heuristic are integrated and summarised at the end of this section, Section 2.2.2.3.11.3.

2.2.2.3.11.1 Study 1

Users commented at the end of the study that there is something wrong with the back button in the library catalogue interface, but the problem was not addressed by the study (George 2005:177).

2.2.2.3.11.2 Study 5

Observations that were made during usability testing included that some users preferred to use the browser's back button instead of the website menu to navigate as a personal preference and not because there was a flaw with the usability of the website (Manzari & Trinidad-Christensen 2006:167).

2.2.2.3.11.3 Summary of "Controllability" recommendations from related studies

These studies contributed the following library website-related recommendation to the "Controllability" heuristic:

- The website should provide functionality that allows a user to go back to previous pages, such as an interactive breadcrumb trail.

This recommendation was added to the sub-criteria of the "Controllability" heuristic in Section 2.2.3.1.11.

2.2.2.3.12 Error recovery

Based on the discussion of existing usability principles in Section 2.2.1.5.9, the following sub-criteria apply to the "Error recovery" heuristic:

- The system can detect if a user has made an error.
- The system clearly indicates what the problem is when the user encounters one.
- The system uses plain language to communicate what the problem is.
- The system provides clear instructions to a simple solution.
- Users are still able to complete their task after recovery.
- The system validates input before processing it.
- The system can correct some errors automatically, informs the user of the correction, and provides the user with an opportunity to override the correction.

The following discussion of a related study applies to this heuristic. The contribution that this study made to this heuristic is summarised below it in Section 2.2.2.3.12.2.

2.2.2.3.12.1 Study 14

Some participants in this study had difficulty interpreting search results due to the misspelling of search terms (Swanson & Green 2011:225). The system corrected misspelt words, but users might not have been aware of this feature.

2.2.2.3.12.2 Summary of "Error recovery" recommendations from related studies

Only one study reported on error recovery, which reveals that related studies might not have paid attention to evaluating how academic library websites handle errors. However, it can

also mean that there were no issues with error recovery, or that it is not an issue that is commonly addressed in academic library websites.

This study contributed the following library website-related recommendation to the "Error recovery" heuristic:

- A search system should make users aware if it has corrected misspelt search terms.

This recommendation was added to the sub-criteria of the "Error recovery" heuristic in Section 2.2.3.1.12.

2.2.2.3.13 Error prevention

Based on the discussion of existing usability principles in Section 2.2.1.5.5, the following sub-criteria apply to the "Error prevention" heuristic:

- The system eliminates conditions where users are likely to make errors.
- The system asks for confirmation before taking serious actions.
- The system warns the user about what might happen when certain actions are taken.
- The system prevents users from clicking on inappropriate links (i.e., inappropriate links are disabled).

The following discussion of a related study applies to this heuristic. The contribution that this study made to this heuristic is summarised below it in Section 2.2.2.3.13.2.

2.2.2.3.13.1 Study 2

The new website made use of visual cues or icons that appear next to all external links throughout the website to alert users if a link would lead them to an external website, thus leaving the library website (King & Jannik 2005:240). This serves as a warning that prevents users from accidentally navigating away from the main website.

2.2.2.3.13.2 Summary of "Error prevention" recommendations from related studies

This study contributed the following library website-related recommendation to the "Error prevention" heuristic:

- A visual cue should be provided next to external links to warn users that they will navigate away from the website.

This is commonly achieved through the use of the icon shown in Figure 2.2-1.

Figure 2.2-1: Font Awesome external link icon (http://fontawesome.io/icon/external-link/)

This recommendation was added to the sub-criteria of the "Error prevention" heuristic in Section 2.2.3.1.13.

2.2.2.3.14 Feedback

Based on the discussion of existing usability principles in Section 2.2.1.5.1, the following sub-criteria apply to the "Feedback" heuristic:

- The system provides feedback for every user action.
- The system provides informative feedback.
- The system provides appropriate feedback (i.e., ranging from modest to substantial, depending on the severity of action taken by the user).
- The system provides feedback within a reasonable period of time when users expect it.
- The system provides status information and shows that input has been received.

None of the related studies reported on problems relating to feedback or provided relevant recommendations for improvement. This shows that these studies are incomplete in that the feedback that the systems provided were not tested.

Feedback can be tested by evaluating the various forms that can be found on academic library websites, such as login and contact forms, to see how the system responds. For example, when a user tries to log into a website and provides incorrect login details, the system should respond with appropriate feedback.

Additionally, feedback should be provided where information that a user requested could not be found, such as links being broken or searches returning no results.

These methods were used to evaluate "Feedback" in the case studies in Chapter 4.

2.2.2.4 Summary of related study integration

One of the main observations of the review of related studies is that the most recent studies focused more on search tools and search results and much less on other issues.

According to Swanson and Green (2011:222), library website design is moving towards a "Googlized" search, which is a website design with a centralised search box, that searches across various databases and platforms. This concept is also referred to as a federated search engine.

The following table shows which heuristics were discussed in each of the studies. An "X" is used to indicate that the corresponding study addressed the heuristic. The columns shaded with grey show the heuristics that none of the studies addressed. The bottom row indicates the number of studies that addressed each of the heuristics. The heuristics are sorted from

most prevalent to least prevalent (from left to right). Labelling problems were the most prevalent and feedback was the least, as it was not addressed at all.

Study	Labelling	Organisation	Clutter	Novice user guidance	Help documentation	Efficiency features	Consistency	Predictable behaviour	Context	Task completion support	Controllability	Error recovery	Error prevention	Feedback
1	X	X	X		X	X	X		X		X			
2	X		X	X			X	X	X				X	
3	X	X					X							
4	X	X	X				X							
5	X	X	X	X	X	X	X				X			
6	X					X	X			X				
7	X	X			X				X					
8			X					X		X				
9	X	X		X	X	X			X					
10	X		X			X		X		X				
11	X	X	X	X			X							
12	X	X		X		X		X						
13	X	X	X		X	X			X					
14	X		X	X	X			X				X		
15	X	X	X											
16	X	X												
17	X	X	X				X							
18	X	X		X	X	X		X						
19				X	X			X						
20	X	X	X	X	X			X						
count	18	14	12	9	9	8	8	8	5	3	2	1	1	0

Table 2.2-2: Summary of occurrences of discussions of heuristics in related studies

This table shows that some of the studies were either incomplete or that some of these heuristics do not apply to academic library websites. This is tested in Chapter 4 where the integrated set of heuristics is used to evaluate three academic library websites.

2.2.3 Integrated heuristics with sub-criteria

The following list of heuristics is the result of the integration of existing lists of principles in Section 2.2.1.5 with the related studies in Section 2.2.2.3. The sub-criteria are derived from the discussions of the various existing principles in Section 2.2.1.5 – 2.2.1.6. The sub-criteria are supplemented or integrated with the IA principles listed in Section 2.1.3.2 to make them more specific to IA. Some of the sub-criteria that focus on the design aspects of interfaces have been modified to focus on the IA aspects exclusively.

The sub-criteria are supplemented with recommendations that are relevant to academic library websites specifically, based on the analysis of problems that were identified or recommendations that were made in related studies in Section 2.2.2.3.

The resulting list comprises fourteen heuristics that are applicable for the heuristic evaluation of the IA of academic library websites.

2.2.3.1.1 Labelling

- The system uses comprehensible terminology and concepts that the intended user is familiar with (based on the user's existing knowledge).
- The system avoids using system-oriented terms but the terms are familiar within the context of the task.
- Terminology in labels corresponds to the content it represents.
- The page title contains information about the current page and the website.
- Recommendations:
    - The use of library jargon that is specific to the library should be avoided (for example, the name of the library's catalogue).
    - Common everyday language that users are likely to be familiar with, should be used where possible and additional explanations should be provided in the form of tooltips where necessary, according to the "Novice user guidance" heuristic.
    - The language used in labels should be clear, concise, comprehensible, and meaningful.
    - Terms that are ambiguous, vague, redundant, or misleading should be avoided.
    - Long labels should start with an identifying keyword.
    - Different labels that overlap in meaning should be renamed to be more distinguishable.

2.2.3.1.2 Organisation

- Information appears in a natural and logical order.
- Information is grouped and classified logically.
- Documents or categories that are grouped together fit well with each other.
- The degree of overlap between categories is low.
- Child content objects represent parent content objects.
- Recommendations:
    - The system should be organised to reflect the way users look for information.
        - Important links should appear in noticeable locations or main sections.
        - Important information should be accessible from the homepage.
        - A link to the homepage should be easy to find and listed first if it is in a list of links.
        - Help links should be prominent and easily accessible.
    - The website should use clear organisation and categorisation.
        - A small number of main navigational categories should subdivide information into logical sections.
        - Multiple pathways to general content areas should be provided.
        - Content should be structured and grouped correctly.
        - Content should be sorted according to possible user goals.
    - The layout and navigation should be simple.
        - The website should be easy to navigate.
        - The layout structure should be intuitive.

2.2.3.1.3 Clutter

- The system does not provide the user with irrelevant information or information that is not needed for the successful completion of tasks.
- There is nothing that takes the user's attention away from important information.
- Links in main navigation bars are limited to eight links.
- Recommendations:
    - All pages should have simple layouts and should be clutter free.
    - Pages should not contain too many links.
    - Links should not contain too many words.
    - Duplication of information on a page should be eliminated.
    - Non-essential information should not appear in multiple locations on a page.
    - There should be a good balance between breadth and depth.
    - Pages should not be too long, requiring users to scroll too much.
    - The system should not make a user feel lost.

2.2.3.1.4 Novice user guidance

- Additional explanations, rules, and underlying concepts that assist the user in gaining a conceptual understanding of the interactive system are provided.
- Guidance and support are provided to help the user learn how to use the system.
- Recommendations:
    - Descriptions for unfamiliar terms should be provided for clarification.
    - Additional explanations should be provided for basic library terms (instead of changing the labels).
    - Tooltips should be used to reveal additional explanations for terms or the target destination of links.
    - New users should be provided with clear navigational choices that guide them to the right resources.
    - Information about expected search results as well of the scope of a search box should be provided so that users will know what search boxes to use.
    - Primary search tools should be emphasised.
    - Search results should be annotated automatically to help users distinguish between the different types of results.
    - Novice users should be provided with web forms that allow them to communicate with library staff.
    - Users should be able to differentiate between different resources.

2.2.3.1.5 Help documentation

- Help documentation is provided.
- Help documentation can be located easily when the need arises.
- Help documentation is searchable.
- Help documentation is easy to use.
- Help documentation does not contain too much information.
- Recommendations:
    - Help documentation provides help and instructions on using library resources and services.
    - Instructional help should be provided on how to search for other libraries' resources.
    - Tutorials should be accessible from a "Help" link.
    - A sitemap should be included as a supplemental navigation system.

2.2.3.1.6 Efficiency features

- Shortcuts are available that enable users to speed up the interaction with less frequent actions.
- Frequent actions are customisable.
- The user can modify their interaction with and the presentation of information.
- Recommendations:
    - A site search feature should be provided for users who prefer not to navigate through browsing.
    - Search tools should support the ways users search for information, i.e., if they prefer to search for journal articles directly, the system should allow it.

2.2.3.1.7 Consistency

- Situations that are similar should require similar sequences of actions.
- The same conventions (for example, terminology, and layout) should be followed throughout the interface.
- The system should behave consistently within tasks and across similar tasks.
- Recommendations:
    - The website should have a consistent global navigation structure.
    - There should be consistency in the placement and labelling of navigational elements.
    - The order of links should stay the same on every page.
    - Terminology should be consistent throughout the website.
    - The search box should stay in the same location on each of the webpages.

2.2.3.1.8 Predictable behaviour

- The system makes the user feel as if they are in control at all times.
- The system responds how the user expects it to respond.
- The system does not change familiar behaviour.
- The system uses commonly accepted conventions from related systems.
- Formats follow appropriate cultural and linguistic conventions.
- Recommendations:
    - Users should know how search boxes will behave before they use them.
    - Search boxes should not cause confusion.
    - Search boxes should make use of web searching conventions.
    - Information that users expect to find on an academic library website, such as the library's address, telephone number, and library calendar, should be provided.
    - Intuitive icons should be used.

2.2.3.1.9 Context

- The system informs the user of where they are in a dialogue.
- Users always know what they can do next.
- In a dialogue that consists of a range of steps/sub-pages, users' progress is indicated, i.e., they know where they are, and how many steps they are away from the end.
- A user's context within the web and the website is indicated.
- Recommendations:
    - Breadcrumb trails should be provided to assist users with navigation and context.
    - Labels should be grouped under subcategories if main categories are too broad.

2.2.3.1.10 Task completion support

- Simple tasks require simple interactions.
- All objects, actions, and options are visible.
- All the information that a user needs to perform a task is visible.
- The system does not require a user to remember information from one screen to use it on a different screen.
- The system helps the user to complete the task effectively and efficiently.
- The technology used to perform the task does not distract the user.
- The system does not require a user to re-enter information that was entered previously.
- The system provides default values where applicable, for example, where typical input values are required.
- Recommendation:
    - The authentication system should be simplified with a single sign-on feature so that users are not required to use a different password to access different parts of the same system.

2.2.3.1.11 Controllability

- The system provides the user with a simple and efficient way to go back to where they came from if they landed in an unwanted situation.
- Users have control over the sequence of their interaction with the system.
- Recommendation:
    - The website should provide functionality that allows a user to go back to previous pages, such as an interactive breadcrumb trail.

2.2.3.1.12 Error recovery

- The system can detect if a user has made an error.
- The system clearly indicates what the problem is when the user encounters one.
- The system uses plain language to communicate what the problem is.
- The system provides clear instructions to a simple solution.
- Users are still able to complete their task after recovery.
- The system validates input before processing it.
- The system can correct some errors automatically, informs the user of the correction, and provides the user with an opportunity to override the correction.
- Recommendation:
    - A search system should make users aware if it has corrected misspelt search terms.

2.2.3.1.13 Error prevention

- The system eliminates conditions where users are likely to make errors.
- The system asks for confirmation before taking serious actions.
- The system warns the user about what might happen when certain actions are taken.
- The system prevents users from clicking on inappropriate links (i.e., inappropriate links are disabled).
- Recommendation:
    - A visual cue should be provided next to external links to warn users that they will navigate away from the website.

2.2.3.1.14 Feedback

- The system provides feedback for every user action.
- The system provides informative feedback.
- The system provides appropriate feedback (i.e., ranging from modest to substantial, depending on the severity of action taken by the user).
- The system provides feedback within a reasonable period of time when users expect it.
- The system provides status information and shows that input has been received.

2.2.4 Chapter 2 summary

In this chapter, a complete usability model is created, IA components are identified, and a complete list of heuristics is created to evaluate the IA components. The IA components of three academic library websites is evaluated in Chapter 4, using the newly created list of heuristics. If a website complies with the fourteen heuristics, it can be deduced that the website supports the six usability measurements as defined in the usability model.

The following research questions were answered in this chapter:

- What is usability?
- How can usability be evaluated?
- What is IA and how can it be evaluated?
- What usability principles are appropriate for evaluating the usability of the IA aspects of academic library websites?

The next chapter (Chapter 3: Methodology) explains how the literature review was planned and executed and how the heuristics that were formulated in this chapter are used to perform a usability inspection in various case studies. Additionally, the dialogue elements that academic library websites can be divided into for the purpose of doing a heuristic evaluation are identified.

Chapter 3 – Methodology

This study consists of the following qualitative research methods: literature review, case study, and heuristic evaluation. A qualitative research method is an investigation of subject matter with the purpose of describing its unique characteristics and features, and getting a better understanding of it (Gorman et al. 2005:47).

This chapter defines and discusses each of the research methods that were used in this study. Part one is a discussion of the literature review in Chapter 2, part two is a discussion of the case studies in Chapter 4 and 5, and part three is a discussion of heuristic evaluations, the data collection method used in the case studies in Chapter 4 and 5.

Disclaimer: It is to be noted that more than four levels of numbering in headings are used throughout this dissertation with the purpose of facilitating (cross) referencing.

3.1 Part 1: The literature review

In this section, the researcher defines the literature review method, explains how to conduct a literature review, and the approach that was followed in this study.

3.1.1 What is a literature review?

The following existing definitions and discussion of the literature review method were used to formulate the integrated definition presented in Section 3.1.1.2.

A literature review, as defined by Pickard (2013:26) is:

> "a critical discussion of all significant, publicly available literature that contributes to the understanding of a subject."

The outcome of a literature review, as defined by Machi and McEvoy (2012:4) is:

> "a written document that presents a logically argued case founded on a comprehensive understanding of the current state of knowledge about a topic of study. This case establishes a convincing thesis to answer a study's question."

According to Leedy and Ormrod (2014:51) it describes:

> "the theoretical perspectives and previous research findings related to the problem at hand."

Based on the various definitions, a literature review can have two different purposes depending on the nature of the study. It can help the researcher identify "what is already known" or "what needs to be explored further" (Pickard 2013:25). If the literature review

helps the researcher to "identify what is already known", then its nature is arguing a position about the current state of knowledge on a topic. This is referred to as a basic literature review by Machi and McEvoy (2012:2).

If the literature review helps the researcher "identify what needs to be explored further" the nature of the review is uncovering a research problem for further study. This is referred to as an advanced literature review (Machi & McEvoy 2012:2).

3.1.1.1 The paradox of a literature review

The paradox of a literature review is that it is needed to frame a relevant and worthwhile research question, but there needs to be a research question before one can start investigating the literature (Pickard 2013:36).

According to Machi and McEvoy (2012:5), the first step (of the six-step approach) for conducting a literature review is to *select the topic* while in Pickard (2013:36), the framing of the research question comes *after* the literature review, in the next stage of the research process. According to Race (2008:488), reviews of various aspects of the literature need to take place before the research project can even begin.

Therefore, there needs to be a *preliminary* research topic statement (Machi & McEvoy 2012:14) or a *loose framework* to help guide the initial search (Pickard 2013:27) at the start of the literature review, but the research question can only be framed after the literature review.

Therefore, in addition to the two purposes of the literature review, it also helps the researcher formulate a specific research question more precisely (Pickard 2013:36; Leedy & Ormrod 2014:51). These three purposes are summarised in the integrated definition below.

3.1.1.2 Definition of a literature review formulated in this study

The nature of a literature review can be summarised as follows based on an integration of various existing definitions.

It is a document consisting of a critical discussion of (all existing credible, significant, and publicly available) research findings that can be used:

1. to contribute to a comprehensive understanding of current state of knowledge of a subject/topic;
2. to formulate a worthwhile research question; and
3. to present a logically argued case for new research to help answer a study's question.

3.1.2 How to conduct a literature review

Pickard (2013:26) presents a four-stage approach that can be followed when conducting a literature review. The four-stage approach consists of the following four skills (Pickard 2013:26):

" 1. Information seeking and retrieval
2. Evaluation
3. Critical analysis
4. Research synthesis"

Machi and McEvoy (2012:5) present a six-step approach for conducting a literature review. The six-step approach consists of the following six steps:

" 1. Select a topic
2. Search the literature
3. Develop the argument
4. Survey the literature
5. Critique the literature
6. Write the review"

Pickard (2013:26) argues that the four-stage approach covers the six steps presented by Machi and McEvoy (2012:5).

3.1.2.1 The four-stage approach

Below is an analysis of the four-stage approach proposed by Pickard (2013:26) that shows where the six steps by Machi and McEvoy (2012) are accounted for.

3.1.2.1.1 Stage 1: Information seeking and retrieval

The first stage of the literature review involves searching for the appropriate sources, with the goal of obtaining useful articles, chapters, and books to use in the study (Pickard 2013:26). This stage is equivalent to Machi and McEvoy's second step in their six-step approach, "searching the literature" (Machi & McEvoy 2012:37).

The following practical steps can be taken to successfully search for sources:

1. State the initial research question and sub-question(s) (Pickard 2013:27; Leedy & Ormrod 2014:60).
2. Determine why information is needed and how it will be used in order to establish boundaries for the search. Race (2008:487) emphasises the importance of realising the complexity of a concept and deciding what *not* to search for in order to find the aspects of the concept that should be addressed in the literature review.

3. Examine the subject and define the basic structure for the initial search, i.e., the initial research question potentially covers a variety of areas (Pickard 2013:27). Use the important words and phrases in each sub-problem and translate them into specific topic groups to use as an agenda while searching the literature (Pickard 2013:27; Leedy & Ormrod 2014:60). Analyse the keywords within topic groups to find the most appropriate search terms. Identify all possible ways to describe the topic groups, e.g. synonyms, distinctive terms, and alternative spellings (Pickard 2013:27).
4. Establish parameters to avoid wasting time. Examples of search limitations include country of publication, language of publication, date, and type of material, for example, only journal articles (Pickard 2013:27). The researcher needs to find a balance between traditional sources such as books and journals and freely available edited sources from the web (Race 2008:287).
5. Use the library catalogue, databases, and the internet to search using the specified search terms (Leedy & Ormrod 2014:60). In addition to searching for literature sources by using resources such as databases and library catalogues, a researcher can find good sources in other researchers' citations or reference lists (Race 2008:489; Leedy & Ormrod 2014:59). According to Leedy and Ormrod (2014:59), this is an essential additional resource as this can provide guidance on seminal research studies that have been published.
6. Maintain a list of all search terms and bibliographic sources as they are used and record the success and value of each of the terms or sources (Pickard 2013:28).

3.1.2.1.2 Stage 2: Evaluation

The evaluation stage involves examining the quality of the sources that have been identified by looking at aspects such as authority, scope, and purpose (Pickard 2013:28). This stage is also part of Machi and McEvoy's second step in their six-step approach "searching the literature" (Machi & McEvoy 2012:37).

Only articles that have a clear scope, aims and objectives, and methods by which data were collected should be used. By looking at the purpose of the source (the reason why the work was produced) one can also get a clear indication of its reliability (Pickard 2013:29). For example, if work was produced for marketing purposes, it may be an unreliable or biased source.

The scope and purpose of a source might not always be clear, especially if it is not an academic publication. Academic publications go through a strict review process that enhances their quality. However, many sources that can be found on a specific topic on the internet do not necessarily go through a strict review process. When such works are

considered as references, they can be verified based on whether they are the work of a credible scholar, or based on the reliability of the company with which they are associated (Leedy & Ormrod 2014:59).

When evaluating the authority of a source, one can consider the "author's previous research, stature, organisational affiliation, political stance, credibility, and reputation among peers" (Pickard 2013:29).

3.1.2.1.3 Stage 3: Critical analysis

An important skill of any researcher during a literature review is to examine the quality of the work of others critically (Leedy & Ormrod 2014:64).

The critical analysis stage involves reading the sources with purpose by identifying the different elements of an argument within the sources. An argument is "the presentation of one or more claims backed by credible evidence that supports a logical conclusion" (Machi & McEvoy 2012:64). An academic argument can be deconstructed into the following four components: claim (conclusion), reason (interpretation of data), evidence (data), and qualifications (Pickard 2013:29). The goal of defining the different components of an argument is to "establish the robustness" of the argument (Pickard 2013:29).

This stage covers Machi and McEvoy's third step in their six-step approach, "develop the argument" (Machi & McEvoy 2012:63). Machi and McEvoy deconstruct an argument into the following three components: claim ("declarations of a proposed truth"), evidence ("data that define and support the claim"), and warrant ("the logical formation of the claims and evidence"). The warrant is the justification that holds the claims and evidence together (Machi & McEvoy 2012:64). Therefore, Machi and McEvoy use the same definition of a claim, except that the reasons and qualifications are combined in the warrant.

3.1.2.1.4 Stage 4: Research synthesis

A good literature review does not just report on the related literature. It includes the organisation and synthesis of all the ideas that have been encountered into a cohesive whole (Leedy & Ormrod 2014:67).

The research synthesis stage is the part of the literature review where the researcher formulates a theoretical framework based on the critical analysis stage and writes the final review (Pickard 2013:33).

This stage covers Machi and McEvoy's fourth, fifth, and sixth steps in their six-step approach, "survey the literature", "critique the literature", and "write the review" (Machi & McEvoy 2012:37).

3.1.3 How the literature review (Chapter 2) in this study was conducted

The preliminary research problem statement was divided into the following three main topics and sub-topics:

- Usability
    - Usability measures
    - Usability evaluation
    - Usability evaluation principles
- Information architecture
- Academic library website usability (related studies)
    - Usability problems that are commonly found on academic library websites

The literature review has multiple purposes. The resources that were used to find literature on the topics varied depending on what the topic is and the purpose of the literature review on that topic.

The literature reviews of *Usability* and *IA* had two purposes. Firstly, to provide the context and the background of the current knowledge of the topic by evaluating and summarising the key concepts used in the study, i.e., usability and IA. Secondly, to find established lists of usability principles that apply to these two topics in order to create an integrated set of heuristics. Therefore, the sources were gathered based on the credibility of the authors and the impact of the contribution they made to the field, and consisted mainly of published books.

The purpose of the literature review on the topic of *academic library websites* was to find out how other related studies on the topic were conducted, and what the results were in the context of this study. Therefore, the sources that were consulted consisted of published articles only. The scope was limited to articles from 2006 – 2016, starting with the newer articles. Older articles were excluded based on the history of academic library website usability and the drastic evolution of websites as discussed in the background to the study in Section 1.1.2.

As the study progressed, articles were added that were found in the reference lists of the newer articles, which resulted in the inclusion of widely cited articles from 2005 as well (since these studies, regardless of their old dates, had a significant influence on the current work).

Based on the different purposes of the subtopics, the literature review was divided into the following two parts.

- Part 1: Background to the study
    - Usability (and usability evaluation)
    - Information architecture
- Part 2: Analysis of established usability principles and related studies
    - Established usability principles
    - Related studies

3.1.3.1 Literature review of usability

The literature review of usability presents various perspectives of usability, i.e., definitions, usability goals, usability measures, and human factors. These perspectives are then integrated to formulate a definition composed of usability measures that encompass each of the perspectives. This definition consisting of usability measures applies to various user interfaces, including websites. This establishes the characteristics that can be used to describe a usable product and how it can be achieved via the UCD process.

The next aspect of usability that is explored is the evaluation phase of the UCD process and various ways in which usability can be evaluated.

3.1.3.2 Literature review of IA

The literature review of IA is used to explain what IA is and describes its relationship to usability. The purpose of this section is to identify the IA components that large websites consist of, as well as heuristics that can be used to evaluate IA specifically. The identification of IA components is used to determine how the library websites can be divided into dialogue elements for the purpose of heuristic evaluation.

3.1.3.3 Literature review of established usability principles

Three lists of established usability principles that are applicable for the heuristic evaluation of websites were identified and analysed to create an integrated set of heuristics for this study.

See Section 2.2.1.1 in the literature review (Chapter 2) for an explanation of how the lists of principles were chosen.

3.1.3.4 Literature review of related studies

Twenty related studies were identified and summarised. The usability problems that were identified in each of the related studies were discussed in the context of the integrated set of heuristics. This helped identify the applicability of each of the heuristics to academic library websites.

The result of part two was a set of heuristics and sub-criteria that are applicable for heuristic evaluations of academic library websites.

3.2 Part 2: Case studies

In this section, the researcher explains what the case study method is, how to go about doing a case study, and the approach that was followed in this study.

3.2.1 What is a case study?

The case study is a common research method in social science disciplines, including psychology, sociology, political science, and anthropology (Yin 2013:4; Leedy & Ormrod 2014:143). The case study method has also been used in multiple information and library science studies (Chisman, Walbridge & Diller 1999; Battleson, Booth & Weintrop 2001; VandeCreek 2005). In all of these disciplines, the need for case studies arises from the desire to understand a complex social phenomenon (Yin 2013).

A case study is a qualitative research method in which a certain phenomenon is studied in depth for a certain period of time (Leedy & Ormrod 2014:143). This is done with the assumption that knowledge of the phenomenon can be derived from the in-depth investigation (Gorman et al. 2005:47). It can consist of one or more instances of a phenomenon in one or more cases (Blatter 2008).

When more than one case is being investigated, it is referred to as a multiple case study (Leedy & Ormrod 2014:143). Mouton (2001:149) specifies that it should be a small number of cases, not more than 50. The specific phenomenon is investigated empirically within its real-life context, and if the boundaries between the phenomenon being investigated and its context are not obvious, multiple sources of evidence are used (Yin 2013:23).

3.2.1.1 Types of case studies

Stake distinguishes between three types of case studies: intrinsic, instrumental, and collective (Stake 2003:136).

An intrinsic case study is one in which a single case is investigated to get a better understanding of the case as a whole and all aspects associated with it (Stake 2003:136). The case being investigated will possess a unique property that validates further investigation (Leedy & Ormrod 2014:143).

An instrumental case study is used to investigate a specific phenomenon within a case. The purpose of this type of case study is to find out more about the phenomenon explored within the case, rather than the case itself (Stake 2003:137).

A collective case study, also known as a multiple case study (Leedy & Ormrod 2014:143), uses more than one case to investigate a particular phenomenon. A collective case study is

intrinsically a collection of instrumental cases, since the purpose is to investigate a particular phenomenon in a case instead of the case itself (Stake 2003:138).

The benefit of using multiple case studies is that it allows the researcher to explore differences or similarities between cases in order to draw comparisons (Leedy & Ormrod 2014:143).

3.2.1.2 Case study research design

When using the case study method, the first task is to design the case study by doing a research design (Yin 2013:26). Any empirical research requires a research design, which can be seen as a "blueprint" for the research. The research design is the "logical sequence that connects the empirical data to a study's initial research questions and, ultimately, to its conclusions" (Yin 2013:26).

Yin (2013:27) lists the following components that need to be identified when doing research design:

" 1. a study's questions;
2. its propositions, if any;
3. its unit(s) of analysis;
4. the logic linking the data to the propositions; and
5. the criteria for interpreting the findings."

The first three components identify *what data are to be collected* and the last two indicate *what should be done after the data have been collected* (Yin 2013:35). The proposition refers to the aspect (or phenomenon) that should be examined within the case, and unit of analysis defines what the case is. This helps with the identification of the relevant information that needs to be collected about the case (Yin 2013:29).

3.2.1.3 Case selection

Instrumental and collective case studies usually require the researcher to choose their cases as opposed to intrinsic case studies where the cases are often already selected before the research has even started (Stake 2003:151).

Purposive sampling occurs when doing case study research to ensure that information-rich sources are identified (Pickard 2013:104). Purposive sampling is when a selection is made based on information-rich cases — cases that can be used to learn a lot about the important aspects of the purpose of the study (Patton 2014).

The a priori approach refers to a sample framework that is chosen before sampling begins, instead of snowball sampling that is an approach where the sample grows as the research

progresses (Pickard 2013:64). A priori is a more structured approach because there are boundaries that are decided upon from the start (Pickard 2013:64).

The purpose of the research should drive the choice of sampling technique (Pickard 2013:64). A priori criteria sampling is useful for analysing and differentiating common features and differences between samples (Flick 2014). Because comparisons will be drawn, it is important to choose cases carefully so that similar results across cases can be predicted, or contrasting results can be predicted based on a theory (Yin 2013).

3.2.2 The approach that was followed for the case studies in this study

The case selection and case study research design that was followed in this study is discussed in this section. The research design is based on the case selection, therefore the case selection is discussed first.

This study consists of two separate case study research designs. The first one is for the multiple-case study of the top three universities' library websites and the second one is a single instrumental case study of the University of Pretoria's library website.

3.2.2.1 How cases were selected for this study

The case selection was driven by the purpose of the study, which is to evaluate the library websites of the top ranked universities in South Africa. The top universities are selected based on the assumption that their library websites will be more usable than the library websites of lower ranked universities. Therefore, the sampling method that is used is purposive sampling with an a priori sampling approach.

The a priori sample map of this study is choosing the top three universities in South Africa according to the QS (Quacquarelli Symonds) World University Rankings and the QS University Rankings: BRICS 2016 (Quacquarelli Symonds 2016a; Quacquarelli Symonds 2016b).

QS have been conducting the QS World University Rankings since 2004 (QS Intelligence Unit 2016). The QS World University Rankings currently considers over 4,300 institutions, and ranks over 916. The top 400 are ranked individually, whereas those placed at 401 and over are ranked in groups (QS Intelligence Unit 2016). The QS University Rankings: BRICS is a dedicated ranking of the top 250 universities in the BRICS countries (Brazil, Russia, India, China and South Africa) (QS Intelligence Unit 2016).

The top three universities in South Africa according to the QS World University Rankings (Quacquarelli Symonds 2016a; Quacquarelli Symonds 2016b) at the time of writing were:

- University of Cape Town,
- University of the Witwatersrand, and
- Stellenbosch University.

These three universities' library websites were evaluated in the multiple-case study in Chapter 4. The University of Pretoria — the main focus of this study — was ranked fourth and is evaluated in the final case study in Chapter 5.

3.2.2.2 Case study research design

The empirical study consists of four case studies. The first three case studies (in Chapter 4) are used in a multiple-case study, and the final case study (in Chapter 5) is a single (instrumental) case study. The research designs for the multiple-case study and single case study are described in this section.

The five components of research design by Yin (2013:27) were addressed in the research design to identify the data that needed to be collected and what to do with the data afterwards.

The research design for the four cases was similar, except that the purpose differs between the multiple-case study (Chapter 4) and the single case study (Chapter 5). Therefore, a single research design was done in which the differences are discussed where relevant.

3.2.2.2.1 Data collection

As discussed in Section 3.2.1.2, Yin (2013:35) specifies that the data that need to be collected are specified by the study's questions, its propositions, and its unit of analysis.

3.2.2.2.1.1 The study's questions

The purpose of the case studies was to answer the main research question of this study as well as a portion of the sub-questions that were posed in the introduction in Chapter 1. Sub-questions 1 – 4 were answered through the literature review and are not further discussed here.

Multiple-case study, Chapter 4

Sub-questions 5 and 6 were answered in a multiple-case study with three cases in Chapter 4.

- *Sub-question 5: To what extent are the library websites of the top universities in South Africa usable?*
- *Sub-question 6: How can the integrated list of principles be improved?*

Single-case study, Chapter 5

Sub-question 7 and the main research question were answered using a single case study in Chapter 5.

- *Main research question: To what extent does the library website of the University of Pretoria comply with an integrated set of usability heuristics, compiled specifically for the evaluation of the IA of academic library websites?*
- *Sub-question 7: What recommendations can be made to improve the usability of the library website of the University of Pretoria?*

3.2.2.2.1.2 The study's propositions

The phenomenon that is studied in each of the cases is the usability of the IA components of the websites. Each of the websites was divided into six dialogue elements based on IA theory, and the usability of each of the dialogue elements was evaluated using the heuristic evaluation method, as discussed in Section 3.3.3.

The data that were recorded comprised a list of all the usability problems that were encountered while inspecting the various dialogue elements using the heuristic evaluation method. Evidence for the data was presented in the form of screenshots of various webpages of the websites.

3.2.2.2.1.3 The study's units of analysis

The unit of analysis was the main library website of the selected universities. Therefore, the main library website is the case that was investigated.

The data consisted of the publicly available webpages of the main academic library websites of the selected universities. All content on subdomains were excluded, except where forms were present. Each of the webpages was interacted with in the state that they were published online and evidence was presented in the form of screenshots. The screenshots were made between 21 August and 28 October 2016.

3.2.2.3 Data analysis

In all four of the case studies the same data were analysed, but with different purposes. In the multiple case study in Chapter 4 the purpose was to find out how usable the library websites of the chosen websites were as well as how the list of heuristics could be updated based on the findings of the evaluations. The purpose of the case study in Chapter 5 was to find out how usable the library website of the University of Pretoria was and what recommendations could be made to improve it.

As discussed in Section 3.2.1.2, Yin (2013:35) specifies that what is to be done after the data have been collected is indicated by the logic linking the data to the propositions and the criteria for interpreting the findings.

3.2.2.3.1.1 The logic that links the data to the propositions

The logic that was used to link the data to the propositions was the heuristics that were compiled in the literature review. For each website, a maximum of six heuristic evaluations were performed. Each dialogue element that was identified had its own heuristic evaluation. The results of each of the heuristic evaluations were recorded in individual tables. The problems that were found in each of the websites were pointed out and discussed, and suggestions or recommendations for improvement were provided.

See Section 3.3.3 for more details on how the heuristic evaluations were conducted.

3.2.2.3.1.2 The criteria for interpreting the findings

In the multiple-case study, the usability problems were identified with the purpose of evaluating if the heuristics cover all the problems that exist in the websites. In the single case study, the usability problems were identified with the purpose of providing recommendations on how to fix the problems. Additionally, in all of the case studies, the usability of each of the websites is reported.

These various purposes determined how the results were analysed.

The purpose of the multiple case study was to establish the usefulness of the integrated heuristics for detecting usability problems and to update them if necessary. This was determined based on occurrences of problems that were found in the websites that were not addressed by any of the heuristics. If such occurrences were found, it was discussed at the end of each of the sections and, based on web development best practices and the experience of the expert evaluator, additional criteria were added to the heuristics.

The purpose of the single case study was to provide recommendations for improvement, based on the updated heuristics. For each of the problems that were found in the website, a single or alternative recommendations for improvement were suggested.

3.3 Part 3: Heuristic evaluations

The heuristic evaluation method was used to collect data in the case studies. In this section, the researcher defines the heuristic evaluation method, how to conduct a heuristic evaluation, and the approach that was followed in this study.

3.3.1 What is a heuristic evaluation?

A heuristic evaluation is a "usability engineering method that involves having a small set of evaluators examine the interface and judge its compliance with recognised usability principles (or heuristics)" (Nielsen & Mack 1994:26). The heuristic evaluation method was developed by Nielsen and his colleagues, Molich, Hollingstead, and Novick in 1990 (Preece, Rogers & Sharp 2015:501).

The heuristic evaluation method uses a set of established usability guidelines or principles. There can be variations in these principles that reflect differences among users, systems, user tasks in the system, and the objective of the evaluation (Nielsen & Mack 1994:7). As discussed in the literature review in Section 2.2.1, the terms guidelines, principles, and heuristics are used interchangeably even though they have slightly different meanings. For the purposes of this study the terms principles and heuristics are used. The term heuristics is used when referring to principles that are used specifically for heuristic evaluation.

The outcome of the heuristic evaluation method is a list of an interface's usability problems with references to the heuristics that were violated by the design according to the opinion of the evaluator (Nielsen 1995b). The results of a heuristic evaluation typically include a list of features that cause usability problems that should be improved, features that do not cause problems and do not need to be changed, and features that should be tested with actual users (TecEd 2016).

Heuristic evaluation is classified as a usability inspection method. Usability inspection is a generic term for several expert-based usability evaluation methods, including heuristic evaluation, pluralistic walkthroughs, cognitive walkthroughs, and formal usability inspections (Nielsen & Mack 1994:8). Heuristic evaluations and cognitive walkthroughs are the most well-known (Preece, Rogers & Sharp 2015:505) and the most actively used usability inspection methods (Hollingsed & Novick 2007:249). The high-level objective of these inspections is to identify potential usability problems and provide recommendations that can be used to improve the usability of an interface (Nielsen & Mack 1994:3).

The heuristic evaluation method is relatively easy to learn and to apply. In comparison with the cognitive walkthrough method, the heuristic evaluation method is also more effective (Nielsen & Mack 1994:12). Heuristic evaluations can be completed faster than many other methods (Nielsen 1994b:25). Heuristic evaluation is also very inexpensive to conduct as it is considered "one of the main discount usability engineering methods" (Nielsen 1994b:26).

3.3.2 How to conduct a heuristic evaluation

Before the evaluation can start, the set of heuristics that will be used needs to be identified (Pickard 2013:133). The set of heuristics that is used will depend on the type of interface and the preference of the expert evaluator.

During the evaluation, the evaluator(s) needs to go through the interface several times to inspect various dialogue elements (Pickard 2013:133). A dialogue element, as defined by Danino (2001) is an element of a website that contributes to a dialogue with a website's visitors and can be different on different websites, depending on the structure of the website. The dialogue elements that are to be evaluated would be identified by the researcher before the heuristic evaluation, and pointed out to the evaluator(s) so they can be investigated, with the purpose of ensuring that each evaluator follows the same process. Each dialogue element must be evaluated against the list of heuristics and the evaluator judges whether each dialogue element follows the heuristics (Nielsen 1995b). This helps them to identify problems and issues as they are encountered. Each of the usability problems must be explained with reference to the heuristics and possible solutions should be noted (Pickard 2013:133). The evaluator is also allowed to consider additional usability principles that may be relevant to a specific element in the interface as they are encountered (Nielsen 1994b:28).

Evaluators are allowed to decide how they want to perform the evaluation of the interface and they are not required to perform tasks. A general recommendation is to go through the interface twice (Nielsen 1994b:29; Pickard 2013:133). The first pass is when evaluators move through the system once to familiarise themselves with the navigation structure and the general scope of the website. The second pass is when the evaluator focuses on the specific elements of the system related to the heuristics identified.

If more than one evaluator is involved in the process, they should perform the evaluations independently and be de-briefed after performing the evaluations so that they can share their experiences and suggest solutions (Nielsen 1995b; Pickard 2013:133). The evaluator should present some form of report after the evaluation (Nielsen 1995b). The findings can then be presented, and system revisions can be recommended.

According to Nielsen (1995c) the location of usability problems can be identified in the following four different ways:

" 1. at a single location in the interface,
2. at two or more locations that have to be compared to find the problem,
3. as a problem with the overall structure of the interface,
4. and finally as something that ought to be included in the interface but is currently missing."

Problems in the last category are easy to find in fully implemented systems as they tend to cause evaluators to get stuck and therefore notice them easily (Nielsen 1995c).

3.3.3 How the heuristic evaluations were conducted in this study

An integrated set of heuristics was identified based on the findings of the literature review in Chapter 2.

The evaluation of the first three websites using the heuristics confirms if the criteria are relevant for evaluating the usability of the IA of academic library websites. Comments were also made on the usability of each of the websites that were evaluated. The criteria were amended accordingly to produce an integrated list of principles that were used in in the case study in Chapter 5. A set of recommendations was compiled on how the library website being evaluated can be improved.

For each of the library websites, a set of *dialogue elements* was identified by the researcher, who was the sole evaluator in this study. The dialogue elements are components that academic library websites typically consist of. The dialogue elements were identified based on the conclusion of reviews of IA literature, related studies, and interactions with the three academic library websites.

The first step through the interface involved identifying the dialogue elements and determining if any were missing. The second step through the system focussed on identifying the usability problems in the dialogue elements.

Each of the dialogue elements was further divided into sub-components, and the heuristic evaluations were used to show how each of the sub-components contributes to the usability of each of the websites. To limit the scope, an evaluation of the *content* (not inclusive of *labels*) of the internal webpages was excluded from the study. The content of the webpages is only evaluated at a surface level to determine if it corresponds with the related link labels, headings, and titles.

For each of the dialogue elements, a screenshot is provided. In the screenshot, the identified sub-components are indicated with red borders and numbers. See Section 3.3.3.2 at the end of this chapter for examples on how IA components are identified in each of the websites.

Since these dialogue elements can be identified on any academic library website, the identification and evaluation of the dialogue elements can be used to draw comparisons between cases (to compare the usability of the various academic library websites with each other).

A heuristic evaluation was conducted on each of the dialogue elements, commenting on the usability of the dialogue element itself as well as how it contributes to the usability of the website as a whole.

3.3.3.1 Evaluation scope: Dialogue elements

The dialogue elements are defined based on what IA components are commonly available on academic library websites, which is determined in the literature review. The two IA components that help users move through a website are navigation and labelling systems. The dialogue elements are chosen based on these two systems, and are sub-divided into global navigation structures, local navigation structures, and search systems. Typical library websites have dialogue elements that fit into one of these structures.

Global navigation structures typically consist of a header and a footer, and a main navigation bar. These systems are known as site-wide navigation systems. Site-wide navigation systems "help users understand where they are and where they can go within a site" (Rosenfeld, Morville & Arango 2015:50). These structures typically allow users to navigate between main sections of a website.

Local navigation structures typically consist of navigation elements that allow a user to navigate between pages within a section of a website (Rosenfeld, Morville & Arango 2015:50). The homepage and the internal pages of a website usually have separate local navigation structures. A homepage will typically provide links to the most visited pages of a website, while internal pages will typically provide various navigation structures to navigate between pages, such as breadcrumb trails and local navigation menus.

Users can also move through websites by using search systems. Some websites provide site search features that allow users to search for content in a website. Not all websites provide this option, however. According to Rosenfeld, Morville and Arango (2015:146), a website should have a site search feature that allows a user to search for content in a website or specific subsets of a website if it consists of a large amount of content. Therefore, site search features are ideal for academic library websites. Additionally, academic library websites sometimes provide a resource search feature that allows users to search for and navigate to library resources.

Based to the discussion above, the navigation systems and search systems in academic library websites can be divided into the following dialogue elements:

Global navigation structures

1. Dialogue element 1: Header and footer (Figure 3.3-1 - Figure 3.3-4)
2. Dialogue element 2: Main navigation bar (Figure 3.3-1, Figure 3.3-2, and Figure 3.3-5)

Local navigation structures

3. Dialogue element 3: Homepage content (Figure 3.3-1 and Figure 3.3-6)
4. Dialogue element 4: Internal page content (Figure 3.3-2, and Figure 3.3-7)

Search systems

5. Dialogue element 5: Site search feature (Figure 3.3-1, Figure 3.3-2, and Figure 3.3-8)
6. Dialogue element 6: Resource search feature (Figure 3.3-1, Figure 3.3-2, and Figure 3.3-9)

These systems are facilitated by well-implemented organisation and labelling systems. These two IA systems are evaluated using the usability heuristics that were compiled in the literature review. The heuristics are supplemented with sub-criteria that apply specifically to IA components.

Each of the heuristic evaluations provides discussions on the usability of the components of the dialogue elements as well as how each dialogue element contributes to the usability of the website as a whole.

3.3.3.2 Academic library website dialogue elements

The dialogue elements of each of the academic library websites in the case studies are represented with screenshots of the pages. The following discussion explains how each of the dialogue elements are identified in the screenshots.

Figure 3.3-1 and Figure 3.3-2 represent examples of how dialogue elements are identified on the homepage and internal pages. Each of the dialogue elements can further be sub-divided into components, therefore the individual dialogue elements are shown separately in the next sections to highlight the individual components.

Industry standard placeholder text, Lorem Ipsum (lipsum.com n.d.), was used to represent body content in the figures.

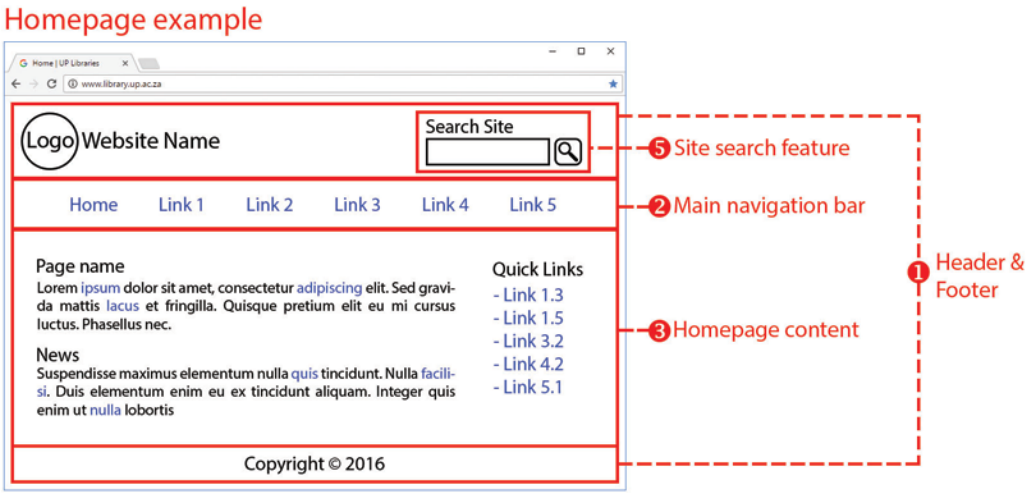


Figure 3.3-1: Academic library website dialogue elements: Homepage example

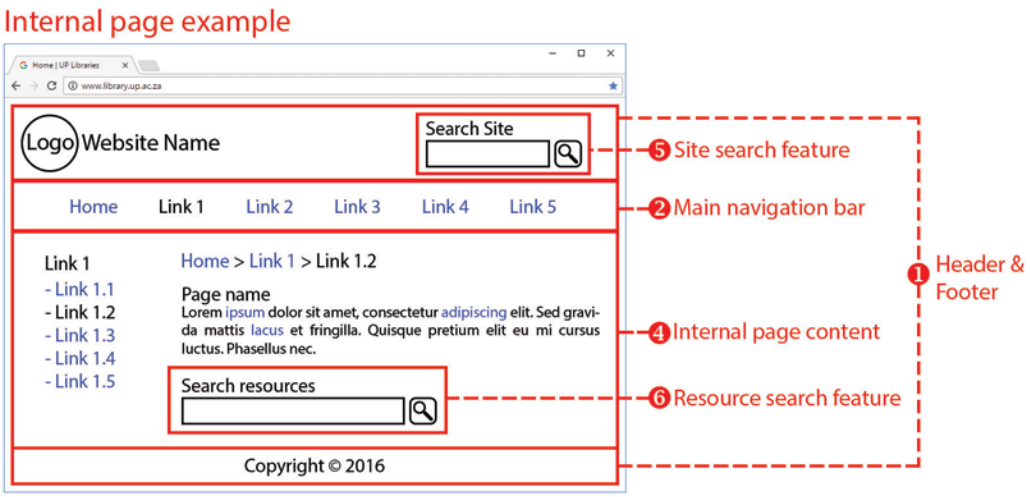


Figure 3.3-2: Academic library website dialogue elements: Internal page example

3.3.3.2.1 Global navigation structures

Dialogue elements that are part of the global navigation structures are present on all the webpages of the website. These elements give users context within the web as a whole as well as navigation options that allow them to have access to key areas from anywhere inside the website. The global navigation structures typically consist of a header and footer, and a main navigation bar.

3.3.3.2.1.1 Dialogue element 1: Header and footer

The header consists of the following components. These components are outlined in the screenshots with red borders and they are numbered.

The example wireframe in Figure 3.3-3 has the following components (the numbers in the list correspond to the numbers in Figure 3.3-3):

1. Website name and logo
2. Site search feature (separate dialogue element)

Figure 3.3-3: Dialogue element 1: Header

The footer consists of the following component (as shown in Figure 3.3-4):

3. Copyright notice

Figure 3.3-4: Dialogue element 1: Footer

3.3.3.2.1.2 Dialogue element 2: Main navigation bar

The main navigation bar consists of the following components:

1. Home
2. Link 1
3. Link 2
4. Link 4
5. Link 3
6. Link 5

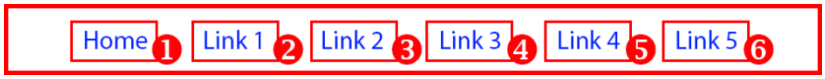


Figure 3.3-5: Dialogue element 2: Main navigation bar

3.3.3.2.2 Local navigation structures

Local navigation structures have different links based on the context within the website. These structures also assist users with context and navigation. Local navigation is divided into two dialogue elements because the navigation structure on the homepage is different to the navigation structure on other internal pages.

3.3.3.2.2.1 Dialogue element 3: Homepage content

The homepage usually contains components that are unique/exclusive to the homepage.

The homepage example consist of the following components:

1. Content area with contextual links
2. Quick links navigation menu

Figure 3.3-6: Dialogue element 3: Homepage content

Quick links are depicted in Figure 3.3-6 as shortcut links to sub-sections of the website.

3.3.3.2.2.2 Dialogue element 4: Internal page content

The internal page example consist of the following components:

1. Local navigation menu
2. Breadcrumbs trail
3. Content area with contextual links
4. Resource search feature

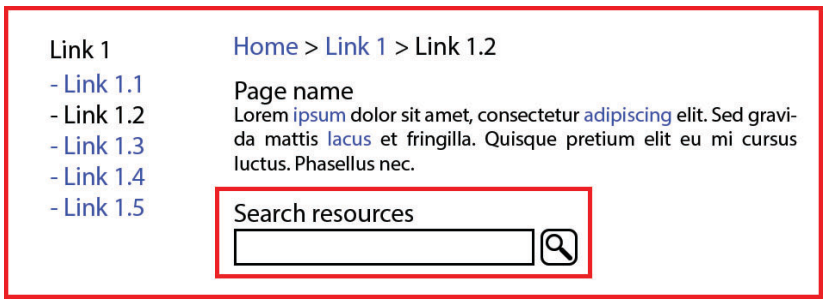


Figure 3.3-7: Dialogue element 4: Internal page content

3.3.3.2.3 Search systems

These dialogue elements allow users to find website or library content by searching with keywords instead of browsing. These elements can be used as shortcut features to resources or locations.

3.3.3.2.3.1 Dialogue element 5: Site search feature

The site search feature example consists of the following components:

1. Label
2. Input box
3. Submit button

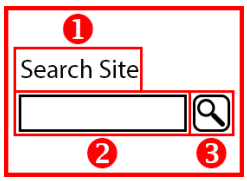


Figure 3.3-8: Dialogue element 5: Site search feature

3.3.3.2.3.2 Dialogue element 6: Resource search feature

The resource search feature consists of the following components:

1. Label
2. Input box
3. Submit button

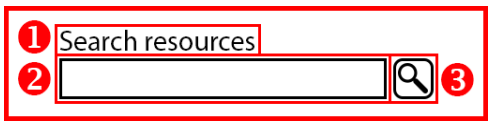


Figure 3.3-9: Dialogue element 6: Resource search feature

Library websites typically host some of their content on webpages in subdomains, for example, http://www.digitalcollections.lib.uct.ac.za/. Subdomains are only evaluated on a surface level to discuss the impact that the pages on the inclusion of subdomains has on the usability of the library websites.

3.4 Chapter 3 summary

This chapter outlined the methods that were used in this study, i.e., literature reviews, case studies, and heuristic evaluations.

One of the goals of the study was to find the most appropriate methods for evaluating the usability of the IA of academic library websites and to use the method to evaluate the usability of academic library websites in South Africa. This chapter explains how the various research methods contribute to achieving this goal.

All of these methods complement each other with the purpose of providing a framework for conducting a usability study from start to end that consists of data collection methods specifically appropriate for the evaluation of one or more academic library websites.

The next chapter (Chapter 4) is the case studies chapter in which the multiple-case study is conducted. The case studies consist of the library websites of the top three universities in South Africa. Each of the websites is divided into the relevant dialogue elements and the usability of each is evaluated using the heuristics that were formulated specifically for this purpose in the literature review.

Chapter 4 – Case studies

This chapter consists of the multiple-case study of three cases, namely the library websites of the top three South African universities. Each of the case studies consists of a heuristic evaluation that was used to collect data about the usability of the website.

The following library websites were evaluated:

- Case study 1: University of Cape Town (www.lib.uct.ac.za)
- Case study 2: University of the Witwatersrand (www.wits.ac.za/library)
- Case study 3: Stellenbosch University (library.sun.ac.za)

The researcher performed a heuristic evaluation on each of the dialogue elements that an academic library website consists of, as defined in the methodology in Chapter 3. An academic library website can consist of six dialogue elements. Some of the websites did not have all of the dialogue elements; therefore, each of the cases consists of six (or less) heuristic evaluations.

Each of the dialogue elements consists of components that are unique to the individual websites. The components were identified (and represented with a screenshot) and numbered. The screenshots in this chapter were made between 21 August and 11 September 2016.

The heuristics that were used for the evaluations were compiled in the literature review in Chapter 2. The evaluation of each of the dialogue elements reveals whether the dialogue element complies with the heuristics as well as how it impacts the usability of the website as a whole. The purpose of this chapter is also to find out if the heuristics are sufficient for the evaluation of academic library websites and to update them if necessary.

All of the statements that are made on the usability of the components in the dialogue elements are based on the sub-criteria of the heuristics, as listed in the literature review in Chapter 2.

4.1 Case study 1: University of Cape Town (UCT)

The University of Cape Town is the top university in South Africa according to the QS University Rankings 2016/17, ranking at number 14 in the BRICS countries ranking (Quacquarelli Symonds 2016a) and number 191 in the world rankings (Quacquarelli Symonds 2016b).

This library website was evaluated in 2008 by Mvungi, de Jager & Underwood (2008). This study was included in the list of related studies in the literature review in Chapter 2.

The main library domain (lib.uct.ac.za) consisted of 294 webpages at the time of writing (based on a scan of the website using https://www.xml-sitemaps.com/, a free sitemap generator). It is to be noted that many of the website's links may have changed since the time of writing and will no longer work.

The majority of the webpages are available from the main library website domain (lib.uct.ac.za). The library also has webpages in the following subdomains:

- Digital collections: http://www.digitalcollections.lib.uct.ac.za/
- Digital services: http://www.digitalservices.lib.uct.ac.za/
- Undergraduate services: http://www.undergraduateservices.lib.uct.ac.za/
- Each library branch also has its own separate library website hosted on a subdomain.

The webpages on the subdomains are excluded from the evaluation because they generally have different structures than the pages on the main domain, as discussed in the "Limitations" section in Chapter 1, Section 1.7.1. Subdomains are only mentioned to comment on the impact the structures of the subdomains have on the usability of the main website.

The homepage of the library website is shown in Figure 4.1-1. It is to be noted that the purpose of this screenshot is to show the entire homepage and that more detailed screenshots of the various components are provided in the following sections.

Figure 4.1-1: UCT library website homepage

4.1.1 UCT library website dialogue elements

The UCT library website consists of the six dialogue elements that are represented in Figure 4.1-2 and Figure 4.1-3. Figure 4.1-2 is a screenshot of the homepage and Figure 4.1-3 is a screenshot of the "Library help" page. The "Library help" page represents the internal pages of the UCT library website and it should be noted that all of the internal pages are evaluated, not just the one represented in the screenshot.

All the dialogue elements that are evaluated are outlined in the two screenshots with red borders and numbers 1 to 6. The numbers of the dialogue elements in the following list correspond to the numbers in the figures. Each number represents a specific dialogue element.

Global navigation structures

1. Dialogue element 1: Header and footer (number 1 in Figure 4.1-2 and Figure 4.1-3)
2. Dialogue element 2: Main navigation bar (number 2 in Figure 4.1-2 and Figure 4.1-3)

Local navigation structures

3. Dialogue element 3: Homepage contents (number 3 in Figure 4.1-2)
4. Dialogue element 4: Internal page contents (number 4 in Figure 4.1-3)

Search systems

5. Dialogue element 5: Site search feature (number 5 in Figure 4.1-2 and Figure 4.1-3)
6. Dialogue element 6: Resource search feature (number 6 in Figure 4.1-2)

It is to be noted that some dialogue elements are components within other dialogue elements. For example, the site search feature (dialogue element 5) is a component in the header (dialogue element 1), and the resource search feature (dialogue element 6) is a component of the homepage contents (dialogue element 3). These dialogue elements are evaluated as separate dialogue elements as well as components of the dialogue element in which they are contained. The location of the various dialogue elements differs from case to case

The dialogue elements as they are outlined in the screenshots are shown in more detail in the subsequent sections, where each of the components within the dialogue elements is outlined.

The UCT library website has all of the required dialogue elements; therefore, it succeeds in the first aspect of the evaluation which involves identifying the dialogue elements.

Figure 4.1-2: UCT dialogue elements on the homepage

Figure 4.1-3: UCT dialogue elements on internal pages (The "Library help" page represents all the internal pages)

4.1.2 Global navigation structures

The global navigation structure of the UCT library website has a header, footer, and two main navigation bars. The second navigation bar is referred to as the secondary navigation bar.

4.1.2.1 Dialogue element 1: Header and footer

The position of this dialogue element is outlined in Figure 4.1-2 and Figure 4.1-3 with the number 1, and the detail (the components in this dialogue element) is outlined in Figure 4.1-4 and Figure 4.1-5).

The header contains the following four components. The numbers in the list correspond to the numbers in Figure 4.1-4:

1. Website name ("UCT Libraries") and logo. This image links to the library homepage.
2. University name and emblem (links to the homepage of the main university website)
3. Three links ("Contact Us", "Libraries Home", and "Off-campus login")
4. Site search box (evaluated separately in Section 4.1.4.1)

Figure 4.1-4: UCT header detail, dialogue element 1 (as represented in Figure 4-1.2)

The footer contains the following four components. The numbers in the list correspond to the numbers in Figure 4.1-5:

5. Address and contact details (i.e., postal address, telephone, fax, and mailto email link to the email address in the label "Libraries@uct.ac.za")
6. Four links ("Suggest a book", "Send us feedback", "UCT Libraries" Facebook link, and "@UCTLibrary" Twitter link)
7. Twitter widget
8. Copyright information

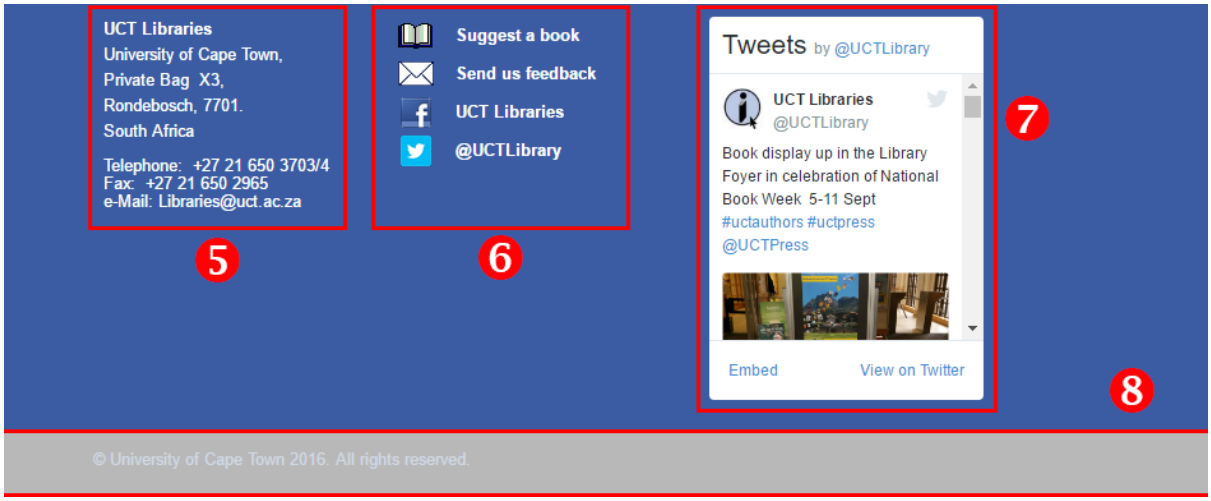


Figure 4.1-5: UCT footer detail, dialogue element 1 (as represented in Figure 4-1.2)

4.1.2.2 Heuristic evaluation of dialogue element 1: UCT header and footer

The table below contains the discussion of each of the problems that were found with the components in this dialogue element. The problems are summarised in the case summary in Section 4.1.5.

Heuristic	Evaluation
4.1.2.2.1 Labelling	All of the labels in the header and footer comply with the sub-criteria of this heuristic. The label "Off-campus login" can potentially be unfamiliar because users had difficulty understanding the label in the related study in which the

	same website was evaluated. In the study, it was suggested that it can be replaced with "Access from home" (Mvungi, De Jager & Underwood 2008:178). However, this label was not changed after the website had been redesigned and is a term that is commonly used on academic library websites. Therefore, it is not listed as a problem here.
4.1.2.2.2 Organisation	There are various problems with the organisation of the components in the header and footer. *4.1.2.2.2.1 Organisation problem 1: Order of links* The order of the links "Contact Us", "Libraries Home", and "Off-campus login" is not logical because the most important link, "Libraries Home", is not listed first. The link to the homepage should always be listed first if it is contained in a list of links according to the sub-criteria of this heuristic. *4.1.2.2.2.2 Organisation problem 2: Positioning of links* The positioning of the university's name and emblem (component 2 in Figure 4.1-4) can be confused for a caption for the content (component 3 in Figure 4.1-4) below it. Users might incorrectly think that the three links ("Contact Us", "Libraries Home", and "Off-campus login") directly below the university's name and emblem are applicable to the *main* UCT website instead of the UCT *library* website.
4.1.2.2.3 Clutter	There is a small number of redundant links in the footer that cause clutter. Some of the links also have unexpected behaviour, but the links should not be removed; only the behaviour should be changed. See a discussion of the problem in the "Predictable behaviour" section (Section 4.1.2.2.8.1). *4.1.2.2.3.1 Clutter problem 1: Redundant social media labels* The labels of the social media links "UCT Libraries" and "@UCTLibrary" in the footer are meaningless without the social media icons next to them. These labels are therefore redundant. The labels can be removed, leaving the logos to stand alone, and still make sense. The social media links in the footer do not include all of the library's social media links. The UCT libraries have more than just Twitter and Facebook accounts, which is evident from the social media links that are available on the homepage. In discussion of "Clutter" in the homepage (Section 4.1.3.2.3.6), it is suggested that the social media links that are on the homepage should be moved to the footer to reduce clutter, making all of the social media links available in the global navigation structure, which means they will be available on all webpages, instead of just the homepage.

4.1.2.2.4 Novice user guidance	This dialogue element lacks novice user guidance features; however, it also has a positive aspect. **Positive aspect**: The Twitter widget in the footer contains library tips and advice that are shared regularly. This can be a useful feature for novice users. *4.1.2.2.4.1 Novice user guidance problem 1: Tooltips* There is a lack of useful tooltips. When a user hovers over the link "UCT LIBRARIES", a tooltip with the text "UCT Libraries" appears, which does not add any value, since it is the same as the link label. No other links have tooltips. More guidance can be provided by adding tooltips to all the links to explain where the link will take the user since it is not obvious.
4.1.2.2.5 Help documentation	There are no links to help documentation available in the header or footer. There are, however, links available in the main navigation bar, which makes it accessible from all the webpages. Therefore, it is not necessary to include it in the header as well.
4.1.2.2.6 Efficiency features	There is a site search feature in the header that might be useful for users who prefer not to find information by browsing. This feature is evaluated separately in Section 4.1.4.1, dialogue element 5. Additionally, this feature is available on all pages because it is located in the header.
4.1.2.2.7 Consistency	The header and footer consistently stay the same on all the library webpages (that are on the same domain). There is one consistency problem with the links in the header and the footer. *4.1.2.2.7.1 Consistency problem 1: inconsistent link targets* All of the links to external websites do not consistently open the new website in a new browser tab or window. The problem that external links opening in the same tab causes is addressed in "Controllability", Section 4.1.2.2.11.1.
4.1.2.2.8 Predictable behaviour	There are two links (one in the header and one in the footer) with unexpected behaviour. *4.1.2.2.8.1 Predictable behaviour problem 1: Unexpected link behaviour* The behaviour of the "Contact Us" link (in the header) and "Send us feedback" link (in the footer) does not follow conventions. The expectation is that "Contact Us" takes the user to a page that provides contact information about the library and "Send us feedback" takes the user to a feedback form. Instead, the hypertext reference of "Contact Us" and "Send

	us feedback" is "mailto:Libraries@uct.ac.za". This link behaviour allows a user to email the library using their e-mail client. This behaviour is only acceptable for the link in the footer with the text "Libraries@uct.ac.za". A more predictable label for the two links would be "Email Us", but this would be less useful than links to a contact us page and feedback form page. Therefore, it would not be appropriate to rename the link labels. Therefore, the "Contact Us" label must stay the same, but it should instead direct the user to the "Library contacts" page that contains contact information for the library (http://www.lib.uct.ac.za/library-contacts). The "Send us feedback" link should navigate the user to a feedback form (similar to the "Suggest a book" form) that the user can fill in to easily send feedback.
4.1.2.2.9 Context	There are no problems with context in the header or footer. Two positive aspects are discussed below. **Positive aspect 1:** The user is provided with context that shows their current location on the website when they are on the homepage because the current link "Libraries Home" is underlined (see component 3 in the UCT header, Figure 4.1-4). The current link refers to a link to the page that the user is currently on. **Positive aspect 2:** Context is also given to the user with regards to their location relative to the web as a whole since the header with a logo that clearly identifies the website is consistently visible on all library pages.
4.1.2.2.10 Task completion support	This heuristic and its sub-criteria do not apply to the components in this dialogue element.
4.1.2.2.11 Controllability	All of the links, except the Facebook link, behave similarly by opening the link location in a new browser tab or window. *4.1.2.2.11.1 Controllability problem 1: External links open in the same tab* The Facebook link in the footer opens the Facebook website in the same browser tab, which makes the user navigate away from the library website. Making external links open in a *new* tab is useful if users want to continue using the library website after browsing the external website. This problem is further discussed as a new problem that is commonly found on academic library websites in the summary of the chapter, Section 4.4.1.

4.1.2.2.12 Error recovery	This heuristic and its sub-criteria do not apply to the components in this dialogue element.
4.1.2.2.13 Error prevention	Links that open external websites in the same tab (as discussed in Section 4.1.2.2.11.1) can lead to errors. Therefore, errors can be prevented by fixing other problems that were reported in the header and footer.
4.1.2.2.14 Feedback	This heuristic and its sub-criteria do not apply to the components in this dialogue element.

Table 4.1-1: Heuristic evaluation of UCT dialogue element 1: Header and footer

4.1.2.3 Dialogue element 2: Main navigation bars

The UCT library website has two navigation bars that are part of the global navigation structure, i.e., they appear on all webpages. The position of the navigation bars is outlined in Figure 4.1-2 and Figure 4.1-3 with the number 2, and the detail (the components in this dialogue element) is outlined in Figure 4.1-6 and Figure 4.1-8. The secondary navigation bar appears at different locations on different pages but is still present on all pages and therefore considered a global navigation structure. It appears below the resource search feature on the homepage and, on internal pages, it appears directly below the main navigation bar.

The main navigation bar is a horizontal bar that consists of nine links. Six of the links (links 1–4, 6, and 9) have drop-down menus that appear underneath them when users hover over them. The drop-down menus that appear when users hover over links 1–4, 6, and 9 in the main navigation bar are outlined in Figure 4.1-7. Three of the links (links 5, 7, and 8) do not have drop-down menus.

The main navigation bar contains the following nine components. The numbers in the list correspond to the numbers in Figure 4.1-6 and Figure 4.1-7:

1. Search & Find
2. Services
3. Research Help
4. Libraries & Collections
5. Open Scholarship (No drop-down menu)
6. About UCT Libraries
7. Library Contacts (No drop-down menu)
8. News (No drop-down menu)
9. Alumni Services

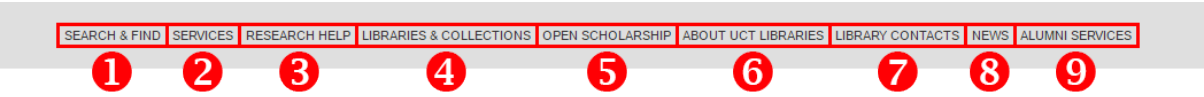


Figure 4.1-6: UCT main navigation bar

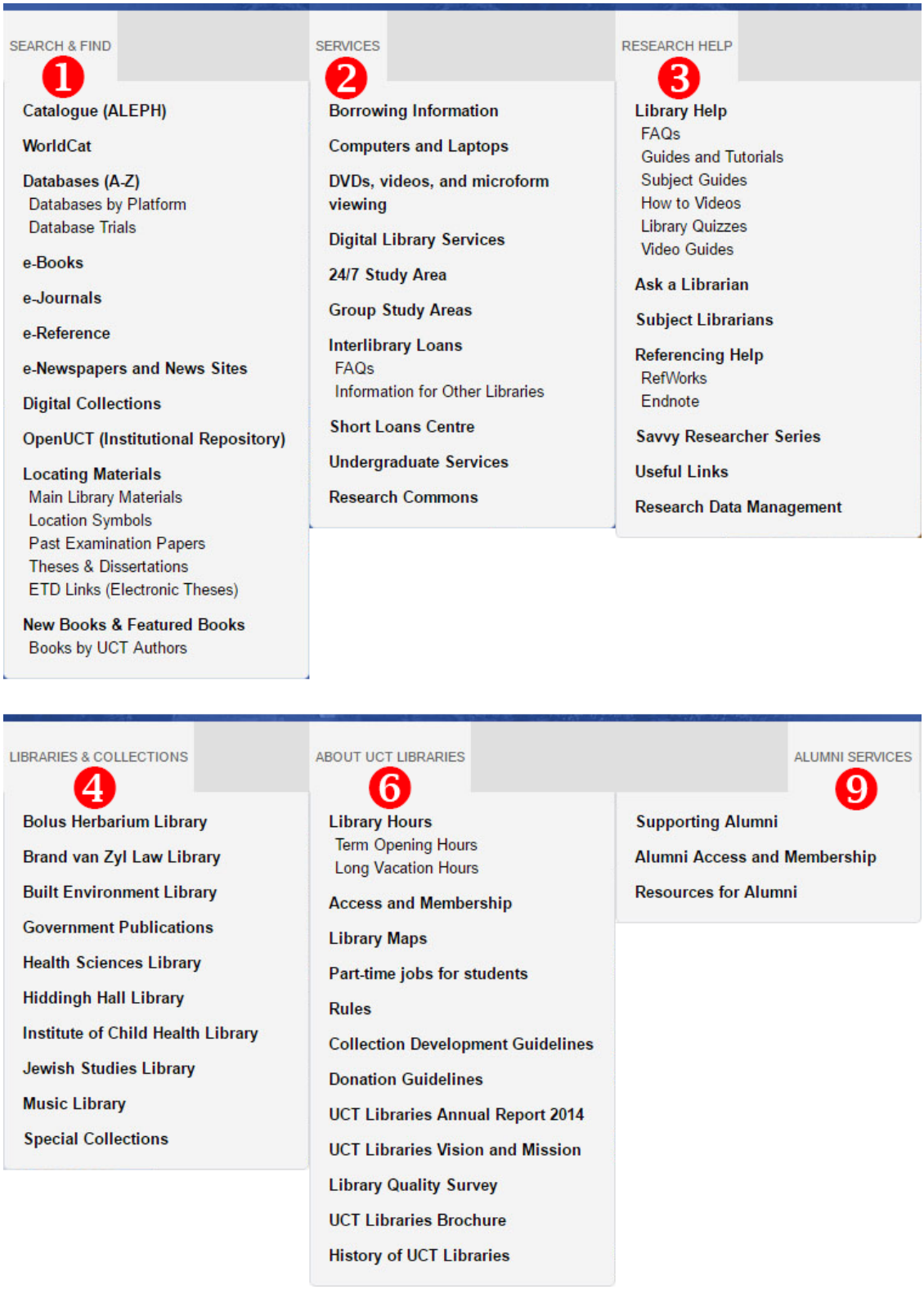


Figure 4.1-7: UCT drop-down menus of links in the main navigation bar (Figure 4-1.6)

The secondary navigation bar contains the following two components. The numbers in the list correspond to the numbers in Figure 4.1-8:

1. Three links "Catalogue (ALEPH)", "WorldCat", and "Digital Collections"
2. "Quick links" drop-down menu

Figure 4.1-8: UCT secondary navigation bar

The three links that are in the secondary navigation bar are also available in the first drop-down menu in the main horizontal navigation. Based on this observation, it is already clear that the secondary navigation bar contains redundant links. This and other problems are discussed in the following section.

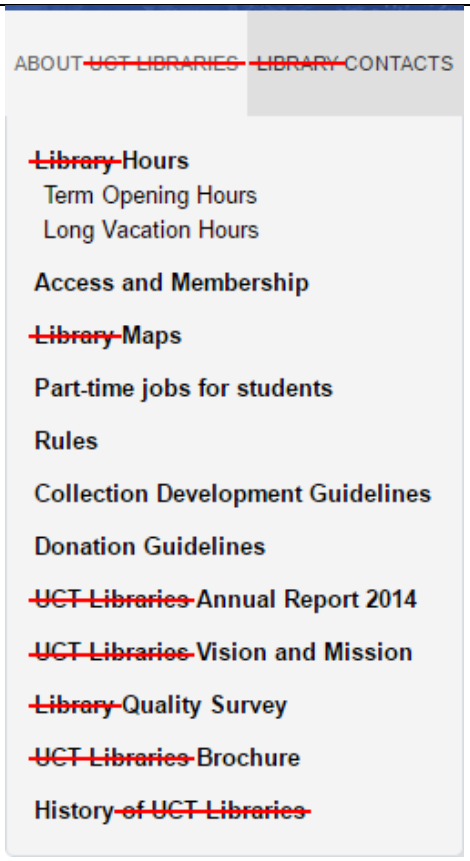
4.1.2.4 Heuristic evaluation of dialogue element 2: UCT main navigation bars

The table below contains the discussion of each of the problems that were found with the components in this dialogue element. The problems are summarised in the case summary in Section 4.1.5.

Heuristic	Evaluation
4.1.2.4.1 Labelling	Some of the labels in the main navigation bars are unfamiliar or incorrect. Additionally, some of the labels are too long; however, this problem is addressed under the "Clutter" heuristic, Section 4.1.2.4.3.3. **Positive aspect:** Some of the possibly unfamiliar labels are made more understandable with the additional explanation next to the label in parenthesis, for example, OpenUCT (Institutional Repository), ETD Links (Electronic Theses). *4.1.2.4.1.1 Labelling problem 1: Unfamiliar labels* Some of the link labels in the drop-down menus are unique to UCT and might therefore be unfamiliar, for example, "Savvy Researcher Series" under "Research help".

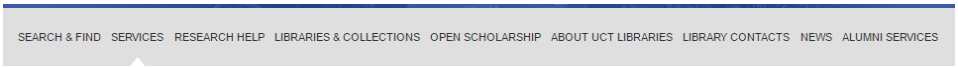
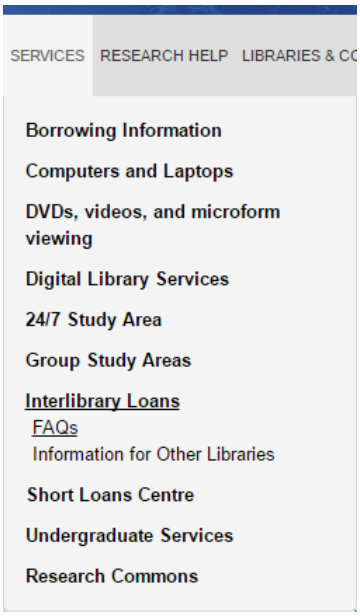
	4.1.2.4.1.2 Labelling problem 2: Incorrect labelling of "Help" link The "Help" link in the main navigation bar is labelled "Research Help". The links that are available in the drop-down menu of the link, however, are a variety of different "Help" links that are not exclusively "Research Help". Therefore, the link is incorrectly labelled and a more appropriate label would be "Help".
4.1.2.4.2 Organisation	There are two problems with regards to the website's organisation due to uncategorised webpages/links and external links in the main navigation bar. *4.1.2.4.2.1 Organisation problem 1: Uncategorised webpages/links* Some of the pages in the website are uncategorised, for example, "News" and "Library Contacts". These pages can be accessed directly from the main navigation bar and do not have drop-down menus. This results in the main navigation bar being inconsistent. Refer to "Consistency" in Section 4.1.2.4.7.3 for a discussion of the consistency problem. The "News" and "Library Contacts" are typical sub-categories of an "About us" section, and can therefore be sub-categorised as such. *4.1.2.4.2.2 Organisation problem 2: External links in main navigation bar* The main navigation bar contains external links, which goes against the purpose of a main navigation bar helping users navigate between main sections of the current website. For example, the "Open Scholarship" link navigates to an external website. When it contains links that navigate away from the library website it causes confusion and can make users feel disoriented. These links also make the main navigation bar inconsistent (see "Consistency") and unpredictable (see "Predictable behaviour").
4.1.2.4.3 Clutter	There are various elements that cause clutter in the main navigation bar, i.e., a large number of links in the main navigation bar (Figure 4.1-7), the presence of a secondary navigation bar (Figure 4.1-8), and the long link labels in the main navigation bar. *4.1.2.4.3.1 Clutter problem 1: Large number of links* The navigation bar and its drop-down menus contain a large number of links that cause clutter. Therefore, the navigation bar and drop-down menus should be revised to determine if there are redundant or unnecessary links that can be removed or categorised into other main sections. Additionally, there are external links in the main navigation bar (as discussed in Section 4.1.2.4.2.2) that can be removed to further reduce clutter.

	4.1.2.4.3.2 Clutter problem 2: Secondary navigation bar The secondary navigation bar (Figure 4.1-8) is redundant and causes clutter. The three links that are in the secondary navigation bar are also available in the main navigation bar under the "Search & Find" drop-down menu. Many of the links that are available under the "Quick links" drop-down menu are also available in the main navigation bar. The links that are not in the main navigation bar, that are considered to be important, can be moved to the main navigation bar. The secondary navigation bar can then safely be removed. *4.1.2.4.3.3 Clutter problem 3: Long labels* Some link labels in the main categories of the main navigation bar, as well as in the drop-down menus, are too long, resulting in unnecessary clutter. Many of them can be shortened without making them less understandable. For example, the label "Search & Find" can be renamed to either "Search" or "Find", and "Research Help" can be renamed to "Help". Additionally, many link labels in the navigation bar and drop-down menus contain the terms "UCT Libraries" or "Library". This is redundant because there is enough context for the links that make it clear to the user that it is with reference to the library. These terms can be removed from most of the labels. For example, "About UCT libraries" can be renamed to "About" and "Library contacts" can be renamed to "Contact Us". Figure 4.1-9 shows where terms can be removed in the "About UCT Libraries" drop-down menu to make labels shorter and reduce clutter. The terms that are crossed out in the figure can be removed from the main navigation bar.

	 **Figure 4.1-9: UCT long link labels with redundant terms "Library" and "UCT Libraries"** The same problem was found in the internal pages and discussed in Section 4.1.3.4.3.1.
4.1.2.4.4 Novice user guidance	There is a lack of guidance for novice users due to a lack of tooltips. *4.1.2.4.4.1 Novice user guidance problem 1: Missing tooltips* None of the possibly unfamiliar links in the main navigation bar has tooltips. Therefore, users might have difficulty predicting where certain links will take them. For example, the term "Savvy Researcher Series" is unfamiliar and is unique to UCT. It should be renamed as mentioned in the "Labelling" heuristic (Section 4.1.2.4.1.1), if there is a more appropriate label for it, and it should have a descriptive tooltip. Only the three main links in the secondary navigation bar have tooltips. These tooltips can be used by adding them to the corresponding links in the main navigation bar.
4.1.2.4.5 Help documentation	The library website has a complete help section containing a collection of help documentation.

	This section might be difficult to locate via the main navigation bar because it is listed under the "Research Help" link. *4.1.2.4.5.1 Help documentation problem 1: Help incorrectly labelled* This link is incorrectly labelled, (as discussed "Labelling" in Section 4.1.2.4.1.2) because the drop-down menu provides more than just *research* help.
4.1.2.4.6 Efficiency features	Main navigation bars usually contain links to main sections of a website and the local navigation menus in main sections are used to navigate between the sub-sections. Therefore, links to sub-sections in the drop-down menus of the main navigation bar can be seen as "shortcuts", which is a useful efficiency feature.
4.1.2.4.7 Consistency	Four issues with regard to consistency are discussed below. *4.1.2.4.7.1 Consistency problem 1: External links do not open in new tabs consistently* Some of the external links or PDFs open in new tabs and others open in the same tab. Making them open in a new tab is a better option because it allows users to keep their position in the library website while they can navigate external websites or view PDFs in other tabs, as discussed in the summary of case study 1 (Section 4.1.5). Therefore, to improve consistency, all of the external links and PDFs should open in a new browser tab. However, the main navigation bar should ideally not contain external links at all, as discussed in "Organisation" in Section 4.1.2.4.2.2, because it causes problems with "Predictable behaviour" as discussed in Section 4.1.2.4.8.1. *4.1.2.4.7.2 Consistency problem 2: Secondary navigation bar position* The main navigation bar appears consistently at the same position on all pages; the secondary navigation bar, however, does not. On the homepage, there are other components between the main navigation bar and the secondary navigation bar. This will no longer be a problem if the secondary navigation bar is removed as suggested in "Clutter", Section 4.1.2.4.3.2. *4.1.2.4.7.3 Consistency problem 3: Inconsistent drop-down menus* Only some of the links in the main navigation bar have drop-down menus. There are three links that do not have drop-down menus. The links that do not have drop-down menus are either links to uncategorised sections (as discussed in the "Organisation" heuristic in Section 4.1.2.4.2.1) or links to external websites or subdomains of the library website.

	The behaviour of the main navigation bar can be made more predictable by moving these main links into other drop-down menus. The uncategorised pages ("News" and "Library Contacts") can be moved to the "About UCT Libraries" drop-down menu (as discussed in the "Organisation" heuristic, Section 4.1.2.4.2.1). The "Open Scholarship" link can be moved to the drop-down menus under "Services" or "Search & Find". The "Open Scholarship" link is a link to a subdomain of the library website, which can be seen as an external website. Linking from the main navigation bar to an external website also contributes to unpredictable behaviour. This problem is further discussed under "Predictable behaviour" in Section 4.1.2.4.8.1. *4.1.2.4.7.4 Consistency problem 4: Context not provided consistently* Context is provided in the main navigation bar, but not consistently. See "Context" in Section 4.1.2.4.9 for an explanation of how context is provided.
4.1.2.4.8 Predictable behaviour	The behaviour of some of the links in the main navigation bar is unpredictable because some of the links link to external websites. The purpose of a global navigation structure in large websites is to help the user navigate to different sections within the website. If the links in the navigation bar do not behave according to this rule, then the behaviour of the main navigation bar and its drop-down menus is unpredictable. *4.1.2.4.8.1 Predictable behaviour problem 1: Links to external websites or PDFs (link targets)* The expected behaviour of a global navigation menu is that it helps users to navigate to main sections within a website. The problem with the behaviour of a typical navigation menu in a library website is that it contains main links that navigate away from the library website to external websites, mainly subdomains. This behaviour is common in a library website, but it makes the behaviour of the links unpredictable. It also has a negative impact on "Controllability". Some links in this navigation bar open pages in the current website, while other links open external websites or PDFs. The links do not provide an indication of their behaviour. For example, the "Open Scholarship" link in the main navigation bar navigates to the subdomain http://www.openaccess.lib.uct.ac.za/. A better solution would be to restructure the website so that the main

	navigation bar does not contain any external links, but that these links are still easy to find. This alternative design solution is discussed in the summary of this section, in Section 4.4.1.
4.1.2.4.9 Context	Context is provided in the main navigation bars, but it is not done consistently. How context is provided is discussed here, but it is not listed as a problem since it is implemented well. The problem is rather with consistency and is listed as a problem under that heuristic in Section 4.1.2.4.7.4. The main navigation bar provides context in two ways. It gives a visual indication to the user where they are within the nine main categories, by styling the current link with a marker as shown in Figure 4.1-10. When the user hovers over that category, the current link in the drop-down menu of the current page is underlined as shown in Figure 4.1-11. However, it does not do so consistently. For example, it does not show context when the user is on the "Libraries & Collections" page. This is addressed as a consistency problem in Section 4.1.2.4.7.4. The secondary navigation bar also provides context in the same way that the main navigation bar does.  **Figure 4.1-10: UCT context in main navigation bar**  **Figure 4.1-11: UCT context in drop-down menu** Even though there are multiple "FAQ" links in the main navigation bar, it is clear which is which since they are sub-categorised under main headings, i.e., there is one under "Interlibrary Loans" and one under "Library help".

4.1.2.4.10 Task completion support	This heuristic and its sub-criteria do not apply to the components in this dialogue element.
4.1.2.4.11 Controllability	Users can easily navigate back to where they came from or to other specific pages by using the main navigation bar; therefore, the main navigation provides controllability sufficiently. External links that open in a new tab also allow a user to feel more in control.
4.1.2.4.12 Error recovery	This heuristic and its sub-criteria do not apply to the components in this dialogue element.
4.1.2.4.13 Error prevention	External links in the main navigation bar do not provide a visual indication that they will open an external website. *4.1.2.4.13.1 Error prevention problem 1: External link icon* The links that open an external website or PDF do not provide a visual indication as a warning that they will make the user navigate away from the website. The external links that open in the same tab cause the user to lose their position in the library website. It will be useful if all external links and PDFs open in a new tab so that users do not lose their position in the library website when they want to continue using it.
4.1.2.4.14 Feedback	This heuristic and its sub-criteria do not apply to the components in this dialogue element.

Table 4.1-2: Heuristic evaluation of UCT dialogue element 2: Main navigation bars

4.1.3 Local navigation structures

The local navigation structures of the UCT library website consist of a homepage and internal pages with local navigation structures that are consistent on most of the pages.

4.1.3.1 Dialogue element 3: Homepage contents

The position of this dialogue element is outlined in Figure 4.1-2 with the number 3, and the detail (the components in this dialogue element) is outlined in Figure 4.1-12. The title in the browser tab of the homepage is also part of this dialogue element and is shown in Figure 4.1-13. The homepage consists of ten components. The numbers in the list correspond to the numbers in the figures. The components in the figure are numbered from left to right.

The homepage contents contains the following ten components. The numbers in the list correspond to the numbers in Figure 4.1-12 and Figure 4.1-13:

1. Resource search feature (evaluated separately – see dialogue element 6)
2. Mini slideshow
3. Secondary navigation bar (evaluated separately – see dialogue element 2)
4. Library hours feature
5. News section
6. Group of links 1 (“Off-campus Login”, “Subject Guides”, “Subject Librarians”, “Interlibrary Loans”, “My Library Card”, “Ask a Librarian”)
7. Group of links 2 (“Facebook”, “Twitter”, “Pinterest”, “YouTube”, “Instagram”, “Open Scholarship”, “OpenUCT”, “Library and Information Studies Centre”, “Alumni Service”, “Google Scholar”)
8. New books feature with links
9. UCT “bookshelf” feature with links
10. Page title “Libraries” (Figure 4.1-13)

Figure 4.1-12: UCT homepage contents

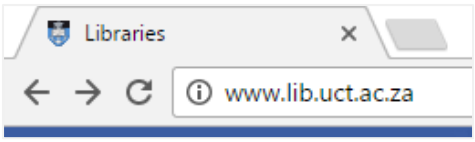
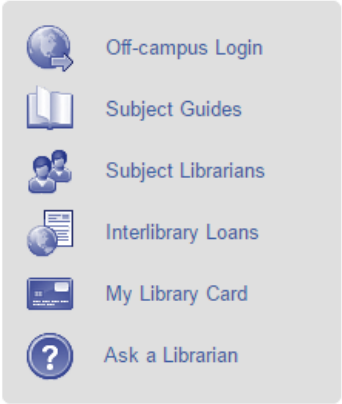


Figure 4.1-13: UCT homepage title

4.1.3.2 Heuristic evaluation of dialogue element 3: UCT homepage contents

The table below contains the discussion of each of the problems that were found with the components in this dialogue element. The problems are summarised in the case summary in Section 4.1.5.

Heuristic	Evaluation
4.1.3.2.1 Labelling	The majority of labels in the homepage consist of familiar labels. Some minor problems are discussed below. *4.1.3.2.1.1 Labelling problem 1: Page title* The page title of the homepage is "Libraries" (Figure 4.1-13). This goes against homepage title labelling conventions, which states that it should contain the name of the *website* followed by a brief description of the website or page. A better title would therefore be "UCT Libraries | Home". *4.1.3.2.1.2 Labelling problem 2: Confusing icon in slideshow* In the slideshow (component 2 in Figure 4.1-12) there is a control button that allows the user to pause the slideshow. Refer to Figure 4.1-14 for a more detailed image of the component.  **Figure 4.1-14: UCT homepage component 2 – slideshow** The icon that is used for the control (outlined in Figure 4.1-14) is misleading because it is an arrow (►) that can either be interpreted as a "next" button that allows the user to move to the next slide, or as a "play" button that allows the user to start the slideshow if it has been paused. Both interpretations are incorrect, however, because it is a button that allows the user to "pause" the slideshow. This behaviour is only clear when the user hovers over the icon. When the mouse cursor is positioned over

	the icon, it changes to a "pause" icon (II), and when it is clicked, the slideshow is paused. The icon should therefore be changed to the appropriate "pause" icon. This is a minor problem since the slideshow is an unnecessary component of a library homepage, which can be removed.
4.1.3.2.2 Organisation	The information on the homepage is uncategorised. *4.1.3.2.2.1 Organisation problem 1: Uncategorised links* Component 6 in Figure 4.1-12 is a container that consists of a collection of links (a more detailed image of component 6 is shown in Figure 4.1-15). It is not immediately clear what types of links are available since the component does not have a heading. It simply looks like an unsorted collection of links.  Off-campus Login Subject Guides Subject Librarians Interlibrary Loans My Library Card Ask a Librarian **Figure 4.1-15: UCT homepage component 6** Component 7 in Figure 4.1-12 also consists of a collection of uncategorised links (a more detailed image of component 7 is shown in Figure 4.1-16). The link images make it look like a banner with ads because all of the links are icons or logos, which may result in users avoiding the component altogether.  Open Scholarship OpenUCT Library and Information Studies Centre Alumni Services Google scholar **Figure 4.1-16: UCT homepage component 7**

	All the links in these components are typical library quick links. These components can be improved by grouping the links in the two components together, reorganising/restructuring them, and adding a descriptive component heading. The social media links in component 7 (Figure 4.1-16) can be removed from the homepage and placed in the footer, replacing the existing social media links in the footer. This suggestion was made in Section 4.1.3.2.3.2 to remove clutter from the homepage.
4.1.3.2.3 Clutter	There are many components on the homepage that are unnecessary and cause clutter. It is clear from this discussion that there is an abundance of redundancy on the homepage and that this redundancy causes the largest number of problems on the homepage. *4.1.3.2.3.1 Clutter problem 1: Homepage too long* The homepage is too long and subsequently requires the user to scroll too much. Some of the components can be rearranged and removed in order to make the page shorter, and therefore, less cluttered. The rest of the problem discussions address ways in which this can be achieved. *4.1.3.2.3.2 Clutter problem 2: Two different containers with uncategorised links* The links in components 6 and 7 (in Figure 4.1-12) can be seen as "quick links" as discussed in "Organisation" Section 4.1.3.2.2.1. These two components' links can be combined into a single structure with the heading "Quick links" and some of the less important links (that are easy to find via the main navigation bar) can be removed as suggested in "Organisation" Section 4.1.3.2.2.1. *4.1.3.2.3.3 Clutter problem 3: Secondary navigation bar* The secondary navigation bar (component 3 in Figure 4.1-12) which was discussed as a separate dialogue element in the global navigation structure section (Section 4.1.2.3), is redundant and can be removed to reduce clutter on the homepage (and internal pages Section 4.1.3.4.3). *4.1.3.2.3.4 Clutter problem 4: Resource search feature* The resource search feature (component 1 in Figure 4.1-12), is available on the "Search & Find" page that is easily accessible by clicking on "Search & Find" in the main navigation bar. Related studies reported that a resource search feature on the homepage can lead to failed searches or unexpected results because novice users tend to use it as an "all-encompassing search for the entire site" (Swanson & Green 2011:227). They commented that the

same problems do not occur when the feature is available on a secondary page. Therefore, it can be removed from the homepage to reduce clutter and reduce errors that are caused by resource search boxes that appear on homepages.

4.1.3.2.3.5 Clutter problem 5: The "New Books" feature

The "New Books" feature (component 8 in Figure 4.1-12) causes unnecessary clutter. A more detailed image of component 7 is shown in Figure 4.1-16.

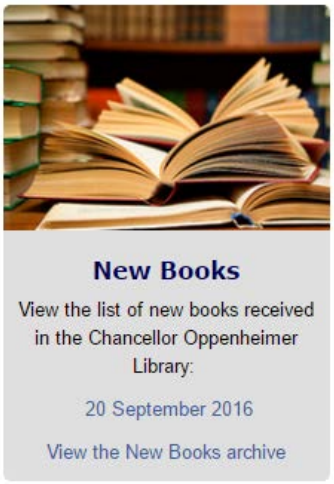


Figure 4.1-17: UCT homepage component 8 – new books

The sole purpose of this component is to provide a link to a list of new books that have been added to the library.

There are two links in the component. The first one is a date that links to a list of books that were added on that date and the second link "View the new books archive" links to a list of dates on which new books were added. The first link can be accessed on the page that the second link links to; therefore it is redundant and can be removed.

Clutter can be reduced on the homepage by removing the component altogether and listing the link "View the New Books archive" in a quick links section. The descriptive text "View the list of new books received in the Chancellor Oppenheimer Library" can be added to the link as a tooltip.

4.1.3.2.3.6 Clutter problem 6: Redundant social media links

The social media links in the homepage contents are redundant. There are social media links on the homepage (in component 7 in Figure 4.1-12) and in the footer (in component 7 in Figure 4.1-5). More detailed images of these components are shown in Figure 4.1-18 and Figure 4.1-19.

	 **Figure 4.1-18: UCT social media links in homepage**  **Figure 4.1-19: UCT social media links in footer** The links in the footer are incomplete because the Pinterest, YouTube and Instagram links are missing. Additionally, it contains clutter because there are unnecessary labels next to the social media icons. This problem can be fixed by replacing the social media links that are in the footer with the social media links that are on the homepage as suggested in Section 4.1.2.2.3.1 and removing the social media links that are in the homepage contents. As a result, all of the library's social media links will be available on all the pages because it will be part of the global navigation structure and the homepage will be less cluttered.
4.1.3.2.4 Novice user guidance	There are various features for novice users on the homepage, but they may be difficult to use or locate. *4.1.3.2.4.1 Novice user guidance problem 1: Slideshow* The slideshow (component 2 in Figure 4.1-12) on the homepage seems like it is intended for novice users, to advertise library features, such as, "Open Monograph Platform", "Library Quality Survey", "Digital Library Services", "Savvy Researcher Series", and "Test your library knowledge". For example, "Test your library knowledge" links to library quizzes that users can use to test their library knowledge. The page that it links to features a collection of videos, slides, and quizzes to help novice users learn how to use the library website. This page is located in the "library help" section. However, the slideshow is not necessarily a useful feature for novice library users. Library users might not know what any of the terms in the slideshow refer to, or they might struggle with the slideshow controls (as discussed in "Labelling", Section 4.1.3.2.1.2). In addition to these problems, a negative aspect of a slideshow is that it loops through pieces of information, and impatient users might not wait until the feature has looped through all the slides, to see what is available. Therefore, it can be difficult to understand and use, which might intimidate users, making them avoid it altogether.

	4.1.3.2.4.2 Novice user guidance problem 2: Lack of descriptive tooltips There is a lack of additional explanations for links in the form of tooltips. Some of the links on the homepage can be made more explanatory with the addition of tooltips.
4.1.3.2.5 Help documentation	The library website has an entire help section that contains various help documentation. This section can easily be located via the "Research Help" link in the main navigation bar. In addition to the link in the main navigation bar, there is a link on the homepage to a page in this section in the "Test your library knowledge" slide in the slideshow. Although this link is not very useful for locating the library's help documentation, the link in the main navigation bar is sufficient because it can easily be located on the homepage. However, it should be renamed to "Help", as suggested in Section 4.1.2.4.1.2.
4.1.3.2.6 Efficiency features	The resource search feature (component 1 in Figure 4.1-12) can be considered to be an efficiency feature since it provides users with shortcuts to resources. However, having it on the homepage might have a negative influence on the overall usability of the homepage, as mentioned in "Clutter", Section 4.1.3.2.3.4. Therefore, suggestions in Section 4.1.3.2.3.4 recommend the removal of this component from the homepage.
4.1.3.2.7 Consistency	There are some inconsistencies between the components on the homepage that cause problems. *4.1.3.2.7.1 Consistency problem 1: Component structures* Each of the components on the homepage has different structures and looks different. The different components do not all have headings and those that have headings have headings that look different between components. The fact that some of the components do not have headings results in the component not having context. The homepage looks like a collection of unrelated components were placed together, and this makes it look even more cluttered than it is.
4.1.3.2.8 Predictable behaviour	The behaviour of some of the components is unpredictable. *4.1.3.2.8.1 Predictable behaviour problem 1: Links that navigate away from the library website* The behaviour of the links in the "bookshelf" feature (component 9 in Figure 4.1-12) is unpredictable because the links direct to the "publications" section of the *main* university website instead of the *library* website. When users click on the links that navigate to a website with a

	different visual design and structure, it can cause confusion if they are not aware that they have navigated away from the library website.
4.1.3.2.9 Context	There is a lack of context for some of the components on the homepage and the page title. *4.1.3.2.9.1 Context problem 1: Lack of context in title* The homepage title (Figure 4.1-13) provides some degree of context because it contains an appropriate Favicon (the icon on the left side of the title label), but it does not contain the name of the page or the website. These two aspects are crucial for a webpage title for the purpose of providing context as well as indexing the page. Refer to "Labelling" in Section 4.1.3.2.1.1 for a description of the problem and suggestions. *4.1.3.2.9.2 Context problem 2: Component headings* Some of the components on the homepage have headings and others do not. Adding headings to all of the components can help provide users with context that helps them understand the purpose of each of the components. This problem is also addressed in "Organisation" Section 4.1.3.2.2.1, as headings will help with the categorisation of certain components.
4.1.3.2.10 Task completion support	There is some support for memory load on the homepage. The colour of links changes after they are visited, helping users remember what pages they have visited.
4.1.3.2.11 Controllability	All external links in the homepage contents open in a new tab, which contributes to controllability positively. Additionally, some of the components with internal navigation also provide some form of controllability, as discussed below. The slideshow on the homepage (component 2 in Figure 4.1-12) gives the user some degree of control since it allows users to skip slides or go back to previous slides. It can also be paused, but this is not clear since the icon that is used to convey that the slideshow can be paused is incorrect. This problem is discussed in "Labelling", Section 4.1.3.2.1.2. The news section (component 5 in Figure 4.1-12) is easy to navigate since it provides numbers at the top that allow the user to see older news when they click on it.
4.1.3.2.12 Error recovery	This heuristic and its sub-criteria do not apply to the components in this dialogue element.

4.1.3.2.13 Error prevention	This heuristic and its sub-criteria do not apply to the components in this dialogue element.
4.1.3.2.14 Feedback	This heuristic and its sub-criteria do not apply to the components in this dialogue element.

Table 4.1-3: Heuristic evaluation of UCT dialogue element 3: Homepage contents

4.1.3.3 Dialogue element 4: Internal pages content

The position of this dialogue element is outlined in Figure 4.1-3 with the number 4, and the detail (the components in this dialogue element) is outlined in Figure 4.1-20 and Figure 4.1-21.

It should be noted that the screenshots that are used show a single page, the "Library Help" page (Figure 4.1-3 and Figure 4.1-20), but that they represent all of the internal pages. The website is divided into various sections that can be found in the internal pages and all of these pages have roughly the same structure and are evaluated as a single dialogue element.

The internal page contents contain the following six components. The numbers in the list correspond to the numbers in Figure 4.1-20 and Figure 4.1-21:

1. Breadcrumb trail
2. Local navigation menu
3. Content
4. Social media links
5. "Back to top" button
6. Page title "Research Help | Libraries" (Figure 4.1-21)

Problems with these components are discussed in Table 4.1-4. The majority of problems apply to all of the internal pages.

Some pages have additional components on the right side of the page; these components are not addressed because they are seen as part of the page content. They provide contextual links and they are not part of the structure of typical pages.

Figure 4.1-20: UCT internal pages structure (The "Library Help" page represents all internal pages)

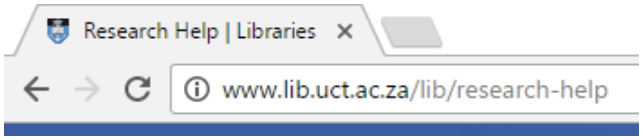


Figure 4.1-21: UCT internal page – research help – title

4.1.3.4 Heuristic evaluation of UCT dialogue element 4: Internal pages structure

The table below contains the discussion of each of the problems that were found with the components in this dialogue element. The problems are summarised in the case summary in Section 4.1.5.

Heuristic	Evaluation
4.1.3.4.1 Labelling	The main labelling problems that were found were problems relating to the webpage titles. Page titles do not sufficiently represent the page content of the internal pages.

4.1.3.4.1.1 Labelling problem 1: Website identifier is incomplete in page titles

Page titles are labelled according to the web development convention that states that they should contain the name of the page and the name of the website. This provides a user with context as to their position within the web and the website they are browsing (as explained in "Context" Section 4.1.3.4.9). However, the website name in the title of the UCT library webpages is "Libraries", which does not specifically identify it as UCT's libraries and consequently does not provide context sufficiently. This can lead to confusion when the page title is used to identify pages in a search engine results. Therefore, "Libraries" should be changed to "UCT Libraries".

4.1.3.4.1.2 Labelling problem 2: Labels in some titles are too long

Additionally, the names of the pages (that must appear before the page name in a title) are too long, which results in titles that are too long in some of the webpage titles.

Page *titles* should not be too long because there is limited space for characters in browser tabs. For example, the title of the "History of the UCT Libraries" page is "History of the UCT Libraries | Libraries", as shown in Figure 4.1-22. It is clear from the image that the full title is not visible, due to a lack of space.

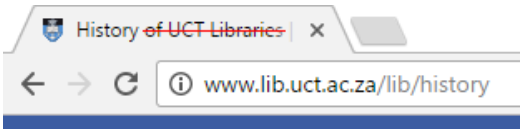


Figure 4.1-22: UCT long page title

In many instances, the labels are too long because they contain the text "UCT Libraries", which is redundant in the case of page titles because the website name "UCT Libraries" should appear right next to the page name. Therefore, the title of the History page: "History of UCT Libraries | UCT Libraries" can be renamed "History | UCT Libraries".

The page name that is in the title should correspond to the page heading, but it should be a shorter version of it. The page headings can be longer and more descriptive.

See "Clutter" in Section 4.1.3.4.3.1 for related problems regarding the length of labels in local navigation menus.

4.1.3.4.2 Organisation	The organisation of some of the internal pages is confusing. The poor organisation of some sections results in blank pages or pages with missing local navigation structures. This problem also causes various consistency issues, as discussed in Section 4.1.3.4.7. The two problems discussed here have a negative impact on various other usability aspects of the library website, i.e., it makes the pages inconsistent (see "Consistency" in Section 4.1.3.4.7), it limits controllability in sections (see "Controllability" in Section 4.1.3.4.11), and it makes the behaviour of the local navigation menu unpredictable (see "Predictable behaviour" in Section 4.1.3.4.8). *4.1.3.4.2.1 Organisation problem 1: Blank pages/missing page content* Some of the pages are blank, i.e., they contain only a local navigation menu, a breadcrumb trail, and a heading, but no content. This can be as a result of poor website organisation or planning. For example, the "Research Help" page is blank (http://www.lib.uct.ac.za/lib/research-help, Figure 4.1-23). This page is the main page of the website's "help" section. There are two ways in which the problem can be improved. The page can either be removed completely, or it can contain an introductory paragraph for the section.  **Figure 4.1-23: UCT blank internal page – Research Help** *4.1.3.4.2.2 Organisation problem 2: Missing local navigation menus* Some pages have the opposite problem as the previous discussion of blank pages. Some pages have page content but lack a local navigation menu and breadcrumb trail. For example, the "Services" page (http://www.lib.uct.ac.za/lib/services, Figure 4.1-24) does not have these local navigation structures.

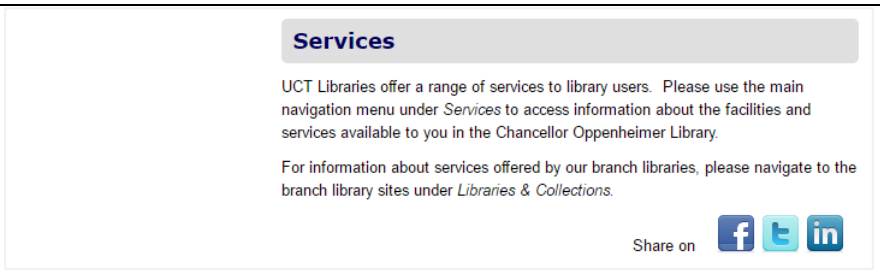


Figure 4.1-24: UCT internal page with missing local navigation menu – Services

A local navigation menu should consistently stay the same (at the same position) on all of the pages in the same section of a website. When a user clicks on a link in the local navigation menu of a section and the link navigates to a page that does not have a local navigation menu, it makes it seem like the menu "disappears" when the user clicks on the link. This results in problems with controllability. See "Controllability" in Section 4.1.3.4.11.

4.1.3.4.3 Clutter

The internal pages are relatively clutter free. However, there are some components with long labels, which makes the webpages appear cluttered.

Clutter can be further reduced if the clutter problems addressed in the global and local navigation menus are fixed, i.e., the removal of the redundant secondary navigation bar (Section 4.1.2.4.3.2) and the shortening of long link labels (Section 4.1.2.4.3.3).

4.1.3.4.3.1 Clutter problem 1: Long link labels in local navigation menus

Some of the labels of the local navigation menu links in the internal pages are too long.

Long *title* labels was listed in "Labelling" as a problem (Section 4.1.3.4.1.2) because there is a limit to the number of characters that can be displayed in a browser tab, making it a "Labelling" problem. However, long link labels is listed as a "Clutter" problem in this section because although there is nothing limiting the length of link labels, they do tend to make an interface look cluttered, especially when the labels contain a large number of redundant terms as discussed here.

The labels in the links of local navigation menus can be shortened by using the same labels that are used in the page titles for page names, according to the suggestions made to shorten page titles in Section 4.1.3.4.1.2.

In many instances, the labels are too long because they contain the text "UCT Libraries" or "Library". This is redundant as there is enough context

	for the links. This problem was also addressed in "Clutter" in the main navigation bar (Section 4.1.2.4.3.3) because it caused clutter in the main navigation bar. Figure 4.1-25 shows how the majority of labels on the history page can be shortened.  **Figure 4.1-25: UCT long labels** Removing all the redundant words as shown in Figure 4.1-25 will make the labels shorter and it will take up less space, reducing clutter. Conversely, it is acceptable if the page heading is longer and more descriptive, for example, "History of the UCT Libraries". *4.1.3.4.3.2 Clutter problem 2: Redundant secondary navigation bar* The redundant secondary navigation bar also causes clutter on the internal pages.
4.1.3.4.4 Novice user guidance	There are no problems with novice user guidance. A positive aspect related to this heuristic is mentioned below. **Positive aspect:** Many of the internal pages provide descriptions of the main content of the page, for example, the term "Savvy Researcher Series" might be unfamiliar to novice users (as discussed in the "Labelling" heuristic in dialogue element 2, Section 4.1.2.4.4.1), however, if the user visits the page, it provides a clear description of the term. The "Savvy Researcher Series" page provides the following description: > "Hosted annually by UCT Libraries, Savvy Researcher is a collective series of seminars and workshops aimed at postgraduate students. The series targets all aspects of the postgraduate experience, covering numerous topics that feed into the research cycle." http://www.lib.uct.ac.za/lib/savvy-researcher-workshop-series/

	Some pages also provide advice for using the website or finding resources. For example, on the "Services" page the user will find the following advice: "UCT Libraries offer a range of services to library users. Please use the main navigation menu under Services to access information about the facilities and services available to you in the Chancellor Oppenheimer Library. For information about services offered by our branch libraries, please navigate to the branch library sites under Libraries & Collections." http://www.lib.uct.ac.za/lib/services Therefore, there is sufficient novice user guidance in the internal pages.
4.1.3.4.5 Help documentation	The main help section of the library website, "Research Help", can cause some confusion due to the following problems. There is also a lack of supplemental navigation systems. *4.1.3.4.5.1 Help documentation problem 1: Blank main page* The "Research Help" page is blank, as discussed under the "Organisation" heuristic in Section 4.1.3.4.2.1. This problem reduces the usability of the help section. See Section 4.1.3.4.2.1 for suggestions. *4.1.3.4.5.2 Help documentation problem 2: Incorrect section name* The help section is incorrectly named "Research Help" (as discussed in Section 4.1.2.4.5.1) and can be accessed by clicking on the "Research Help" link in the main navigation bar. Novice users might avoid clicking on the link, thinking that it might not contain help documentation that is appropriate to them. The section contains more than just *research* help. Therefore, the section and all links associated with it should be renamed to "Help". *4.1.3.4.5.3 Help documentation problem 3: Lack of supplemental navigation systems* A supplemental navigation system for this website, such as a sitemap, could not be located in the internal webpages of this website.
4.1.3.4.6 Efficiency features	There are not many sub-criteria that are applicable to this dialogue element. One positive aspect is discussed below. **Positive comment:** The "Back to top" link that appears at the bottom of long pages can be considered a useful shortcut for improving efficiency.
4.1.3.4.7 Consistency	Many pages lack some of the core components of the local navigation structure, such as page content, a breadcrumb trail, or a navigation menu.

4.1.3.4.7.1 *Consistency problem 1: Missing local navigation menu*

As discussed under the "Organisation" heuristic (in Section 4.1.3.4.2.2), some of the pages lack core local navigation components such as a local navigation menu and a breadcrumb trail. To ensure consistency, all internal pages should have a local navigation menu and a breadcrumb trail.

4.1.3.4.7.2 *Consistency problem 2: Inconsistent context in local navigation menus*

One of the usable features of the local navigation menus is that it indicates the user's current position within the website by highlighting the current link (the link of the current page), providing the user with context. See "Context" (in Section 4.1.3.4.9) for more details.

Context is provided in the local navigation menus by making the link of the current page bold and underlined in the local navigation menu. It is not indicated in the local navigation menus consistently on all the pages, however. The same problem was found in the global navigation structure.

For example, in the "Alumni Services" section of the website, context is provided if the user is on the "Resources for Alumni" page by making the current link bold and underlined, as shown in Figure 4.1-26 with the number 1. However, if the user is on the "Supporting Alumni" page (the main page of the section), context is not provided because the link is not bold and underlined, as shown in Figure 4.1-26 with the number 2.

Figure 4.1-26: UCT internal pages – inconsistent context

4.1.3.4.7.3 *Consistency problem 3: Inconsistent size of local navigation menu*

The local navigation menu sizes change between pages in the same section, depending on the users' context, when it should not. There are two reasons for the size change.

Firstly, it changes based on the amount of space that the links within it take up. Current links are bold, which makes the link take up more space. For example, when the user is on the "Collection Development Guidelines"

page in the "About" section (see Figure 4.1-27), the current link in the local navigation menu is bold, and as a result of not enough horizontal space, it takes up two lines when it is the current link. As a result, the local navigation menu's size increases in length. In Figure 4.1-27 the same local navigation menu is shown as it appears on two different webpages. Even though it is the same menu, it looks like two different menus because of the different sizes.

Figure 4.1-27: UCT internal pages – local navigation size

Secondly, the size changes because some of the links have submenus that are not visible on all the pages. The submenus are only visible if a link that has a submenu is the current link. In Figure 4.1-28 the same local navigation menu is shown as it appears on two different webpages. However, when the user is on the "Library Help page", there are 6 extra sub-links in the local navigation menu that are not visible when the user is on the "Ask a Librarian" page.

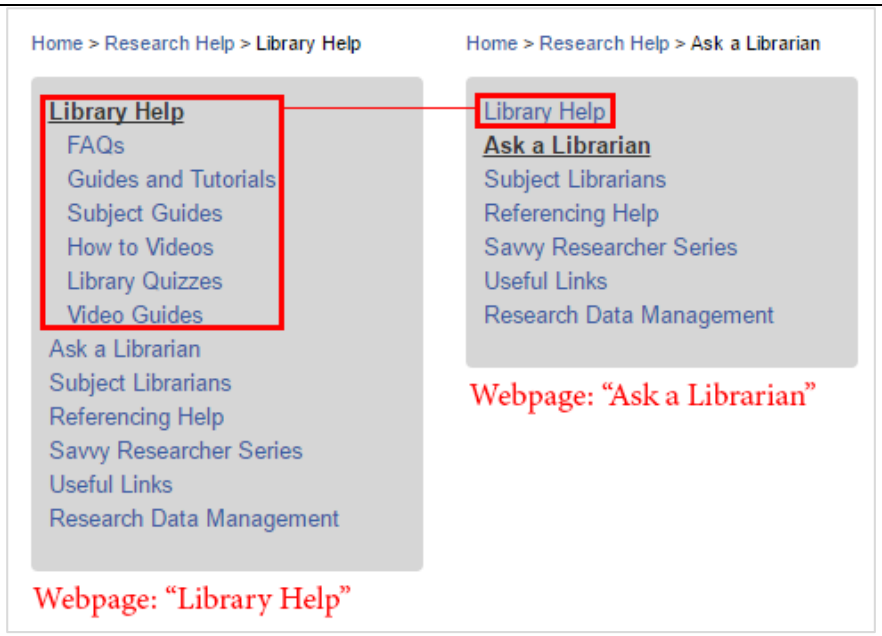


Figure 4.1-28: UCT local navigation menu size change

This is a consistency issue because the local navigation menus should consistently stay the same on all the pages.

4.1.3.4.8 Predictable behaviour

Some of the links in the local navigation menus have unpredictable behaviour because the expectation is that all the links open a page within the section, which in some cases it does not (as discussed in Section 4.1.2.4.8.1).

4.1.3.4.8.1 Predictable behaviour problem 1: PDF links & external websites

Some of the links in the local navigation menu open external websites or PDFs in the same tab, which makes it navigate away from the library website. For example, the "UCT Libraries Annual Report 2014" link in the local navigation menu on the "About us" page navigates to a PDF on an external website. The links in the local navigation menus should not allow the user to navigate away from the current section or website, as this causes confusion and they lose their position in the website. As recommended in Section 4.1.2.4.8.1, all external websites and PDFs must open in a new tab and provide some sort of visual indication that they open a PDF or external website.

This problem was discovered in dialogue element 1 and is further discussed in the summary of the chapter, Section 4.4, as a new sub-criterion.

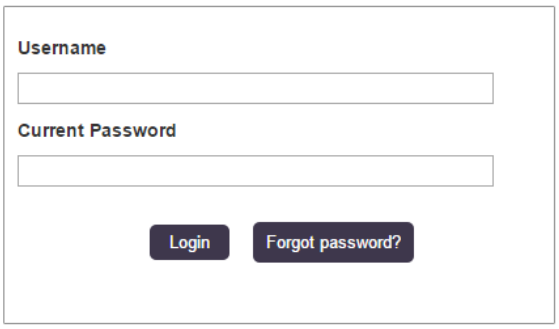
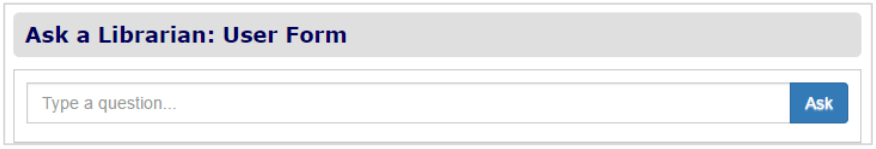
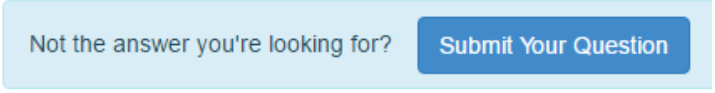
4.1.3.4.9 Context

Context is provided in some components of the internal pages, and in others, it is lacking, which is a consistency issue rather than a context issue.

There is a lack of context in the title as information about the page and the

	website is not sufficiently provided. This is addressed in "Labelling" in Section 4.1.3.4.1. Two positive aspects related to this heuristic are discussed below. **Positive aspect 1**: Users' context within the website is provided in various components of the website, i.e., with two components in the internal pages as well as in the main navigation bar, as mentioned in global navigation Section 4.1.2.4.9. The only problem is that it is not provided on all pages, which is a consistency issue, see "Consistency" (in Section 4.1.3.4.7.2) for a discussion of the problem. **Positive aspect 2:** The university emblem is provided in the browser tab next to the title as a Favicon (as shown in Figure 4.1-21), which helps provide context. The context within the web as a whole can be improved (as discussed in "Labelling" Section 4.1.3.4.1.1) by identifying the website more specifically with "UCT Libraries" instead of just "Libraries".
4.1.3.4.10 Task completion support	The "Off-campus login" form does not provide any form of task completion support. A positive aspect is also discussed below. **Positive aspect**: There is some support for task completion in the local navigation menus. The colour of the links in the local navigation bar changes to purple if they have been visited, reducing memory load. As a result, the user is not required to remember what pages they have visited. *4.1.3.4.10.1 Task completion support problem 1: "Off-campus login" form* The form is not supplemented with any form of guidance that helps the user to fill in the correct details. For example, placeholder text can be provided to show the format of the username. Users should also be provided with the option to reset their password even before trying and failing to log in.
4.1.3.4.11 Controllability	The consistency and organisation problems with the local navigation menus cause controllability problems as discussed below. A positive aspect is also discussed below. **Positive aspect:** The links in the breadcrumb trails are interactive, allowing the user to go back to any section of the breadcrumb trail. *4.1.3.4.11.1 Controllability problem 1: Missing local navigation bars* Some of the pages do not contain local navigation bars as discussed in "Organisation", in Section 4.1.3.4.2.2. This problem also has a negative

	impact on controllability. *4.1.3.4.11.2 Controllability problem 2: Hidden links on local navigation menus* The local navigation bars that do not show all the links that are available within the section (as discussed in Section 4.1.3.4.7.3) can have a negative impact on the user's ability to control the sequence of their actions since they cannot always see all of the links that are available within the section.
4.1.3.4.12 Error recovery	This heuristic was tested by filling in the "Off-campus login" form and observing how the system responds to incorrect or blank data. The "Off-campus login" form can be accessed by clicking on the link with the corresponding label in the header. When blank data are submitted, the user is presented with the information shown in Figure 4.1-29.  **Figure 4.1-29: UCT "Off-campus login" form** *4.1.3.4.12.1 Error recovery problem 1: Error message incorrect* The system detects that an error was made and uses plain language to communicate the problem, but the error message that is provided does not describe the error correctly. It states that the password is incorrect, but the problem is that the form fields are empty. The same message is provided when incorrect data are filled in. *4.1.3.4.12.2 Error recovery problem 2: Solution not simplified* The system does not provide clear instructions for a simple solution. It states that the user should visit the URL: "https://password.uct.ac.za". The URL is not a link that the user can simply click on. The user has to copy and paste it into the browser address bar. The URL takes the user to a new login form (shown in Figure 4.1-30) where the user can fill in a username and password, and below the form, there is a button with the text "Forgot password?". The assumption is the user is supposed to click on this button.

	 **Figure 4.1-30: UCT password reset button** A simpler solution would have been to provide a "Forgot password" button on the original form so that the user would not have to go through unnecessary steps to find the link.
4.1.3.4.13 Error prevention	There is no visual indication provided with external links that they will open external websites. *4.1.3.4.13.1 Error prevention problem 1: No external link "warning" icons* Users might click on various links in the website in order to explore the structure. They might not prefer to click on external links to navigate away from the website, but there are no visual indicators (such as the icon shown in Figure 2.2-1) that warn them when they will navigate away from the library website.
4.1.3.4.14 Feedback	This heuristic was tested by using the "Ask a librarian" feature (Figure 4.1-31) on the "Ask a Librarian" page and looking at how the system provides feedback after the form has been submitted. The "Ask a librarian" form is a standard feature on academic library websites.  **Figure 4.1-31: UCT "Ask a Librarian" feature** When a user enters and submits a question on the "Ask a Librarian" page, the user is navigated to the http://libanswers.lib.uct.ac.za/ subdomain. If the answer is not available on the result page, the user is provided with the option to submit a new question by clicking on the button shown in Figure 4.1-32.  **Figure 4.1-32: UCT submit a question to "Ask a librarian"**

If a user clicks on the button, a form is provided on top of the current webpage. The form uses standard HTML validation to check data. Standard HTML validation provides sufficient feedback when empty form fields are submitted.

For testing purposes, the form was submitted using the data shown in Figure 4.1-33.

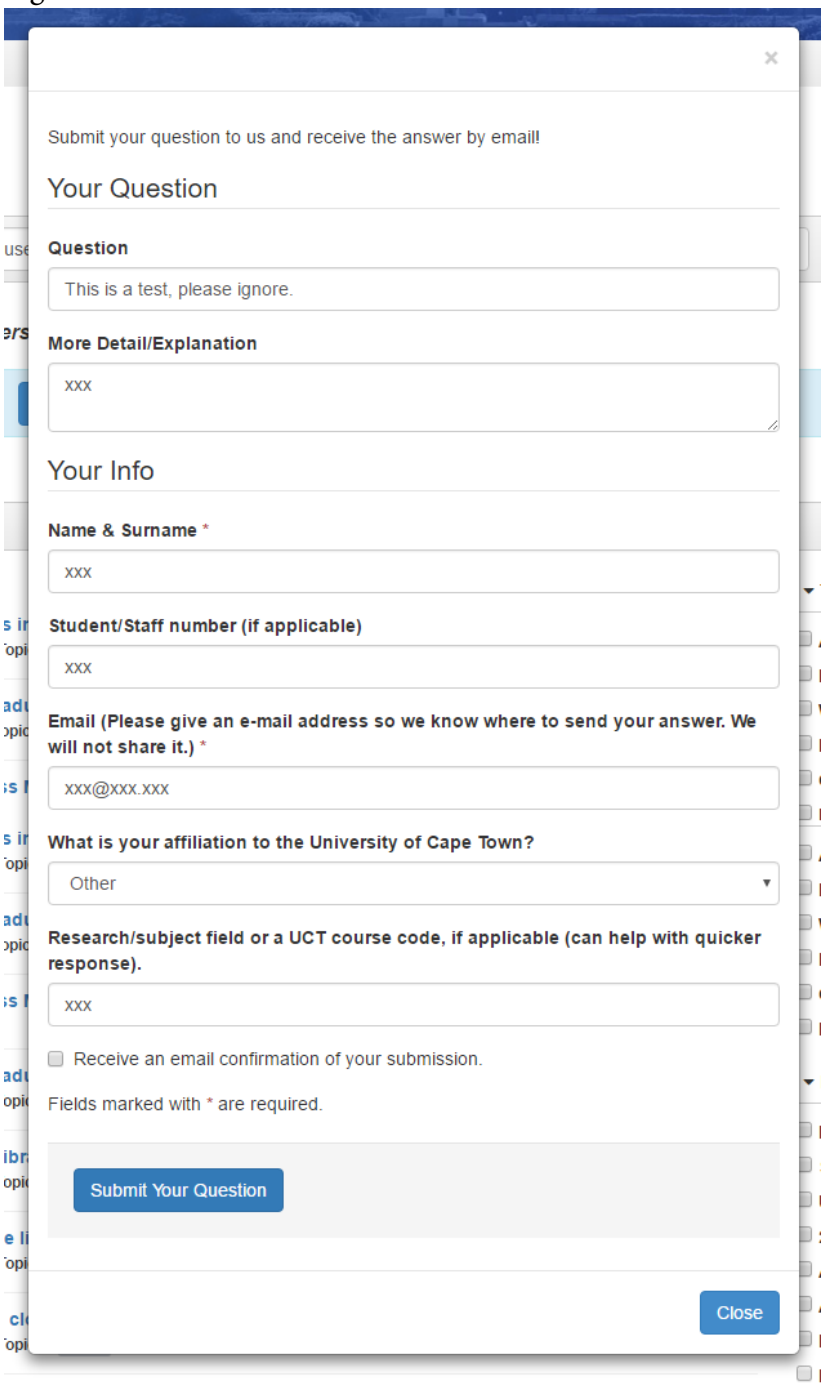


Figure 4.1-33: UCT "Ask a librarian" form

After the form is submitted by clicking on the "Submit your question" button, the form data are erased and the user is presented with the message

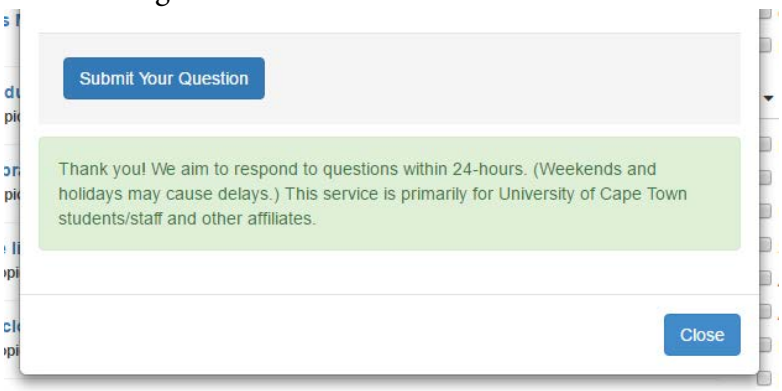
	shown in Figure 4.1-34.  **Figure 4.1-34: UCT "Ask a librarian" feedback** The feedback provided by the "Ask a librarian" form is sufficient.

Table 4.1-4: Heuristic evaluation of UCT dialogue element 4: Internal pages content

4.1.4 Search systems

The UCT library website has both a site search feature and a resource search feature. The site search feature is located in the header and the resource search feature is located on both the homepage and the "Search and Find" page.

4.1.4.1 Dialogue element 5: Site search feature

The location of this dialogue element on the website is outlined in Figure 4.1-2 and Figure 4.1-3 with the number 5, and the detail (the components in this dialogue element) is outlined in Figure 4.1-35).

The site search feature contains the following two components. The numbers in the list correspond to the numbers in Figure 4.1-35:

1. Input box
2. Submit button

Figure 4.1-35: UCT site search feature

When a user types in a query in the search box and submits it, it directs the query to a new webpage (http://www.lib.uct.ac.za/search/) and overlays the page with a scrollable "lightbox" that contains the search results as shown in Figure 4.1-36. A lightbox is a website feature that overlays content over a webpage while dimming out the rest of the webpage. Figure 4.1-36

shows what the search results look like in the lightbox if the user searches for the term "catalogue".

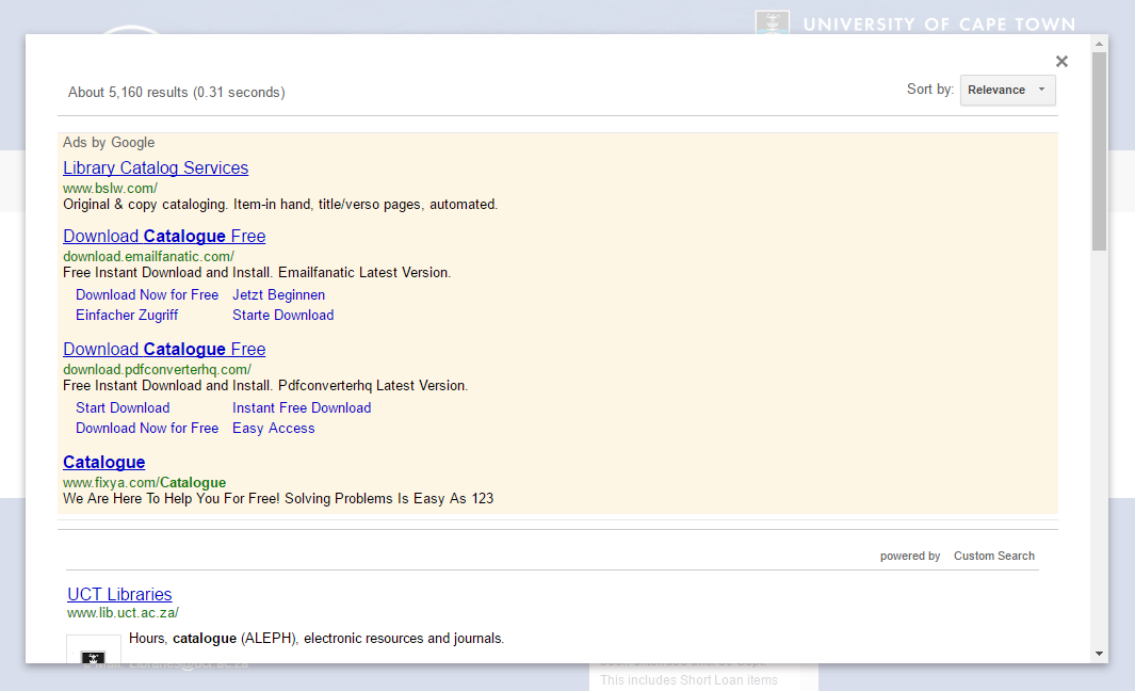


Figure 4.1-36: UCT site search feature lightbox

Figure 4.1-37 shows what the search page (http://www.lib.uct.ac.za/search/) looks like if the lightbox is removed (by clicking on the "x" in the top right corner).

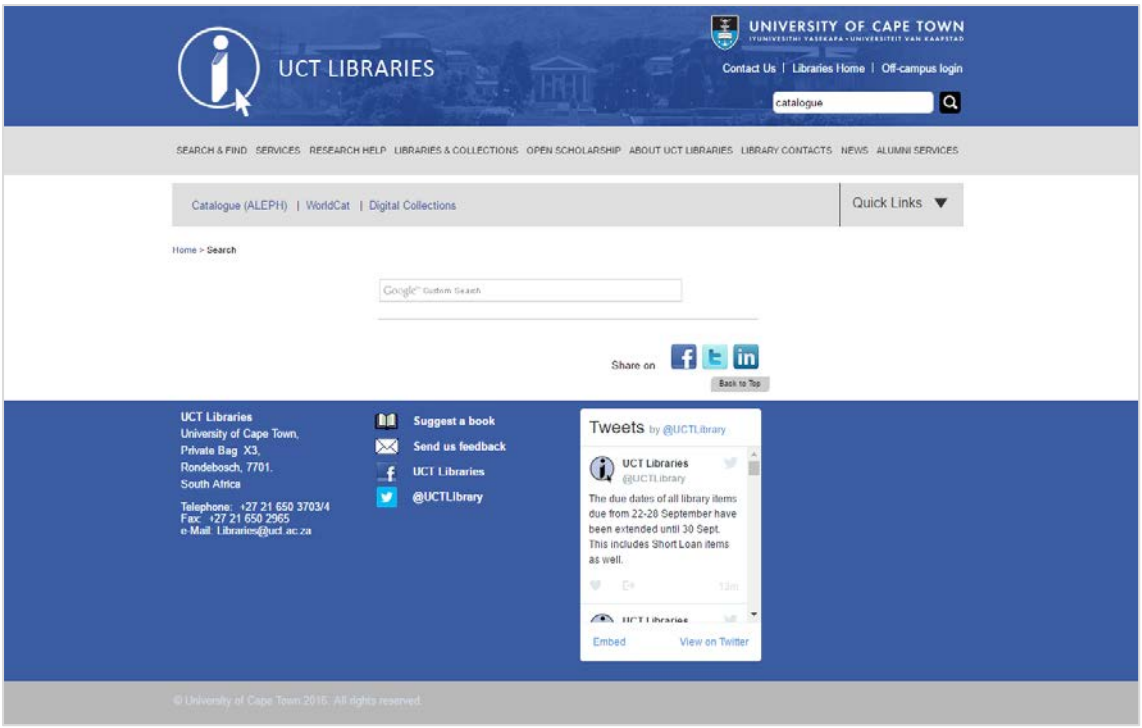


Figure 4.1-37: UCT site search results page

The lightbox and the destination page are evaluated together with the search box.

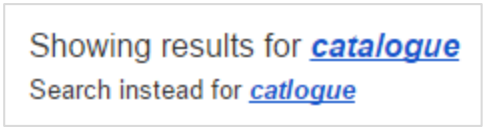
4.1.4.2 Heuristic evaluation of UCT dialogue element 5: Site search feature

The table below contains the discussion of each of the problems that were found with the components in this dialogue element. The problems are summarised in the case summary in Section 4.1.5.

Heuristic	Evaluation
4.1.4.2.1 Labelling	The search box does not contain any text. The only labels that apply to this dialogue element are the labels on the search results pages. The lightbox contains information provided by Google, which is beyond the scope of the evaluation, and the search page is blank except for the global and local navigation structures. *4.1.4.2.1.1 Labelling problem 1: Missing search box label* The search box in the header has no label that gives an indication of the purpose of the search box. A label that specifies that it is a site search feature should be provided. For example, "Search the library website".
4.1.4.2.2 Organisation	There is one aspect of this dialogue element that is applicable to this heuristic, i.e., the order of the search results. *4.1.4.2.2.1 Organisation problem 1: Order of search results* Users have some degree of control over the order of the search results because there is a drop-down menu in the top-right corner of the lightbox (see Figure 4.1-36) that allows the user to choose between sorting the search results in the lightbox by *relevance* or *date*. The relevance ranking, however, does not return the most relevant results, because when the keyword "help" was searched for, the library homepage (lib.uct.ac.za) was listed on the first page of results and it is not relevant. The cause of this problem is further discussed in "Clutter", Section 4.1.4.2.3.3.
4.1.4.2.3 Clutter	There are some aspects of the search results that cause clutter. *4.1.4.2.3.1 Clutter problem 1: Google ads* In the search results lightbox (Figure 4.1-36), there are Google advertisements that are listed before the list of search results. The advertisements are not relevant to the website and do not add any value to it. This can distract users from their tasks and cause them to make errors by accidentally clicking on ads. The library should implement an advertisement-free version of a search engine instead.

	4.1.4.2.3.2 Clutter problem 2: Lightbox The fact that the user is directed to a new page and a lightbox is overlaid on the new page adds unnecessary additional layers to the website. It does not make sense to direct the user to a blank webpage and then display the search results in a lightbox over the blank page (Figure 4.1-36). When the user closes the lightbox, they are on the blank "Search" page (Figure 4.1-37) on which they can do nothing. The page is empty except for the consistent global navigation structure. The page is useless otherwise. A more sensible solution would be to remove the lightbox and display the search results directly on the search page or remove the "Search" page and overlay the lightbox on the user's current page. *4.1.4.2.3.3 Clutter problem 3: Too many search results* The search box returns too many search results. It is not clear exactly how the search algorithm is implemented, but from the search results that were returned when the keyword "help" was searched the following deduction was made. The search algorithm searches for the keyword "help" and returns a result for every instance of the keyword in the website. Therefore, the same page can be returned multiple times, depending on how many instances of the keyword are present on the page. In this case, it returned "About 23,200 results". All the pages are returned at least once because the keyword "help" appears in the global navigation structure of all the pages as well as in the local navigation structure of some of the pages. As mentioned in "Organisation", Section 4.1.4.2.2.1, the first result that was returned for this query was the homepage, which is an irrelevant result. This is not an effective implementation of a search engine. It should be optimised to return fewer, more relevant search results.
4.1.4.2.4 Novice user guidance	There is a lack of guidance on the purpose of the search box. *4.1.4.2.4.1 Novice user guidance problem 1: Search box guidance* The search box does not provide any guidance that informs the user about its purpose. It consists only of the input field and the search icon button. In addition to providing a label as suggested in "Labelling", Section 4.1.4.2.1.1, users can also be made aware that the site search specifically returns Google search results for the library website. This additional information

	can be provided in a tooltip when users hover over the submit button.
4.1.4.2.5 Help documentation	It is difficult to find help documentation using this feature. *4.1.4.2.5.1 Help documentation problem 1: It is difficult to find help documentation using the site search feature* When the search box was used to search for the keyword "help", it returned "About 23,200" results, which is very unhelpful. The problem pertaining to the large number of search results is discussed in "Clutter", Section 4.1.4.2.3.3.
4.1.4.2.6 Efficiency features	The search box can be useful for users who prefer to locate information by searching for keywords rather than navigating by browsing, depending on how well the feature is implemented.
4.1.4.2.7 Consistency	There is a consistency issue with the order of the search results. *4.1.4.2.7.1 Consistency problem 1: Order of search results* The search results are sorted by relevance by default, but it does not return the search results in the same order every time when the same search query is repeated.
4.1.4.2.8 Predictable behaviour	The behaviour of the search box is unpredictable because of a lack of guidance that explains its behaviour (see "Novice user guidance" in Section 4.1.4.2.4.1 and "Labelling" in Section 4.1.4.2.1.1). *4.1.4.2.8.1 Predictable behaviour problem 1: Expected search results* As discussed in "Labelling", a label should be added to the search box and as discussed in "Novice user guidance" a tooltip to the submit button that would give the user more information about the type of search results the user can expect.
4.1.4.2.9 Context	A user is provided with some context when they land on the search page through the use of "breadcrumbs" (Figure 4.1-38) and by showing their location within the search results pages in the results navigation system. The link of the current page is bold (Figure 4.1-39).  **Figure 4.1-38: UCT breadcrumbs on "Search" page**  **Figure 4.1-39: UCT search results navigation system**

4.1.4.2.10 Task completion support	There are some positive aspects in this dialogue element that are applicable to this heuristic. **Positive aspect 1:** The functionality of the search box remembers previous search terms so that users are not required to retype it if they want to repeat a previous search query. It remembers all the search terms, not just the last one. **Positive aspect 2:** If a user has typed in a search term in the search box but has made a mistake, the term remains in the box so that the user can modify it instead of retyping it.
4.1.4.2.11 Controllability	There are some problems with the controllability of some components. *4.1.4.2.11.1 Controllability problem 1: Browsing search results* The user only has access to the first 10 search results pages, regardless of the number of search results that are returned. The user can browse the search results pages using the ten numbers at the bottom of the lightbox (as shown in Figure 4.1-39). When the user reaches the tenth page, however, there is no option to go to a next page.
4.1.4.2.12 Error recovery	A positive aspect related to this heuristic is discussed below. **Positive aspect:** Since the search box uses the Google's search engine, incorrect search terms are corrected automatically, and the user is given the option to search for the incorrect term. Figure 4.1-40 shows an example of when the search term "catlogue" was used instead of "catalogue":  **Figure 4.1-40: UCT example of automatic error recovery**
4.1.4.2.13 Error prevention	This heuristic and its sub-criteria do not apply to this dialogue element.
4.1.4.2.14 Feedback	The extra number of steps that the interface goes through before displaying search results has a negative impact on the feedback time. *4.1.4.2.14.1 Feedback problem 1: Loading time* Search results take a long time to load in comparison to just using Google directly. Two measures can be taken to improve the feedback time of the search results. Firstly, the efficiency of the search algorithm can be altered.

	Secondly, the number of steps can be reduced the as suggested in the "Organisation" heuristic in Section 4.1.4.2.3.2.

Table 4.1-5: Heuristic evaluation of UCT dialogue element 5: Site search feature

4.1.4.3 Dialogue element 6: Resource search interface

The location of this dialogue element on the homepage is outlined in Figure 4.1-2 with the number 6, and the detail (the components in this dialogue element) is outlined in Figure 4.1-41. A larger version of the feature can also be found in the contents of the "Search and Find" webpage (http://www.lib.uct.ac.za/lib/search/) as shown in Figure 4.1-42. The "Search & Find" page can be accessed directly from the homepage by clicking on the "Search & Find" link in the main navigation bar. It is to be noted that this is a different page than the one the user is directed to when they use the site search feature (http://www.lib.uct.ac.za/search).

The resource search feature contains the following four components. The numbers in the list correspond to the numbers in Figure 4.1-41:

1. Resource search feature tabs
2. Information paragraph
3. Input box
4. Submit button

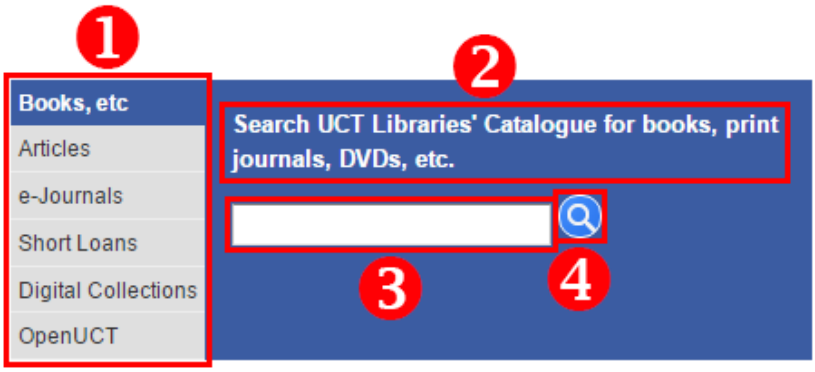


Figure 4.1-41: UCT resource search feature

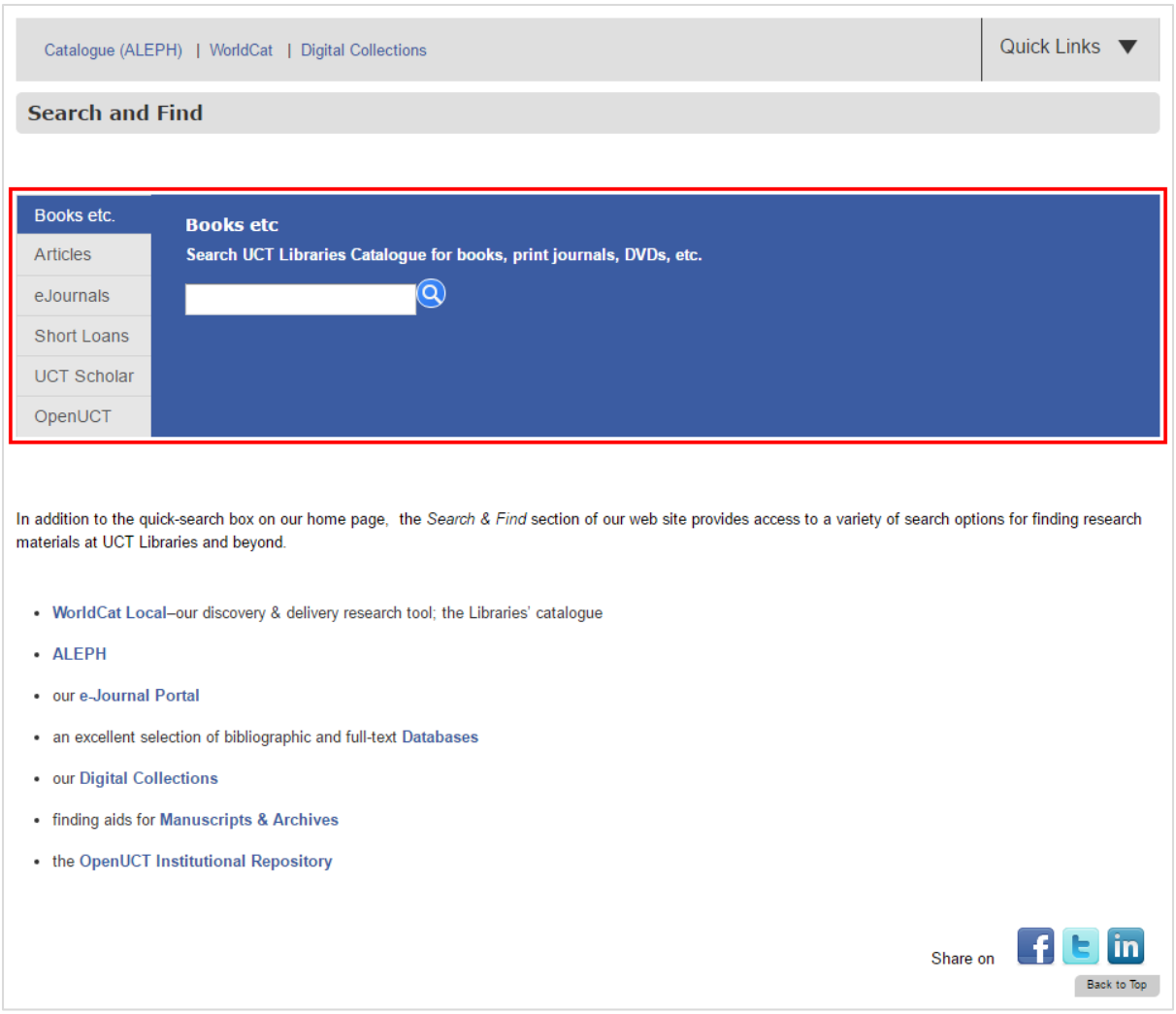


Figure 4.1-42: UCT "Search and Find" page

The resource search feature has the following six tabs that users can select to choose the type of resource that they want to search for. The different tabs are also shown in Figure 4.1-43. The numbers in the image correspond to the numbers in the following list:

1. "Books, etc."
2. "Articles"
3. "eJournals"
4. "Short Loans"
5. "UCT Scholar"
6. "OpenUCT"

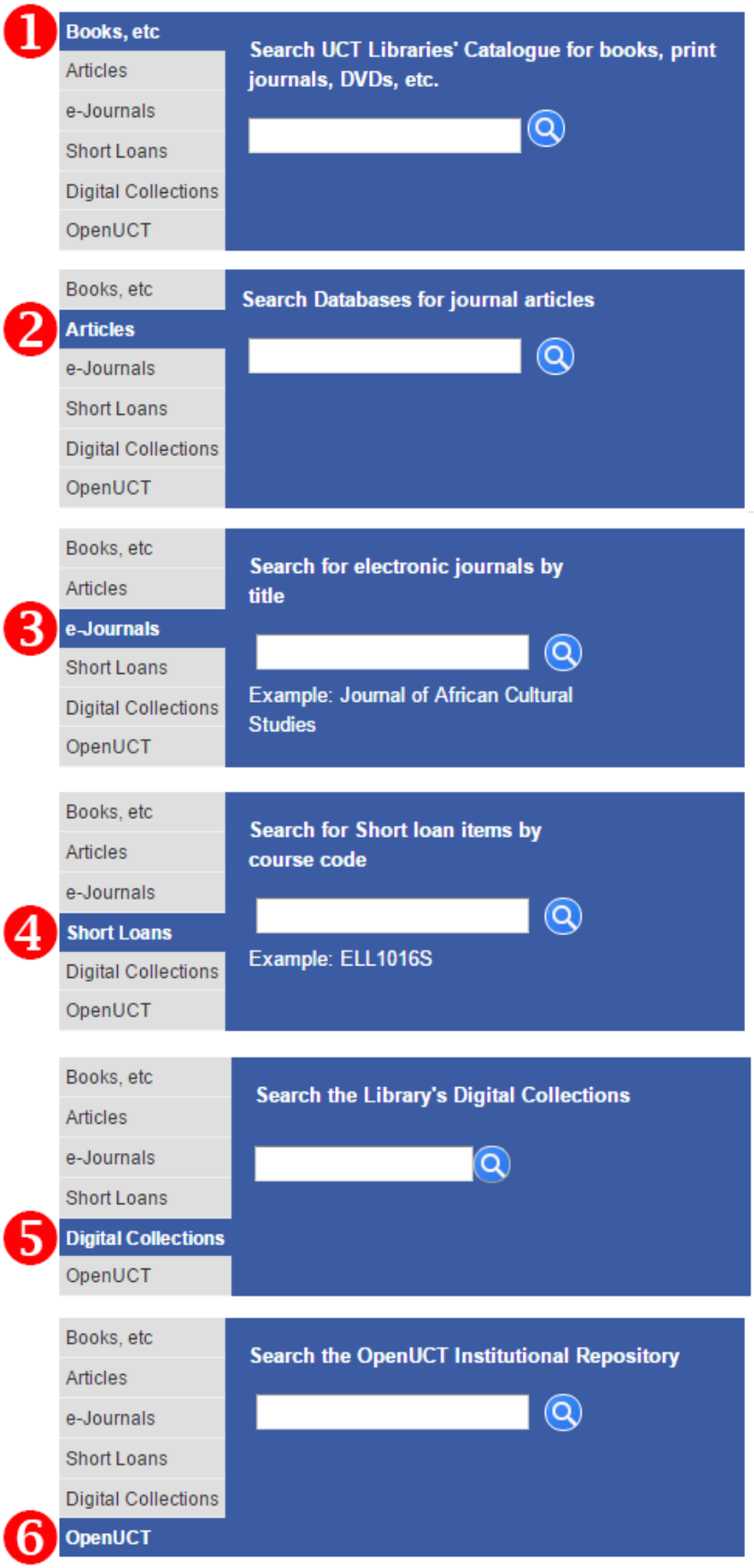


Figure 4.1-43: UCT resource search feature tabs

The search button in each of the tabs links to an external website that is beyond the scope of this study. However, the functionality of the components of the feature that is on the library is evaluated.

1. The "Books, etc." tab is displayed by default. It contains a paragraph with the text: "Search UCT Libraries' Catalogue for books, print journals, DVDs, etc." and a search box. When users search for terms in this tab, they are directed to the search results in the library catalogue (ALEPH).
2. The "Articles" tab contains a paragraph with the text: "Search Databases for journal articles" and a search box. When users search for terms in this tab, they are directed to the WorldCat authentication page.
3. The "eJournals" tab contains a paragraph with the text: "Search for electronic journals by title", a search box, and example text "Example: Journal of African Cultural Studies" below the search box. When users search for terms in this tab, they are directed to the search results in the "eJournals Portal".
4. The "Short Loans" tab contains a paragraph with the text: "Search for Short loan items by course code", a text box, and example text "Example: ELL1016S". When users search for terms in this tab, they are directed to the search results in the library catalogue (ALEPH).
5. The "Digital Collections" tab contains a paragraph with the text: "Search the Library's Digital Collections", and a search box. When users search for terms in this tab, they are directed to the search results on the digital collections subdomain (http://www.digitalcollections.lib.uct.ac.za/).
6. The "OpenUCT" tab contains a paragraph with the text: "Search the OpenUCT Institutional Repository", and a search box. When users search for terms in this tab, they are directed to the search results on the OpenUCT domain (http://open.uct.ac.za/).

For each of the tabs, the search results are displayed in an external website in the *same tab*. Therefore using this search box will cause the user to be directed away from the library website and to lose their current position in the search feature.

4.1.4.4 Heuristic evaluation of UCT dialogue element 6: Resource search feature

The table below contains the discussion of each of the problems that were found with the components in this dialogue element. The problems are summarised in the case summary in Section 4.1.5.

Heuristic	Evaluation
4.1.4.4.1 Labelling	The labels in this dialogue element use familiar language. The only exception is the "OpenUCT" tab, which novice users might not be familiar with. When the tab is selected, however, the term is explained.
4.1.4.4.2 Organisation	There are no problems with the organisation of the information in the search interface.
4.1.4.4.3 Clutter	The interface is clutter free.
4.1.4.4.4 Novice user guidance	In each of the tabs, there are useful additional explanations of what each of the search boxes can be used for. Some of the additional explanations also include examples of search terms. It is not clear, however, what the purpose of the resource search component is upon first inspection or *where* the query will be searched. *4.1.4.4.4.1 Novice user guidance problem 1: Missing component caption* The search interface can benefit from having a caption that reveals the overall purpose of the component, for example, "search for resources"/ "find resources". It is, however, clear if the user is using it on the "Search and Find" webpage, as the webpage has a heading with the same label. *4.1.4.4.4.2 Novice user guidance problem 2: Search destination* Each of the search boxes in the different tabs searches in a different website. There is no indication of where it searches. For example, the search box in the "Articles" tab sends the query to WorldCat. This should be indicated to the user.
4.1.4.4.5 Help documentation	No help documentation for using the dialogue element could be located. *4.1.4.4.5.1 Help documentation problem 1: No help documentation* A more complicated search feature such as this one should provide some form of help documentation. Search features such as this one can provide options that are not normally intuitive for users, for example, the use of truncation, wild cards, operators, and phrases. Therefore, a help link to help documentation would be required to explain these advanced search options and if they are available. This will depend on the website that implements the search feature, for example, the catalogue.
4.1.4.4.6 Efficiency features	The library refers to the search box as a "Quick-search box" on the "Search and Find" page, i.e., it can be used as a shortcut to resources. **Positive aspect:** In addition to clicking on the button to submit the search

	query, a user can submit it faster by pressing the enter key on the keyboard.
4.1.4.4.7 Consistency	Each of the tabs has the same consistent design and the overall design of the feature is the same on the homepage and "Search and Find" page.
4.1.4.4.8 Predictable behaviour	The lack of "Novice user guidance" mentioned in Section 4.1.4.4.4.1 makes the behaviour unpredictable. It is not clear what will happen when the user clicks on the search button. The behaviour can be made more predictable by providing the user with more guidance as suggested in Section 4.1.4.4.4.1.
4.1.4.4.9 Context	There is a lack of context for the various search boxes. *4.1.4.4.9.1 Context problem 1: No context is provided to reveal where the individual search boxes will search* The tabs give the user context for the type of resources they are searching but not *where* it will search. This problem is also addressed in "Novice user guidance", Section 4.1.4.4.4.1.
4.1.4.4.10 Task completion support	There is some support for task completion in this interface. The search interface "remembers" previous search terms, therefore, users are not required to remember or retype their previous search terms if they want to search for them again or modify them. The previous search term remains in the search box after the lightbox is closed.
4.1.4.4.11 Controllability	The search results open in external websites but in the same browser tab. This limits the controllability of the library website. *4.1.4.4.11.1 Controllability problem 1: Submit button behaviour* The search results for each of the search boxes are displayed in the same tab but in an external website. This causes the user to navigate away from the library website. A better alternative is to make external websites open in a *new* tab. The majority of the links on this website open external websites in a new tab, which has a positive effect on controllability. If it opens in a new tab, the user can use the external website without losing their position within the library website. When they are done, they can go back to the tab in which the library website is open and continue using it. It is, therefore, a good idea to make search results open in a new tab. Making search results open in a new tab also allows users to have various search results in various tabs, giving users more control over their search queries.

	If search results are *not* opened in a new tab, the user has to, after using the external website to search for something, click the browser's back button repeatedly until they are on the library website again, or they would have to open the library website again and start over. This problem is further discussed in the case study analysis in Section 4.4 and a new heuristic criterion is suggested based on it.
4.1.4.4.12 Error recovery	The search engines of the various resources provide some aspect of automatic error recovery. However, this is implemented by the resource website being searched and not the library itself.
4.1.4.4.13 Error prevention	The suggestions in "Novice user guidance" (Section 4.1.4.4.4.1) to provide users with more information about where the various search boxes will search will prevent users from accidentally searching the wrong resource.
4.1.4.4.14 Feedback	Some of the search results take a long time to load, but this problem is beyond the control of the library because it is dependent on the resource that is being searched.

Table 4.1-6: Heuristic evaluation of UCT dialogue element 6: Resource search interface

4.1.5 Summary of case study 1: UCT library website

A total of 70 usability problems were found on the library website of the University of Cape Town.

This is the only case study that passed the first round of the inspection, which is to evaluate if it contains all six of the dialogue elements.

It is evident from the evaluations that the heuristics will find problems that overlap. Although the heuristics are mutually exclusive, a problem with one heuristic can result in problems with other heuristics. For example, a lack of novice user guidance can result in unpredictable behaviour.

The problems that were found in this website are summarised below and divided into the fourteen heuristics. The abbreviation "DE" is used to show in what dialogue element the problem was identified.

4.1.5.1 Labelling

1. Some of the labels in the main navigation bar (DE2) are unfamiliar because they are jargon unique to UCT.
2. The "Help" link is incorrectly labelled "Research Help" in the main navigation bar (DE2).

3. The page title of the homepage (DE3) does not represent page content effectively.
4. There is a confusing icon in the slideshow component on the homepage (DE3).
5. The page titles of the internal pages (DE4) do not sufficiently provide information about the website.
6. Some of the page titles in the internal pages (DE4) are too long.
7. The site search box (DE5) does not have a descriptive label.

4.1.5.2 Organisation

8. The "Home" link is not listed first in a list of links in the header (DE1).
9. The positioning and grouping of links in the header (DE1) can cause confusion.
10. Some of the webpages are uncategorised, which causes their corresponding links to be uncategorised in the main navigation bar (DE2).
11. There are external links in the main navigation bar (DE2) which makes the behaviour of the navigation bar inconsistent and unpredictable.
12. Some of the components on the homepage (DE3) do not have headings and are therefore uncategorised.
13. The internal pages (DE4) are poorly organised, resulting in blank webpages.
14. There are internal pages (DE4) without local navigation systems.
15. Search results of the site search feature (DE5) that are sorted by relevance do not return the most relevant results first.

4.1.5.3 Clutter

The largest number of problems per single dialogue element related to clutter on the homepage.

16. There are redundant social media links in the footer (DE1).
17. There is a large number of links in main navigation bar (DE2) and its drop-down menus.
18. Some of the link labels in the main navigation bar (DE2) are too long.
19. The homepage (DE3) is too long.
20. There is a large number of uncategorised links on the homepage (DE3).
21. There is a redundant secondary navigation bar on the homepage (DE3).
22. The resource search feature is redundant on the homepage (DE3).
23. The new books feature on the homepage (DE3) is redundant.
24. There are redundant social media links on the homepage (DE3).
25. The local navigation menus on the internal pages (DE3) have link labels that are too long.
26. There is a redundant secondary navigation bar on the internal pages (DE4).
27. There are Google ads in the site search feature's (DE5) search results.
28. The display of the site search feature's (DE5) search results in a lightbox causes clutter.

29. The site search feature (DE5) returns too many (mainly irrelevant) search results.

4.1.5.4 Novice user guidance

30. There is a lack of descriptive tooltips in the header (DE1).
31. There is a lack of descriptive tooltips in the main navigation bar (DE2).
32. The slideshow feature on the homepage (DE3) seems to be intended for novice users but might prove to not be useful for novice users.
33. There is a lack of descriptive tooltips on the homepage (DE3).
34. There is no guidance for the site search feature (DE5) that reveals its purpose or expected search results.
35. The resource search feature (DE6) does not have a descriptive caption that reveals its purpose.

4.1.5.5 Help documentation

36. Help documentation might be difficult to identify as it is located under the main link "Research Help" in the main navigation bar (DE2).
37. The main help section in the internal pages (DE4) is identified with the incorrect label "Research Help".
38. The main "Research Help" internal page (DE4) is blank.
39. It is difficult to find help documentation using the site search feature (DE5).
40. There is no help documentation for the resource search feature (DE6).

4.1.5.6 Efficiency features

No problems were found in this heuristic category.

4.1.5.7 Consistency

41. External links in the header (DE1) do not consistently open in a new tab.
42. External links in the main navigation bar (DE2) do not consistently open in a new tab.
43. The secondary navigation bar (DE2) is not at the same position on all pages.
44. Not all of the links in the main navigation bar (DE2) have the same behaviour.
45. Context is not provided consistently in the main navigation bar (DE2).
46. Each of the components on the homepage (DE3) has different structures and looks different.
47. Only some of the internal pages (DE4) have local navigation structures.
48. Context is only provided in the local navigation menus on some of the internal pages (DE4).
49. The size of the local navigation menus is different on different internal pages (DE4).
50. A supplemental navigation system for this website, such as a sitemap, could not be located in the internal webpages (DE4) of this website.
51. The order of the site search feature's (DE5) search results does not consistently stay the same if the same search query is repeated more than once in a row.

4.1.5.8 Predictable behaviour

52. Two of the links in the header and footer (DE1) are mailto links instead of links to more appropriate pages.
53. The behaviour of some of the links in the main navigation bar (DE2) is unpredictable because it contains links to external websites or PDFs.
54. There are library links on the homepage (DE3) that navigate away from the library website.
55. The behaviour of some of the links in the local navigation menus on the internal pages (DE4) is unpredictable because it contains links to external websites or PDFs.
56. The behaviour of the site search feature (DE5) is unpredictable because of a lack of guidance that explains its purpose.

4.1.5.9 Context

57. There is a lack of context in the title of the homepage (DE3).
58. There is a lack of context for some of the components on the homepage (DE3).
59. There is a lack of context in the title of the internal pages (DE4).
60. There is a lack of context for the various search boxes in the resource search feature (DE6).

4.1.5.10 Task completion support

61. The system does not assist the user with filling in the "Off-campus login" form on an internal page (DE4).

4.1.5.11 Controllability

62. The Facebook link in the footer (DE1) opens in the same tab.
63. There are hidden links in local navigation menus on the internal pages (DE4).
64. There are missing local navigation menus on some of the internal pages (DE4).
65. Only the first ten search results pages of the site search box's search results are accessible.
66. The submit button of the resource search (DE6) feature opens an external website in the same tab.

4.1.5.12 Error recovery

67. The error message provided by the "Off-campus login" form on an internal page (DE4) does not describe the error accurately.
68. The error message provided by the "Off-campus login" form on an internal page (DE4) does not provide simple steps to a solution.

4.1.5.13 Error prevention

69. There are no icons next to external links in the internal pages (DE4) that warn users that they would navigate away from the library website.

4.1.5.14 Feedback

70. The feedback time of the site search feature (DE5) is slow.

The number of problems that were found under each of the heuristics is summarised below in Table 4.1-7. They are sorted from the largest number of problems to the smallest number of problems.

Number of problems	Heuristic
15	Clutter
10	Consistency
8	Organisation
7	Labelling
6	Novice user guidance
5	Help documentation
5	Predictable behaviour
5	Controllability
4	Context
2	Error recovery
1	Task completion support
1	Feedback
1	Error prevention
0	Efficiency features

Table 4.1-7: Number of problems that were found in the UCT library website

The majority of problems were found with the clutter heuristic, specifically on the homepage, and the smallest number of problems were found with task completion support, feedback, and error prevention. No problems were found with efficiency features.

The majority of usability problems that were found were caused by the great number of external links in various components of the different dialogue elements. External links caused problems with controllability. An easy way to solve the problem with controllability is to make the external link open in a new tab. This is suggested as a new criterion in Section 4.4. It would still be necessary to provide an icon next to the external link to warn users that it is an external link.

There is a limited amount of space for a title label in a browser tab, therefore the length of the title label should be limited. This finding can be used to add a sub-criterion to the “Labelling” heuristic and is further discussed the case study analysis in Section 4.4.

The title should represent the page contents by containing information about the page and the website. This finding can also be used to add a sub-criterion to the "Labelling" heuristic and is further discussed the case study analysis in Section 4.4.

4.2 Case study 2: University of the Witwatersrand (Wits)

The University of the Witwatersrand is the second best university in South Africa according to the QS University Rankings 2016/17, ranking at number 26 in the BRICS countries ranking (Quacquarelli Symonds 2016a) and at number 359 in the world rankings (Quacquarelli Symonds 2016b).

The library website is *not* a separate website from the main university website; instead, it is a section of the main university website: https://www.wits.ac.za/library/. In Figure 4.2-1, the section marked with a red rectangle is the part of the university website that contains the first page of the library section, i.e., the library homepage. This section is shown as a separate image in Figure 4.2-2 in which the homepage dialogue elements are shown. The library website is therefore not strictly a library website as it is a section of the main university website, but it is referred to as a library website for the purpose of this study.

As a result of the library not having a website on a separate domain, it lacks core library dialogue elements such as a header and footer specific to the library. The header and footer are only specific to the main university website and as such cannot be used to navigate the library website. The lack of a header and a footer has a negative influence on various aspects of the website. This statement is elaborated in the discussion in Section 4.2.1.

The main library website consisted of only 22 webpages at the time of writing (based on a scan of the website on 9 September 2016 using https://www.xml-sitemaps.com/, a free sitemap generator). This is a very small number of webpages compared to the number of webpages in case studies 1 and 3. It is to be noted that many of the website's links may have changed since the time of writing and will no longer work.

The library has the following subdomains:

- Library guides: http://libguides.wits.ac.za/
- Institutional repository: http://wiredspace.wits.ac.za/

These subdomains are not included in the evaluations, as discussed in the "Limitations" Section in Chapter 1.

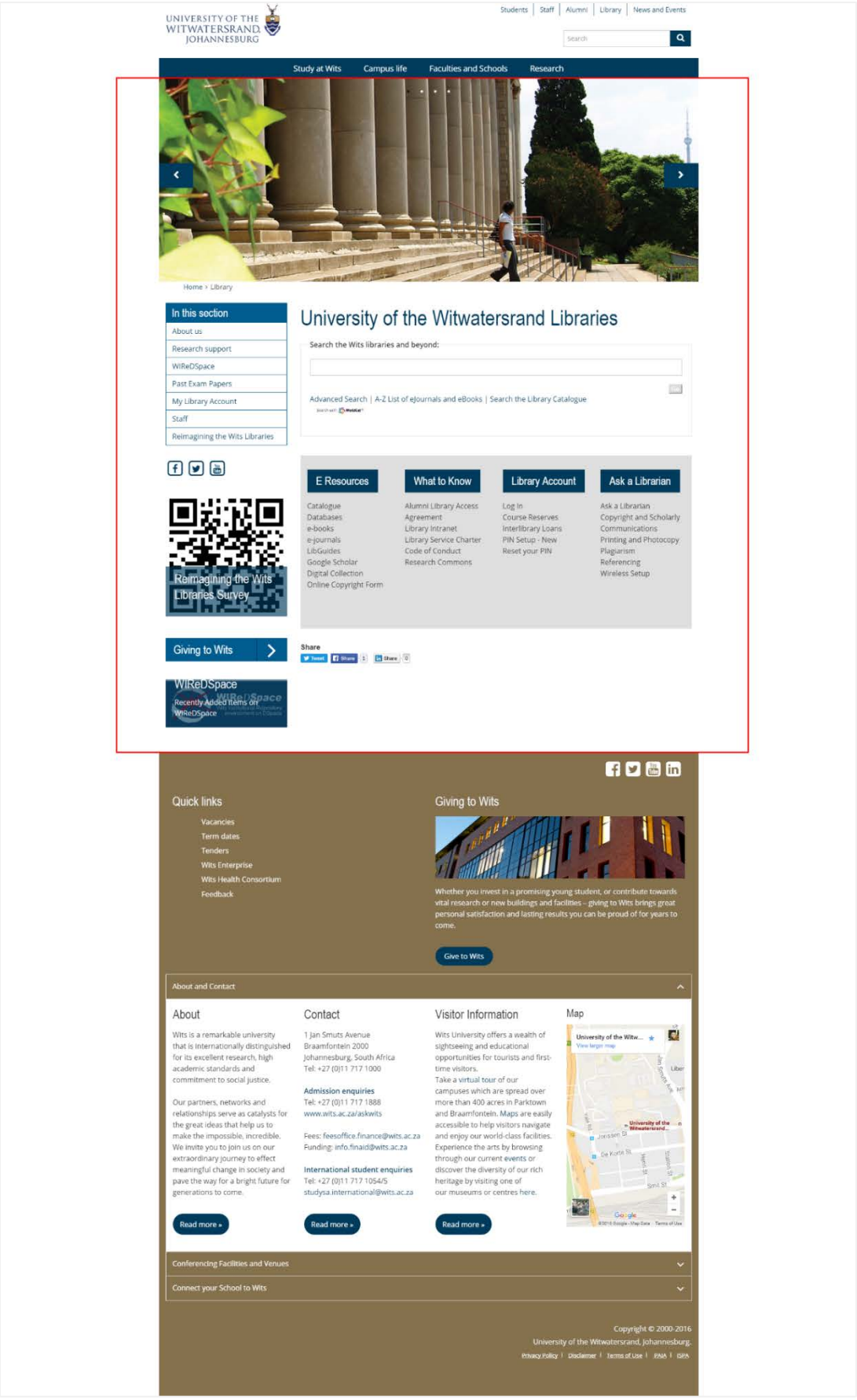


Figure 4.2-1: Wits library section – full webpage

For the purpose of the library's evaluation, the rest of the screenshots will *not* include the Wits website's global structures (the aspects that are not in the section marked with red in Figure 4.2-1).

4.2.1 Wits library website dialogue elements

The Wits library website consists of the three dialogue elements that are represented in Figure 4.1-2 and Figure 4.1-3. Figure 4.1-2 is a screenshot of the homepage and Figure 4.1-3 is a screenshot of the "About us" page. The "About us" page represents the internal pages of the UCT library website and it should be noted that all of the internal pages are evaluated, not just the one represented in the screenshot.

All the dialogue elements that are evaluated are outlined in the two screenshots with red borders and numbers 1 to 6. The numbers of the dialogue elements in the following list correspond to the numbers in the figures. Each number represents a specific dialogue element.

Global navigation structures

1. Dialogue element 1: Header and footer – not present in Wits library website
2. Dialogue element 2: Main navigation bar – not present in Wits library website

Local navigation structures

3. Dialogue element 3: Homepage contents (number 3 in Figure 4.1-2)
4. Dialogue element 4: Internal page contents (number 4 in Figure 4.1-3)

Search systems

5. Dialogue element 5: Site search feature – not present in Wits library website
6. Dialogue element 6: Resource search feature (number 6 in Figure 4.1-2)

As is evident in the above list, three of the main dialogue elements that an academic library website typically consist of are not present on the Wits library website. This has drastic negative effects on the usability of the website.

It is to be noted that dialogue element 6 is a component within dialogue element 3. This dialogue element is evaluated as a separate dialogue element as well as a component of the dialogue element in which it is contained.

The dialogue elements as they are outlined in the screenshots are shown in more detail in the subsequent sections, where each of the components within the dialogue elements is outlined.

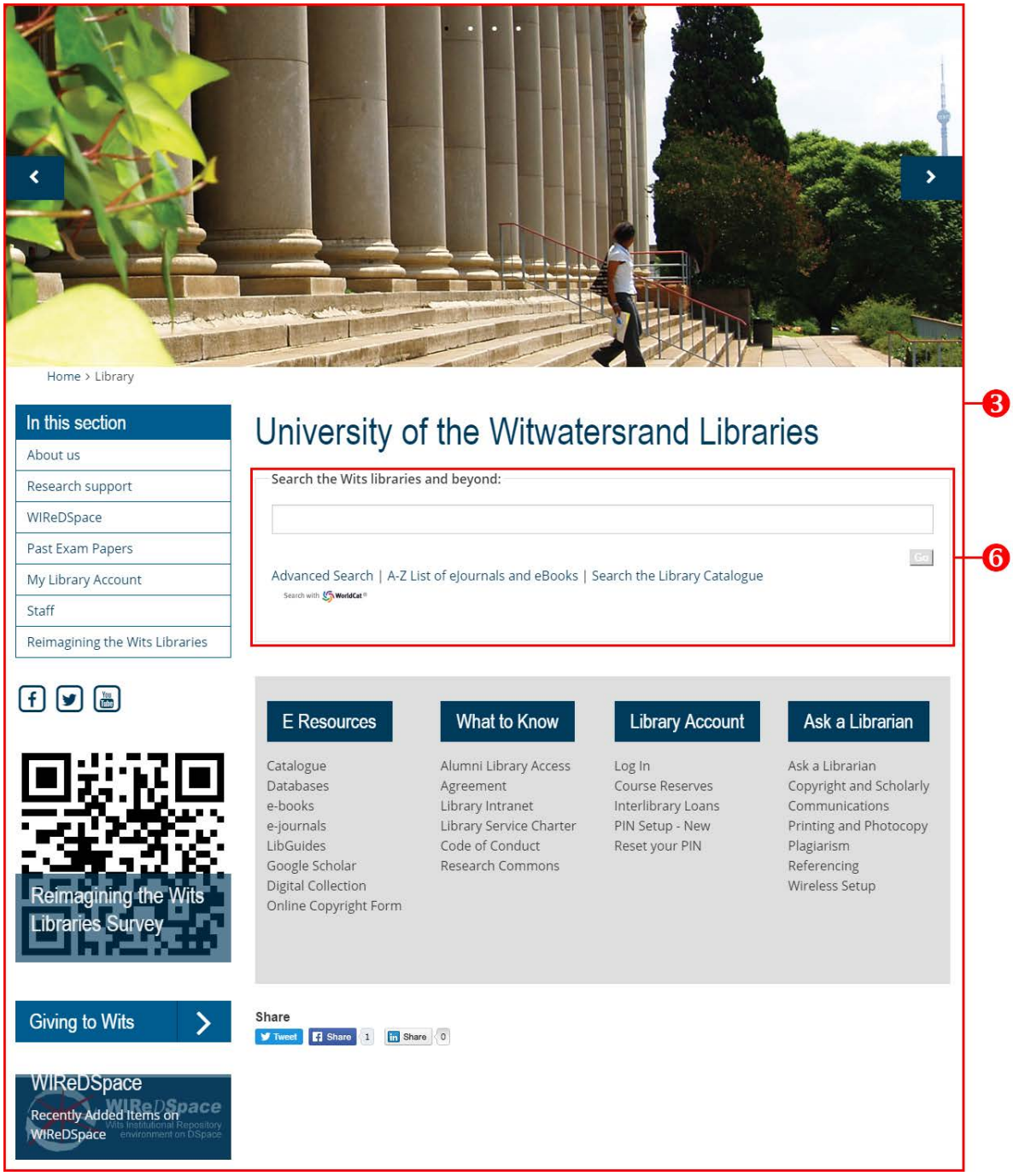


Figure 4.2-2: Wits website library section / "homepage" dialogue elements

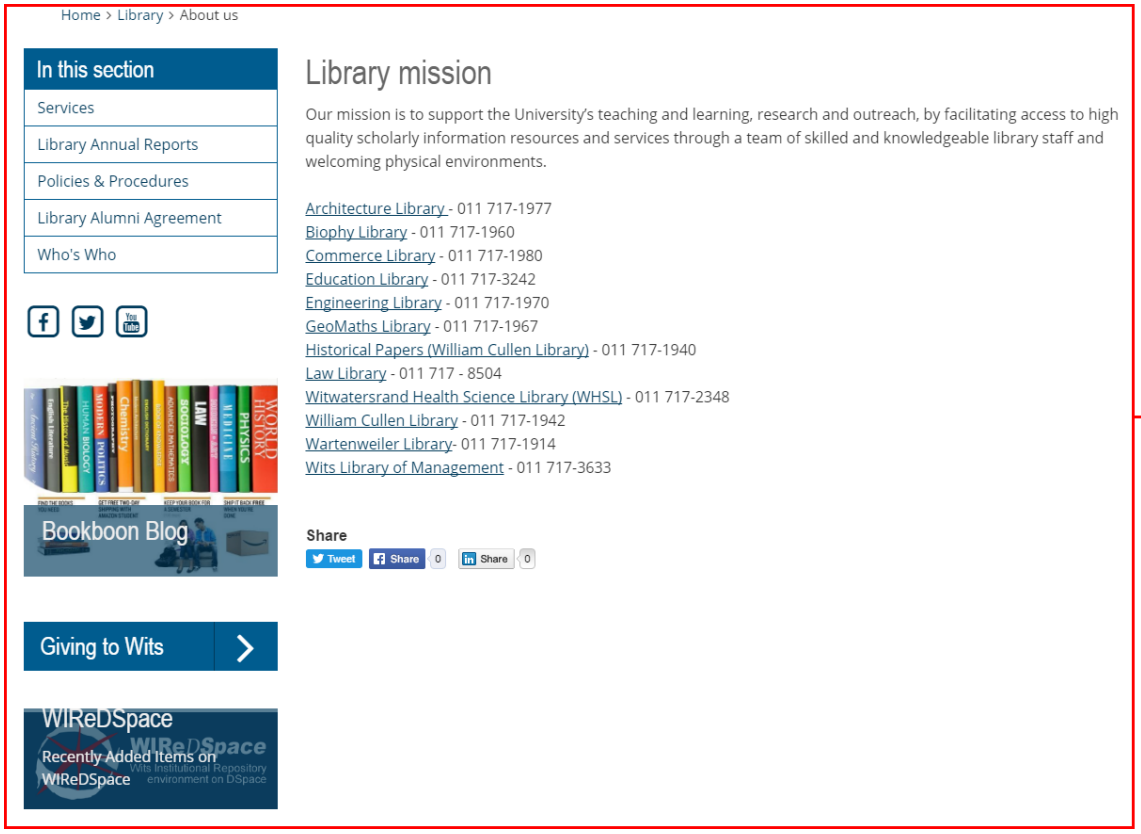


Figure 4.2-3: Wits dialogue elements on internal pages (The "About us" page represents all the internal pages)

4.2.2 Global navigation structures

The Wits website has no global navigation structure for the library website. The only global structure that is consistently on all pages comprises the header, footer, and main navigation bar for the *main* university website, which is not part of the library website, and therefore, beyond the scope of this evaluation.

The only aspect of the library website that consistently stays the same on all the pages is the links that are located below the navigation menu on the homepage shown in Figure 4.2-2.

These links are not considered a global navigation dialogue element as they cannot be used to navigate to the main sections of the library website; therefore, they are evaluated as a *component* of the homepage in the heuristic evaluation of the homepage.

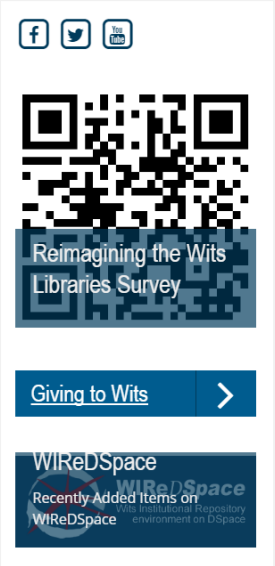


Figure 4.2-4: Wits – The only consistent links on the Wits library website

The lack of global navigation structures results in various usability problems. These problems are discussed in the case summary in Section 4.2.5.

4.2.2.1 Dialogue element 1: Header and footer

The website has no header and footer specific to the library website. The lack of a header and a footer results in having a website with various usability problems. These problems are mentioned in the other dialogue elements as well as in the case summary in Section 4.2.5.

The main problem is that there is a lack of context in the library internal pages (that should identify them as pages of the library website).

4.2.2.2 Dialogue element 2: Main navigation bar

The website has no main navigation bar that can be used specifically to navigate the library website. The lack of a main navigation bar results in the various usability problems.

One of the purposes of a main navigation bar is to give a "bird's-eye view" of the available sections that are available within the website and to allow the user to navigate easily between sections. This causes the following problem on the Wits library website. The user is required to navigate through the website sequentially using the available links on the pages to discover sections, and if the links that they require are not available, they have to navigate back and start over by trying a different path.

4.2.3 Local navigation structures

All of the pages of the library website are internal pages of the main university website. There is a vertical local navigation bar on all of the pages, including the homepage, each with the caption "In this section".

The homepage of the library website is, therefore, not strictly a *homepage* since it is a section of the main university website. However, it does have features that are unique to a homepage of a library website, i.e., slideshow, resource search feature, and categorised library links. Therefore, the homepage contains features of both a homepage and internal pages.

4.2.3.1 Dialogue element 3: Homepage contents

This dialogue element is outlined in Figure 4.2-2 with the number 3 and the detail (the components in this dialogue element) is outlined in Figure 4.2-5. The title of the homepage is also part of this dialogue element and is shown in Figure 4.2-6.

The homepage contains the following nine components. The numbers in the list correspond to the numbers in Figure 4.2-5 and Figure 4.2-6:

1. Image slideshow
2. Breadcrumbs (evaluated as an internal page component in dialogue element 4 in Section 4.2.3.3)
3. Local navigation menu
4. Library advertisements
5. Page heading
6. Resource search interface (evaluated separately as a dialogue element in Section 4.2.4.2)
7. Homepage links "quick links"
8. Social media network "share" links
9. Page title "Library – Wits University" (Figure 4.2-6)

The homepage of this website has a local navigation bar because the library "website" is a section of the main university website. The local navigation bar is evaluated in both the homepage and internal pages, in order to comment on its influence on the usability of the pages within the different contexts.

Figure 4.2-5: Wits homepage structure

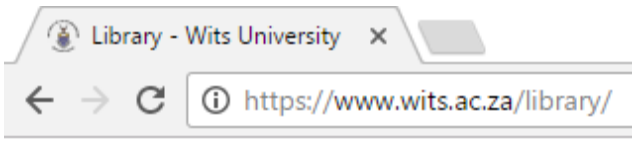


Figure 4.2-6: Wits library homepage title

4.2.3.2 Heuristic evaluation of Wits dialogue element 3: Homepage contents

The table below contains the discussion of each of the problems that were found with the components in this dialogue element. The problems are summarised in the case summary in Section 4.2.5.

Heuristic	Evaluation
4.2.3.2.1 Labelling	Most of the labels on the homepage are easy to understand. There are only two labels that consist of library jargon specific to the Wits library. The labels in component 7 in Figure 4.2-5 use familiar language, but there are problems with the organisation of these labels. Therefore, those problems are discussed under "Organisation" in Section 4.2.3.2.2.1. *4.2.3.2.1.1 Labelling problem 1: Jargon* In the local navigation menu on the homepage, two out of seven of the links are unfamiliar. The first unfamiliar label is "WIReDSpace". Novice users will not know what this term means unless they click on it. WIReDSpace stands for "Wits Institutional Repository on DSpace". This is library jargon that is unique to the Wits library website. In the other case studies, the name of the institutional repository was clarified with the text "Institutional Repository" in parenthesis, for example, "WIReDSpace (Institutional Repository)". The second unfamiliar label is "Reimagining the Wits Libraries". This is a link to a web-based survey. This is not clear from the label itself. The links can be renamed to be more intuitive. Additionally, links can be made more descriptive by providing users with tooltips. See "Novice user guidance" in Section 4.2.3.2.4.1 for more details. *4.2.3.2.1.2 Labelling problem 2: Title* The page title follows web development conventions, i.e., it consists of the name of the page and the name of the website. However, it is clear from the title that the library is a section of the main university website, because it is "Library - Wits University", whereas if it had its own domain, it would have been something like "Home - Wits Libraries". Therefore, this is not strictly a usability problem in the current design of the library website. It does lead to problems in the internal pages, however, because it does not provide enough context. See "Labelling" in the internal pages (dialogue element 4), in Section 4.2.3.4.1.2 for a description of the problem.
4.2.3.2.2 Organisation	The organisation and categorisation of the links on the homepage are confusing.

	4.2.3.2.2.1 Organisation problem 1: Categorisation of "quick links" The links in component 7 in Figure 4.2-5 are divided into four categories: "E Resources", "What to know", "Library account", and "Ask a librarian". The categories are not descriptive of their contents, for example, by only looking at the category "What to know", it is not clear what would be found. Some of the links categorised under "What to know", for example, "Agreement", "Library Service Charter", and "Code of Conduct" would make more sense under a common category label such as "About Us". The category "Ask a Librarian" is also not descriptive of its contents and not sensible as a main category. The first link listed under the category is "Ask a librarian". This and other links in this category are typical library help features. Therefore, a more sensible category label would be "Help". *4.2.3.2.2.2 Organisation problem 2: Local navigation menu* The local navigation menu (component 3 in Figure 4.2-5) on the homepage has the caption "In this section" (like all the local navigation menus on the internal pages). The links that are provided, however, are not sensible in the context. They do not make sense as the main links that are available on the homepage of a library website. They are more appropriate as "quick links". A better solution would be to remove the local navigation menu from the homepage and integrate/incorporate the important links into the categorised links (in component 7 in Figure 4.2-5).
4.2.3.2.3 Clutter	There are some redundant components on the homepage that cause unnecessary clutter. *4.2.3.2.3.1 Clutter problem 1: Main university website components* The combination of the main library components with the library homepage components results in a cluttered webpage. The page requires an unnecessary amount of scrolling due to the long footer of the main university website. The footer is too long and contains too much information, but this is a problem with the main university website and not the library website. However, when the two websites are combined, the problems that are in the main university websites cause problems on the library website. If the library website is separated from the main website it would result in a more clutter free library website.

	4.2.3.2.3.2 Clutter problem 2: Local navigation menu not applicable on homepage A local navigation menu is not applicable on the homepage. Its removal will reduce clutter. This problem is also discussed in "Organisation" in Section 4.2.3.2.2.2.
4.2.3.2.4 Novice user guidance	The homepage does not have sufficient support for novice users. There is a lack of tooltips that provide guidance. One of the features that novice users can find useful, however, is the "Ask a librarian" feature that can be accessed from component 7 in Figure 4.2-5 on the homepage. *4.2.3.2.4.1 Novice user guidance problem 1: Tooltips* Only some of the links on the homepage have tooltips. The webpage would be more usable if all the unfamiliar links had tooltips that describe the location of links. For example, an appropriate tooltip for "WIReDSpace" would be "Wits' Institutional Repository" (In addition to updating the label as suggested in "Labelling" in Section 4.2.3.2.1.1).
4.2.3.2.5 Help documentation	The library website's help documentation is not directly accessible from the homepage. This is a major problem since users should have easy access to help documentation from the homepage. *4.2.3.2.5.1 Help documentation problem 1: Access to help* The library website has some help documentation (that could be located), but it is not directly accessible from the homepage. It might be very difficult for users to find it because they have to go to the "About us" (https://www.wits.ac.za/library/about-us/how-to-guides/) section first, which is not a logical section for categorising help documentation.
4.2.3.2.6 Efficiency features	The resource search feature on the homepage can be seen as an efficiency feature because it is a shortcut to library resources. It is further discussed as a separate dialogue element in Section 4.2.4.2.
4.2.3.2.7 Consistency	There are some consistency problems as discussed below. *4.2.3.2.7.1 Consistency problem 1: External links* Some external links open in the same tab while others open in a new tab. The problem with external links that open in the same tab is that the user is navigated away from the library website. External links that open in a new tab give a user more control. Therefore, external links should consistently open in a new tab. This problem is discussed in the case study analysis in Section 4.4.

4.2.3.2.8 Predictable behaviour	The behaviour of the links in the local navigation menu (component 3 in Figure 4.2-5), advertisements for new library features (component 4 in Figure 4.2-5), and the categorised links (component 7 in Figure 4.2-5) is unpredictable. *4.2.3.2.8.1 Predictable behaviour problem 1: Local navigation menu* Some links in component 3 in Figure 4.2-5, the local navigation menu, navigate away from the library website. Links in local navigation menus should link to pages within a section, and therefore, should not contain links to external websites. Only the first and the last links open pages in the library website. The others open external websites or library subdomains and they are opened in the same tab, navigating the user away from the library website.
4.2.3.2.9 Context	Users' context in the website relative to the web as a whole and the main university website is provided by various components. A breadcrumb trail is used to show the user's position within the website, and the university's name and emblem in the page header and title shows the user's position in the web as a whole. The page heading and title make it clear that the user is on the library website. This becomes a problem on the internal pages, however, since the same heading is not provided on all pages and therefore it is not clear that the user is on the library website. Refer to "Context" in the internal pages in Section 4.2.3.4.9.2 for the discussion.
4.2.3.2.10 Task completion support	There is no support for task completion on the homepage. Visited links look the same as unvisited links. This is not a major problem, however, and often a design choice is made not to change visited links as it affects the homepage's aesthetic design negatively.
4.2.3.2.11 Controllability	The lack of a header and footer and main navigation bar limits the controllability on the homepage. *4.2.3.2.11.1 Controllability problem 1: Library sections not clear* A main navigation bar (that is accessible on all pages) makes users aware of the sections that are available on a website by giving them a "bird's-eye view". The lack thereof has a negative influence on the usability of the homepage because the user can already feel lost on the homepage before they have even started browsing.
4.2.3.2.12 Error recovery	No error recovery problems were found.

4.2.3.2.13 Error prevention	The correction of the aforementioned problems will contribute to error prevention.
4.2.3.2.14 Feedback	This heuristic and its sub-criteria do not apply to the components in this dialogue element.

Table 4.2-1: Heuristic evaluation of Wits dialogue element 3: Homepage contents

4.2.3.3 Dialogue element 4: Internal pages contents

This dialogue element is outlined in Figure 4.2-3 with the number 4, and the detail (the components in this dialogue element) is outlined in Figure 4.2-7 and Figure 4.2-8.

It should be noted that the screenshots that are used show a single page, the "About us" page (Figure 4.2-3 and Figure 4.2-7) but represent all of the internal pages. The website is divided into various sections that can be found in the internal pages, and all of these pages have roughly the same structure, so they are evaluated as a single dialogue element.

The internal pages contain the following six components. The numbers in the list correspond to the numbers in Figure 4.2-7 and Figure 4.2-8:

1. Breadcrumb trail
2. Local navigation menu
3. Social media links and library advertisements
4. Page content
5. "Back to top" button
6. Page title "Library – Wits University" (Figure 4.2-8)

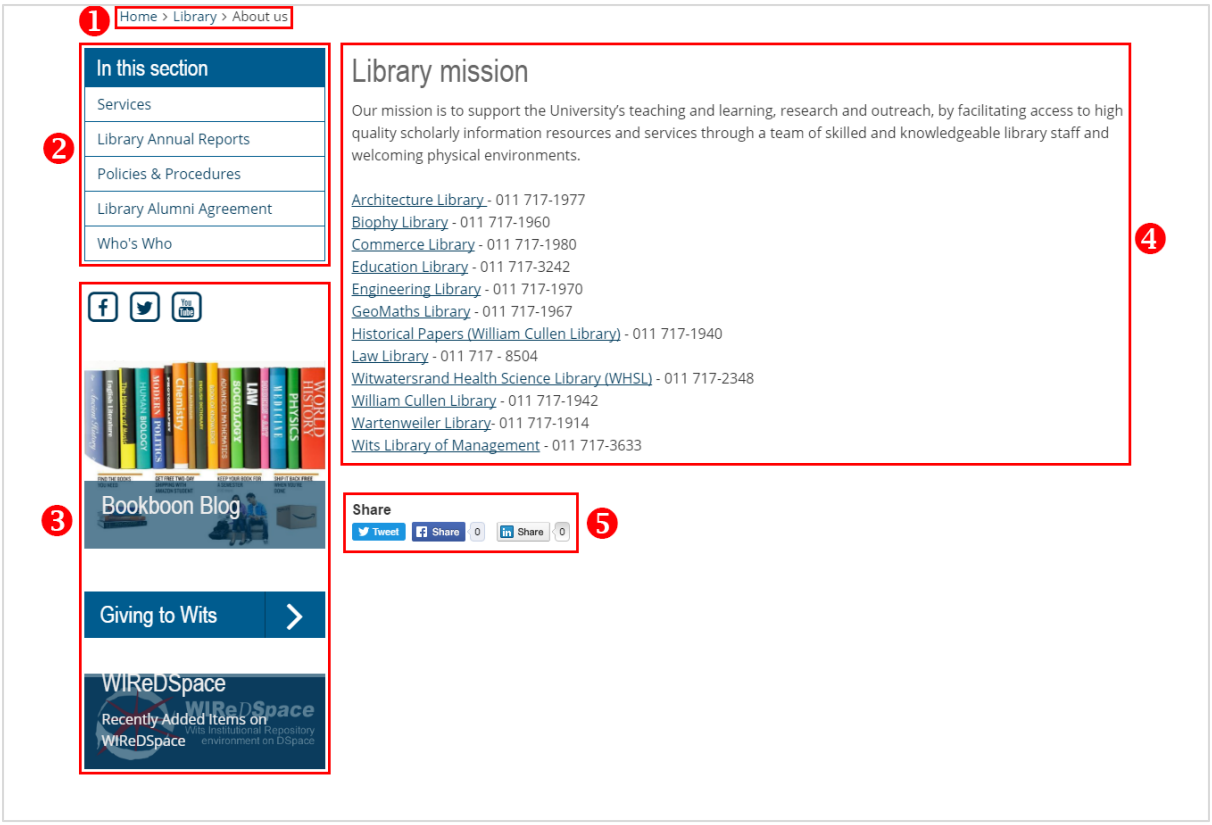


Figure 4.2-7: Wits internal page structure – "About us"

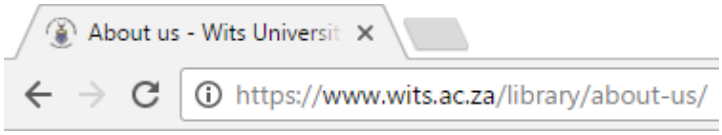


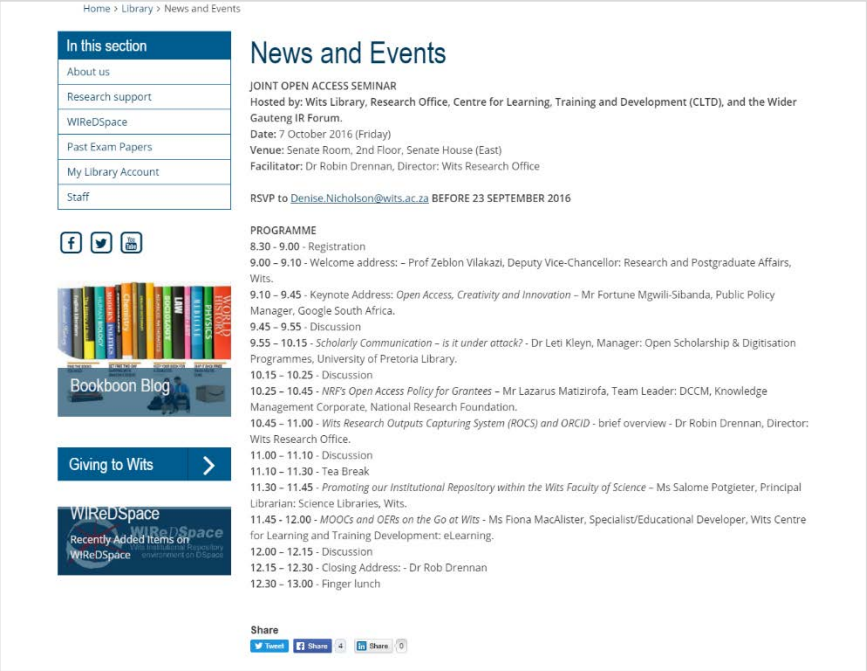
Figure 4.2-8: Wits internal page – "About Us" – page title

4.2.3.4 Heuristic evaluation of Wits dialogue element 4: Internal page contents

The table below contains the discussion of each of the problems that were found with the components in this dialogue element. The problems are summarised in the case summary in Section 4.2.5.

Heuristic	Evaluation
4.2.3.4.1 Labelling	There are various problems with the labelling in the internal pages. The caption of the local navigation menus is redundant, and the fact that the library is a section in the main university website causes problems with the titles. *4.2.3.4.1.1 Labelling problem 1: Local navigation menus' caption* Each of the pages has a local navigation structure with the caption "In this section". It is not clear, however, what the section is. The caption "In

	this section" is not descriptive of the section and should rather be replaced with the name of the section, for example, "Services" or "About us". *4.2.3.4.1.2 Labelling problem 2: Titles* The fact that the library website is a section on the main university website results in problems with the internal page titles. For example, the page title of the "About us" page is "About us – Wits University" (Figure 4.2-8). The title does not convey that it is the "About us" page of the library website, which makes it seem like the page title of the "About us" page on the *main* university website.
4.2.3.4.2 Organisation	The Wits library website has a confusing organisation structure. *4.2.3.4.2.1 Organisation problem 1: Local navigation structure functionality/incorrect use of local navigation* The local navigation structures function as both a global navigation bar and a local navigation bar because they contain links that navigate between sections and links that navigate to pages within sections. It is not clear when it is which and where it will navigate. For example, on the "About us" page, all the links except the first one navigate to other pages in the same section. The first link, however, navigates to the "Services" section of the library website, which contains a new local navigation menu. Many of the links in the local navigation menu navigate away from the section, for example, "Services" can be accessed from the "About us" section, but it is not part of the section and clicking on it navigates away from the section. "Services" should be a separate section. All the links in the local navigation menu of the homepage navigate away from the section. *4.2.3.4.2.2 Organisation problem 2: Irrelevant links in local navigation menus* The caption of the local navigation menus is "In this section", but not all of the links in the local navigation menus are relevant in the sections. For example, "Services" is not applicable to the "About us" section. The organisation is confusing because the "Services" section is a subsection of the "About us" section.

	4.2.3.4.2.3 Organisation problem 3: Irrelevant local navigation menus on pages Some of the pages are not categorised into a section, for example, "News and Events" (shown in Figure 4.2-9), as well as the "Digital collections", and "Copyright and Scholarly Communications" pages. These pages have the same local navigation menu as the homepage. Therefore, all of the links in the local navigation menu are irrelevant to the section.  Home › Library › News and Events In this section About us Research support WIReDSpace Past Exam Papers My Library Account Staff Bookboon Blog Giving to Wits WIReDSpace Recently Added Items on WIReDSpace News and Events JOINT OPEN ACCESS SEMINAR **Hosted by: Wits Library, Research Office, Centre for Learning, Training and Development (CLTD), and the Wider Gauteng IR Forum.** **Date:** 7 October 2016 (Friday) **Venue:** Senate Room, 2nd Floor, Senate House (East) **Facilitator:** Dr Robin Drennan, Director: Wits Research Office RSVP to Denise.Nicholson@wits.ac.za BEFORE 23 SEPTEMBER 2016 PROGRAMME **8.30 - 9.00** - Registration **9.00 – 9.10** - Welcome address: – Prof Zeblon Vilakazi, Deputy Vice-Chancellor: Research and Postgraduate Affairs, Wits. **9.10 – 9.45** - Keynote Address: *Open Access, Creativity and Innovation* – Mr Fortune Mgwili-Sibanda, Public Policy Manager, Google South Africa. **9.45 – 9.55** - Discussion **9.55 – 10.15** - *Scholarly Communication – is it under attack?* - Dr Leti Kleyn, Manager: Open Scholarship & Digitisation Programmes, University of Pretoria Library. **10.15 – 10.25** - Discussion **10.25 – 10.45** - *NRF's Open Access Policy for Grantees* – Mr Lazarus Matizirofa, Team Leader: DCCM, Knowledge Management Corporate, National Research Foundation. **10.45 – 11.00** - *Wits Research Outputs Capturing System (ROCS) and ORCID* - brief overview - Dr Robin Drennan, Director: Wits Research Office. **11.00 – 11.10** - Discussion **11.10 – 11.30** - Tea Break **11.30 – 11.45** - *Promoting our Institutional Repository within the Wits Faculty of Science* – Ms Salome Potgieter, Principal Librarian: Science Libraries, Wits. **11.45 - 12.00** - *MOOCs and OERs on the Go at Wits* - Ms Fiona MacAlister, Specialist/Educational Developer, Wits Centre for Learning and Training Development: eLearning. **12.00 – 12.15** - Discussion **12.15 – 12.30** - Closing Address: - Dr Rob Drennan **12.30 – 13.00** - Finger lunch Share **Figure 4.2-9: Wits internal pages – irrelevant local navigation menu** *4.2.3.4.2.4 Organisation problem 4: Link labels and content do not correspond* The main heading in the "About us" section is "Library Mission" and the page contains all the contact numbers for the different libraries. Therefore, the page title does not correspond to the page heading and content.
4.2.3.4.3 Clutter	The same components that cause clutter on the homepage cause clutter on the internal pages, i.e., the main library website components and the advertisement links (see Section 4.2.3.2.3.1 for a full description of the problem).
4.2.3.4.4 Novice user guidance	The "Ask a Librarian" page is a useful feature for novice users. It can be accessed by clicking on "About us" > "Services" > "Ask a librarian" in the local navigation menu or the direct "Ask a librarian" link on the homepage.

	There is a lack of tooltips in the local navigation structures. This problem was discussed on the homepage (Section 4.2.3.2.4.1) because it also contains a local navigation menu.
4.2.3.4.5 Help documentation	The library help documentation is difficult to locate. There is also a lack of supplemental navigation systems. *4.2.3.4.5.1 Help documentation problem 1: Difficult to find* There are two separate sections that contain help documentation: • First time user guide: https://www.wits.ac.za/library/about-us/services/ask-a-librarian/first-time-user-guide/ • How to guides: https://www.wits.ac.za/library/about-us/how-to-guides/ Both of the aforementioned help sections are difficult to locate. The "First time user guide" can be accessed by clicking on "About us" > "Services" > "Ask a librarian" > "First time user guide". The path to the "How to guides" could not be located. The URL was discovered through the sitemap generator. It would be more accessible if they were located in the same section and if that section could be accessed via a "Help" link that is available and visible on all pages. *4.2.3.4.5.2 Help documentation problem 2: Lack of supplemental navigation systems* A supplemental navigation system for this website, such as a sitemap, could not be located in the internal webpages of this website.
4.2.3.4.6 Efficiency features	There is a lack of efficiency features on the internal pages, for example, there are no shortcut links. *4.2.3.4.6.1 Efficiency features problem 1: Long pages* Long pages do not have a shortcut link to go back to the top of the page such as a "Back to top" button.
4.2.3.4.7 Consistency	The problems addressed in other heuristics cause various consistency issues, as discussed below. *4.2.3.4.7.1 Consistency problem 1: Local navigation bars* The local navigation structures are inconsistent because they contain links that navigate between pages in the same section and other sections.

	4.2.3.4.7.2 Consistency problem 2: Subdomains The library also consists of webpages that are located in subdomains of the Wits website. The webpages in the subdomains have layouts that are completely different to the main website. These subdomains include the library guides and institutional repository (http://libguides.wits.ac.za/) and (http://wiredspace.wits.ac.za/), both of which are directly accessible from the homepage. The different layout can confuse users since the subdomains are part of the library website. They should have the same consistent layout since they are part of the library website. A possible solution to the problem is to develop a completely separate library website, that is not a section of the main university website, and then include webpages from the subdomains in the main library website, making sure all pages have the same consistent layout. There are currently only 24 pages in the library section of the university website.
4.2.3.4.8 Predictable behaviour	The behaviour of the local navigation menus is unpredictable. *4.2.3.4.8.1 Predictable behaviour problem 1: Local navigation menus* The behaviour of the links in the vertical navigation bars is unpredictable because some of them open pages in the same section, some open pages in other sections, and others even open external websites.
4.2.3.4.9 Context	There is a major lack of context in the internal pages. The only way for users to know where they are within the website is via the breadcrumbs or URL. There is also no indication that the user is on the library website when they are on the internal library pages. *4.2.3.4.9.1 Context problem 1: No context in local navigation menus* Current links in the local navigation menus are not visually distinct from the other links. *4.2.3.4.9.2 Context problem 2: Library context in titles* Many of the internal pages' titles and headings do not indicate that they are part of the library website. For example, on the "Who's Who" page, the title is "Who's Who – Wits University" and the page heading is "Who's Who". Users who land on this page from outside of the library website will not immediately know that this page gives information about library staff specifically. The only way for users to know that they are in the library section is to look at the URL or breadcrumbs. Otherwise, it looks like a page of the main university website.

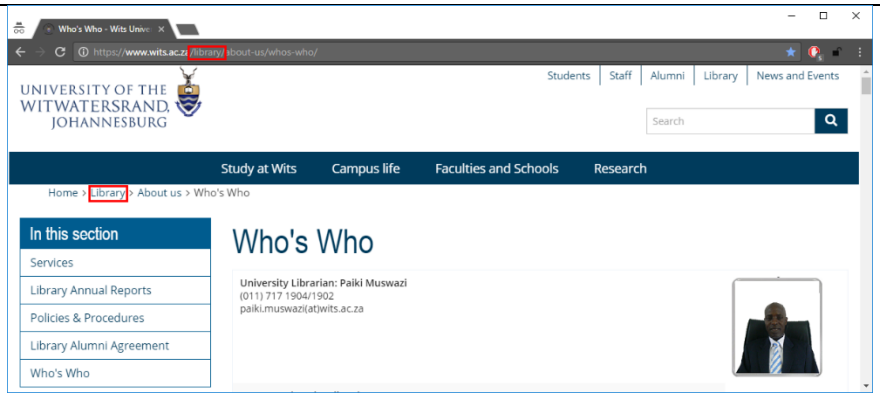
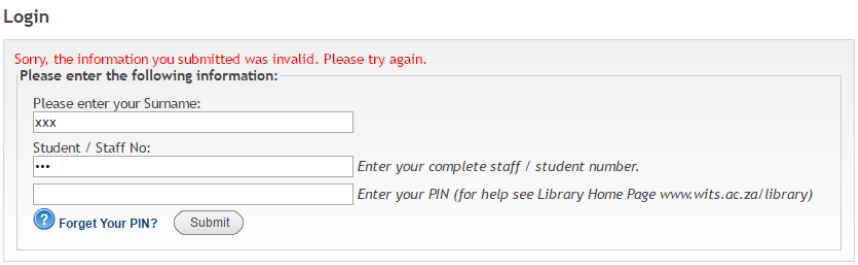


Figure 4.2-10: Wits "Who's Who" page with lack of context

4.2.3.4.10 Task completion support	Support for task completion was provided sufficiently in forms. For example, drop-down menus and radio buttons were provided for relevant form inputs.
4.2.3.4.11 Controllability	The inconsistency and unpredictable behaviour of the local navigation structures have a negative impact on the controllability (as discussed in Section 4.2.3.4.7.1 and 4.2.3.4.8.1).
4.2.3.4.12 Error recovery	This heuristic can be evaluated by submitting incorrect or blank data in the "My Library Account" login form. The form does not respond with any message when it is submitted with empty form fields, but it responds with the message "Sorry, the information you submitted was invalid. Please try again." if invalid data were submitted (see Figure 4.2-11).  **Figure 4.2-11: Wits login form error message** It also provides a link "Forget Your PIN?" that users can click on if they have forgotten their pin. The information provided is sufficient.
4.2.3.4.13 Error prevention	This heuristic and its sub-criteria do not apply to the components in this dialogue element.

4.2.3.4.14 Feedback

Feedback was tested using the "Ask a librarian" form. Data were submitted to see how the system responds (see Figure 4.2-12).

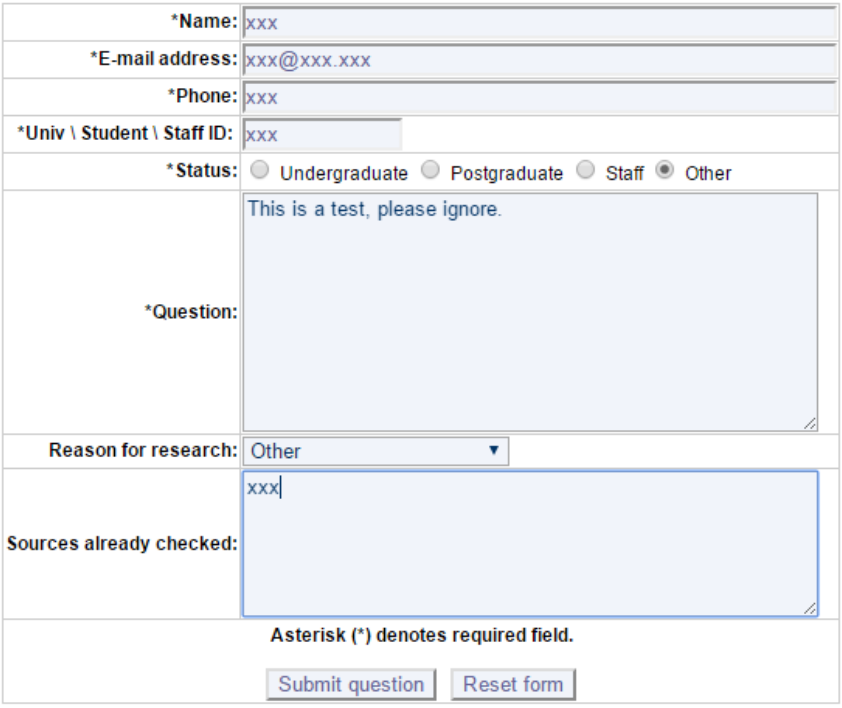


Figure 4.2-12: Wits "Ask a librarian" form

When the form is submitted, the user is redirected to a new webpage on the external website "www.questionpoint.org". The website responds with the message shown in Figure 4.2-11.

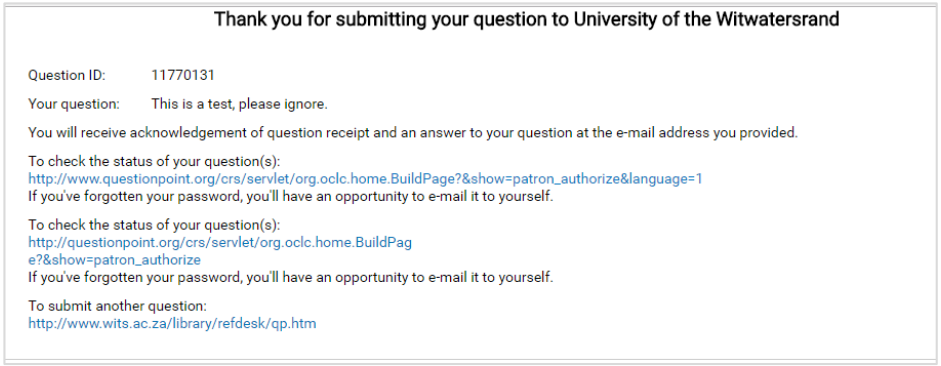


Figure 4.2-13: Wits "Ask a librarian" response

4.2.3.4.14.1 Feedback problem 1: Response message

The response message provides redundant and confusing information.

The following message is listed twice in the response, but each time with a different URL:

> "To check the status of your question(s):
> http://www.questionpoint.org/crs/servlet/org.oclc.home.BuildPag
> e?&show=patron_authorize&language=1

	If you've forgotten your password, you'll have an opportunity to e-mail it to yourself." The second part of the message: "If you've forgotten your password, you'll have an opportunity to e-mail it to yourself" is confusing. It is not clear why it is referring to a password, since it was not required to use a password to submit a question.

Table 4.2-2: Heuristic evaluation of Wits dialogue element 4: Internal page contents

4.2.4 Search systems

The Wits library website only has a resource search feature that is located on the homepage. There is no site search feature.

4.2.4.1 Dialogue element 5: Site search feature

A site search feature is a useful feature that users can use when they prefer to find information by searching for keywords rather than browsing. The lack of a search feature can have negative effects if users are unable to find information by browsing.

4.2.4.2 Dialogue element 6: Resource search feature

The resource search feature is the first component available in the homepage content of the library website, below the page heading.

The location of this dialogue element on the website is outlined in Figure 4.2-2 of the homepage with the number 6, and the detail (the components in this dialogue element) is outlined in Figure 4.2-14.

The resource search feature contains the following five components. The numbers in the list correspond to the numbers in Figure 4.2-14:

1. HTML legend "Search the Wits libraries and beyond:"
2. HTML input element
3. Submit button with the text "Go"
4. Three links: "Advanced Search", "A–Z List of eJournals and eBooks", and "Search the Library Catalogue"
5. Image with the text "Search with WorldCat"

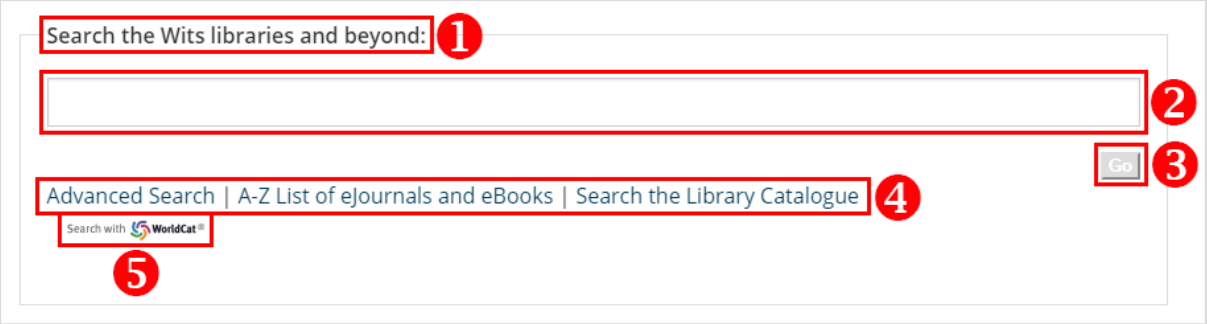


Figure 4.2-14: Wits resource search feature

4.2.4.3 Heuristic evaluation of Wits dialogue element 6: Resource search interface

The table below contains the discussion of each of the problems that were found with the components in this dialogue element. The problems are summarised in the case summary in Section 4.2.5.

Heuristic	Evaluation
4.2.4.3.1 Labelling	The language in the dialogue element is familiar but potentially misleading. *4.2.4.3.1.1 Labelling problem 1: Search box caption (HTML legend)* The caption "Search the Wits libraries and beyond" can be misleading because it is not clear what "beyond" refers to. It can be misinterpreted as "the rest of the website" or "other libraries". According to Swanson and Green (2011:227), users might treat it like an all-encompassing search box, potentially using it to search the website, and therefore resulting in failed searches.
4.2.4.3.2 Organisation	The positioning of links can cause confusion. *4.2.4.3.2.1 Organisation problem 1: Grouping of links* The position of the links below the search box can cause confusion since there is an image below the first link with the text "Search with WorldCat". It is not clear if this refers to the search box and if it applies to the link above it. But it does not apply to all the links, since the last one, "Search the library catalogue", does not make use of "WorldCat"; instead, it links to http://innopac.wits.ac.za/ .
4.2.4.3.3 Clutter	The interface is clutter free.
4.2.4.3.4 Novice user guidance	There is no novice user guidance. *4.2.4.3.4.1 Novice user guidance problem 1: No description* A useful feature would be a short description of what search results can

	be expected when the search box is used, as well as descriptive tooltips for all the links.
4.2.4.3.5 Help documentation	No help documentation could be located for the dialogue element. *4.2.4.3.5.1 Help documentation problem 1: No help documentation* Search features can provide options that are not normally intuitive for users, for example, the use of truncation, wild cards, operators, and phrases. Therefore, a help link to help documentation would be required to explain these advanced search options and if they are available. This will depend on the website that implements the search feature, for example, the catalogue.
4.2.4.3.6 Efficiency features	Two positive aspects related to this heuristic are mentioned below: **Positive aspect 1:** There is a link to an advanced search that users can use in order to narrow their searches. **Positive aspect 2:** Users can submit the search query by pressing the enter button.
4.2.4.3.7 Consistency	The browser tab in which the links and button in this element open is inconsistent. See "Predictable behaviour" in Section 4.2.4.3.8 for a description of the problem.
4.2.4.3.8 Predictable behaviour	The behaviour of the "Go" button and the other links is unexpected. *4.2.4.3.8.1 Predictable behaviour problem 1: Behaviour of submit button* When the "Go" button next to the search box, or the link "search the library catalogue" is clicked, the results are displayed in the same tab. When the other two links "Advanced Search" and "A–Z List of eJournals and eBooks" are clicked, the results open in a new tab. This behaviour is inconsistent and therefore unpredictable. The best solution would be to make all the results that open an external website open in a new tab.
4.2.4.3.9 Context	This heuristic and its sub-criteria do not apply to this dialogue element.
4.2.4.3.10 Task completion support	There is some support for task completion, as discussed below. The last search term that was searched in the search box is remembered when the user comes back to the page using the browser back button. All other search terms are remembered, so when the search box is cleared and the user starts typing a term that has been searched before, the

	complete term will be suggested in a drop-down menu below the search box.
4.2.4.3.11 Controllability	This heuristic and its sub-criteria do not apply to the components in this dialogue element.
4.2.4.3.12 Error recovery	The search engine does not automatically fix incorrect search terms. This is not necessarily a problem with the library website, as the search is performed by WorldCat and not the library website.
4.2.4.3.13 Error prevention	This heuristic and its sub-criteria do not apply to the components in this dialogue element.
4.2.4.3.14 Feedback	This heuristic and its sub-criteria do not apply to the components in this dialogue element.

Table 4.2-3: Heuristic evaluation of Wits dialogue element 6: Resource search interface

4.2.5 Summary of case study 2: Wits library website

A total of 33 usability problems were found on the library website of the University of the Witwatersrand.

Many of the problems that were reported were a result of the library not having its own website on a separate domain. All of the other websites that were evaluated in both the case studies, related studies, and analysis had their own library websites on separate domains.

The library website has many usability problems that are inherited from the main university website. To solve this problem, the library section must be separated from the main university website, on a separate domain, and it must get a global navigation structure that is specific to the library.

The library website of a university has a different purpose than the main university website. Therefore, it is used by a different range of users with different information needs. Different information needs will result in websites with different structures and components. Typically, both a university and a library's websites are large, information-rich websites. The combination of the two into a single website results in a cluttered or confusing website. Therefore, it is essential for the library to have a separate website.

This website had the most missing dialogue elements compared to the other cases. The elements that are missing are:

- Dialogue element 1

- Dialogue element 2
- Dialogue element 5

The impact that these missing elements have on the usability of the website had a direct influence on the usability of the other dialogue elements as well as the overall usability.

The problems that were found in this website are summarised below and divided into the fourteen heuristics. The abbreviation "DE" is used to show in what dialogue element the problem was identified.

4.2.5.1 Labelling

1. There are labels on the homepage (DE2) that are unfamiliar or that consist of library jargon.
2. The homepage (DE3) title is correct if the library website is a section of the main university website, but not as a standalone website.
3. The local navigation menus in the internal pages (DE4) have captions that are not descriptive.
4. The page titles of the internal pages (DE4) do not provide appropriate information.
5. The caption of the resource search feature (DE6) is misleading.

4.2.5.2 Organisation

6. The categorisation of links on the homepage (DE3) causes confusion.
7. The links in the local navigation menu on the homepage (DE3) do not make sense.
8. The organisation of internal pages (DE4) and the links on the navigation menus on the internal pages are confusing.
9. There are irrelevant links in the local navigation menus on the internal pages (DE4).
10. Some of the internal pages (DE4) have local navigation menus that are irrelevant in the context.
11. Some of the link labels in the local navigation menus in the internal pages (DE4) do not correspond to the content they link to.
12. The grouping of content in the resource search feature (DE6) can cause confusion.

4.2.5.3 Clutter

13. The main university website components cause clutter on the homepage (DE3).
14. The local navigation menu is irrelevant on the homepage (DE3).
15. The main university website components cause clutter on the internal pages (DE4).

4.2.5.4 Novice user guidance

16. There is a lack of descriptive tooltips for links on the homepage (DE3).

17. There is a lack of descriptive tooltips for links in the local navigation menus on internal pages (DE4).
18. The resource search feature (DE6) lacks a description of what type of search results can be expected if the user uses it.

4.2.5.5 Help documentation

19. It is difficult to locate help documentation from the homepage (DE3).
20. The path to the help documentation sections is difficult to locate in the internal pages (DE4).
21. A supplemental navigation system for this website, such as a sitemap, could not be located in the internal webpages (DE4) of this website.
22. There is no help documentation for the resource search feature (DE6).

4.2.5.6 Efficiency features

23. There are no shortcut links to the top of the page on long internal pages (DE4).

4.2.5.7 Consistency

24. Some external links on the homepage (DE3) open in the same tab while others open in a new tab.
25. The functionality of the local navigation menus on the internal pages (DE4) is inconsistent because some links navigate to other sections while other links navigate to sub-sections.
26. The library website has internal pages (DE4) that are hosted on subdomains that have completely different structures.

4.2.5.8 Predictable behaviour

27. The behaviour of links in the local navigation menu on the homepage (DE3) is unpredictable because it contains external links, links to sections, and links to sub-sections.
28. The behaviour of links in the local navigation menu on the internal pages (DE4) is unpredictable because it contains external links, links to sections, and links to sub-sections.

4.2.5.9 Context

29. Users' context is not shown in the local navigation menus in the internal pages (DE4).
30. Many titles and headings in the internal pages (DE4) do not indicate that they are pages within the library section of the website.

4.2.5.10 Task completion support

No problems relating to task completion support were found in any of the dialogue elements.

4.2.5.11 Controllability

31. It is not clear what sections are available from the homepage (DE3) due to the lack of a main navigation bar.
32. The local navigation menus on the internal pages (DE4) have a negative impact on controllability.

4.2.5.12 Error recovery

No problems relating to error recovery support were found in any of the dialogue elements.

4.2.5.13 Error prevention

No problems relating to error prevention support were found in any of the dialogue elements.

4.2.5.14 Feedback

33. The response message on the form on the "Ask a librarian" internal page contains redundant and confusing information.

The number of problems that were found under each of the heuristics is summarised below in Table 4.2-4. They are sorted from the largest number of problems to the smallest number of problems.

Number of problems	Heuristic
7	Organisation
5	Labelling
4	Help documentation
3	Clutter
3	Novice user guidance
3	Consistency
2	Predictable behaviour
2	Context
2	Controllability
1	Efficiency features
1	Feedback
0	Task completion support
0	Error recovery
0	Error prevention

Table 4.2-4: Number of problems that were found in the Wits library website

The largest number of problems was found with the organisation of components. It is clear from the descriptions of the problems that many of these problems were caused by the missing dialogue elements.

4.3 Case Study 3: Stellenbosch University (SU)

The Stellenbosch University is the third best university in South Africa according to the QS University Rankings 2016/17, ranking at number 35 in the BRICS countries ranking (Quacquarelli Symonds 2016a) and at number 395 in the world rankings (Quacquarelli Symonds 2016b).

The main library domain (http://library.sun.ac.za/English/Pages/default.aspx) consisted of more than 500 webpages at the time of writing (based on a scan of the website using https://www.xml-sitemaps.com/, a free sitemap generator). It is to be noted that many of the website's links may have changed since the time of writing and will no longer work.

When the user visits library.sun.ac.za, the English version of the website is displayed by default: http://library.sun.ac.za/English/Pages/default.aspx. The user also has the option to switch to an Afrikaans version of the website using the "Afrikaans" link in the top right corner. Only the English version of the website is evaluated in this study.

The majority of the webpages are available from the main library website domain (library.sun.ac.za). The library also has webpages in the following subdomains:

- Library guides: http://libguides.sun.ac.za/
- Ask a librarian: http://libanswers.sun.ac.za/

There is no clear reason why this content is on subdomains and why the pages do not have the same structure as the pages on the main domain. This is therefore a consistency issue and is further discussed in the heuristic evaluations of the individual dialogue elements.

The homepage of the library website is shown in Figure 4.3-1.

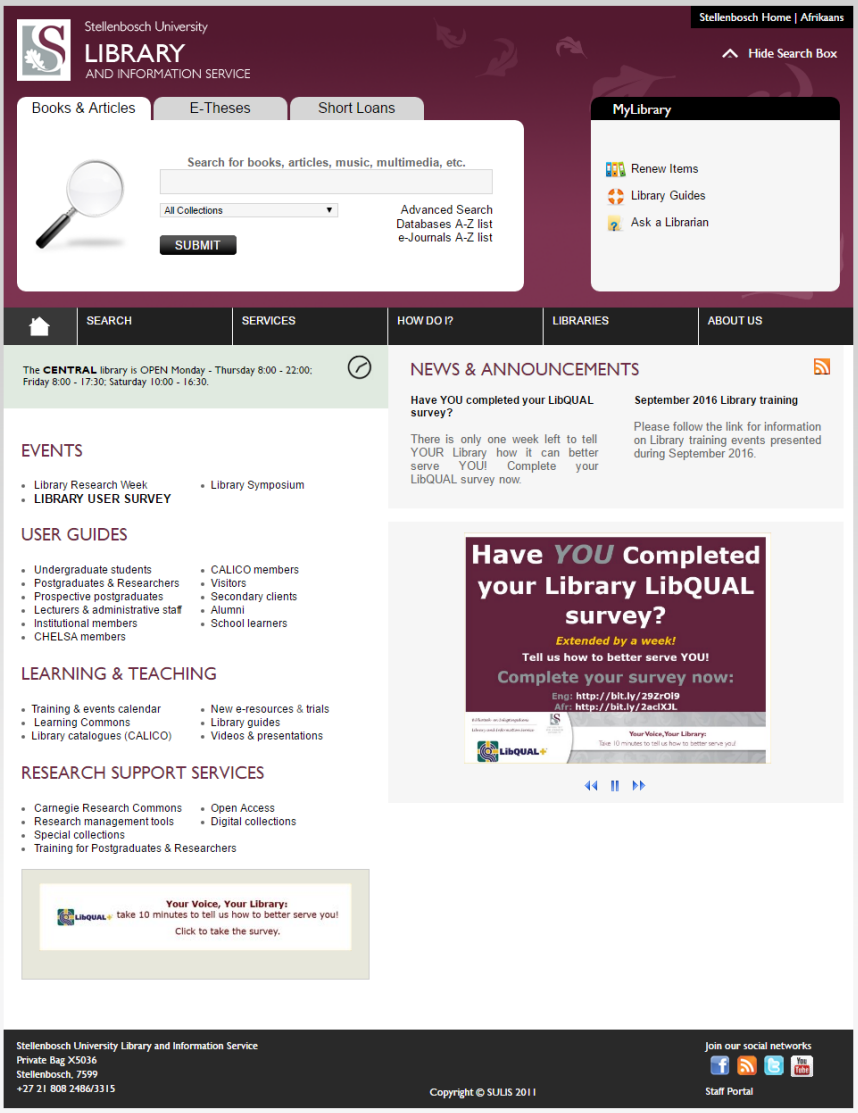


Figure 4.3-1: SU library homepage

4.3.1 SU library website dialogue elements

The SU library website consists of the 5 dialogue elements that are represented in Figure 4.3-2 and Figure 4.3-3. Figure 4.3-2 is a screenshot of the homepage and Figure 4.3-3 is a screenshot of the "General Contact Details" page. The "General Contact Details" page represents the internal pages of the UCT library website and it should be noted that all of the internal pages are evaluated, not just the one represented in the screenshot.

All the dialogue elements that are evaluated are outlined in the two screenshots with red borders and numbers 1 to 6. The numbers of the dialogue elements in the following list correspond to the numbers in the figures. Each number represents a specific dialogue element:

Global navigation structures

1. Dialogue element 1: Header and footer (number 1 in Figure 4.3-2 and Figure 4.3-3)
2. Dialogue element 2: Main navigation bar (number 2 in Figure 4.3-2 and Figure 4.3-3)

Local navigation structures

3. Dialogue element 3: Homepage contents (number 3 in Figure 4.3-2)
4. Dialogue element 4: Internal page contents (number 4 in Figure 4.3-3)

Search systems

5. Dialogue element 5: Site search feature (not present in SU library website)
6. Dialogue element 6: Resource search feature (number 6 in Figure 4.3-2)

It is to be noted that some dialogue elements are components within other dialogue elements. For example, the resource search feature (dialogue element 6) is a component in the header (dialogue element 1). These dialogue elements are evaluated as separate dialogue elements, as well as components of the dialogue element in which it is contained, since it has an impact on its usability.

The dialogue elements as they are outlined in the screenshots are shown in more detail in the subsequent sections, where each of the components within the dialogue elements is outlined.

As can be seen on the screenshots, and as explained in Section 3.3.3.2, some dialogue elements appear on all pages, while others appear only on the homepage or internal pages. The locations of the various dialogue elements differ from case to case.

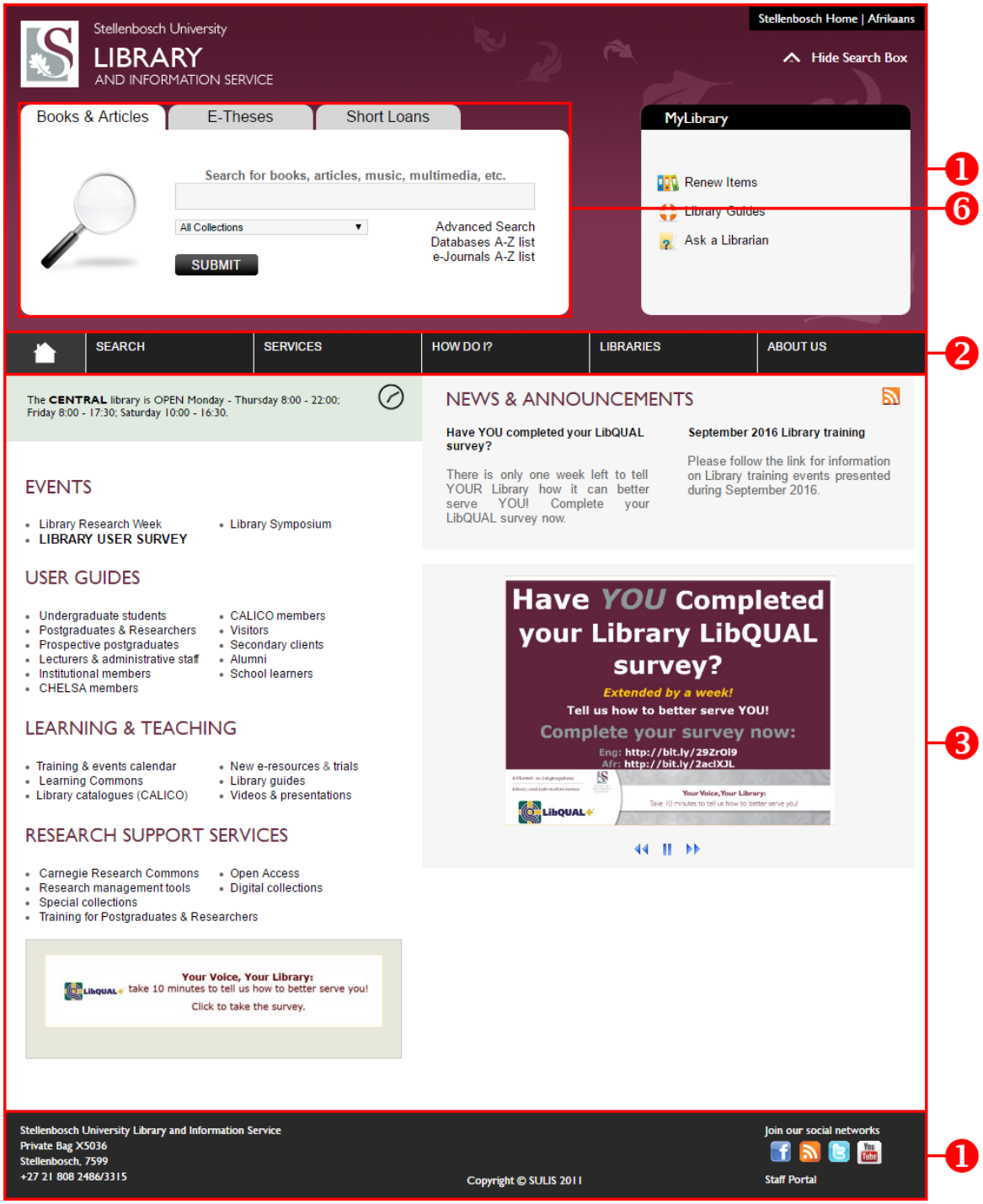


Figure 4.3-2: SU dialogue elements on the homepage

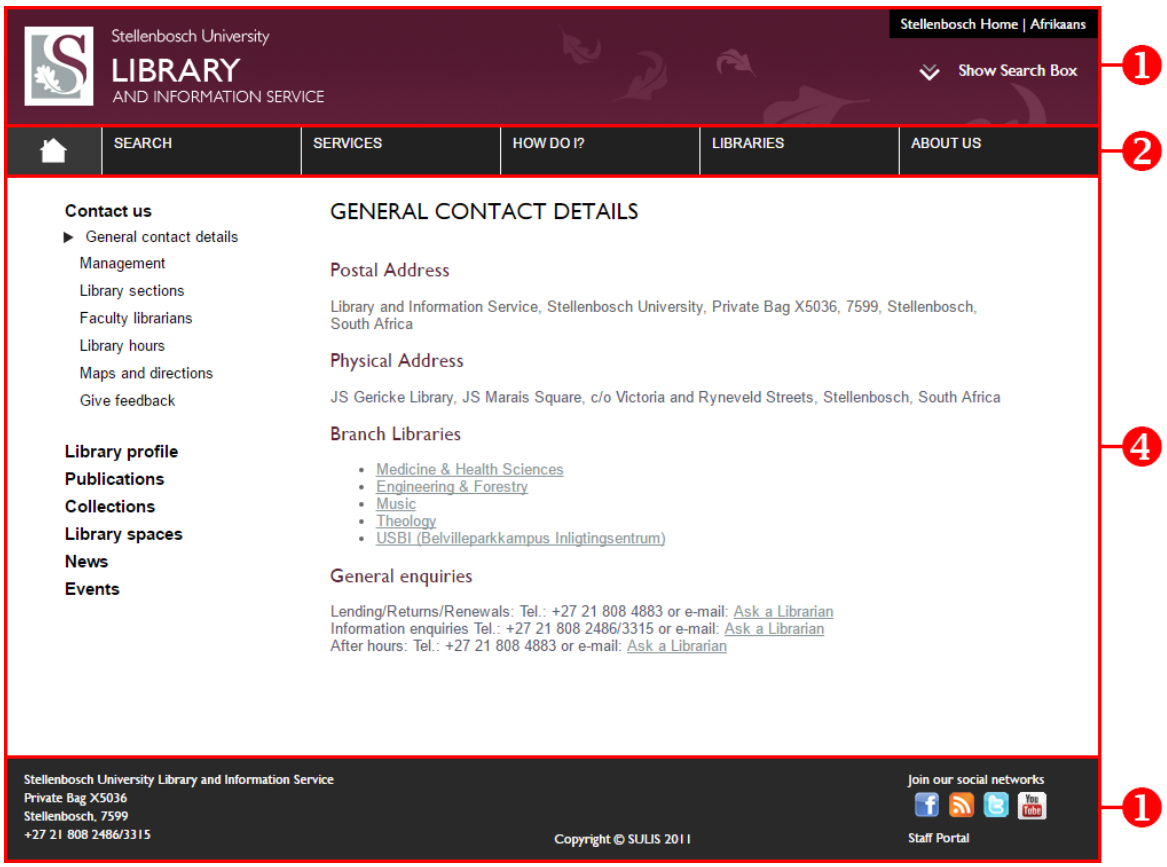


Figure 4.3-3: SU dialogue elements on internal pages (The "General Contact Details" page represents all the internal pages)

4.3.2 Global navigation structures

The global navigation structure of the SU library website consists of a header, the main navigation bar, and a footer (numbers 1 and 2 in Figure 4.3-2 and Figure 4.3-3). The header in this website contains a search box and additional links that can be condensed or expanded. By default, it is expanded on the homepage and condensed on all the other pages.

The evaluation of the header excludes the evaluation of the resource search interface because it is a separate dialogue element that is evaluated in Section 4.3.4.2.

4.3.2.1 Dialogue element 1: Header and footer

This dialogue element is outlined in Figure 4.3-2 and Figure 4.3-3 with the number 1, and the detail (the components in this dialogue element) is outlined in Figure 4.3-4, Figure 4.3-5, and Figure 4.3-6).

The header contains the following five components. The numbers in the list correspond to the numbers in Figure 4.3-4 and Figure 4.3-5:

1. Logo and name ("Stellenbosch University LIBRARY AND INFORMATION SERVICE") image link to library homepage
2. Two links ("Stellenbosch Home" and "Afrikaans"). The first link, "Stellenbosch Home" takes the user to the homepage of the *main* university website, and the second one, "Afrikaans", takes the user to an Afrikaans version of the library website
3. "Show Search Box" / "Hide Search Box", a toggle link that hides the search feature together with the MyLibrary section next to it
4. Resource search feature (dialogue element 6)
5. "MyLibrary" quick links section that contains three links: "Renew Items", "Library Guides", and "Ask a Librarian"

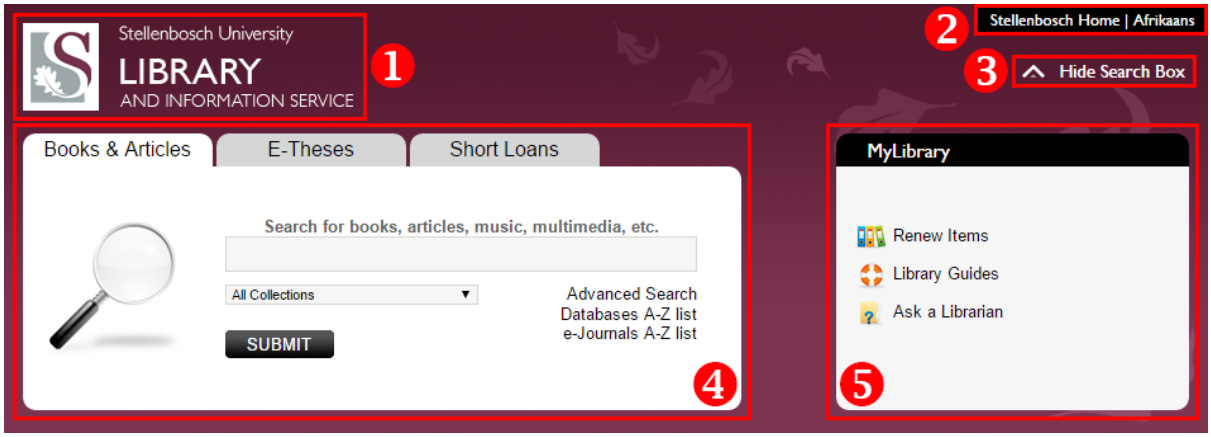


Figure 4.3-4: SU header (expanded)

The header can be made smaller by clicking on "Hide Search Box" (component 3). This hides the resource search interface and "MyLibrary" as shown in Figure 4.3-5. On the homepage, the full header is shown by default, and on all the other pages the small version is shown by default.

Figure 4.3-5: SU header (collapsed)

The footer contains the following four components. The numbers in the list correspond to the numbers in Figure 4.3-6:

6. Postal address and two contact telephone numbers
7. Copyright message
8. Four social media links
9. Staff portal link

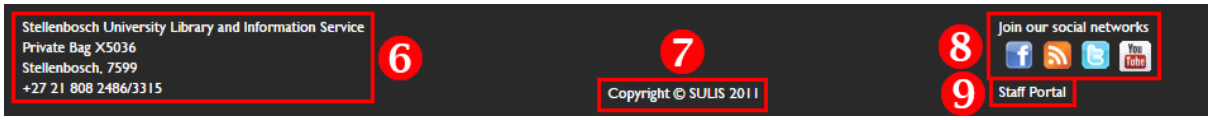


Figure 4.3-6: SU footer

4.3.2.2 Heuristic evaluation of SU dialogue element 1: Header and footer

The table below contains the discussion of each of the problems that were found with the components in this dialogue element. The problems are summarised in the case summary in Section 4.3.5.

Heuristic	Evaluation
4.3.2.2.1 Labelling	All of the labels in the header and footer are easy to understand and do not need revision. The only issue is that the missing space in the caption "MyLibrary" causes confusion. It is not clear if a space is missing due to a typographical error, or if it is done purposefully.
4.3.2.2.2 Organisation	The order and layout of information are sensible. There is a small issue with the "Staff Portal" link in the footer. *4.3.2.2.2.1 Organisation problem 1: "Staff Portal" link in footer* The position of the "Staff Portal" link in the bottom right corner of the footer can cause problems. The link is only relevant to staff, but it is positioned very close to the social network links that are intended for all library users. The links should therefore not be grouped together. It would make more sense to separate it from those links and position it on its own. A possible solution would be to move the social media links to the centre of the footer, away from the "Staff Portal" link.
4.3.2.2.3 Clutter	When considering both the (expanded) header and footer the design looks clear and clutter free.
4.3.2.2.4 Novice user guidance	There is a lack of useful tooltips for novice users in the header. **Positive aspect**: The social media icon links in the footer have descriptive tooltips that show the full name of the social media network. *4.3.2.2.4.1 Novice user guidance problem 1: Header tooltips* None of the links have descriptive tooltips. It is a good idea to provide tooltips for all the links that are not intuitive in the header that explain where the link will take the user.

	For example, the following links can have the tooltips that are suggested in the quotation marks. • Library logo: "Go to homepage" • Stellenbosch Home: "Go to main university homepage" • Afrikaans: "Link to Afrikaans website – homepage" • Hide Search Box: "Reduce the content of the header" • Show Search Box: "Expand the content of the header" • Renew Items: "Go to the catalogue to renew items" • Library Guides: "Go to libguides.sun.ac.za"
4.3.2.2.5 Help documentation	Some of the help documentation is easily accessible from the "MyLibrary" section in the header. It contains "Library Guides" and "Ask a Librarian" links. The "Library Guides" link opens the website http://libguides.sun.ac.za/ (in the same browser tab) that has a similar visual design but a different layout structure than the main library website. The "Ask a Librarian" link opens the website http://libanswers.sun.ac.za/ in the same browser tab that has the same layout and visual design as the library guides website. The problem is that the links open external websites in the same tab, causing the user to lose their position in the library website. This is a controllability problem and is therefore discussed in Section 4.3.2.2.11.1.
4.3.2.2.6 Efficiency features	There are no efficiency features in the header or footer (as opposed to UCT that has a site search feature in the header). The feature that allows users to change the language to Afrikaans is an aspect of individualisation, but it is not a feature that specifically helps improve the efficiency of expert users. It is rather for the purpose of providing accessibility, and it is beyond the scope of this study, as discussed in the limitations in Chapter 1, Section 1.7.4. *4.3.2.2.6.1 Efficiency features problem 1: Missing site search feature* There is no site search feature that users can use as an alternative to browsing. A site search feature is listed as a core dialogue element of a library website. The lack of a site search feature in the header of an academic library website can have a negative impact on users' efficiency, as a well-implemented site search feature can be used to locate specific information faster.
4.3.2.2.7 Consistency	The header and footer stay consistently the same across pages that are part of the website. The header is only expanded on the homepage, but

	this does not cause usability problems. Instead, it serves to reduce clutter on the internal pages.
4.3.2.2.8 Predictable behaviour	The behaviour of the links in the "MyLibrary" container might be unexpected. *4.3.2.2.8.1 Predictable behaviour problem 1: External links in header* The links in the "MyLibrary" container all open webpages that are not part of the main library website. The "Library Guides" and "Ask a Librarian" links open in subdomains of the library website, i.e., http://libguides.sun.ac.za/ and http://libanswers.sun.ac.za/. The subdomains do not have the same global structure as the main library website. The "Renew Items" link opens an external website (http://aleph20.calico.ac.za/). The behaviour is unexpected because the links are under a "MyLibrary" caption, which gives the idea that the links will open pages within the same website that have the same domain and layout structure.
4.3.2.2.9 Context	The header sufficiently gives context in relation to the web since it shows the name of the website on all the pages and it consistently stays the same.
4.3.2.2.10 Task completion support	This heuristic and its sub-criteria do not apply to the components in this dialogue element.
4.3.2.2.11 Controllability	There are some links in the header that allow users to easily change states. For example, the "Hide Search Box" link changes to "Show Search Box", and "Afrikaans" changes to "English". When these links are clicked again, the website goes back to its previous state. *4.3.2.2.11.1 Controllability problem 1: External links in header* All the links (except the above mentioned) require the user to use the browser's back button if they want to go back to where they came from, simply because all of the links go to different websites or subdomains. Therefore, users cannot make use of the global navigation structure to go back (like they can on the UCT website). The pages on which the user lands do have links to the library homepage, but they might have navigated to the webpages in the subdomain from a different page, so it would not take them back to the exact same location within the website where they came from. A simple solution is to make all external links open in a new browser tab.

	Users would still be required to navigate back to where they came from using the browser's functionality, but the page will not need to be loaded again.
4.3.2.2.12 Error recovery	This heuristic and its sub-criteria do not apply to the components in this dialogue element.
4.3.2.2.13 Error prevention	This heuristic and its sub-criteria do not apply to the components in this dialogue element.
4.3.2.2.14 Feedback	This heuristic and its sub-criteria do not apply to the components in this dialogue element.

Table 4.3-1: Heuristic evaluation of SU dialogue element 1: Header and footer

4.3.2.3 Dialogue element 2: Main navigation bar

The location of the navigation bar is outlined in Figure 4.3-2 and Figure 4.3-3 with the number 2, and the detail (the components in this dialogue element) is outlined in Figure 4.3-7 and Figure 4.3-8.

The main navigation bar is a horizontal bar that consists of six links in total (as opposed to nine in the UCT website). The first link is a link to the homepage and the five other links have drop-down menus that appear underneath the link when the user hovers over them.

The main navigation bar contains the following six components (each component is a link). The numbers in the list correspond to the numbers in Figure 4.3-7 and Figure 4.3-8:

1. Home icon
2. "Search"
3. "Services"
4. "How do I?"
5. "Libraries"
6. "About us"

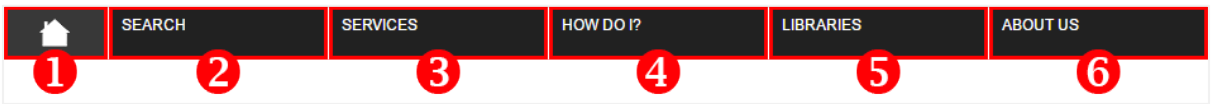


Figure 4.3-7: SU navigation bar

The drop-down menus that appear when a user hovers over links 2–6 in the main navigation bar are outlined in Figure 4.3-8.

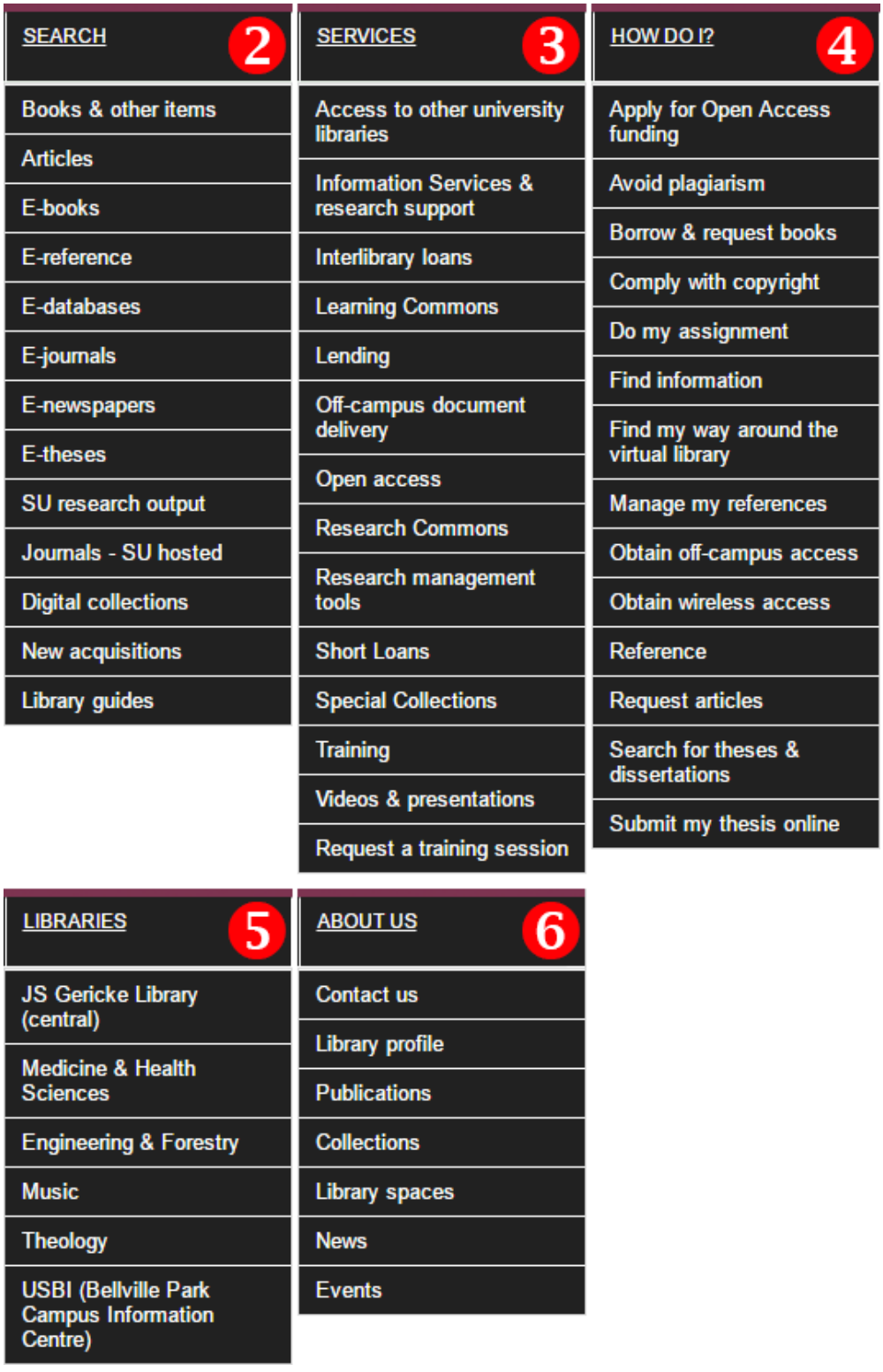


Figure 4.3-8: SU main navigation bar, drop-down menus

4.3.2.4 Heuristic evaluation of SU dialogue element 2: Main navigation bar

The table below contains the discussion of each of the problems that were found with the components in this dialogue element. The problems are summarised in the case summary in Section 4.3.5.

Heuristic	Evaluation
4.3.2.4.1 Labelling	Most of the terms use clear and familiar language but some of them are vague and not descriptive enough of the content represented. Additionally, some of the link labels do not correspond to the linked content. **Positive aspect:** There is a good example of labels that start with identifying keywords in the drop-down menu of "Search", i.e., "Journals – SU Hosted", instead of "SU hosted journals". *4.3.2.4.1.1 Labelling problem 1: Vague link labels* The following link labels were a little vague and need clarification: • "New acquisitions" refer to "New books acquired". • "Publications" refer to "Newsletters & Annual reports" to be more specific. • "Collections" specifically refers to "Departmental collections". • "Videos & Presentations" *4.3.2.4.1.2 Labelling problem 2: Incorrect link labels* Many of the link labels do not correspond to the page that they link to. This is either a result of incorrect labels or incorrect hyperlinks. For example, "Request a training session" links to "Ask a librarian". It is not clear if there is a page where a user can request a training session. The link "About us" in the main navigation bar links to the first page in the "Contact us" section because the "Contact us" section is the first sub-section in the "About us" section. There is no "About us" page. Likewise, "Library profile" links to a page that contains library history, therefore "Library history" would be a better label. All the labels should correspond to the page they link to and, if not, either the label should be changed or removed. Alternatively, if the link label makes sense in the context, change the hypertext reference to a more appropriate page, if one exists, or create one.
4.3.2.4.2 Organisation	The organisation of some of the links can cause confusion. *4.3.2.4.2.1 Organisation problem 1: Categorisation* Many of the links in the drop-down menus do not fit under the main categories in the navigation bar. For example, under the category "Search", one can find a link "Library guides", or under "Services" there is a "Videos & Presentations" link. It seems more appropriate to list resources under the search category and library guides under a "Help" category.

	Additionally, the categorisation is confusing because links under the "Services" category, for example, "Videos & Presentations", open pages in the "About us" section.
4.3.2.4.3 Clutter	The number of links in the main navigation bar is sensible but some of the drop-down menus are too long. *4.3.2.4.3.1 Clutter problem 1: Long drop-down menus* Some of the drop-down menus contain too many links, for example, "Services" and "How do I?". A card sorting exercise can be used to find out which links are not essential and can be removed.
4.3.2.4.4 Novice user guidance	Some additional explanations are provided in the labels of links, for example, "JS Gericke library (central)" under "Libraries", however, there is a lack of informative tooltips. *4.3.2.4.4.1 Novice user guidance problem 1: Lack of useful tooltips* There are no tooltips that tell the user where a link will take them in the main navigation bar. Informative tooltips that inform the user where a link will take them can be provided.
4.3.2.4.5 Help documentation	Help documentation for various aspects of the library can easily be located under the main category "HOW DO I?", however, the label is not useful. *4.3.2.4.5.1 Help documentation problem 1: Link not descriptive* A more useful label for the help documentation would be "Help" as users seeking help would more likely scan for a link with the label "Help".
4.3.2.4.6 Efficiency features	The drop-down menus in the main navigation bar can be seen as efficiency features as they provide shortcuts to content within sections.
4.3.2.4.7 Consistency	Links do not consistently open in the same tabs. *4.3.2.4.7.1 Consistency problem 1: Link targets* Some of the links that link to pages of the library website open in the same tab and others open in a new tab. *4.3.2.4.7.2 Consistency problem 2: Links to subdomains* Some links link to pages of the library website that are hosted on subdomains. The structure of the pages in the subdomains is inconsistent with the main library website. Users might not be aware that the pages are on subdomains, which can cause confusion if the pages have different structures. Essential library information or resources should be hosted on

	the same domain and all of the pages should have the same consistent layout structure.
4.3.2.4.8 Predictable behaviour	The unpredictable behaviour of some of the links is caused by other usability problems discussed in this table, as discussed below. *4.3.2.4.8.1 Predictable behaviour problem 1: Labelling of links in the main navigation bar does not correspond to contents* The first problem that causes unpredictable behaviour is the incorrect labelling. This causes users to link to unexpected pages because the result pages do not match corresponding link labels (refer to the "Labelling" heuristic in Section 4.3.2.4.1.2). *4.3.2.4.8.2 Predictable behaviour problem 2: Inconsistent link targets* The second problem that causes unpredictable behaviour is the inconsistent targets of links. Some internal links open in the same tab while others open in a new tab (refer to the "Consistency" heuristic in Section 4.3.2.4.7.1).
4.3.2.4.9 Context	Context is not indicated in the main navigation bar. *4.3.2.4.9.1 Context problem 1: Current links* Current links are not visually distinct from other links, whereas in the UCT website, context was clearly indicated on the main navigation bar to show the user what page they are on in the website. The way that it is indicated in the UCT website it a good example of how it can be done.
4.3.2.4.10 Task completion support	This heuristic and its sub-criteria do not apply to the components in this dialogue element.
4.3.2.4.11 Controllability	External links that open in the same tab limits controllability. *4.3.2.4.11.1 Controllability problem 1: External links* The main navigation bar contains external links. Main navigation bars should typically only contain links that link to main sections in a website. Many library websites (including UCT in case study 1) have navigation bars that contain external links. This problem is further discussed in the chapter summary in Section 4.4.1.
4.3.2.4.12 Error recovery	This heuristic and its sub-criteria do not apply to the components in this dialogue element.

4.3.2.4.13 Error prevention	The main links in the navigation bar, whose purpose is to reveal drop-down menus, are clickable. This can result in users accidentally clicking on them. *4.3.2.4.13.1 Error prevention problem 1: Main section links that do not have corresponding pages are clickable* The main categories in the navigation bar are clickable, but they take the user to the first link in the drop-down menu, which might not be where a user intended to go. Users might click them by accident when they intend to expand the drop-down menu. A possible solution is to make the main categories inactive to prevent errors. The links should either be disabled or pages should be created for the main sections so that the links can link to the expected pages.
4.3.2.4.14 Feedback	This heuristic and its sub-criteria do not apply to the components in this dialogue element.

Table 4.3-2: Heuristic evaluation of SU dialogue element 2: Main navigation bar

4.3.3 Local navigation structures

The local navigation structures are all the navigation components that are not part of the global navigation structures. The navigation components on a website's homepage are usually different from the navigation components on the rest of the internal pages. A single internal page screenshot is used to outline the components of the internal pages; however, all internal pages are evaluated.

4.3.3.1 Dialogue element 3: Homepage contents

This dialogue element is outlined in Figure 4.3-2 with the number 3, and the detail (the components in this dialogue element) is outlined in Figure 4.3-9). The title of the homepage is also part of this dialogue element and is shown in Figure 4.3-10.

The homepage contains the following six components. The numbers in the list correspond to the numbers in Figure 4.3-9 and Figure 4.3-10:

1. Library hours
2. Categorised links
3. Library survey
4. News and announcements
5. Slideshow
6. Title "Stellenbosch University Library and Information Service" (Figure 4.3-10)

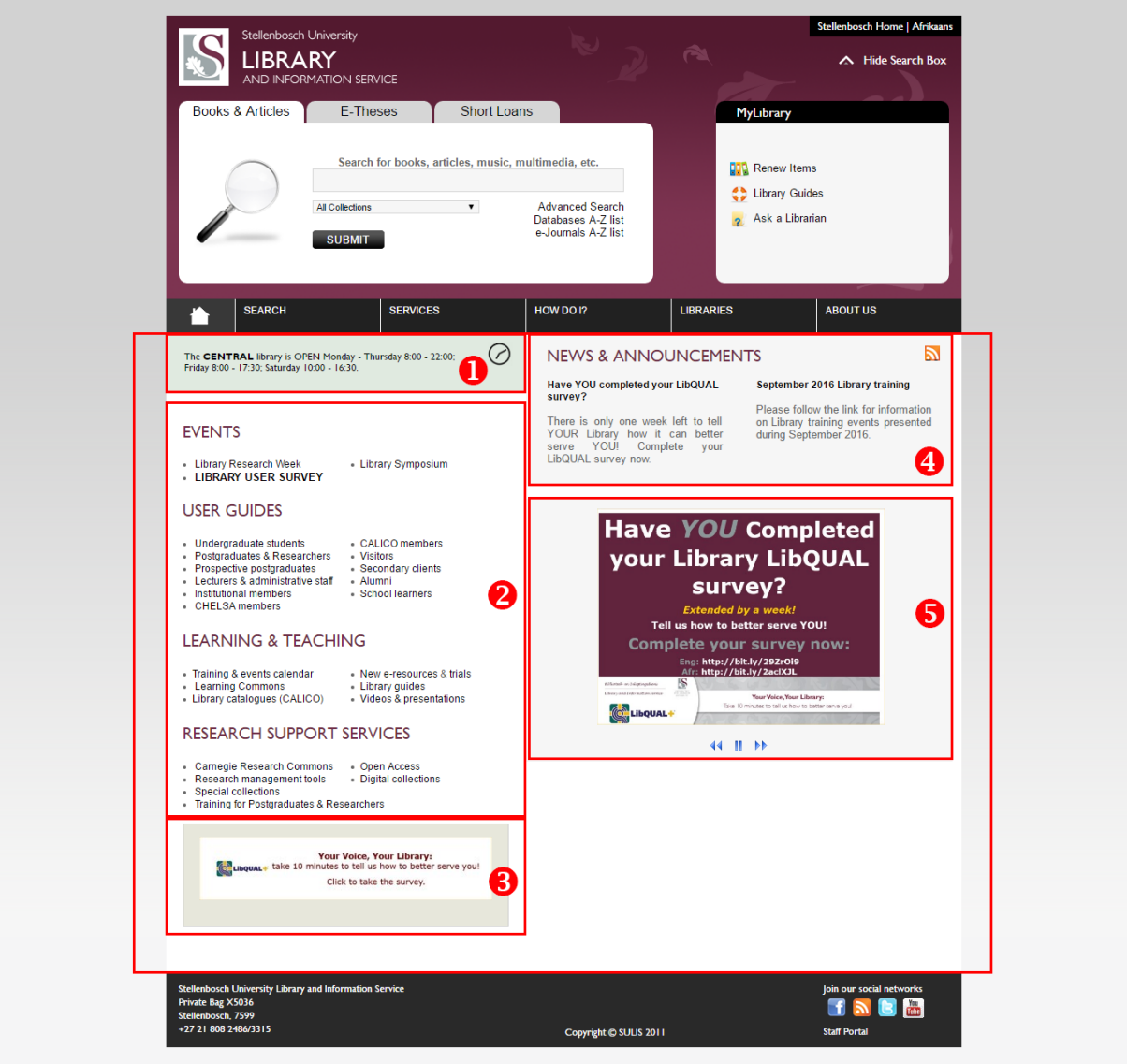


Figure 4.3-9: SU homepage components

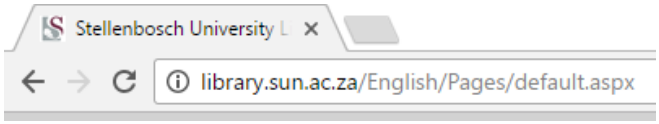


Figure 4.3-10: SU homepage title

4.3.3.2 Heuristic evaluation of SU dialogue element 3: Homepage contents

The table below contains the discussion of each of the problems that were found with the components in this dialogue element. The problems are summarised in the case summary in Section 4.3.5.

Heuristic	Evaluation
4.3.3.2.1 Labelling	The homepage consists of labels with clear and familiar language. The homepage title is "Stellenbosch University Library and Information

	Service". There are two problems with this title. *4.3.3.2.1.1 Labelling problem 1: Page title* The full name of the library website is too long for the page title. If a page title is too long, the full title is not visible in the browser tab because there is a limited amount of space for it. To keep the title short, it should only contain a short version of the name, for example, SU Libraries. *4.3.3.2.1.2 Labelling problem 2: Page title does not contain all the necessary information* The page title only contains information about the website and lacks information about the page. Conventions state that it should contain the name of the page and the name of the website, and if it is the homepage, the information can be reversed, i.e., with the name of the website first, for example, "SU Libraries | Home".
4.3.3.2.2 Organisation	The order and categorisation of the content on the homepage are logical.
4.3.3.2.3 Clutter	There is some clutter on the homepage which makes the page longer than necessary, requiring users to scroll. *4.3.3.2.3.1 Clutter problem 1: Redundant components* The slideshow on the homepage is redundant since it contains links that either already are or can be made available under the "Events" or "News & Announcements" categories. The placement of the components around the slideshow leaves a large amount of unnecessary white space, which makes the page unnecessarily long. The length of the homepage can be reduced by removing the slideshow and rearranging the remaining components.
4.3.3.2.4 Novice user guidance	There are links on the homepage that can be useful for novice users. The "user guides" category of links on the homepage contains links to user guides specifically for typical novice users, such as visitors, school learners, and undergraduate students.
4.3.3.2.5 Help documentation	There are two different sources of help documentation that can be accessed via the library homepage. Users can click on the "Library guides" link in the header (dialogue element 1, Figure 4.3-4) to go the subdomain http://libguides.sun.ac.za/ or they can click on one of the options under the "user guides" category to go to the user guides section on the library website, for example, http://library.sun.ac.za/English/userguides/Pages/undergraduates.aspx.

4.3.3.2.6 Efficiency features	There are no efficiency features on the homepage.
4.3.3.2.7 Consistency	The behaviour of the links on the homepage is not consistent, as some of the external links open in the same tab. This problem is also discussed in the "Controllability" heuristic in Section 4.3.3.2.11.1. *4.3.3.2.7.1 Consistency problem 1: External links do not consistently open in a new tab* The problem with the external links on the homepage is that some of them open in the same tab while others open in a new tab. The links that open in the same tab are links to pages in subdomains. However, the pages on the subdomains do not have the same structure as the main library pages, i.e., the main navigation bar does not have drop-down menus on these pages. This prevents users from navigating the library website further. This problem is explained in detail in the case study analysis, Section 4.4. The best solution for the external links on the homepage is to make them open in a new tab and to provide a visual indicator (Figure 2.2-1) next to the link to show that it is an external link.
4.3.3.2.8 Predictable behaviour	No problems with predictable behaviour were found.
4.3.3.2.9 Context	A user is provided with sufficient context when they are on the homepage because it is clear that they are on the SU library website and it is clear that it is the homepage based on the available components. For example, the name of the website is clearly identified in the header and the title.
4.3.3.2.10 Task completion support	There is no support for task completion on the homepage, for example, visited links are not styled differently to unvisited links. This is not a major problem, however, and is not listed as such.
4.3.3.2.11 Controllability	The behaviour of links on the homepage, as discussed in "Consistency", Section 4.3.3.2.7.1, has a negative impact on the website's "Controllability". *4.3.3.2.11.1 Controllability problem 1: External links open in the same tab* As mentioned in the "Consistency" heuristic, some external links, specifically links to library subdomains, open in the same browser tab. This is a problem because the subdomains have a similar, but not exactly the same structure (Figure 4.3-11), i.e., the main links in the main

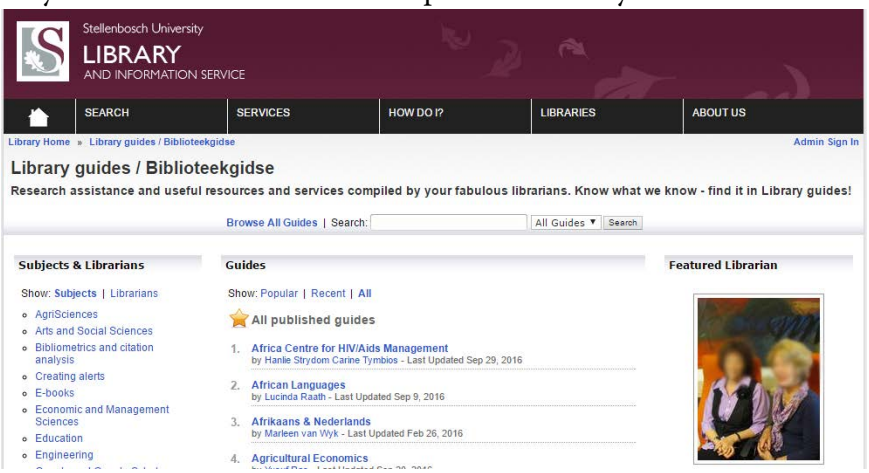
	navigation bar are the same, but they do not have drop-down menus. This behaviour limits users from further navigating the library website if they could not find what they were looking for on the subdomain, or if they have found it but want to explore the library website further.  **Figure 4.3-11: SU "Library Guides" subdomain (libguides.sun.ac.za) (faces in image intentionally obscured)**
4.3.3.2.12 Error recovery	This heuristic and its sub-criteria do not apply to the components in this dialogue element.
4.3.3.2.13 Error prevention	This heuristic and its sub-criteria do not apply to the components in this dialogue element.
4.3.3.2.14 Feedback	This heuristic and its sub-criteria do not apply to the components in this dialogue element.

Table 4.3-3: Heuristic evaluation of SU dialogue element 3: Homepage contents

4.3.3.3 Dialogue element 4: Internal pages contents

The location of this dialogue element is outlined in Figure 4.3-3 with the number 4, and the detail (the components in this dialogue element) is outlined in Figure 4.3-12 and Figure 4.3-13.

It should be noted that the screenshots that are used show a single page, the "General Contact Details" page (Figure 4.3-12 and Figure 4.3-13), but that they represent all of the internal pages. The website is divided into various sections that can be found in the internal pages and all of these pages have roughly the same structure, and are evaluated as a single dialogue element.

The internal pages contain the following three components. The numbers in the list correspond to the numbers in Figure 4.3-12 and Figure 4.3-13:

1. Local navigation menu
2. Page heading and content
3. Page title, for example, on the "Contact us" page, the title is "General contact details" (Figure 4.3-13)

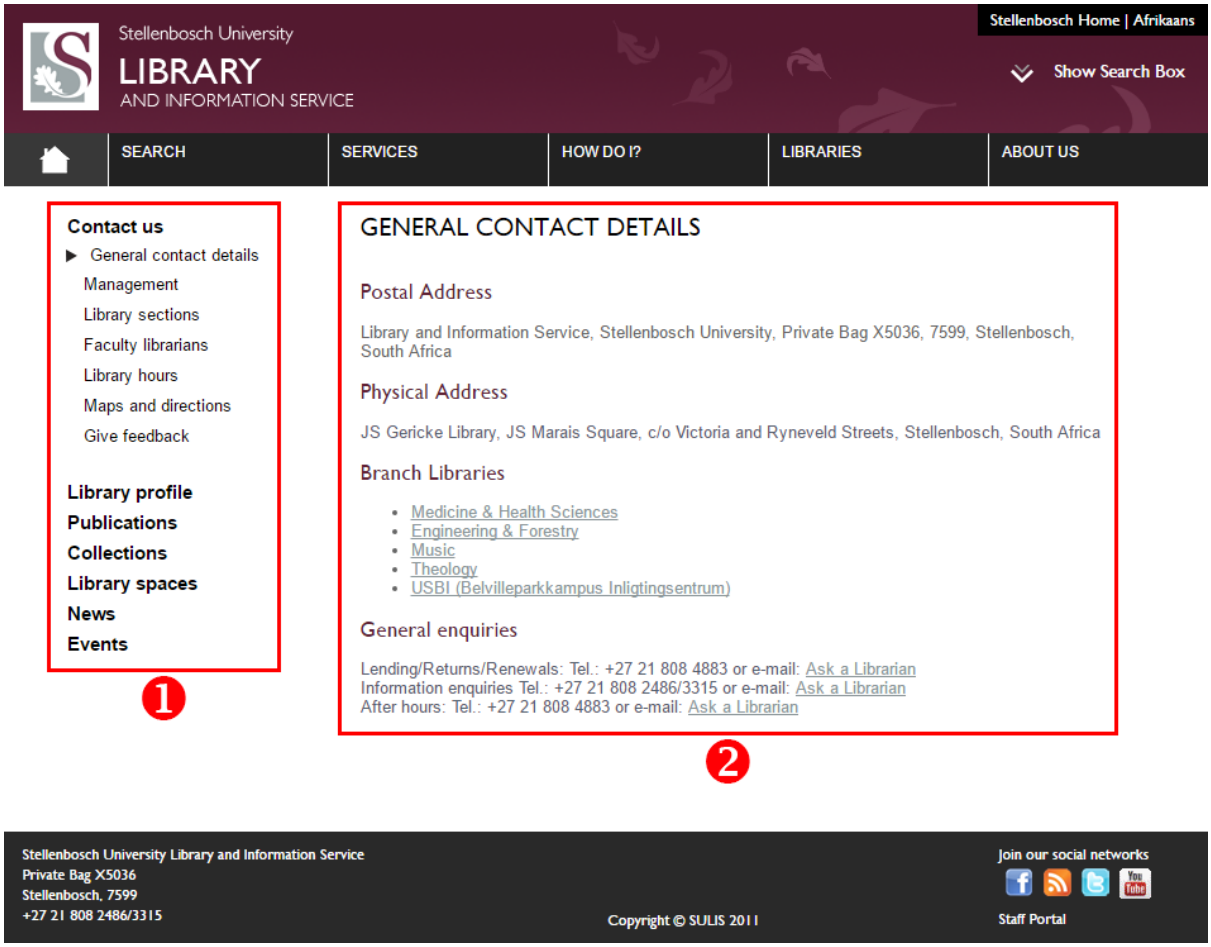


Figure 4.3-12: SU internal page components structure

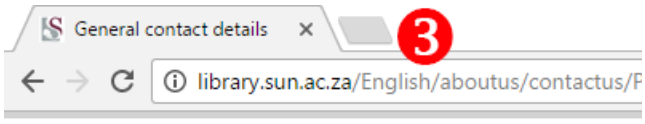


Figure 4.3-13: SU internal page title example

4.3.3.4 Heuristic evaluation of SU dialogue element 4: Internal pages structure

The table below contains the discussion of each of the problems that were found with the components in this dialogue element. The problems are summarised in the case summary in Section 4.3.5.

Heuristic	Evaluation
4.3.3.4.1 Labelling	The labels that are evaluated in the internal pages are the labels of the *links in the local navigation menu,* the *main headings,* and the *titles* in the pages. The labels in the local navigation menus correspond with the labels in the respective drop-down menus that are in the main navigation bar. Therefore, some of the problems that were found with labelling in the main navigation bar also apply in this section, i.e., some of the labels in the internal pages are vague and/or incorrect (because they do not correspond with the respective page content). See "Labelling" in dialogue element 2 (main navigation bar) in Section 4.3.2.4.1.1 for the related problem. There are additional problems with the labels in the internal pages as well, i.e., the page titles, because they do not contain all the necessary information, and some pages do not have titles. *4.3.3.4.1.1 Labelling problem 1: Link labels in local navigation do not correspond with the page content they link to* Some of the link labels are incorrect or vague because the links do not correspond exactly with the page they link to. For example, the link "Library profile" in the local navigation menu in the "About us" section (Figure 4.3-15) links to the "History of central library" page. This is also an organisation problem, which is described in the next heuristic, in Section 4.3.3.4.2.1. From a labelling perspective, however, the website should not have link labels that do not correspond with the content and heading of the page they link to. *4.3.3.4.1.2 Labelling problem 2: Page titles incomplete* The page titles (the labels in the browser tabs) are not labelled according to web development conventions. Titles should reveal information the page and the website. They only display the name of the page, for example, the page title of the "Events" page is "Events" (Figure 4.3-14). The title should also contain (a short version of) the name of the website, for example, "Events | SU Libraries". *4.3.3.4.1.3 Labelling problem 3: Missing page titles* Another problem with the page titles is that some pages do not contain titles at all. For example, the "News" page does not have a title. When a webpage does not have a title, the URL is displayed in the browser tab as shown in Figure 4.3-14.

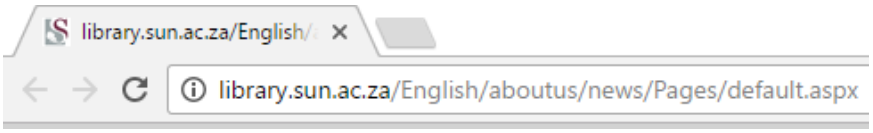


Figure 4.3-14: SU internal pages, missing titles

4.3.3.4.2 Organisation

The organisation of the internal pages is confusing. As mentioned in "Labelling", not all of the link labels correspond with the pages they link to.

4.3.3.4.2.1 Organisation problem 1: Website structure

There are many links in the local navigation menus that do not correspond with the page content they link to. Consider the example mentioned in "Labelling", Section 4.3.3.4.1.1; the link "Library profile" (Figure 4.3-15) links to the "History of central library" page. This is because "Library profile" is the name of a section and there is no main page for the section. The "History of central library" page is a subsection of the "Library profile" section. Therefore, the problem is that there are links to sections but some of the sections do not have a main section webpage and, therefore, it links to one of the pages in the section. The page that it links to is not necessarily the first page in the section (as can be seen in the example).

There are three possible solutions for this problem.

1. New webpages can be created for main sections and these links should link to these new pages.
2. The links to main sections can be removed and replaced with links that navigate to specific pages in sections.
3. The links to main sections can be disabled to function only as headings that give context to links.

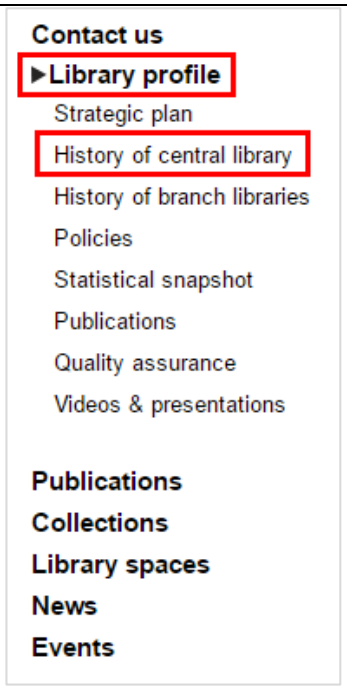


Figure 4.3-15: SU internal pages organisation – the "History of central library" page is displayed if a user clicks on the "Library profile" link

4.3.3.4.2.2 Organisation problem 2: Same link, various destinations

There are some links that appear in different locations on the website, they do not link to the same destination. For example, there is a link with the label "Special collections" available on the homepage (under the category "Research Support Services"), in the main navigation bar (under the category "Services"), and in the local navigation menu on pages in the "Services" section. Each of them links to a different destination, as shown below.

- Homepage: http://library.sun.ac.za/English/aboutus/collections/Pages/specialcollections.aspx
- Main navigation bar: http://library.sun.ac.za/English/aboutus/collections/sc/Pages/services.aspx
- Local navigation menu: http://library.sun.ac.za/English/aboutus/collections/sc/Pages/default.aspx

Links with the same link labels within the same context should link to the same destination.

4.3.3.4.3 Clutter	The majority of SU's internal pages are less cluttered than the internal pages of case studies one and two because they only consist of two

components, i.e., the local navigation menu and the page content.

The local navigation menus have submenus that expand based on the user's context. This causes problems with clutter.

4.3.3.4.3.1 Clutter problem 1: Local navigation submenus

Some of the links in the local navigation menus have submenus that are displayed below them when the user is on a page of that section as shown in Figure 4.3-16.

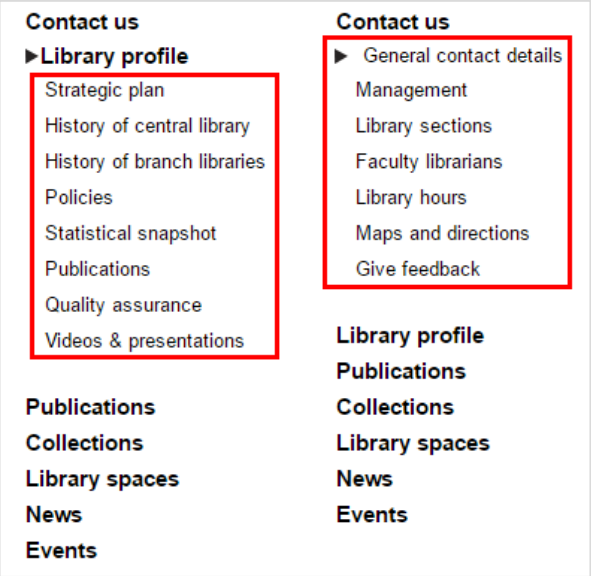
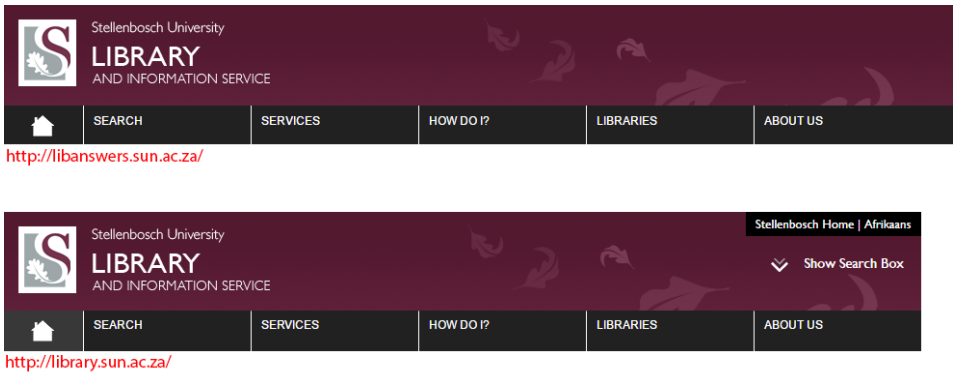


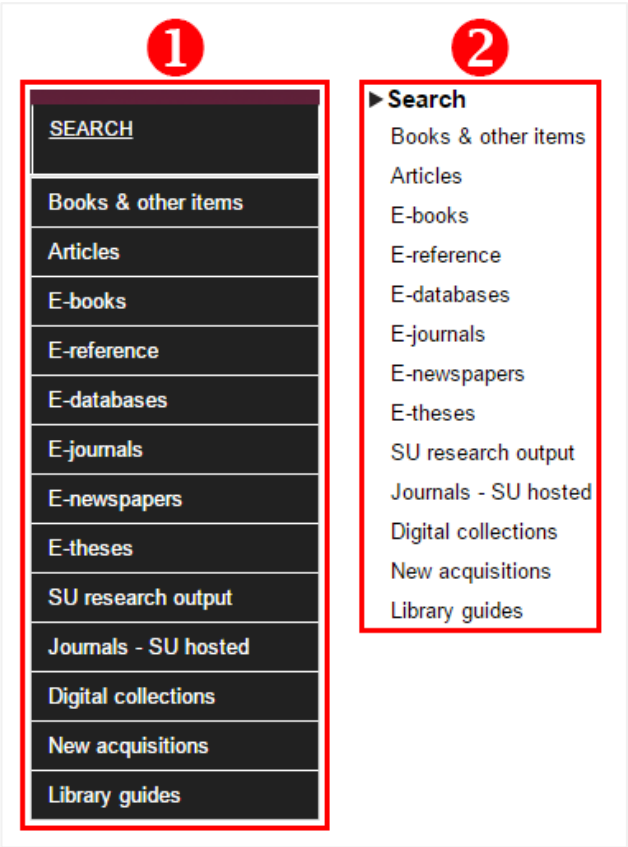
Figure 4.3-16: SU internal page submenu clutter

The submenus cause clutter in the local navigation menus. Clutter can be reduced by showing only the main section links in the local navigation menu on all the pages, but the main section links should have a clickable icon next to them that allows the user to expand or collapse the submenus anytime when the need arises. This will also help the user in understanding what sections have subsections without having to click on the section first. If the local navigation menu looks the same on all the pages, it will result in a more consistent design.

This problem also makes the local navigation menus inconsistent, as discussed in Section 4.3.3.4.7.2.

4.3.3.4.4 Novice user guidance	The website contains features that can be useful for novice users. The "Training" page in the "Services" section provides information about library literacy training. There is also an "Ask a librarian" feature that can be accessed from a link in the header. The "Ask a librarian" feature is hosted on a subdomain, which can cause confusion for novice users.

	There is a lack of additional explanations for novice users, such as tooltips. *4.3.3.4.4.1 Novice user guidance problem 1: "Ask a librarian" location* The "Ask a librarian" link can be difficult to find. The only link to it that could be located is in the expanded header. The header is collapsed on all of the internal pages. Users who are not aware of the three links that are hidden in the collapsed header might struggle to find the "Ask a librarian" link. *4.3.3.4.4.2 Novice user guidance problem 2: Subdomains* The "Ask a librarian" link links to a page on a subdomain (http://libanswers.sun.ac.za/) which can cause confusion. The subdomain page structure is similar to the main library website structure but it does not have the same functionality (as shown in Figure 4.3-17). For example, the main navigation bar on the "Ask a librarian" page looks the same as the main navigation on the SU homepage but it does not have drop-down menus. Additionally, the header is different because it is not expandable and does not provide all the links that are provided in the header on the homepage. This similar design can confuse users if they are not aware that they have navigated to a subdomain. It would be more usable if the page has exactly the same structure and functionality as the main library website and if it is hosted on the main domain.  **Figure 4.3-17: SU similarity/differences between global navigation structure on main library websites and subdomains**
4.3.3.4.5 Help documentation	The library website provides collections of help documentation in the "How do I" and "User guides" sections. Many of the links that are available in these sections link to pages in subdomains (e.g. http://libguides.sun.ac.za/), which can cause confusion. See "Novice user guidance" in Section 4.3.3.4.4.2 for a description of the problem. Additionally, there is a lack of supplemental navigation systems, as discussed below.

	4.3.3.4.5.1 Help documentation problem 1: Lack of supplemental navigation systems A supplemental navigation system for this website, such as a sitemap, could not be located in the internal webpages (dialogue element 4) of this website.
4.3.3.4.6 Efficiency features	The website lacks the efficiency features that were present on the UCT library website as observed in case study 1. *4.3.3.4.6.1 Efficiency features problem 1: "Back to top" shortcut* Long pages do not have a link at the bottom of the page that users can click on to go back to the top of the page more efficiently.
4.3.3.4.7 Consistency	There are various consistency issues with the local navigation menus on the internal pages. **Positive aspect**: The links in some of the local navigation menus (2 in Figure 4.3-18) correspond to the links in the respective drop-down menus (1 in Figure 4.3-18) that are in the main navigation bar.  **Figure 4.3-18: SU correspondence between global navigation bar drop-down menu and local navigation menu**

	However, the local navigation menus are not consistent on all the pages. For example, not all pages have a local navigation menu, and in the sections that do have local navigation menus, they are not consistently the same on different pages within the same section. *4.3.3.4.7.1 Consistency problem 1: Missing local navigation menus* Not all of the internal pages have a local navigation menu that can help the user navigate within the section. For example, none of the pages in the "libraries" section have local navigation menus that allow users to navigate between the different libraries' pages. The website should have local navigation menus on in the internal pages in the libraries section and it should represent the corresponding drop-down menu in the main navigation bar. *4.3.3.4.7.2 Consistency problem 2: The same local navigation menus look different on pages in the same sections* There are differences between the local navigation menus on pages in the same sections. The differences are represented in Figure 4.3-19 and Figure 4.3-20. The numbers in the following list correspond to the numbers in the images. There are four aspects that change depending on the user's context: 1. The section heading is only displayed on some pages. 2. On some pages, links in the local navigation menus have submenus. 3. When there is a submenu, the links that are not in the submenu have bold text. 4. On some pages, main links in the navigation menus are removed when submenus have submenus. The aspects that are different are numbered in the examples below and the numbers correspond to the numbers above.

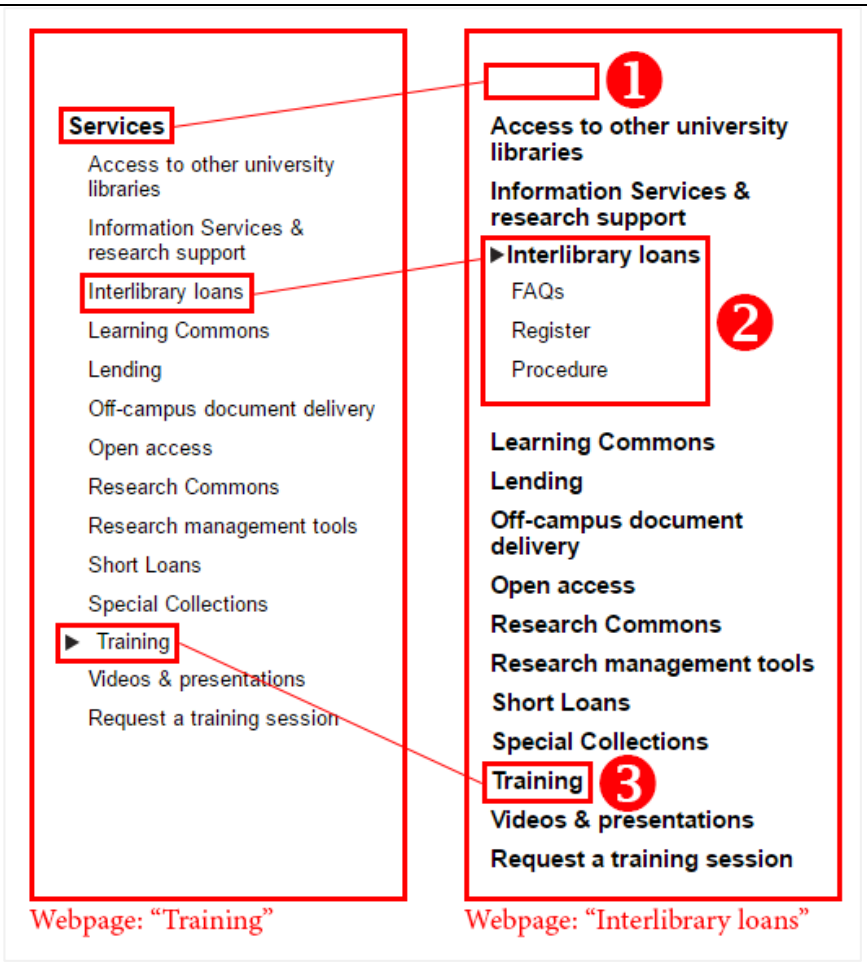


Figure 4.3-19: SU internal pages – inconsistent navigation menus

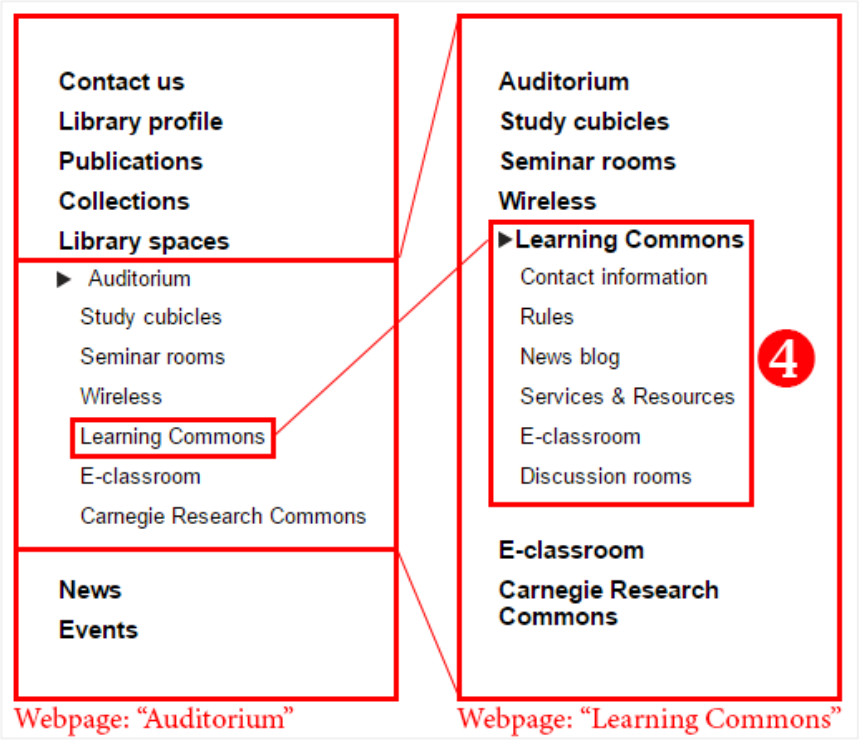


Figure 4.3-20: SU internal pages – inconsistent navigation menus

	This problem causes problems with other heuristics, as discussed below. Firstly, the fact that submenus are only visible on some pages means that users are not provided with all the possible options on all the pages in a section. This causes problems with "Controllability" because users only have access to links in a subsection when they have clicked on the main link of that section; therefore, they do not have access to all the sections at all times when they are within a specific section. For example, when users are on the "Training page" (Figure 4.3-19), they cannot link directly to the Interlibrary loans "FAQ" page. They first have to go to the "Interlibrary loans" page, so that they can see the link to "FAQ" before they can click on it. This problem is addressed in Section 4.3.3.4.11.1. Secondly, the local navigation menu looks different between pages in the same section. The problem with this is that the user might not be aware that they are still in the same section when they link between pages in the same section. A sensible solution would be to make submenus expandable with buttons. This solution is further discussed under "Clutter", Section 4.3.3.4.3.1. The same navigation menus must look exactly the same on all the pages. *4.3.3.4.7.3 Consistency problem 3: Local navigation menu position* The position of the local navigation menu changes on some of the pages because an image is inserted above the menu (Figure 4.3-21). The local navigation menu should consistently stay in the same position on all the pages. Therefore, an image should not be inserted above the local navigation menu on some of the pages. The image can be moved to the right side of the page, away from the local navigation menu.

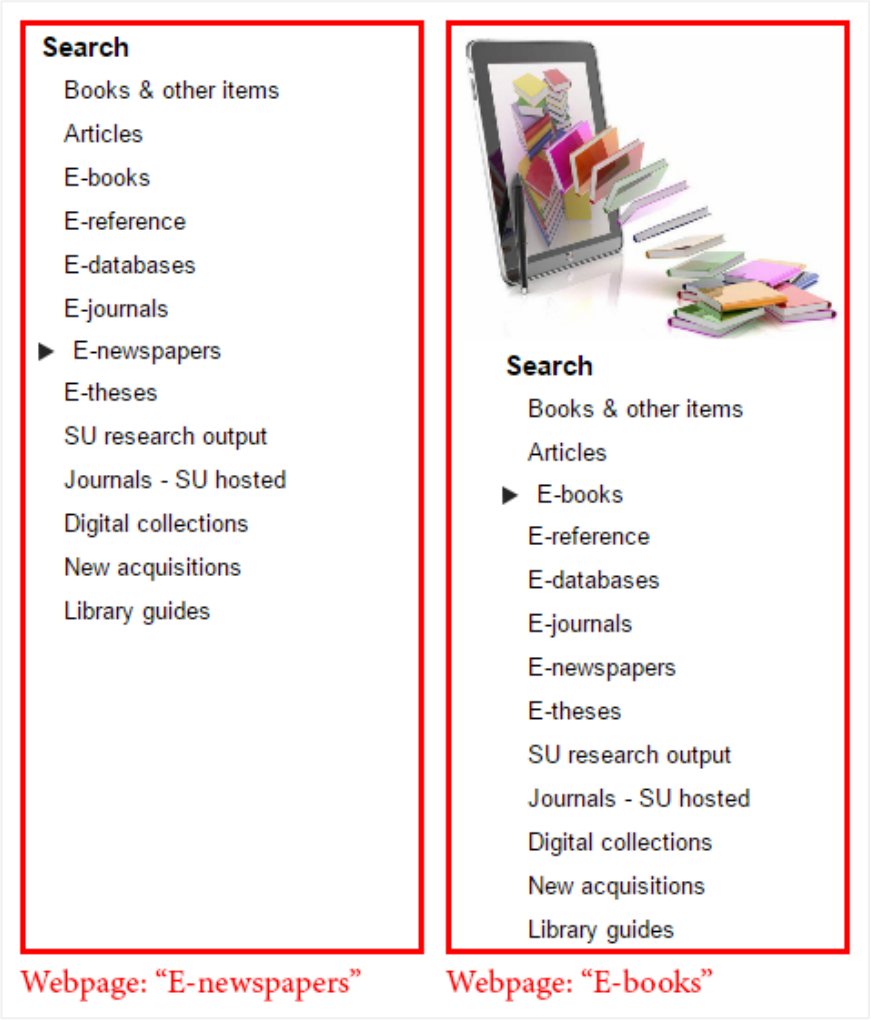


Figure 4.3-21: SU internal pages – local navigation menu

4.3.3.4.7.4 Consistency problem 4: Context not provided consistently

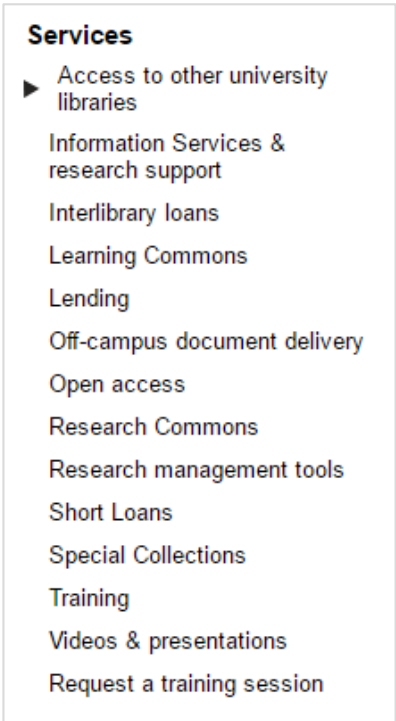
The user's context is indicated with an arrow marker that appears to the left of the current link (see Figure 4.3-21). On some of the pages, however, the marker is missing or next to the incorrect link.

4.3.3.4.8 Predictable behaviour

Some of the links in the local navigation menus are unpredictable because they link to external websites and sometimes these links open in the current tab.

4.3.3.4.8.1 Predictable behaviour problem 1: Local navigation links to other sections/external pages

This problem is similar to the problem of external links in the main navigation bar, as discussed in "Controllability" in Section 4.3.2.4.11.1. Local navigation menus should contain links to pages within a section and therefore should not contain external links.

4.3.3.4.9 Context	Context is provided in various ways on the internal pages, as discussed below. **Positive aspect 1**: There is a Favicon next to the titles in the browser tab, which serves the purpose of providing context within the web. **Positive aspect 2**: Context is indicated in the local menus. A small marker is inserted next to the current link of the current page. There are some consistency issues, however, because the marker is not next to the correct link on all the pages. See "Consistency", Section 4.3.3.4.7.4 for a description and example. There are some aspects of context that are lacking. These problems are discussed below. *4.3.3.4.9.1 Context problem 1: Local navigation menu captions* Some of the local navigation menus do not have context because their captions are missing (see Figure 4.3-19 for an example). All of the local navigation menus should have captions so that users can clearly see what section they are in. For example, Figure 4.3-22 shows a local navigation menu with a caption.  Services Access to other university libraries Information Services & research support Interlibrary loans Learning Commons Lending Off-campus document delivery Open access Research Commons Research management tools Short Loans Special Collections Training Videos & presentations Request a training session **Figure 4.3-22: SU local navigation menu with caption**

4.3.3.4.9.2 Context problem 2: Breadcrumbs

There are no breadcrumb trails that provide users with context or their location in the hierarchy. This can be a useful addition to the internal pages. This can help users make sense of sections in sub-sections. This is a better solution than what the website currently has implemented, where the local navigation menu changes based on the user's context.

4.3.3.4.9.3 Context problem 3: Context not indicated correctly

A user's current position within a section is indicated in the local navigation menus with a marker that appears next to the current link (Figure 4.3-23).

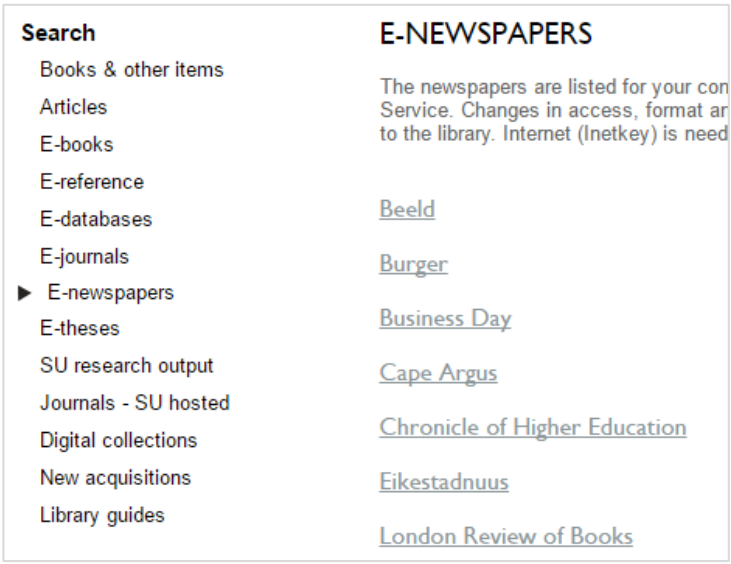


Figure 4.3-23: SU context in local navigation menus

However, on some of the pages, the marker that shows the user's current position within the local navigation menu is next to the wrong link. For example, on the "E-databases" page the marker is next to "Search" (see Figure 4.3-24).

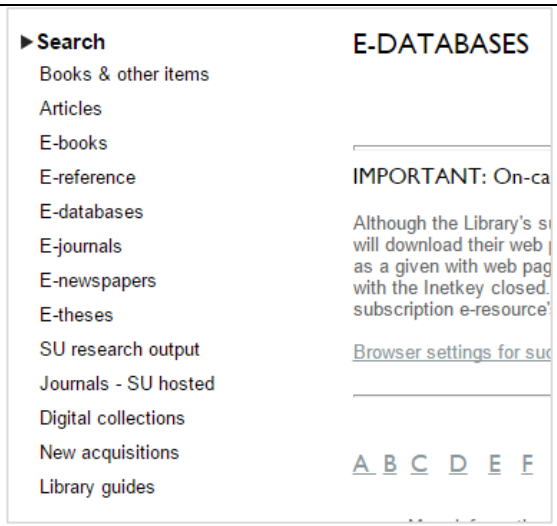


Figure 4.3-24: SU marker next to incorrect link in local navigation menu

4.3.3.4.10 Task completion support

The contextual links in page content sections change colour based on the links' state, which helps with reducing memory load. For example, in Figure 4.3-25 of the "training" page, number 1 shows what unvisited links look like and number 2 shows what visited links look like. This helps users with memory load because they are not required to remember what pages they have visited.

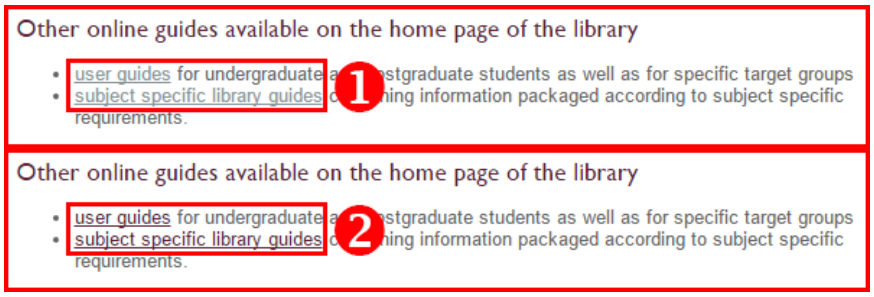


Figure 4.3-25: SU internal pages, visited links (http://library.sun.ac.za/English/services/Pages/training.aspx)

4.3.3.4.11 Controllability

The fact that the submenus in the local navigation menus are only visible on some pages limits the website's controllability. Controllability is also limited by external links that open in the same tab.

4.3.3.4.11.1 Controllability problem 1: All navigation options not visible on all pages within the same section

Users are not fully in control of the sequence of actions since all the options in the local navigation bar are not always visible, which means that some of the links will only be discovered based on what page they're on. This problem is discussed in more detail in "Consistency" Section 4.3.3.4.7.2.

	4.3.3.4.11.2 Controllability problem 2: External links open in the same tab Some of the local navigation menus contain external links that open in the same tab. Controllability is limited when external links open in the same tab because the user is navigated away from the library website.
4.3.3.4.12 Error recovery	This heuristic was tested by submitting incorrect data in the "My Library Account" login form. *4.3.3.4.12.1 Error recovery problem 1: Error message does not appear in a noticeable location* When the form is submitted with the data as shown in Figure 4.3-26, the password field is cleared. It is not immediately clear that there is an error because the error message is displayed in the header and it is very small, making it difficult to find.  **Figure 4.3-26: SU "My Library Account" login form**  **Figure 4.3-27: SU login form error message that appears in the header**
4.3.3.4.13 Error prevention	No serious problems relating to error prevention were found.
4.3.3.4.14 Feedback	This heuristic was tested using the "Ask a librarian" feature. The "Ask a librarian" form was filled in with test data, to see how the system responds. The SU library website responded with a "toast" message with the text "Thank you! A Stellenbosch University librarian will answer your question" (as shown in Figure 4.3-28). The form fields are emptied as soon as the form is submitted and the toast message disappears after a while. If a blank form is submitted, a "toast" with an error message is displayed. The "toast" also disappears after a short while, which can result in the user not seeing it.

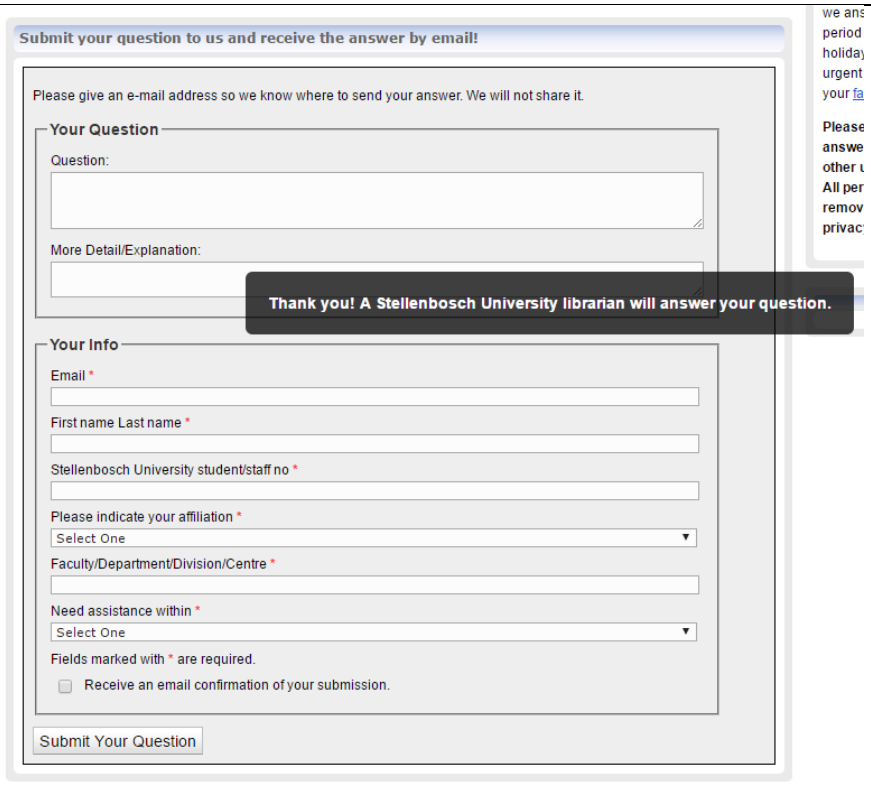


Figure 4.3-28: SU "Ask a librarian" feedback

4.3.3.4.14.1 Feedback problem 1: "Ask a librarian" system feedback

The message that tells the user that the question was successfully submitted does not provide sufficient information and disappears after a while. The message does not explain that the question will be answered via email. The user is also not provided with any sort of reference that they can use to follow up on their question if they do not receive a response.

Table 4.3-4: Heuristic evaluation of SU dialogue element 4: Internal pages structure

4.3.4 Search systems

The only search feature that the SU library has is a resource search feature that is located in the header of all the pages in the main library domain. There is no site search feature.

4.3.4.1 Dialogue element 5: Site search feature

A site search feature is a useful feature that users can use when they prefer to find information by searching for keywords rather than browsing. The lack of a search feature can have negative effects if users are unable to find information through browsing.

4.3.4.2 Dialogue element 6: Resource search interface (in header)

The location of this dialogue element on the website is outlined in Figure 4.3-2 of the homepage with the number 6, and the detail (the components in this dialogue element) is

outlined in Figure 4.3-29. The resource search feature is also accessible on all of the internal pages in the header, but it is hidden by default. It is revealed if the user clicks on the "Show Search Box" link.

The resource search feature contains the following seven components. The numbers in the list correspond to the numbers in Figure 4.3-29:

1. Tabs
2. Image
3. Search box caption
4. Input box
5. Drop-down menu "All collections", "Books & other items", "Articles", "Journal titles", and "e-Books"
6. Submit button
7. List of links "Advanced Search", "Databases A-Z list", "e-Journals A-Z list"

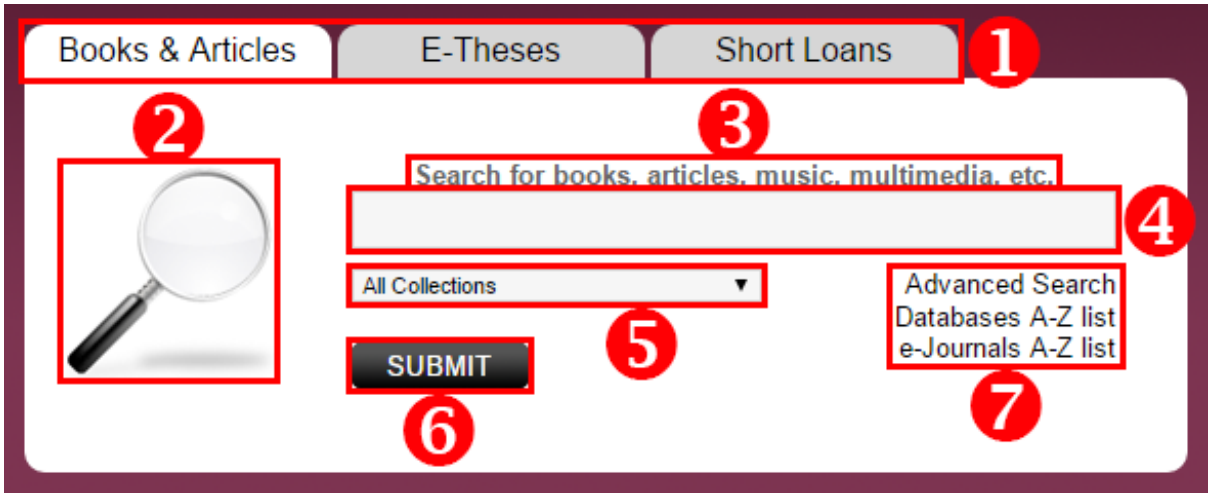


Figure 4.3-29: SU resource search feature components

The search interface has tabs that users can select to choose the type of resource that they want to search for.

The search interface has tabs that users can select to choose the type of resource that they want to search for. The different tabs are also shown in Figure 4.3-30. The numbers in the image correspond to the numbers in the following list:

1. "Books & Articles"
2. "E-Theses"
3. "Short Loans"

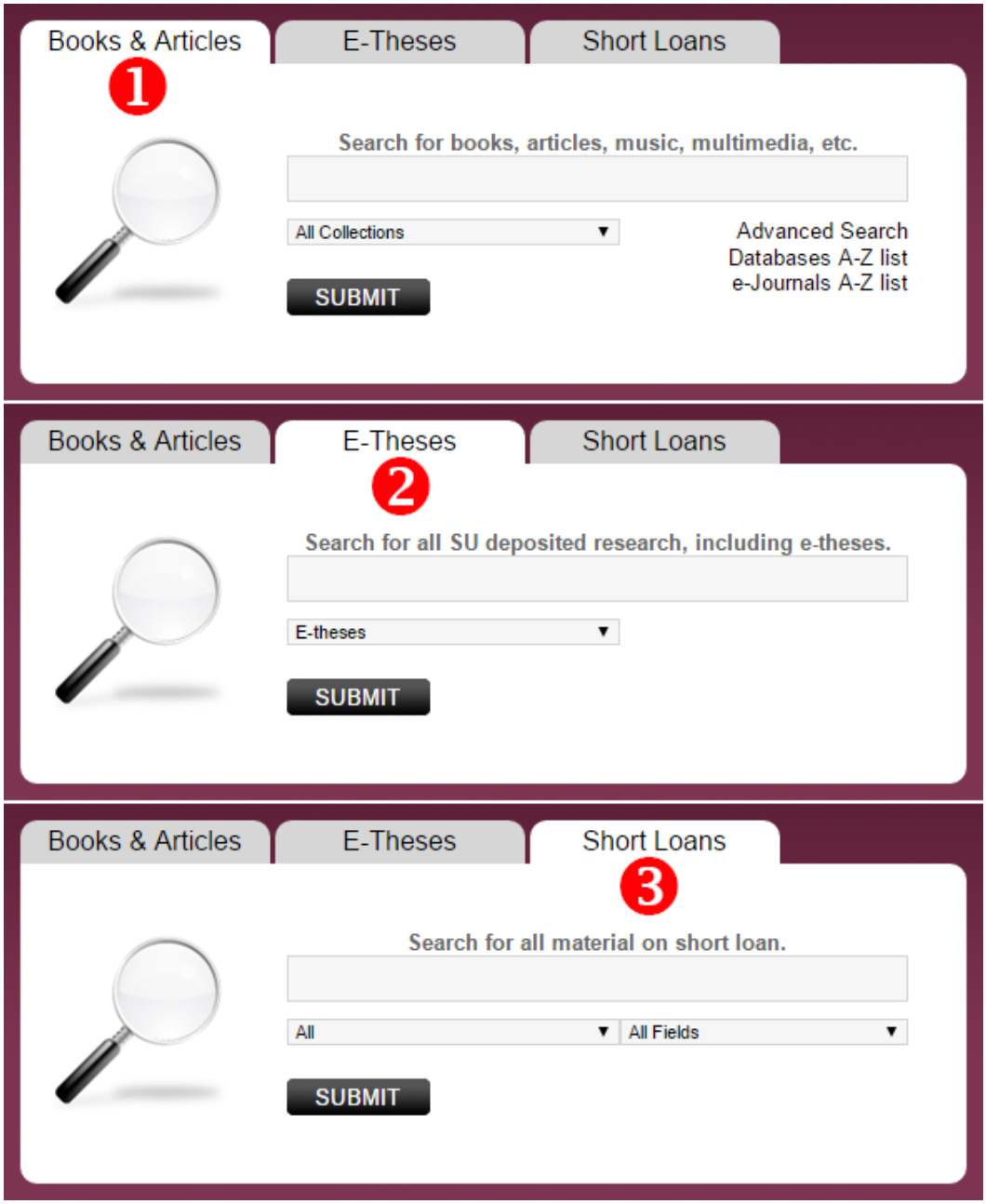


Figure 4.3-30: SU resource search tabs

The search results for the search queries (in each of the tabs) open an external website in the same tab. The contents of the tabs are discussed in more detail below:

1. "Books & Articles": The website displays this tab by default. It contains a search box with the caption "Search for books, articles, music, multimedia, etc.". There is also a drop-down menu that allows the user to specify what type of resource they want to search for. The options are: "All Collections", "Books & other items", "Articles", "Journal titles", and "e-Books". There are also three links with more options: "Advanced Search", "Databases A-Z list", and "e-Journals A-Z list". The "Advanced

Search" link takes users to https://sun.worldcat.org/advancedsearch where they can narrow their search. The "Databases A-Z list" link directs to the "e-databases" page within the main library website. The "e-Journals A-Z list" link directs to a login page (https://login.ez.sun.ac.za/login?url=http://atoz.ebsco.com/home.asp?Id=wpuos). When a search query is submitted, the search results are displayed in WorldCat.

2. "E-Theses": This tab contains a search box with the caption "Search for all SU deposited research, including e-theses." There is also a drop-down menu that allows the user to specify what type of resource they want to search for. The options are: "E-theses" and "All SU research deposited". When a search query is submitted, the search results are displayed in http://scholar.sun.ac.za/, the university's institutional research repository. SunScholar is not evaluated, but it is important to mention that the same university logo that is present on the main library website, that takes the user to the library homepage, is present on the scholar website. However, it does not take the user to the main library website, but rather to the homepage of SunScholar. It should instead take the user to the library homepage.
3. "Short Loans": This tab contains a search box with the caption "Search for all material on short loan." There are also two drop-down menus. The first one allows the user to choose between "All" or "Electronic" resources. The second drop-down menu has the following options: "All Fields", "Title", "Course", "Lecturer/Instructor", "Department", "Period", "Course/Instructor", and "Barcode" that allow the user to specify the field. When a search query is submitted, the search results are displayed in the Aleph library catalogue (http://aleph20.calico.ac.za/) on the "Stellenbosch University Library & Information Service" page.

4.3.4.3 Heuristic evaluation of SU dialogue element 6: resource search interface

The table below contains the discussion of each of the problems that were found with the components in this dialogue element. The problems are summarised in the case summary in Section 4.3.5.

Heuristic	Evaluation
4.3.4.3.1 Labelling	Most of the labels make sense, except for the "E-Theses" label in the second tab. *4.3.4.3.1.1 Labelling problem 1: Incorrect label "E-Theses"* The label "E-Theses" is incorrect because the search box is not exclusive to "E-Theses". It can also be used to find dissertations and other electronic materials that can be located in the university's repository, as specified in the drop-down menu. The two options in the drop down menu are "E-theses" and "All SU research deposited".

4.3.4.3.2 Organisation	Information is ordered and categorised logically.
4.3.4.3.3 Clutter	The dialogue element is clutter free.
4.3.4.3.4 Novice user guidance	The captions above the search boxes in each of the tabs serve as guidance for novice users. For example, in the tab "Books & Articles", the caption "Search for books, articles, music, multimedia, etc." informs the user of what type of resources they can search for. However, it does not specify where it will search. More guidance can be provided with tooltips. *4.3.4.3.4.1 Novice user guidance problem 1: Missing tooltips* Tooltips are usually used to inform users where a link will take them. It is not clear where each of the search queries will take the user. Tooltips can be added to the links and submit buttons in each of the tabs, to inform the user where the action will take them, for example, in "Books & Articles", the submit button tooltip can be "Search WorldCat". Suggested tooltips: • Submit button in "Books & Articles": "Search in WorldCat" • "Advanced Search" link: "Go to WorldCat advanced search" • "Databases A-Z list" link: "Go to e-databases page in library website" • "e-Journals A-Z list" link: "Go to the e-resources page" • Submit button in "E-Theses": "Search in SUNScholar Research Repository" • Submit button in "Short Loans": "Search in Aleph catalogue"
4.3.4.3.5 Help documentation	No help documentation for using the dialogue element could be located. *4.3.4.3.5.1 Help documentation problem 1: No help documentation* A more complicated search feature such as this one should provide some form of help documentation. Search features such as this one can provide options that are not normally intuitive for users, for example, the use of truncation, wild cards, operators, and phrases. Therefore, a help link to help documentation would be required to explain these advanced search options and if they are available. This will depend on the website that implements the search feature, for example, the catalogue.
4.3.4.3.6 Efficiency features	There are some efficiency features in the interface. For example, there is an advanced search option as well as an option to limit the search to specific collections in the "Books & Articles" tab. The user also has the option to limit their searches in the other tabs.

	4.3.4.3.6.1 Efficiency features problem 1: Submitting query The user cannot submit the query by pressing the "Enter" key on the keyboard. Enabling this can increase efficiency.
4.3.4.3.7 Consistency	The search feature is consistently accessible from all pages of the library website. The various search features in the different tabs also have the same consistent layout.
4.3.4.3.8 Predictable behaviour	The search feature is an implementation of an HTML form, but some of the components in the feature do not behave as expected, based on the expected functionality of HTML forms. Users might also have difficulty predicting where the search will navigate them. This problem is discussed in "Novice user guidance", Section 4.3.4.3.4.1. *4.3.4.3.8.1 Predictable behaviour problem 1: Form labels* The captions above the search boxes look like they are the labels of the search boxes although they do not have the expected functionality of labels. When labels are clicked, they should give their corresponding form field focus. Therefore, the captions above the search boxes should be marked up with HTML label tags to provide this functionality.
4.3.4.3.9 Context	The tabs clearly indicate where the user is searching. More context can be provided by indicating where each of the boxes will search. This is addressed in "Novice user guidance" in Section 4.3.4.3.4.
4.3.4.3.10 Task completion support	The dialogue element provides some support for task completion. The last search term that the user submitted is remembered, so when a user goes back to the library page after they have searched for a term, it remains in the search box. Therefore the user does not have to retype it if they want to search for a modified version of the term. However, it only remembers the *last* search term and all previous search queries are "forgotten". *4.3.4.3.10.1 Support for task completion problem 1: Previous search queries* Sometimes users will want to search again for older search queries, but the search box only suggests the latest search string. If the search interface is modified to suggest older search queries, it will reduce user memory load.
4.3.4.3.11 Controllability	When a search query is submitted in any of the tabs, an external website is loaded in the current tab, which can have a negative influence on the website's controllability.

	4.3.4.3.11.1 Controllability problem 1: Browser tab When the user wants to search for a resource, they might still want to do other tasks on the library website, but searching for a resource navigates a user away from the library website. The user might want to continue using the library website while being able to search for various search queries in other browser tabs. Therefore, a better alternative would be to enable the form to open search queries in a new tab. This will then allow the user to keep their position on the library website and they will be able to submit multiple search queries, and each of them will open in a new tab.
4.3.4.3.12 Error recovery	Error recovery is not applicable because the search algorithm is not implemented by the library website.
4.3.4.3.13 Error prevention	This heuristic and its sub-criteria do not apply to the components in this dialogue element.
4.3.4.3.14 Feedback	For each of the search boxes, the search results are presented within a reasonable time.

Table 4.3-5: Heuristic evaluation of SU dialogue element 6: Resource search interface

4.3.5 Summary of case study 3: SU library website

A total of 51 usability problems were found on the library website of the University of Stellenbosch.

The problems that were found in this website are summarised below and divided into the fourteen heuristics. The abbreviation "DE" is used to show in which dialogue element the problem was identified.

If the same problem was found in more than one dialogue element, it is counted and listed as a new problem for every occurrence.

4.3.5.1 Labelling

1. Some of the link labels in the main navigation bar (DE2) do not correspond with the content they represent.
2. Some of the link labels in the local navigation menus in the internal pages (DE4) do not correspond with the content they represent.
3. Some of the link labels in the main navigation bar (DE2) are vague and not descriptive enough of the content they represent.

4. One of the link labels in the tabs of the resource search system (DE6) is not descriptive enough of the content it represents.
5. The homepage (DE3) title is too long.
6. The homepage (DE3) title does not contain the relevant information about the page.
7. Internal page (DE4) titles only contain information about the page and not information about the website.
8. Some internal pages (DE4) do not have titles.

4.3.5.2 Organisation

9. Links that are intended for different types of users are grouped together in the footer (DE1).
10. The categorisation of links in the drop-down menus of the main navigation bar (DE2) is confusing
11. There are no landing pages for the main sections in the internal pages (DE4), therefore links to main sections go to arbitrary pages within the section.
12. Links that have the same labels within the same context link to different destinations in the internal pages (DE4).

4.3.5.3 Clutter

13. Some of the drop-down menus in the main navigation bar (DE2) are too long.
14. There is a redundant component on the homepage (DE3) which causes white space and makes the page longer than necessary.
15. The submenus in the local navigation menus on the internal pages (DE4) cause clutter.

4.3.5.4 Novice user guidance

16. There is a lack of useful tooltips in the header (DE1).
17. There is a lack of useful tooltips in the main navigation bar (DE2).
18. The “Ask a librarian” link can be difficult to locate on the internal pages (DE4).
19. The “Ask a librarian” link navigates to a subdomain and not an internal page (DE4), which can cause confusion.
20. It is not clear where the user will be navigated when they click the submit buttons in the resource search feature (DE6) because this information is not specified.

4.3.5.5 Help documentation

21. The link label “HOW DO I?” in the main navigation bar (DE2) to help documentation is not descriptive enough.
22. A supplemental navigation system for this website, such as a sitemap, could not be located in the internal webpages (DE4) of this website.

23. No help documentation could be located for the resource search feature (DE6).

4.3.5.6 Efficiency features

24. There is no site search feature in the header (DE1).
25. Long internal pages (DE4) do not have a link at the bottom of the page that users can click on to go back to the top of the page more efficiently.
26. The user cannot submit a search query in the resource search feature (DE6) by pressing the "Enter" key on the keyboard.

4.3.5.7 Consistency

27. Some of the links in the header (DE1) open in the same tab while others open in a new tab (both external and internal links).
28. Some of the links on the homepage (DE3) open in the same tab while others open in a new tab (both external and internal links).
29. Some links in the main navigation bar (DE2) open external websites or subdomains.
30. Not all of the internal pages (DE4) have a local navigation menu.
31. The local navigation menus are not consistently the same on different internal pages (DE4) within the same section.
32. The position of the local navigation menu on internal pages (DE4) is not consistent across pages.
33. Context is not consistently provided in all local navigation menus on internal pages (DE4).

4.3.5.8 Predictable behaviour

34. The behaviour of the links in the "MyLibrary" container in the header (DE1) might be unexpected because they navigate away from the main library domain.
35. Links in the main navigation bar (DE2) link to unexpected content because the link labels do not match with the corresponding pages' contents.
36. The inconsistent link targets of the links in the main navigation bar (DE2) cause unpredictable behaviour.
37. The local navigation menus in the internal pages (DE4) contain external links.
38. The form labels in the resource search feature (DE6) do not have the expected functionality because clicking on them does not give focus to the corresponding form fields.

4.3.5.9 Context

39. Context is not indicated in the main navigation bar (DE2).
40. Not all of the local navigation menus in the internal pages (DE4) have captions that specify the section.

41. There is a lack of breadcrumb trails on the internal pages (DE4) which can serve to provide a user's exact location within a hierarchy.
42. On some internal pages (DE4), the marker that is used to show the user's context in the local navigation menu is next to the wrong link.

4.3.5.10 Task completion support

43. The search box in the resource search feature (DE6) only "remembers" the last search term that was used and not older search terms.

4.3.5.11 Controllability

44. External links in the header (DE1) open in the same tab.
45. External links in the main navigation bar (DE2) open in the same tab.
46. External links on the homepage (DE3) open in the same tab.
47. External links on the internal pages (DE4) open in the same tab.
48. The search feature (DE6) opens an external website in the same tab.

4.3.5.12 Error recovery

49. The error message for the login form on the "My Library Account" page (DE4) is difficult to find because it is in the header and it is too small.

4.3.5.13 Error prevention

50. Main section links in the main navigation bar (DE2) that do not have corresponding pages are clickable and link to unexpected locations.

4.3.5.14 Feedback

51. The feedback for the "Ask a librarian" form (DE4) does not provide sufficient information and is short-lived.

The number of problems that were found under each of the heuristics is summarised below in Table 4.3-6. They are sorted from the largest number of problems to the smallest number of problems.

Number of problems	Heuristic
8	Labelling
7	Consistency
5	Novice user guidance
5	Predictable behaviour
5	Controllability
4	Organisation
4	Context
3	Clutter

3	Help documentation
3	Efficiency features
1	Task completion support
1	Error recovery
1	Error prevention
1	Feedback

Table 4.3-6: Number of problems that were found in the SU library website

Therefore, the majority of problems were found with the labelling heuristic and the smallest number of problems were found with task completion support, error recovery, error prevention, and feedback.

4.4 Case study analysis

The cases in this chapter were chosen based on the assumption that top ranked universities will have high-quality websites. All three of the cases had major usability problems that were found because they do not comply with all of the usability principles. Therefore, the fact that these are top ranked universities does not necessarily mean that the university libraries have good websites.

The method used to evaluate the three library websites proved to be useful for identifying and classifying usability problems.

Some of the cases lacked some of the dialogue elements that are considered to be core components of library websites. The results of the heuristic evaluations of these websites proved that the lack of all of the dialogue elements had a great negative impact on the overall usability of the websites.

The “Feedback” heuristic did not apply to many of the dialogue elements, but it is still valuable to include it as a heuristic in the evaluation of academic library websites because it helps with the identification with problems in forms and thus results in a more complete evaluation.

Some problems were discovered that were not addressed by the sub-criteria of the heuristics. These problems were used to create additional sub-criteria that can be used for the evaluation of academic library websites. However, the heuristics proved to be thorough with helping the evaluator identify usability problems, as only two new sub-criteria were suggested. The new sub-criteria that were added are discussed below.

4.4.1 External link problems

A common problem that was found in all the cases was that many links in the library websites, including links in the main navigation structures, link to external websites. Some, but not all of the external links open in a new browser tab.

Main navigation bars should contain links to sections within a website and local navigation menus should contain links to pages within a section. Therefore, main navigation structures should not contain external links.

Websites with main navigation structures that contain external links should be restructured so that the main navigation bar only contains links to main sections of the website and local navigation bars only contains links to pages within a section. External links should be listed in a container which labels them explicitly as external links.

4.4.1.1 Controllability

External links (including submit buttons that show search results in an external website) that open in the user's current browser tab can cause problems with controllability because users might want to continue using the library website after using the external website. If external links open in the same tab as the library website, the user is navigated away from the library website and might need to take extra steps to return to their position in the library website after using the external website. Therefore, controllability can be improved by making all external links open in a new browser tab.

A new sub-criterion can be added to the "Controllability" heuristic based on this solution.

New sub-criterion for Controllability

External links and search results should open in a new tab.

4.4.2 Long page titles

Another problem that was found in all the websites was that their page titles are not named effectively and that the majority of them were too long. As a result, the full title is not visible to the user, as there is a limited amount of space in the browser tab.

A sub-criterion of the "Labelling" heuristic specifies that the page title should contain information about the current page and the website, but it does not specify a limitation on length. Therefore, this new criterion modifies an existing criterion of the "Labelling" heuristic.

4.4.2.1 Labelling

There is a limited amount of space for titles in browser tabs. In many of the pages of the case studies, the full page title was not visible because it was too long. Page titles also serve the purpose of identifying a page in search results, browser history, or bookmarks. It must uniquely identify every page of a website. Therefore, the title must be as short and descriptive as possible. Title sizes can be reduced by using a shorter version of the webpage and website name.

The name of the page and the website can be separated with either a dash (-) or a pipe (|). A pipe is preferable as it uses slightly less horizontal space, resulting in a title that is shorter (see Figure 4.4-1).

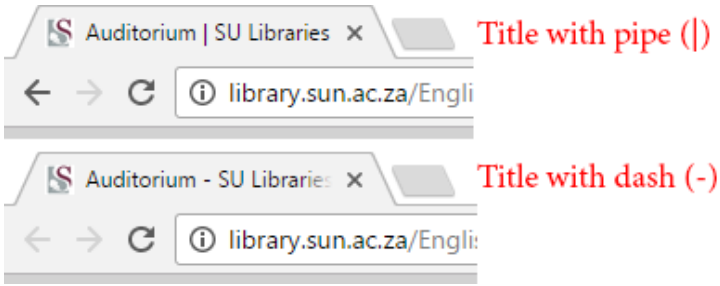


Figure 4.4-1: Title length – pipe vs. dash (SU example)

A new sub-criterion can be added to the "Labelling" heuristic based on this solution.

New sub-criterion for Labelling

The page title contains information about the current page and the website, separated by a pipe (|).

4.5 Chapter 4 summary

This chapter provided three individual case studies of academic library websites that were evaluated using an integrated set of heuristics that were compiled in Chapter 2. Each case study presented valuable insights about the usability of each of the websites and also revealed problems that were not identified by the heuristics. This contributed to the study by adding sub-criteria to the integrated list of heuristics. The final list of heuristics with the new sub-criteria is presented in Chapter 6.

This chapter also confirms that expert evaluations are a valid method for evaluating the usability of academic library websites because a single researcher was able to identify multiple problems in these evaluations.

This chapter validates the heuristics as well as the methodology that was used. This proves that all of the preparation that was done in the previous chapters is useful for the evaluation of the UP academic library website in the next chapter.

In the next chapter, the library website of the University of Pretoria is evaluated using the same method that was followed in this chapter. The heuristics that are used include the new sub-criteria as discussed in the case study analysis.

Chapter 5 – Evaluation and analysis of the UP library website

This chapter consists of the report of the case study of the library website of the University of Pretoria. The purpose of this case study was to evaluate the usability of the IA of the website and to provide recommendations for improving the problems that were found. The usability was evaluated using the heuristics that were composed in the literature review in Chapter 2, which were supplemented with additional sub-criteria after the multiple-case study in Chapter 4.

5.1 University of Pretoria library website

The University of Pretoria is the fourth best university in South Africa according to the QS University Rankings 2016/17, ranking at number 49 in the BRICS countries ranking (Quacquarelli Symonds 2016a) and between 551 and 600 in the world rankings (Quacquarelli Symonds 2016b).

The library website is available at the following URL: http://www.library.up.ac.za/. It consisted of more than 500 webpages at the time of writing (based on a scan of the website using https://www.xml-sitemaps.com/, a free sitemap generator). It is to be noted that many of the website's links may have changed since the time of writing and will no longer work.

The majority of the webpages are available from the main library website domain (library.up.ac.za). The library also has library guides on the subdomain: http://up-za.libguides.com/. The webpages on the subdomain are excluded from the evaluation as discussed in the "Limitations" section in Chapter 1, Section 1.7.1.

The university website has undergone a major redesign, and the new version was published on 25/07/2016. The homepage of the library website is shown in Figure 5.1-1.

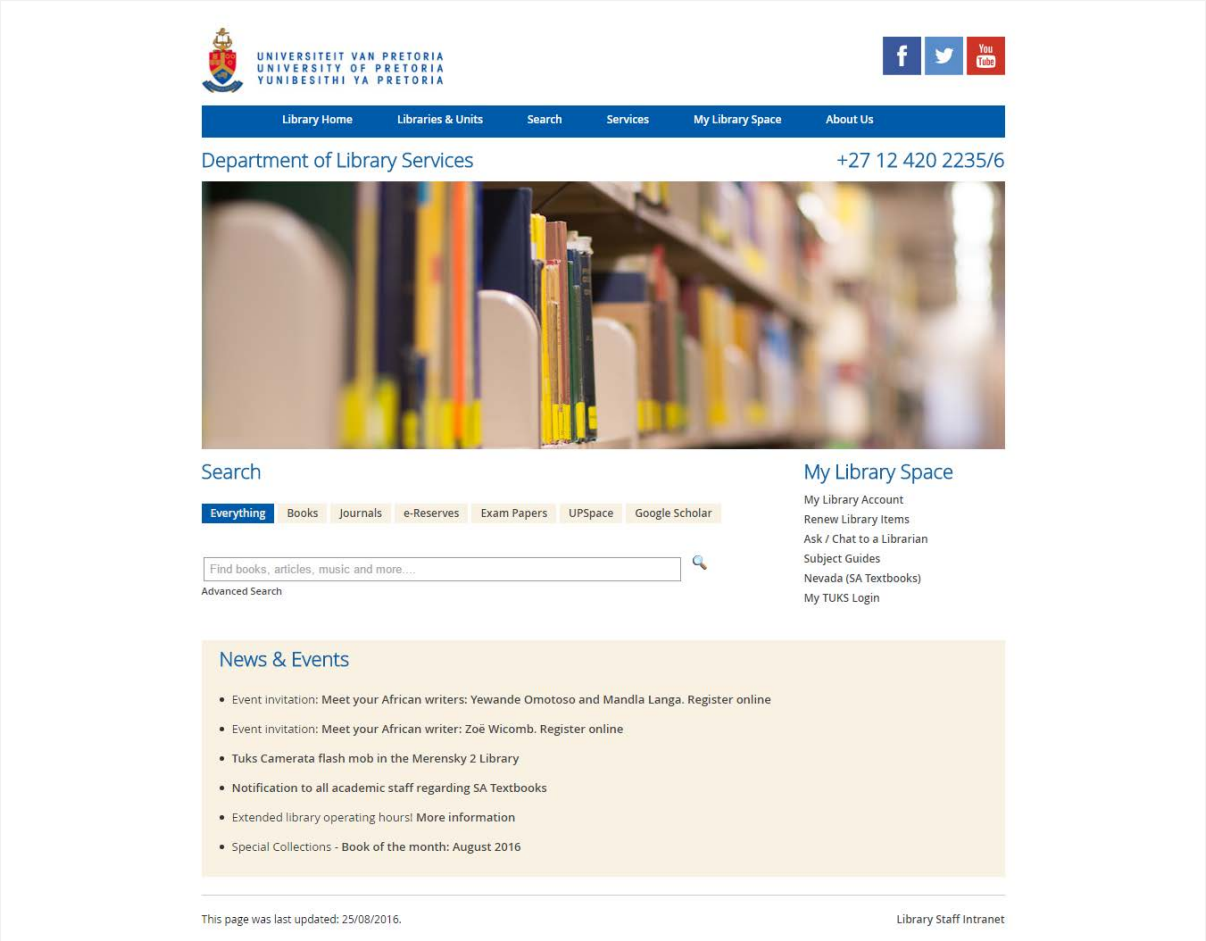


Figure 5.1-1: UP library website homepage

The redesigned website has only been implemented partially, however, leaving a large part of the website unchanged. See Figure 5.1-2 for an example of a page of the library website that has not been redesigned at the time of writing.

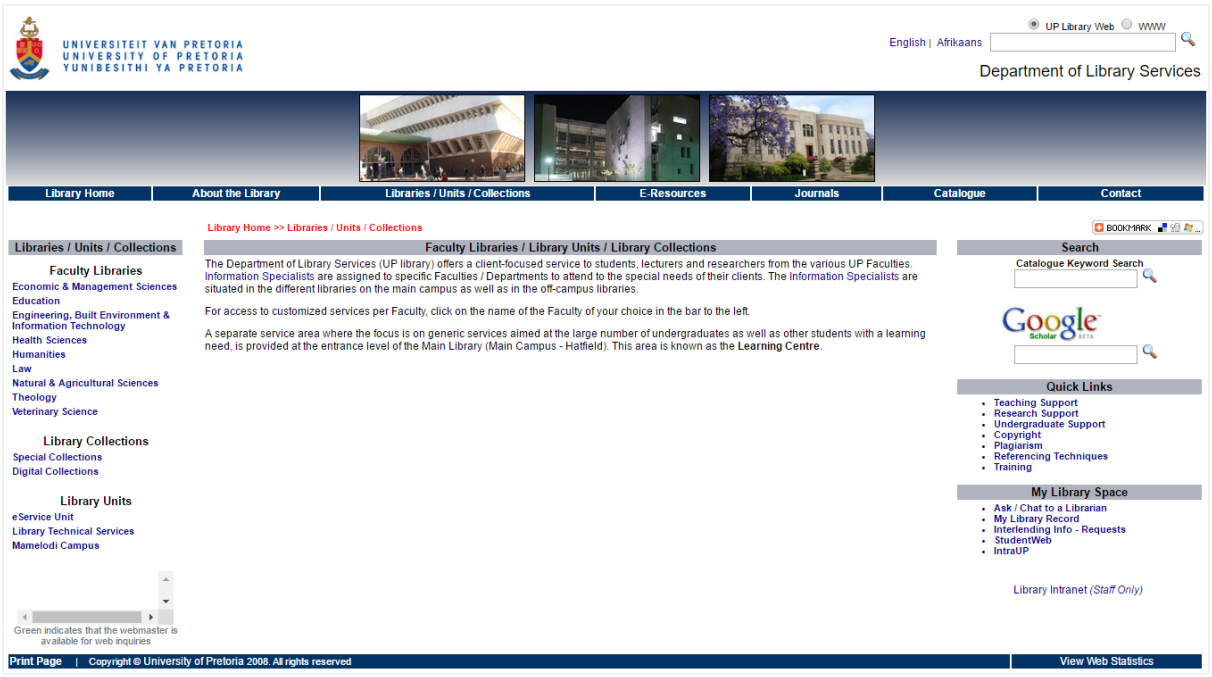


Figure 5.1-2: UP library website old design (faculty page)

At the time of this evaluation, the website consisted of a combination of pages from the new and old version of the library website. Some of the links in the main navigation bar take the user to webpages with the new design (consistent with the homepage as shown in Figure 5.1-1), and other links take the user to webpages with the old design (that is completely different to the design and layout of the homepage, as shown in Figure 5.1-2).

This analysis only focusses on the evaluation of the new webpages, because the assumption is that the old pages will eventually be replaced with new pages. This had a great negative impact on the study as only a limited evaluation could be done.

This website was evaluated using the same method that was used in the case studies in Chapter 4, where each of the websites was sub-divided into six dialogue elements, and each of the dialogue elements was evaluated separately using the heuristic evaluation method that was applied in Chapter 4.

The only difference between the heuristic evaluations in Chapter 4 and the heuristic evaluation in this chapter is that each dialogue element in this chapter is accompanied with a list of recommendations on how its usability can be improved.

5.1.1 UP library website dialogue elements

The UP library website consists of five of the six dialogue elements that an academic library website can consist of, as shown in Figure 5.1-3 and Figure 5.1-4. Figure 5.1-3 is a screenshot of the homepage and Figure 5.1-4 is a screenshot of the “About us” page. The “About us”

page represents the internal pages of the UP library website and it should be noted that all of the internal pages are evaluated, not just the one represented in the screenshot.

All the dialogue elements that are evaluated are outlined in the two screenshots with red borders and numbers 1 to 6. The numbers of the dialogue elements in the following list correspond to the numbers in the figures. Each list number represents a specific dialogue element.

Global navigation structures

1. Dialogue element 1: Header and footer (number 1 in Figure 5.1-3 and Figure 5.1-4)
2. Dialogue element 2: Main navigation bar (number 2 in Figure 5.1-3 and Figure 5.1-4)

Local navigation structures

3. Dialogue element 3: Homepage contents (number 3 in Figure 5.1-3)
4. Dialogue element 4: Internal page contents (number 4 in Figure 5.1-4)

Search systems

5. Dialogue element 5: The UP library website does not have a site search feature.
6. Dialogue element 6: Resource search feature (number 6 in Figure 5.1-3)

It is to be noted that some dialogue elements are components within other dialogue elements. For example, the main navigation bar (dialogue element 2) is a component in the header (dialogue element 1), and the resource search feature (dialogue element 6) is a component of the homepage contents (dialogue element 3). These dialogue elements are evaluated as separate dialogue elements as well as components of the dialogue element in which they are contained.

The dialogue elements as they are outlined in the screenshots are shown in more detail in the subsequent sections, where each of the components within the dialogue elements is outlined.

A list of recommendations is provided for each of the dialogue elements.

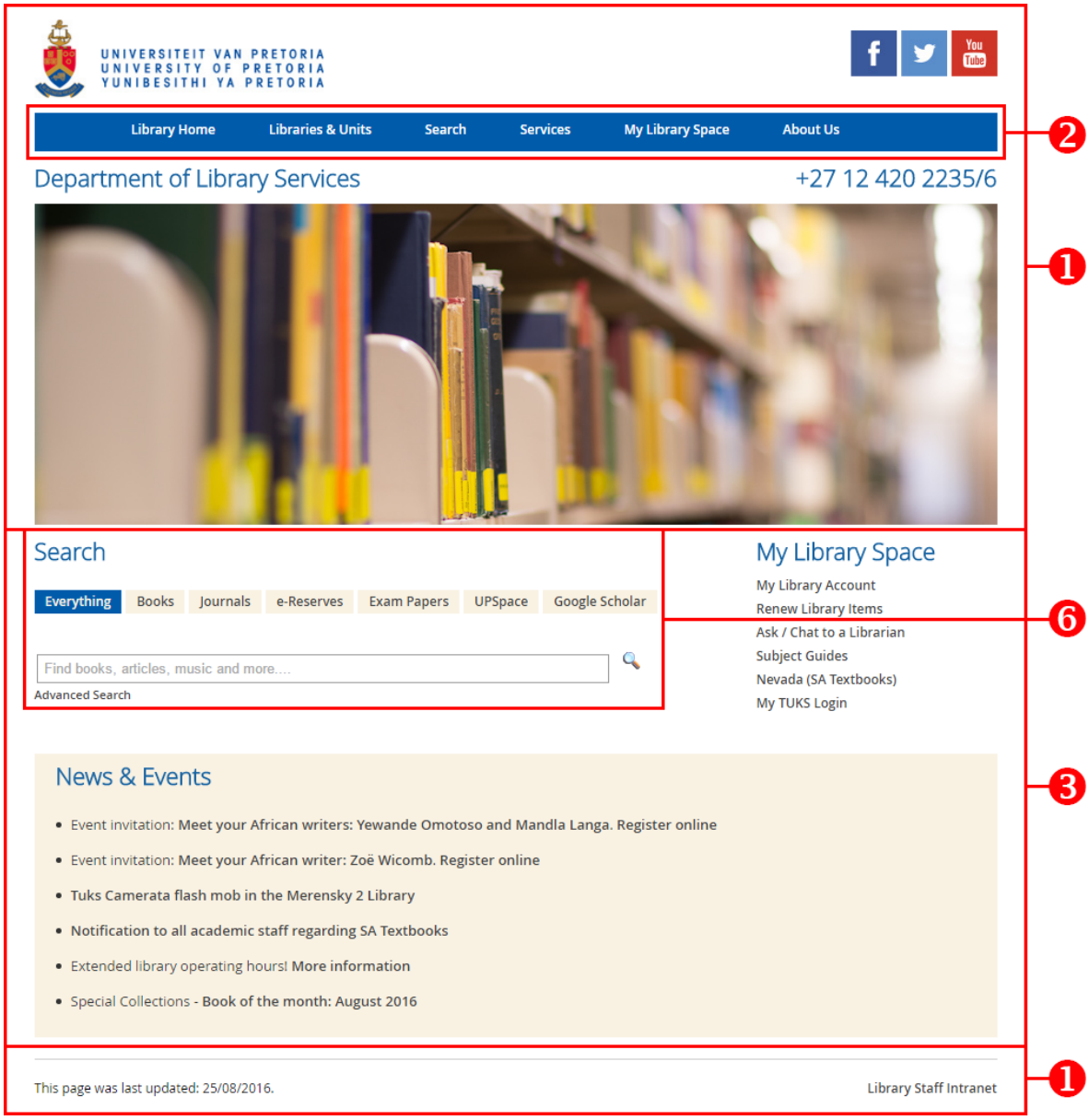


Figure 5.1-3: UP dialogue elements on the homepage

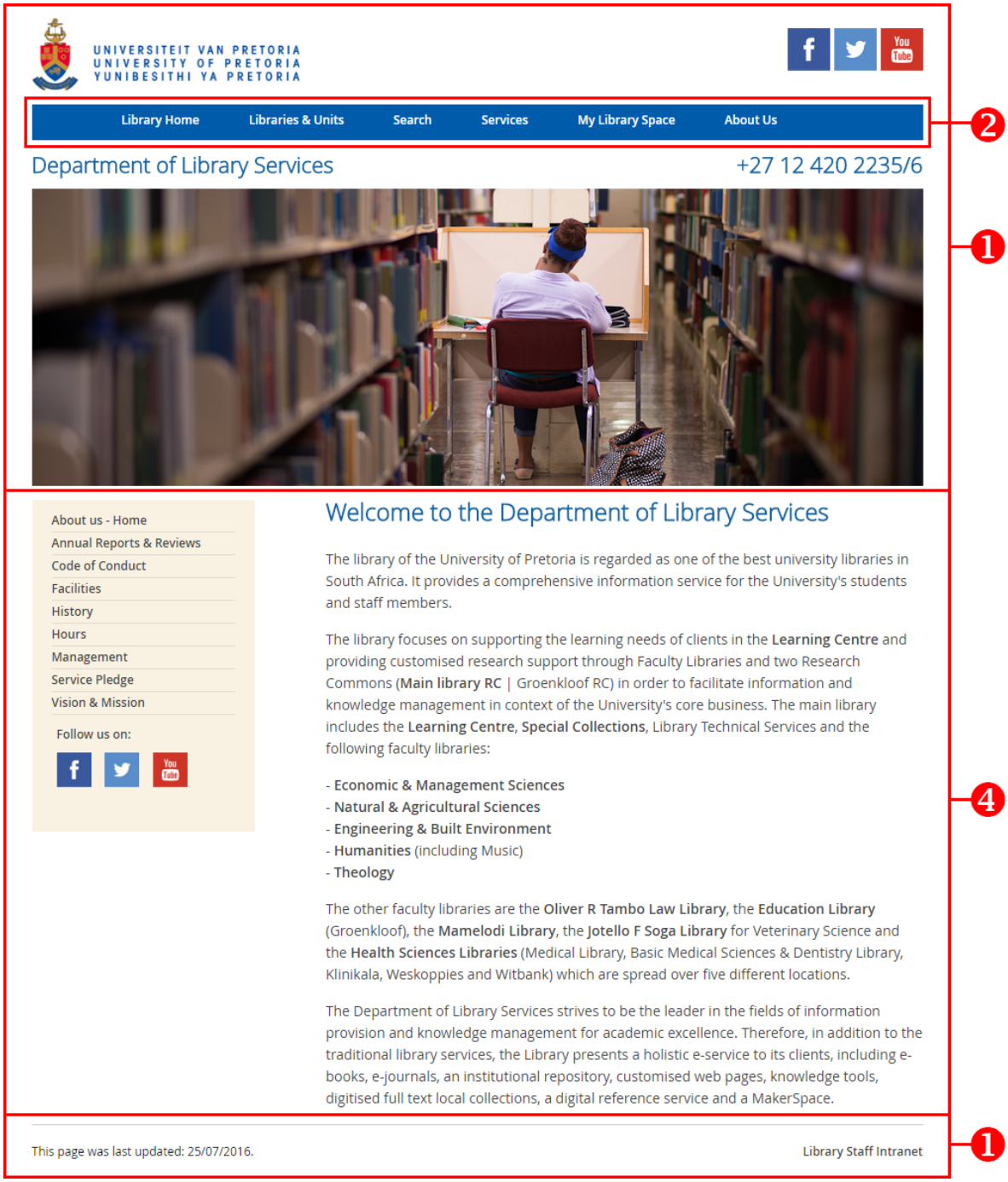


Figure 5.1-4: UP dialogue elements on internal pages (the "About us" page represents all the internal pages)

5.1.2 Global navigation structures

The global navigation structure of the UP library website consists of a header, a main navigation bar, and a footer. The navigation bar is nested inside the header.

There are no additional search features in the header, compared to case study 1 and case study 3, which contain a site search feature and a resource search feature in the headers.

There is, however, a "search" feature in the main navigation bar, but it is not a *site* search feature. Problems related to this search feature are discussed in the discussion of the main navigation bar in Section 5.1.2.3.

5.1.2.1 Dialogue element 1: Header and footer

The position of this dialogue element is outlined in Figure 5.1-3 and Figure 5.1-4 with the number 1, and the detail (the components in this dialogue element) is outlined in Figure 5.1-5 and Figure 5.1-6).

The header contains the following six components. The numbers in the list correspond to the numbers in Figure 5.1-5:

1. University emblem and name image. It links to the homepage of the *main* university website
2. Three social media links (Facebook, Twitter, and YouTube)
3. Main navigation bar (evaluated separately in Section 5.1.2.3)
4. Website name "Department of Library Services"
5. Telephone number
6. Image of books in a library. The image in the header is different on the internal pages but remains in the same position at the same size; therefore, it is part of the global structure according to the definition in the literature review

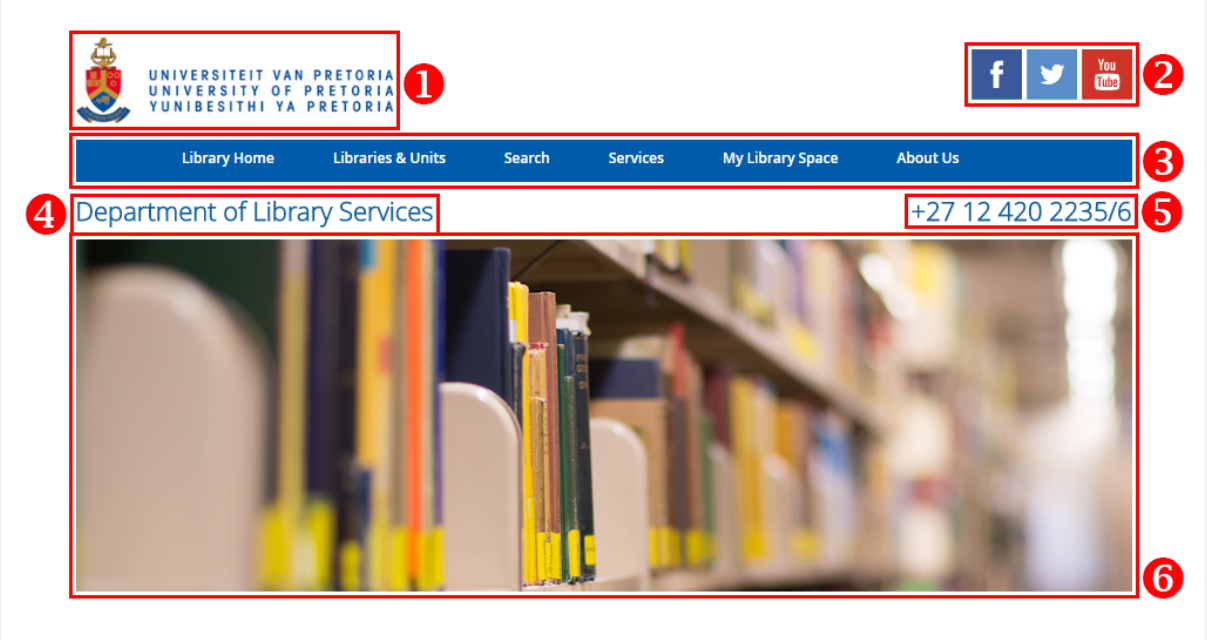


Figure 5.1-5: UP header components

The footer contains the following two components. The numbers in the list correspond to the numbers in Figure 5.1-6:

7. Page modification date
8. Staff portal link

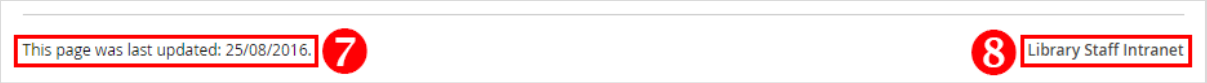


Figure 5.1-6: UP footer

5.1.2.2 Heuristic evaluation of dialogue element 1: UP header and footer

The table below contains the discussion of each of the problems that were found with the components in this dialogue element. The problems are summarised in the case summary in Section 5.1.5.

Heuristic	Evaluation
5.1.2.2.1 Labelling	The header and footer contain a small number of labels compared to the headers and footers in the other case studies. All of the labels use clear and familiar language. The only label that can potentially cause confusion is the telephone number (component 5 in Figure 5.1-5). This problem is addressed in the "Organisation" heuristic, in Section 5.1.2.2.2.
5.1.2.2.2 Organisation	The organisation of the information in the header, i.e., the name of the website and telephone number, can cause confusion. *5.1.2.2.2.1 Organisation problem 1: Website name and logo* Website development conventions dictate that the website identifier (for example, the logo and name) should be in a prominent position at the top of all webpages and, when users click on it, it should take them to the website's homepage (Nielsen 1999:189). In UP's library website header, however, the university's name and crest (component 1 in Figure 5.1-5) is in a more prominent position (top-left corner) than the name of the website (component 4 in Figure 5.1-5). The university name and crest is a link to the homepage of the *main* university website and not the library website. Throughout the evaluation, the researcher clicked on the link to go to the homepage of the library website, only to be navigated to the homepage of the main university website. Therefore, the link that goes to the homepage of the main university website causes confusion. The name of the website is "Department of Library Services" and it appears below the main navigation bar, making it seem like it is the main heading of the current page and not the website as a whole. The name is also not a clickable link that takes the user to the homepage. This causes

	problems with "Predictable behaviour", since it is a convention. See Section 5.1.2.2.8.1 for a description of the problem. The library websites in case study 1 and 3 each had a unique logo for their library websites which emphasised or made the library name more prominent, and users could click on it to go to the homepage. ***Recommendation 1*** Emphasise the name of the library website by placing it in a more prominent position and move the main library website link to a less prominent position (not in the top-left corner). The name of the website can also be emphasised with a custom logo. *5.1.2.2.2.2 Organisation problem 2: Unnecessary telephone number in header* It is not clear what the purpose of the telephone number in the header (component 5 in Figure 5.1-5) is. This is the telephone number for the Merensky library, but there is no additional information that indicates this. This was only clear once the number was compared to the telephone numbers on the "Contact Us" page. All the libraries' contact details are available on the "Contact Us" page. Developers can assume that users know that they can find contact details on a website's "Contact Us" page. Therefore, it does not make sense to display a single telephone number for the Merensky library in the header of the library pages. ***Recommendation 2*** The telephone number in the header can be replaced with a more essential library website element that is commonly found in the header of academic library websites. For example, a site search (Rosenfeld, Morville & Arango 2015:146), or a link to the website's help documentation (Mvungi, De Jager & Underwood 2008:179). The telephone number is not essential in the header, since it can easily be accessed from the "Contact Us" link in the main navigation bar.
5.1.2.2.3 Clutter	The header is clutter free because it has a minimal number of components (excluding the clutter in the main navigation bar).
5.1.2.2.4 Novice user guidance	There is no guidance for novice users in the header and footer section, although its usability can be improved by including such features. *5.1.2.2.4.1 Novice user guidance problem 1: Lack of tooltips* The links in the header and footer do not have tooltips. Tooltips are useful for informing users where a link will take them.

	Recommendation 3 Add tooltips to links (that might not be intuitive) in the header and footer to explain where they will take users. Suggested tooltip text (shown in quotation marks): **Tooltip suggestions for the header:** • University crest and name: "Go to UP website" • Social media icon links can be made more self-explanatory for users who might not be familiar with the icons. Tooltips that contain the names of the respective social networks can be added. For example, "Facebook", "Twitter", and "YouTube". • Department of Library Services (if the recommendation to make this heading a link to the homepage is followed, as suggested in "Predictable behaviour" in Section 5.1.2.2.8.1): "Go to library homepage" **Tooltip suggestion for the footer:** Library Staff Intranet: "Staff only link"
5.1.2.2.5 Help documentation	There is a lack of links to help documentation in the header. *5.1.2.2.5.1 Help documentation problem 1: Limited access* Help documentation is not directly accessible from the header or footer. It is not necessary if there are links to help documentation in the main (horizontal) navigation bar; however, help documentation is also difficult to find via the main navigation bar (as discussed in Section 5.1.2.4.5.1). ***Recommendation 4*** The telephone number in the header can be replaced with a more useful feature, such as a "Help" link as discussed in the recommendation in Section 5.1.2.2.2.2 in "Organisation".
5.1.2.2.6 Efficiency features	There are no efficiency features in the header or footer. *5.1.2.2.6.1 Efficiency features problem 1: No site search feature* A site search feature is a useful feature for websites with a large number of pages, like a library website (Rosenfeld, Morville & Arango 2015:146). It is useful for users who prefer to find information by searching rather than browsing. The previous version of the UP library website had a site search feature similar to the one on the UCT website (in case study 1) that performs a Google search on the contents of the website. It was not well-implemented, however, which might explain why it was removed.

	Recommendation 5 A well-implemented site search feature in the header can improve the efficiency for both novice and expert users. The telephone number in the header can be replaced with a more useful feature, such as a site search feature as discussed in recommendation 2 in Section 5.1.2.2.2.2.
5.1.2.2.7 Consistency	The header and footer are consistently the same on all the redesigned pages, but the old pages have a completely different layout and structure because they have not been redesigned (at the time of writing). *5.1.2.2.7.1 Consistency problem 1: Partial redesign* The incomplete redesign of the library website breaks the consistency between pages. This has a significant negative influence on usability. The new pages were available since 25/07/2016 and the rest of the pages had not been redesigned as of 20/09/2016. It is not good practice to publish a partially redesigned website since new users might not be aware that it is partially redesigned, and might simply experience it as being inconsistent and badly designed. ***Recommendation 6*** The redesign of all the library pages should be prioritised. For future redesigns, make sure that all webpages have been redesigned before publishing the website. Alternatively, if circumstances force an institution to roll out an implementation of the redesigned website over a certain period of time, a note should be visible on the website which clarifies this and possibly includes dates that specify when it will be completed.
5.1.2.2.8 Predictable behaviour	Some of the components in the header, i.e., the university name (component 1 in Figure 5.1-5) and website identifier (component 4 in Figure 5.1-5), do not behave as expected. *5.1.2.2.8.1 Predictable behaviour problem 1: Link to main university website in header* The university's crest and name (component 1 in Figure 5.1-5) can be mistaken as the site's identifier instead of the name of the website (component 4 in Figure 5.1-5) because it is positioned where a website's logo is normally positioned (in the top-left corner). This can lead to unexpected behaviour because users might click on the site identifier, expecting to go to the homepage of the current site. However, if they click on it to go to the homepage of the library, it will navigate them away from the library website to the *main* university website (as discussed in

	Section 5.1.2.2.2.1). This behaviour is unpredictable because a prominent link on the current website should not navigate the user to another website. The main university website is separate from the library website. Therefore, a link to the homepage of the main university website should not be prominent on the library website. ***Recommendation 7*** Make the link to the main university website less prominent and make it clear that it navigates away from the current website, for example, with tooltip text, as suggested in recommendation 3. *5.1.2.2.8.2 Predictable behaviour problem 2: Site identifier link to homepage* Additionally, if the user is aware that the above-mentioned link does take the user to the main university website, they might expect the name of the website in the header to link to the homepage of the library website. The name of the website, however, is only marked up as a heading and not a link, as it should be. This limits the website's "Controllability" as well, as discussed in Section 5.1.2.2.11.1. ***Recommendation 8*** Make the name of the website more prominent (as discussed in recommendation 1) and mark it up as a link to the library homepage.
5.1.2.2.9 Context	Context can be provided by showing the user their position within the page or their position relative to the web as a whole. Showing a user's context within the website is not applicable to the components in the header. It is only appropriate to the links in the main navigation bar, which is addressed in Section 5.1.2.4.9.1. One of the main purposes of a header, however, is to show a user's position relative to the web as a whole. This is not provided sufficiently in the header. *5.1.2.2.9.1 Context problem 1: Position relative to the web not sufficiently provided* The header does not provide the user with adequate context showing their position relative to the web as a whole due to the name of the website not being prominent as discussed in Section 5.1.2.2.2.1.

	This problem can result in the user mistaking the library website for the main university website. The user may think that they are on the main university website and that the "Department of library services" is simply a section of the main library website as opposed to a completely separate website. This problem is also addressed under "Organisation" in Section 5.1.2.2.2.1 and "Predictable behaviour" in Section 5.1.2.2.8.1. ***Recommendation 9*** Make the user's position relative to the web as a whole more prominent. See "Organisation" in Section 5.1.2.2.2.1 for suggestions.
5.1.2.2.10 Task completion support	This heuristic and its sub-criteria do not apply to the components in this dialogue element.
5.1.2.2.11 Controllability	The website's name that is not clickable limits controllability. This problem is also discussed in "Predictable behaviour" in Section 5.1.2.2.8.1 and recommendations are made in that section. *5.1.2.2.11.1 Controllability problem 1: Website name not a link to the homepage* Users who get lost, and who know they can easily navigate back to the homepage by clicking on the website name, will not be able to do that since the name of the website is not marked up as a link to the homepage. ***Recommendation 10*** Mark the name of the website up as a link to the homepage.
5.1.2.2.12 Error recovery	This heuristic and its sub-criteria do not apply to the components in this dialogue element.
5.1.2.2.13 Error prevention	The researcher regularly clicked on the university logo by accident, expecting it to navigate to the homepage but then being directed to the main university website instead. Therefore, the problems discussed in this section relating to the name of the university that is a link to a homepage of the main university website can result in errors. These errors can be prevented by following the recommendations in Section 5.1.2.2.2.1 and Section 5.1.2.2.8.1.
5.1.2.2.14 Feedback	This heuristic and its sub-criteria do not apply to the components in this dialogue element.

Table 5.1-1: Heuristic evaluation of dialogue element 1: UP header and footer

5.1.2.3 Dialogue element 2: Main navigation bar

The position of the main navigation bar is outlined in Figure 5.1-3 and Figure 5.1-4 with the number 2, and the detail (the components in this dialogue element) is outlined in Figure 5.1-7 and Figure 5.1-8.

The main navigation bar is a horizontal bar that consists of six links in total. The first link is a link to the library homepage. The other five links (links 2–6) have drop-down menus that appear below the links when the user hovers over them. The drop-down menus that appear when a user hovers over links 2–6 in the main navigation bar are outlined in Figure 5.1-8. Only the first link and the last link have hypertext references that link to a different location; the others do not. Their purpose is only to show drop-down menus when a user hovers over them.

The main navigation bar contains the following six components (each component is a link). The numbers in the list correspond to the numbers in Figure 5.1-7 and Figure 5.1-8:

1. “Library Home”
2. “Libraries & Units”
3. “Search”
4. “Services”
5. “My Library Space”
6. “About Us”

The drop-down menus that appear below components 1–6 are outlined in Figure 5.1-8.

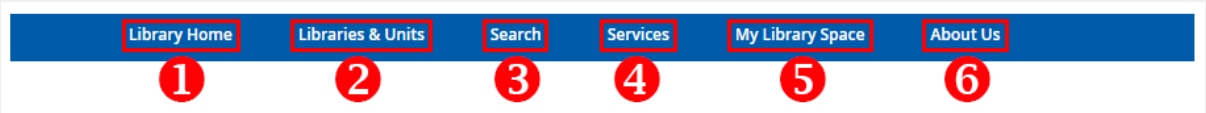


Figure 5.1-7: UP main navigation bar

Figure 5.1-8: UP main navigation bar – drop-down menus

5.1.2.4 Heuristic evaluation of dialogue element 2: UP main navigation bar

The table below contains the discussion of each of the problems that were found with the components in this dialogue element. The problems are summarised in the case summary in Section 5.1.5.

Heuristic	Evaluation
5.1.2.4.1 Labelling	Some of the labels in the main navigation bar are confusing as discussed in detail below. The organisation of some items in the drop-down menus is confusing and is further discussed under "Organisation" in Section 5.1.2.4.2. *5.1.2.4.1.1 Labelling problem 1: Confusing or unfamiliar link labels* The labels of each main category in the navigation bar and its drop-down menu links are discussed separately. ***Link 1: Library Home (Component 1 in Figure 5.1-7)*** The language in the label is familiar. This link does not have a drop-down menu. ***Link 2: Libraries & Units (Component 2 in Figure 5.1-7 and Figure 5.1-8)*** a) The label "Units" is not a common label for categorising items on a library website as the terms were not used in any of the related studies or case studies. Units, in this case, refer to divisions, sections, collections, and services in the Merensky library. Therefore, it reflects the internal organisational structure of the university, which may not be familiar to novice users. This problem is further discussed in "Organisation" in Section 5.1.2.4.2.1. ***Recommendation 11*** The "Libraries & Units" category should be split into two separate categories and the "Units" category should be renamed using a more appropriate label. See "Organisation" in Section 5.1.2.4.2.1 for a detailed discussion of the categorisation problem. Links should not be labelled according to the organisational structure of an institution. The labels under the "Units" category should rather represent the purpose they serve. ***Link 3: Search (Component 3 in Figure 5.1-7 and Figure 5.1-8)*** There is an organisational problem with the "Search" label as the same label is used on the homepage but it represents different content. This is an "Organisation" problem and is discussed in Section 5.1.2.4.2.1. The first three links in the drop-down menu may cause confusion because it is not clear what the difference is between: "Catalogue", "WorldCat Discovery", and "EBSCO" or what their purposes are. New users might also not be familiar with the terms "WorldCat" and "EBSCO". The purpose of each of the links should be clear so that users

	can make informed decisions instead of having to click on the links in order to discover their purpose. The purpose of each of the links can be clarified with tooltips. Both the "Catalogue" and "WorldCat Discovery" links link to the WorldCat website. However, the first one links to the "simple" search feature, while the second one links to the "advanced" search feature. These links can be renamed to represent this difference. The last link in the "Search" drop-down menu contains the term "UPSpace" that new users might also not be familiar with, but the term is further explained in parenthesis next to it, i.e., "UPSpace (Institutional Repository)"; therefore, it is not a problem. The rest of the links in this drop-down menu are self-explanatory. ***Recommendation 12*** The first two links in the drop-down menu "Catalogue" and "WorldCat Discovery" should be renamed to reveal the difference between the two. For example, "Catalogue" can be renamed to "WorldCat Catalogue Basic Search" and "WorldCat Discovery" can be renamed to "WorldCat Catalogue Advanced Search". Alternatively, to reduce clutter, the link to the advanced search feature can be removed. See "Clutter" in Section 5.1.2.4.3.1 for a discussion and recommendation. EBSCO discovery can be renamed to "EBSCO Discovery Basic Search" and a tooltip should be added to make its purpose clear. ***Link 4: Services (Component 4 in Figure 5.1-7 and Figure 5.1-8)*** The term "MakerSpace" that is categorised under services is jargon that is specific to the University of Pretoria and might be unfamiliar to novice users. Some of the links are incorrectly categorised into this category, for example, "Plagiarism", "Referencing", and "Wi-Fi access". These items are more likely "help" features. However, this is an "Organisation" problem and is further discussed in Section 5.1.2.4.2.1. ***Recommendation 13*** Add more information to the "MakerSpace" link to add meaning to it. Additionally, a tooltip can be added to explain its purpose.

	Link 5: My Library Space (Component 5 in Figure 5.1-7 and Figure 5.1-8) The following links in the drop-down menu under this category might cause confusion: a) There are two login links, "Log in" and "My TUKS login" and it is not clear what the difference between the two is. The "My TUKS login" link links to the UP portal. b) Is it not clear what the difference between the links "Ask a Librarian" and "Chat to a Librarian" is. The link "Chat to a Librarian" links to a live chat feature that is only available on weekdays between 14:00 and 16:00, while "Ask a Librarian" links to a web form that the user can use to send an email to a librarian. The "Ask a Librarian" page also contains the "Chat to a Librarian" live chat feature. Since the "Chat to a Librarian" feature is only available for two hours on a weekday, and it can be accessed from the "Ask a Librarian" page, the "Chat to a Librarian" link can be removed and the "Ask a Librarian" link can be renamed to "Ask / Chat to a Librarian". ***Recommendation 14*** The labelling of the two links, "Log in" and "My TUKS login" should be changed so that the difference between the two links is clear. Label suggestions: "Library Account Login" and "My TUKS Login (UP Portal)". ***Recommendation 15*** Remove the "Chat to a librarian" link and rename the "Ask a Librarian" link to "Ask / Chat to a Librarian". This way, the user can have access to both features by clicking on a single link, and if they land on the page during inactive chat active hours, they can simply use the "Ask a Librarian" feature. ***Link 6: About Us (Component 6 in Figure 5.1-7 and Figure 5.1-8)*** The term "About Us" is self-explanatory and easy to understand, as well as the labels in the drop-down menu.
5.1.2.4.2 Organisation	The order of the main links in the navigation bar is logical, but there are problems with the organisation of links in the drop-down menus of the main categories. Problems with both the grouping and ordering of links in the drop-down menus are discussed below. *5.1.2.4.2.1 Organisation problem 1: Grouping and categorisation* Some of the links that are listed in the drop-down menus under the main categories in the main navigation bar do not make sense or do not fit

	together. Only the links where problems were found are discussed below. ***Link 2: Libraries & Units (Component 2 in Figure 5.1-7 and Figure 5.1-8)*** a) Some of the links categorised under "Libraries & Units" represent the organisational structure of the university, which might not be familiar to users. A website should not be organised by an institution's organisational structure. b) The links categorised under "Libraries" do not specifically refer to *library buildings*, which might be the assumption. Most of the links refer to *faculty units* of the university that can be located in the Merensky 2 library building. No distinction is made between the two concepts *UP library buildings* and *faculty units*. This can cause confusion for users who are not familiar with the university's organisational structures. For example, it is not clear that "Economic and Management Sciences" is not a separate library, but rather a faculty entity in the Merensky 2 library building. Therefore, faculty units that are housed within the Merensky 2 library are incorrectly referred to as *libraries*. ***Recommendation 16*** Remove the category "Units" and rearrange the links under more appropriate categories, such as "Services". Additionally, a new, more suitable category can be added to the main navigation bar for items that do not fit under the "Services" category — for example, "Library Help", a useful category that is missing from the main navigation bar. Some of the links that are listed under "Units" are services that provide help and can be categorised under "Library Help". Conduct a card sorting exercise to find out what the most appropriate categories would be. ***Recommendation 17*** There should be a clear distinction between the *library building* and *faculty unit* links in the "Libraries" category. For example, the drop-down menu under the "Libraries" link can contain the sub-headings "UP library buildings" and "Faculty units". ***Link 3: Search (Component 3 in Figure 5.1-7 and Figure 5.1-8)*** This link in the main navigation bar has the same identifying label as the resource search feature in the content of the homepage (as shown in Figure 5.1-9). The contents of the drop-down menu of the link in the main navigation bar, however, do not match the contents of the resource search feature on the homepage and the two have different purposes. This may cause confusion.

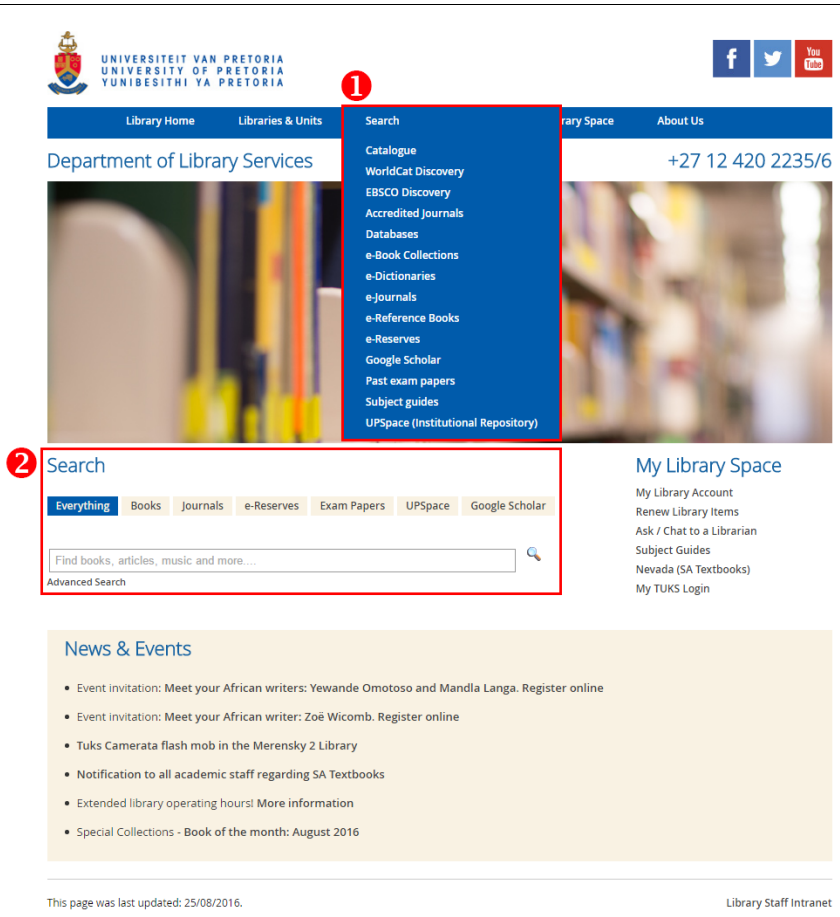


Figure 5.1-9: UP search feature confusion

No distinction is made between the two components, as both have the same identifying label "Search". There is a critical difference between the two components; therefore, they should not be identified with the same label.

The search feature in the main navigation bar only provides a drop-down menu and not a site-search feature. A site-search feature would have been a useful feature for an academic library website.

Recommendation 18

The search label in the navigation bar can be renamed to "Locate/Find resources". Additionally, a site search feature can be provided with the label "Search website" and the search feature on the homepage can be renamed to "Search library resources", to avoid confusion.

Link 4: Services (Component 4 in Figure 5.1-7 and Figure 5.1-8)

Some of the links listed under this category are incorrect as they cannot be defined as "Services". For example, the following links are not "Services": "Plagiarism", "Referencing", and "Wi-Fi access". These items are more suitable as a "help" features.

Recommendation 19
Links in the "Services" drop-down menu that are not services should be removed and listed in a different category, for example, "Library Help". This is also suggested in recommendation 6.

Recommendation 20
In order to determine how the main navigation should be organised, a card sorting exercise should be performed. This is also recommended in recommendation 6, to find more appropriate categories for the links under "Units". An open card sorting exercise allows the participants to create new categories. All of the links that were categorised under "Units" and "Services" should be sorted.

Link 5: My Library Space (Component 5 in Figure 5.1-7 and Figure 5.1-8)
The links in this drop-down menu do not correspond exactly with the links in the "My Library Space" section on the homepage. This problem is further discussed under "Labelling" in Section 5.1.2.4.1.1.

Link 6: About Us (Component 6 in Figure 5.1-7 and Figure 5.1-8)
The "Management" link provides contact information, which makes the link redundant if there is already a "Contact Us" link. As recommended in dialogue element 4, "Internal page contents" under "Organisation" in Section 5.1.3.4.2.2, the "Management" contact details should be located on the "Contact Us" page and then the "Management" link can be removed from the drop-down menu.

5.1.2.4.2.2 Organisation problem 2: Difference in ordering concepts
Some of the links in the drop-down menus are sorted in alphabetical order (i.e., "Libraries & Units" and "Services"), while others are sorted in order of importance (i.e., "My Library Space"). Additionally, some are either a combination of the two ordering schemes or are erroneous (i.e., "Search" and "About Us").

Under "Search", the top three links are not sorted alphabetically, while the rest of the links are. Under "About Us" all links are sorted alphabetically except that "Management" is listed before "Library Newsletter". This alteration in ordering schemes can cause confusion.

Recommendation 21
The lists should be sorted according to the purpose of the items in them, i.e., for known item searching, lists should be sorted alphabetically. However, it should be clear what ordering scheme is used and there should not be any errors. Lists that use a combination of ordering

	schemes can cause confusion. When a combination is necessary, aids or additional subcategories could be provided. The only list that makes sense with an alphabetical sorting scheme is the "Faculty units" (listed under "Libraries"). An alphabetical arrangement under "About Us" is not an optimal organisation scheme. The "Contact Us" link should be listed first (since it is a common link that should be easy to find) and "Hours", "Facilities", and "Management" should be listed together with "Contact Us" because the information is related. The "Code of Conduct", "Service Pledge", and "Vision and Mission" links should be grouped together and listed underneath each other. The following list is a recommendation for a more sensible ordering (important links first): • Contact us • Hours • Facilities • Management (should be removed because it contains contact details that should rather be listed on the "Contact Us" page, as suggested in Section 5.1.3.4.2.2) • Vision and mission • Service pledge • Code of conduct • Library Newsletter • Annual Reports • History
5.1.2.4.3 Clutter	The number of links in the main navigation bar is small enough so that it is clutter free. Some of the drop-down menus, however, are cluttered because they are too long and contain redundant links. *5.1.2.4.3.1 Clutter problem 1: Long drop-down menus* The problems in the individual drop-down menus are discussed below. ***Link 1: Library home (Component 1 in Figure 5.1-7)*** No drop-down menu. ***Link 2: Libraries & Units (Component 2 in Figure 5.1-7 and Figure 5.1-8)*** The drop-down menu is too long; therefore, it is cluttered. The problem is addressed in "Organisation", Section 5.1.2.4.2.2, and the suggested recommendation (to remove all "units" from the list) will solve the problem. Removing the units section will also result in having the

	subcategories "Libraries" and "Units" in the drop-down menu being removed, therefore further reducing clutter. ***Link 3: Search (Component 3 in Figure 5.1-7 and Figure 5.1-8)*** The first two links in this drop-down menu, "Catalogue" and "WorldCat Discovery", both link to the WorldCat website. The first links to the simple search feature and the second links to the advanced search feature. As suggested in "Labelling" in Section 5.1.2.4.1.1, the two links should be renamed to make the distinction between the two clear, for example, "WorldCat Catalogue Basic Search" and "WorldCat Catalogue Advanced Search". Alternatively, since both links link to the same website and the second link is available on the page that the first link links to, the second link (the advanced search link) can be removed from the library website to reduce clutter. Then the first link can simply be named "WorldCat Catalogue Search" instead of "WorldCat Catalogue Basic Search". ***Recommendation 22*** Choose between renaming the first two links in the "Search" drop-down menu to make the distinction clear (as recommended in Section 5.1.2.4.1.1) or removing the second link "WorldCat Discovery", and renaming the "Catalogue" link to "WorldCat Catalogue Search". ***Link 4: Services (Component 4 in Figure 5.1-7 and Figure 5.1-8)*** The drop-down menu is clutter free, but this might need to be re-evaluated if the links under the "Units" sub-category under "Libraries & Units" are subdivided between "Search" and "Services" as suggested in the recommendation in Section 5.1.2.4.2.1. ***Link 5: My Library Space (Component 5 in Figure 5.1-7 and Figure 5.1-8)*** Clutter can be reduced by collapsing "Ask a Librarian" and "Chat to a Librarian" into a single link with the label "Ask / Chat to a Librarian" as suggested in "Labelling" Section 5.1.2.4.1.1. ***Link 6: About Us (Component 6 in Figure 5.1-7 and Figure 5.1-8)*** The drop-down menu is relatively clutter free. Clutter will further be reduced if the "Management" link is removed as suggested under "Organisation" in Section 5.1.2.4.2.1.
5.1.2.4.4 Novice user guidance	The "Ask a Librarian" and "Chat to a librarian" links under "My Library Space" can be seen as novice user guidance features. The library also provides library training and more information about this can be

	accessed via the "Training" link under "Services". *5.1.2.4.4.1 Novice user guidance problem 1: Tooltips* There are no tooltips in the main navigation bar that inform users of where a link will navigate. ***Recommendation 23*** The addition of useful tooltips to links that are not obvious in the navigation bar and drop-down menus can greatly contribute to making them more useful for novice users.
5.1.2.4.5 Help documentation	Help documentation for the library is difficult to find or not available. *5.1.2.4.5.1 Help documentation problem 1: Availability* Help documentation for the library was difficult to find or there is none available. Content links that were available under "Services" can be seen as help documentation, as suggested in Section 5.1.2.4.2.1. The websites in the case studies had more help documentation available, or it was easier to find. For example, in case study 1, there is a main category in the main navigation bar with the label "Research Help" and a list of various help documentation resources in the drop-down menu. ***Recommendation 24*** Provide more visible help features from the main navigation bar. A "Help" category can be included that contains links that were previously available under "Units" or "Services".
5.1.2.4.6 Efficiency features	Main navigation bars usually contain links to main sections of a website and the local navigation menus in main sections are used to navigate between the sub-sections. Therefore, links to sub-sections in the drop-down menus of the main navigation bar can be seen as "shortcuts", which helps users with efficiency. There are no problems that are applicable to this heuristic.
5.1.2.4.7 Consistency	The navigation bar is consistent on most of the new pages of the library website. Some of the link labels have been updated, however, and this has not been done across all the pages. *5.1.2.4.7.1 Consistency problem 1: Updating information* Links that have been updated since the redesign have not been updated consistently on all the pages. For example, on the homepage under the "My Library Space" menu there is a link to http://www.nevada-cloud.com/, called "Nevada (SA Textbooks)", but on the Accredited

Journals page in the same menu the link is called "SA Textbooks UP (Guide)" and links to https://www.satextbooks.net/upii/staff/login.aspx, a page that no longer exists. SA Textbooks was replaced by Nevada; therefore, this problem is due to the fact that the link has not been updated on all the pages throughout the website.

Recommendation 25
Ensure that when link labels in the main navigation bar are updated that they are changed on all the pages. A simple solution that can be implemented in this website is to have a single HTML file that contains the main navigation bar that is referenced in all the pages. This way, when the navigation bar needs to be updated, it only needs to be updated in a single file and the change will appear on all the pages.

5.1.2.4.7.2 Consistency problem 2: Partial redesign

Consistency is also affected by the fact that the website consists of a combination of old and new webpages. The navigation bar in the old pages is completely different to the new one and at a different position. As mentioned in "Consistency" of the header (Section 5.1.2.2.7.1), this can cause confusion if users are not aware that these are pages of the same website, but with a different design. Novice users might think that it is a different website.

Recommendation 26
The redesign of the entire website needs urgent attention. As recommended in Section 5.1.2.2.7.1, a note can be added.

5.1.2.4.7.3 Consistency problem 3: The behaviour of the main links in the navigation bar is inconsistent

All of the links in the main navigation bar look the same, but some of them behave differently. The "Library Home" link has a hypertext reference to the library website homepage. The next four links do not have hypertext references, but they do have drop-down menus when users hover over them. The last link "About Us", has a hypertext reference and a drop-down menu. Users might not click on the "About Us" link, thinking that it does not have a hypertext reference like the other links.

Recommendation 27
All links that have drop-down menus should not have a hypertext reference as well. Users often click on such links by accident when they want to see the options in the drop-down menu. Therefore, the "About us" link should not have a hypertext reference. When a user hovers over a link that does not have a hypertext reference (i.e., it is not clickable), the

	cursor must not change to a pointer, as discussed in "Predictable behaviour", in Section 5.1.2.4.8.1. Only the homepage link should be clickable because it does not have a drop-down menu. It must also be visually distinct in order to convey this difference, for example, with a text underline.
5.1.2.4.8 Predictable behaviour	The behaviour of the links in the main navigation bar can cause confusion. *5.1.2.4.8.1 Predictable behaviour problem 1: Cursor pointer of links without hypertext references* When hovering over the main categories in the main navigation bar, a cursor pointer appears. An example of a cursor pointer is shown in Figure 5.1-10. A cursor pointer's purpose is to convey that something can be clicked. Only two of the links are interactive (the first one "Library Home" and the last one "About Us"); the rest are blank hyperlinks (#), which do not perform any action when the user clicks on them. The purpose of the links is to display drop-down menus when users *hover* over them. Due to the behaviour of the four links that do not perform any action when clicked on, the user might not know that the last one "About Us" is a hyperlink, and therefore avoid clicking on it.  **Figure 5.1-10: Cursor pointer example** ***Recommendation 28*** Change the markup of links that do not have hypertext references so that a cursor pointer will not appear when users hover over them. Their only purpose must be to reveal their drop-down menus. The links that are interactive, however, namely "Library Home" and "About Us", should indicate that they are interactive with a pointer cursor and should be visually distinct (for example, with an underline) since they have different functionality.
5.1.2.4.9 Context	Context is not indicated in the main navigation bar, which causes the following problem.

	5.1.2.4.9.1 Context problem 1: Main navigation context The user's location within the website is not provided. This results in a lack of context. Context should be indicated in the main navigation bar by changing the style of the current link (i.e., the link of the page that the user is on). For example, when the user is on the "About Us" page, the "About Us" link in the main navigation bar is a "current" link, and this should be indicated by making the link appear visually distinct. A good example of an implementation of this can be found in the main navigation bar of the UCT library website (case study 1). ***Recommendation 29*** Provide context in the main navigation bar by making the link label of the current link look visually distinct.
5.1.2.4.10 Task completion support	This heuristic and its sub-criteria do not apply to the components in this dialogue element.
5.1.2.4.11 Controllability	Users can easily control the sequence and speed of their actions using the main navigation bar, as long as they are on new pages of the library website. The old website is so visually distinct that it might have a negative impact on controllability. As recommended in "Consistency" Section 5.1.2.2.7.1 and 5.1.2.4.7.2, the complete redesign of the library website should be prioritised and a note conveying information about the redesign can be added. Links to external websites consistently open in a new tab. This consistent behaviour has a positive influence on controllability. However, it is not ideal for the main navigation bar to contain external links, as the purpose of the main navigation bar is to help users navigate to different sections within the same website.
5.1.2.4.12 Error recovery	This heuristic and its sub-criteria do not apply to the components in this dialogue element.
5.1.2.4.13 Error prevention	The main navigation links that are not clickable helps with error prevention. Users often click main links by accident when they intend to expand the drop-down menu below the link. This was a problem with the main categories in the SU website (case study 3) navigation bar.

5.1.2.4.14 Feedback	This heuristic and its sub-criteria do not apply to the components in this dialogue element.

Table 5.1-2: Heuristic evaluation of dialogue element 2: UP main navigation bar

5.1.3 Local navigation structures

The homepage and internal pages have completely separate components (as they should). From the first pass through the system, the local navigation structures seem simple and intuitive. They seem to consist of standard components supported by web conventions.

5.1.3.1 Dialogue element 3: Homepage contents

The position of this dialogue element is outlined in Figure 5.1-3 with the number 3, and the detail (the components in this dialogue element) is outlined in Figure 5.1-11). The title of the homepage is also part of this dialogue element and is shown in Figure 5.1-12.

The homepage contains the following four components. The numbers in the list correspond to the numbers in Figure 5.1-11 and Figure 5.1-12:

1. Resource search feature labelled “Search” (evaluated separately as a dialogue element in Section 5.1.4.2)
2. “My Library Space” component (features the same links as the ones that are available in the drop-down menu in the main navigation bar under the “My Library Space” category)
3. “News & Events” (bulleted list with the latest news about the library, with contextual links)
4. Page title “Department of Library Services” (Figure 5.1-12)

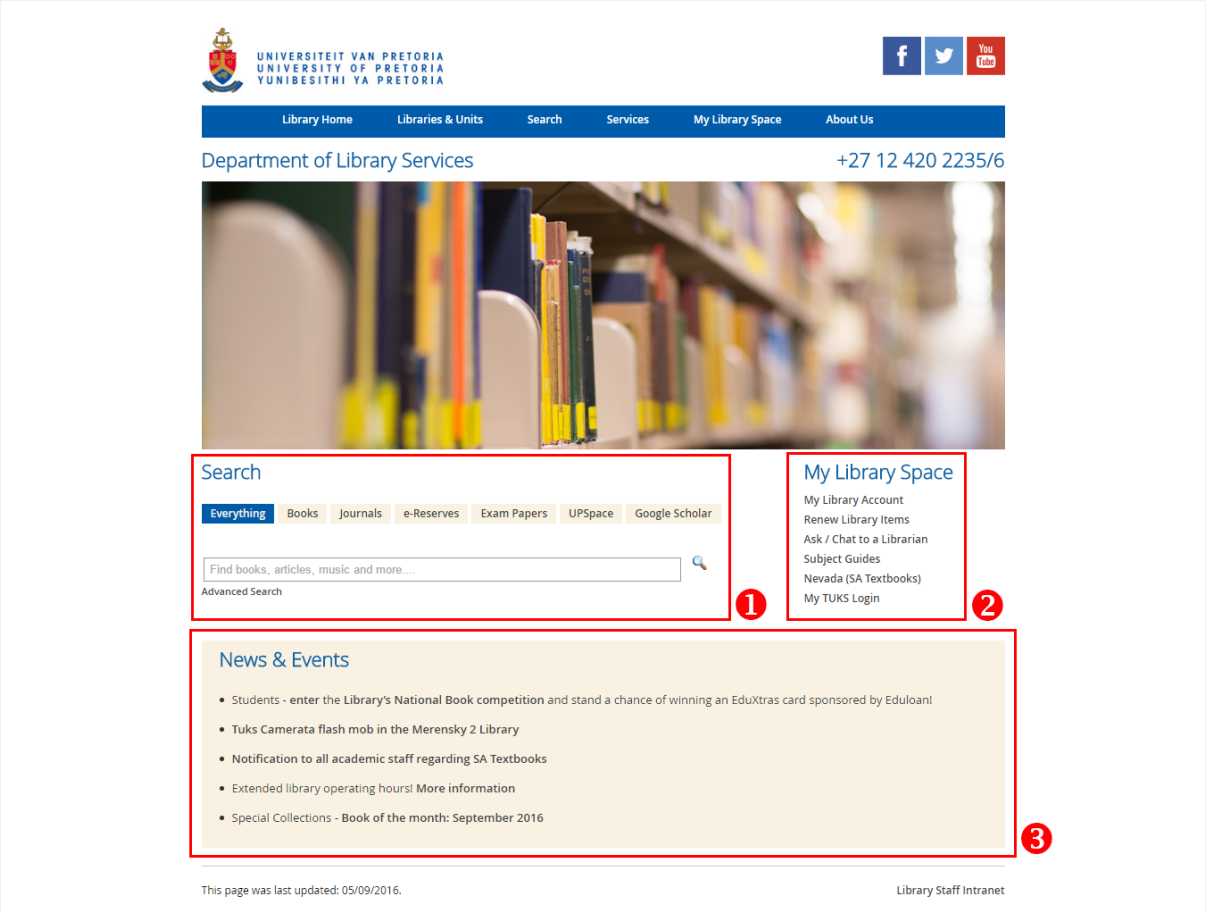


Figure 5.1-11: UP homepage structure

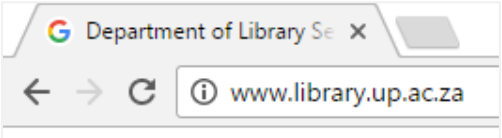


Figure 5.1-12: UP homepage title

5.1.3.2 Heuristic evaluation of dialogue element 3: UP homepage contents

The table below contains the discussion of each of the problems that were found with the components in this dialogue element. The problems are summarised in the case summary in Section 5.1.5.

Heuristic	Evaluation
5.1.3.2.1 Labelling	Each of the components on the homepage have simple and clear headings: "Search", "My Library Space" and "News & Events". However, "Search" and "My Library Space" correspond to a limited extent to components with the same labels in the main navigation bar. The contents of the components differ and this results in consistency issues.

The problems related to labelling are discussed below. Consistency issues are discussed in the "Consistency" heuristic, in Section 5.1.3.2.7.

Additionally, the page title is incorrect based on web development conventions.

5.1.3.2.1.1 Labelling problem 1: Page title

The homepage title is the name of the website: "Department of Library Services" (Figure 5.1-12). It is too long for the title and does not follow conventions. According to web development conventions, titles should contain the name of the page and the name of the website, separated with hyphens (-) or pipes (|). Titles must also be short and descriptive. The only exception is the homepage title, which may start with the name of the website.

Recommendation 30

Rename the homepage title so that it contains the name of the website followed by the name of the page. The name of the website should also be shortened, for example, "UP Libraries | Home".

5.1.3.2.1.2 Labelling problem 2: Difference between labels in "My Library Space"

The "My Library Space" component features the same links as the ones that are available in the drop-down menu in the main navigation bar under the "My Library Space" category, but some of the labels are different. See Figure 5.1-13 for a comparison.

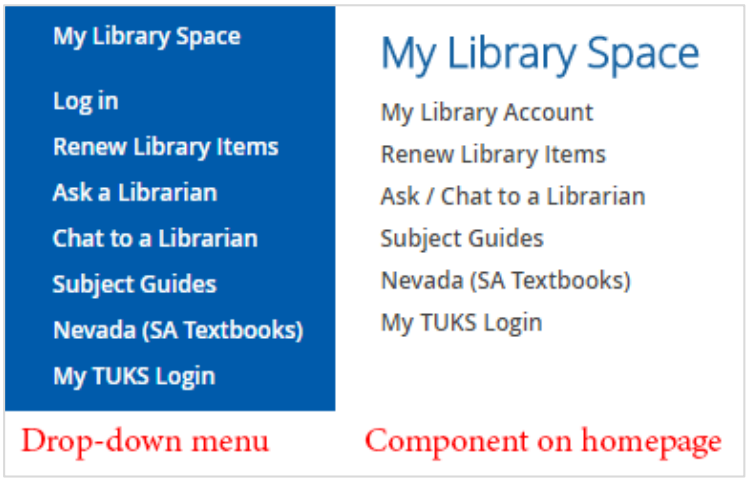


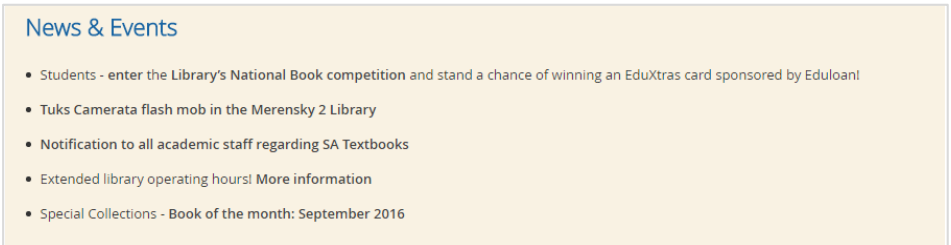
Figure 5.1-13: UP "My Library Space" menus

This is a consistency issue that is addressed in Section 5.1.3.2.7.2. However, some of the labels are unclear, which is addressed in this section.

	The first link in the component is a library account login link. The labels of the two links do not correspond. In the drop-down menu, it is labelled "Log in" while the label in the component on the homepage is "My Library Account". The label "My Library Account" is more descriptive. The recommendation in Section 5.1.2.4.1.1 was to rename the link in the main navigation bar "Library Account Login". This recommendation should be applied to the label in both components. Additionally, the two links "Ask a Librarian" and "Chat to a Librarian" in the drop-down menu, were merged into a single line "Ask / Chat to a Librarian" where "Ask" is a link to the "Ask a Librarian" page and "Chat" is a link to the "Chat to a Librarian" page. ***Recommendation 31*** Change the labels in the two "My Library Space" components so that they correspond to each other since the links link to the same locations. As recommended Section 5.1.2.4.1.1, "Log in" should be changed to "Library Account Login". As recommended in Section 5.1.2.4.1.1, remove the "Chat to a Librarian" link and change the label of the "Ask a Librarian" link to "Ask / Chat to a Librarian".
5.1.3.2.2 Organisation	The organisation of the three components on the page is logical. The news in the news section is sorted in reverse chronological order, which is appropriate for the type of information.
5.1.3.2.3 Clutter	The homepage is relatively clutter free due to having a small number of components. There is a redundant link that can be removed to reduce clutter further, i.e., "Chat to a Librarian". This recommendation is made in Section 5.1.2.4.1.1 and Section 5.1.3.2.1.2.
5.1.3.2.4 Novice user guidance	The "Ask / Chat to a librarian" feature can be seen as a feature for novice users. The links can cause some confusion, however, as discussed in "Predictable behaviour", Section 5.1.3.2.8.1. A recommendation is provided to remove confusion. The recommendation is to have a single link that links to both features and, since both features can be found on the "Ask a Librarian" page, the link to chat to a librarian can be removed and the link to ask a librarian can be renamed to "Ask / Chat to a Librarian". There is a lack of tooltips to guide novice users.

	5.1.3.2.4.1 Novice user guidance problem 1: Missing tooltips There is a lack of tooltips. Tooltips can be added to provide guidance for novice users. ***Recommendation 32*** Provide tooltips for all the links on the homepage that further explain where they navigate. Suggested tooltips: • My Library Account: "Go to library account" • Renew Library Items: "Go to library account" • Ask a Librarian: "Questions, Comments, or Suggestions" • Subject Guides: "Sources, Tips, Content" • Nevada (SA Textbooks): "Order prescribed textbooks" • My TUKS Login: "UP Portal login"
5.1.3.2.5 Help documentation	There is no access to help documentation from the components on the homepage. This can be due to it not being available or simply because links to it have not been added. Many related study results showed that access to help is an important aspect that should be available from the homepage of a library website. *5.1.3.2.5.1 Help documentation problem 1: Access* There is not enough access to help documentation on the homepage or the website does not have sufficient help documentation. ***Recommendation 33*** Provide users with a link labelled "Help" on the homepage to provide access to a collection of help documentation sources. If the website does not have sufficient help documentation, additional documentation should be added, for example, documentation that informs users about the different search features or how to use advanced search features. A "help" category can be useful in the main navigation bar, as suggested in Section 5.1.2.4.2.1.
5.1.3.2.6 Efficiency features	The resource search feature can be seen as a "shortcut" to some of the library's resources. It is the only component on the homepage that can be seen as an efficiency feature. It is further discussed as a separate dialogue element in Section 5.1.4.2.
5.1.3.2.7 Consistency	There are some consistency issues between the components in the main navigation bar and components on the homepage that have the same

	identifying labels, but not the same contents. See Section 5.1.2.4.2.1 in the "Main navigation bar" heuristic evaluation table for a discussion of the problems related to "Organisation". *5.1.3.2.7.1 Consistency problem 1: Different components with the same label "Search"* The resource search feature is evaluated as a separate dialogue element in Section 5.1.4.2; however, the consistency issue with the component in the main navigation bar is addressed here. As discussed under "Organisation" in Section 5.1.2.4.2.1, the label "Search" causes confusion because it is the same as the "Search" label in the main navigation bar, yet it does not have the same corresponding contents. A recommendation was made to give the components different labels in Section 5.1.2.4.2.1 (recommendation 18). *5.1.3.2.7.2 Consistency problem 2: "My Library Space" component* The labels that are available in the two menus are not exactly the same (see Figure 5.1-13). This may cause confusion. ***Recommendation 34*** Make the labels the same across the two components. Links that are the same should have the same labels. Make the changes according to the recommendation in Section 5.1.2.4.1.1: 1- Library Account Login 2- My TUKS Login (UP Portal) 3- Renew Items 4- Ask / Chat to a Librarian (single link) 5- Subject Guides
5.1.3.2.8 Predictable behaviour	The behaviour of the links "Ask / Chat to a librarian" is unexpected. *5.1.3.2.8.1 Predictable behaviour problem 1: Two links on one line* In the "My Library Space" section, the label "Ask / Chat to a Librarian" consists of two links that look like a single link. It is only clear that there are two links when a user hovers over the text "Ask" or "Chat". This grouping of two links on a single line can cause confusion. ***Recommendation 35*** In a list of links, there should not be list items that consist of more than one link. The link to the "chat" feature can safely be removed, as discussed in Section 5.1.2.4.2.2, because the "Ask a librarian" page contains both the "ask" and the "chat" features. This would leave only a single link, which would solve the problem. The whole label "Ask / Chat

	to a Librarian" should be marked up as a single hyperlink to the "Ask a Librarian" page.
5.1.3.2.9 Context	There is a lack of context in the page title. *5.1.3.2.9.1 Context problem 1: Title* The information that is displayed in the browser tab can provide context in two ways, firstly by containing a title with the name of the page and the website and secondly by containing an appropriate favicon. The favicon is the icon next to the title. The favicon of the library website is not an appropriate icon because it is the "Google" logo (as shown in Figure 5.1-12). The title label is also incorrect, as discussed in "Labelling", Section 5.1.3.2.1.1. ***Recommendation 36*** Change the favicon in the title to the university's emblem and the text to "UP Libraries | Home" as suggested in "Labelling", Section 5.1.3.2.1.1.
5.1.3.2.10 Task completion support	There is no support for task completion. Memory load can be reduced by changing the style of visited links. This is not necessary, however (and therefore not recommended), because there is a small number of links on the homepage. Changing the design of visited links can have a negative impact on the aesthetics of a website, therefore many developers choose to avoid it.
5.1.3.2.11 Controllability	There are contextual links in the text in the "News & Events" component; however, the links are not obvious and can easily be missed/overlooked. *5.1.3.2.11.1 Controllability problem 1: Links not obvious* Not all the links that can be visited on the homepage are obvious. The links in the "News & Events" section look like words that are emphasised because they are bold (as shown in Figure 5.1-14). Text that is bold conveys emphasis. It is only clear that they are links when the user hovers over the bold text because the cursor changes to a pointer and the text colour changes to blue. Without hovering, it looks like plain text.  **Figure 5.1-14: UP homepage, "News & Events", component 3**

	Recommendation 37 Use web development conventions to style links, for example, instead of making the links bold, underline them or make them blue.
5.1.3.2.12 Error recovery	This heuristic and its sub-criteria do not apply to the components in this dialogue element.
5.1.3.2.13 Error prevention	All external links open in a new tab, which is useful for preventing users from accidentally navigating away from the library website.
5.1.3.2.14 Feedback	This heuristic and its sub-criteria do not apply to the components in this dialogue element.

Table 5.1-3: Heuristic evaluation of dialogue element 3: UP homepage contents

5.1.3.3 Dialogue element 4: Internal pages structure

The position of this dialogue element is outlined in Figure 5.1-4 with the number 4, and the detail (the components in this dialogue element) is outlined in Figure 5.1-15 and Figure 5.1-16. The "About Us" page (Figure 5.1-4 and Figure 5.1-15) represents all of the internal pages. The majority of pages consist of the components that are visible on the "About Us" page.

The internal page structure contains the following three components. The numbers in the list correspond to the numbers in Figure 5.1-15 and Figure 5.1-16:

1. Local navigation menu
2. Page content
3. Page title "Department of Library Services" and no favicon (Figure 5.1-16)

Problems with these components are discussed in Table 5.1-4. The majority of problems apply to all of the internal pages.

Figure 5.1-4 and Figure 5.1-15 are examples/representative screenshots of the internal pages to show what components the internal pages consist of. Not all internal pages are shown in the evaluation, and only internal pages on which problems were found are discussed.

Figure 5.1-16 is representative of the page titles of all of the internal pages, since all of them are the same.

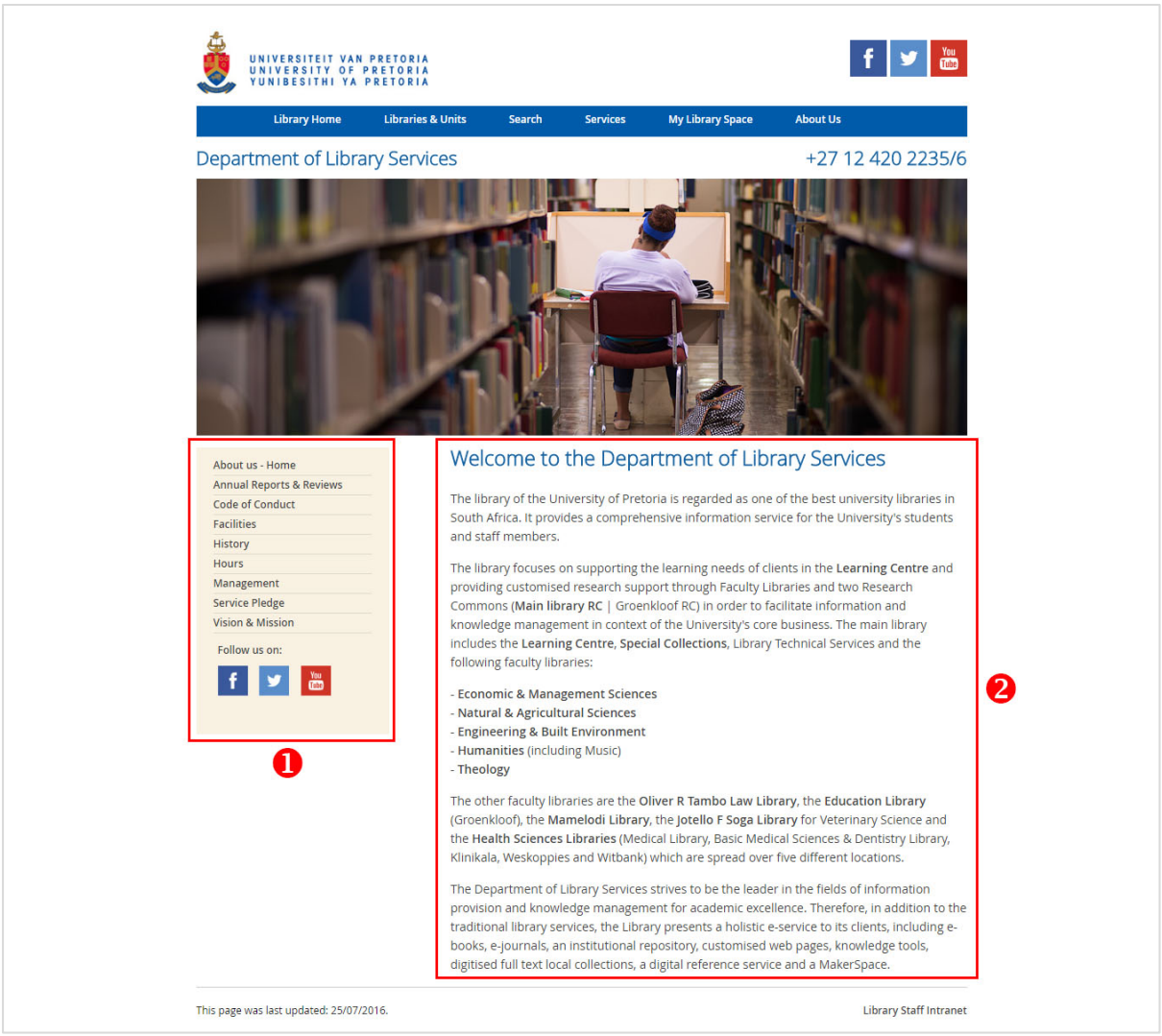


Figure 5.1-15: UP internal page structure example ("About Us" page)

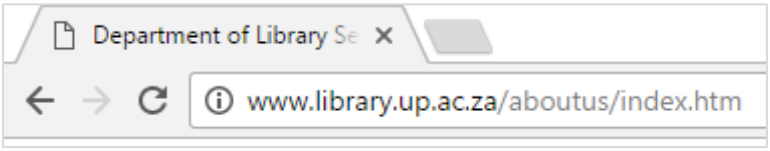


Figure 5.1-16: UP internal pages – title

5.1.3.4 Heuristic evaluation of dialogue element 4: UP internal pages

The table below contains the discussion of each of the problems that were found with the components in this dialogue element. Only internal pages on which problems were found are discussed. Therefore, this section does not include a discussion of all the internal pages. The problems are summarised in the case summary in Section 5.1.5.

Heuristic	Evaluation
5.1.3.4.1 Labelling	There are labelling problems with the titles of the internal pages and links in the local navigation menus.

	5.1.3.4.1.1 Labelling problem 1: Internal page titles All of the internal page titles are labelled incorrectly according to web development best practices because all of the titles are "Department of Library Services" (as shown in Figure 5.1-16). Firstly, the titles should not be the same because search engines use the titles to index pages in order to list them in search results. Secondly, the title should consist of the name of the page, a separator such as a pipe (|), and the name of the website. Finally, it should be short, since the full title will not be visible to users if it is too long. The page titles should have an identifying logo on its left called a "Favicon" to identify the website further. ***Recommendation 38*** Change all of the titles of all the internal pages to contain a short version of the name of the page and the website. In this case, the name of the website is "Department of Library Services" but it can be shortened to "UP Libraries". For example, the title on the "About Us" page can be renamed to "About Us | UP Libraries". A pipe (|) is used instead of a dash because it uses less horizontal space. *5.1.3.4.1.2 Labelling problem 2: Confusing redundant labels in the local navigation menus* Some of the labels in the local navigation menus are confusing. For example, in the local navigation menu of the Natural and Agricultural Sciences (NAS) faculty library section (Figure 5.1-17), there are multiple redundant or unclear link labels.

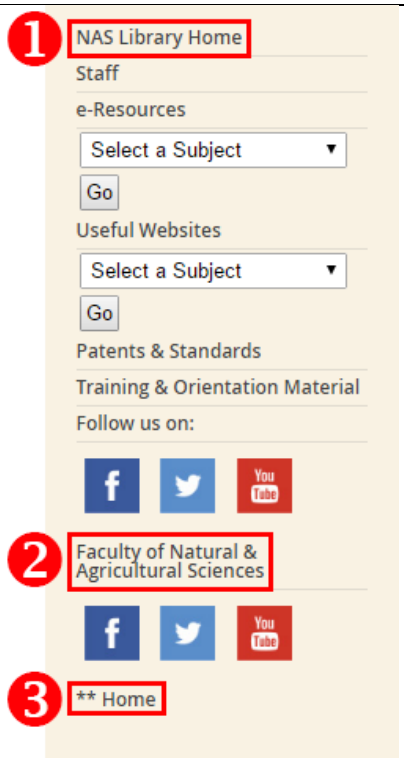


Figure 5.1-17: UP internal pages – labels

It is not clear what the difference between the three links "NAS Library Home" (number 1 in Figure 5.1-17), "Faculty of Natural & Agricultural Sciences" (number 2 in Figure 5.1-17) and "**Home" (number 3 in Figure 5.1-17) is by looking at them. The links marked with number 1 and 3 link to the faculty library page and the link marked with 3 links to the faculty page on the main university website. This is also not consistent on other pages. See "Consistency" in Section 5.1.3.4.7. These problems are also on other internal pages. Therefore, Figure 5.1-17 is representative of a problem that is found on various pages.

Recommendation 39

Rename confusing labels so that it can be easy for users to distinguish between them, and remove duplicate/redundant labels. For example, on the NAS page shown in Figure 5.1-17, remove the link with the label "**Home" at the bottom since it is a duplicate link with a confusing label. Rename the second link "Faculty of Natural & Agricultural Sciences" to "NAS Faculty homepage" and include a visual indication, for example, the university crest, to indicate that the link goes to the main university website. A tooltip should also be provided — see "Novice user guidance" in Section 5.1.3.4.4.2.

5.1.3.4.2 Organisation	There are two organisation problems on the "Contact us" internal page. The page lists contact details of various libraries, however, the "libraries" that are listed on the page do not correspond to the "libraries" that are

listed in the drop-down menu in the main navigation bar. There is a discrepancy with the term "libraries" between the use of the term in the main navigation bar and on the "Contact Us" page.

Additionally, the "Contact Us" page lacks some other essential contact details of various library units such as management and faculty units.

5.1.3.4.2.1 Organisation problem 1: Discrepancy with the term "libraries"

The concepts that are referred to as *libraries* on the "Contact Us" page are different to the concepts that are referred to as *libraries* in the drop-down menu in the main navigation bar under "Libraries & Units".

As discussed in Section 5.1.2.4.2.1, in the section on the "Organisation" of links in the main navigation bar, no distinction is made between *UP library buildings* and *faculty units*. These concepts are listed together under "Libraries & Units". The problem with this grouping is that users who are not familiar with the university's organisational structures will not be able to differentiate between the two. For example, users might think that "Economic and Management Sciences" is a library building and might want to find its contact details on the "Contact Us" page. Subsequently, when they visit the "Contact Us" page, they will not find it and will not know to go look for it somewhere else, or know why they are not able to find it.

Recommendation 40

Make sure that when *libraries* are listed at two different places that both lists correspond to each other. If they do not, either the lists should be changed or the label should be changed. In the case of "libraries" in the drop-down menu, it was recommended in Section 5.1.2.4.2.1 "Organisation" to change the heading to "Faculty Units" instead of libraries. This way, when "libraries" are listed, it specifically refers to library buildings.

5.1.3.4.2.2 Organisation problem 2: Missing contact details

Finding the contact details for the library management or faculty libraries can be harder than necessary because it is not listed on the "Contact Us" page; rather, it is listed on separate pages.

The different libraries' names are listed alphabetically on the "Contact Us" page in vertical tabs, and when the user clicks on a tab, contact details for the selected library are displayed on the right side of the tabs.

Figure 5.1-18 shows the contact details that are currently available on the

library website. The contact details of the first library in the list ("BMS & Dentistry Library") are listed by default. These are only the contact details of the individual library buildings. However, if users are looking for "faculty units" (as listed under "Libraries" in the main navigation bar) or library management contact details (as listed under "About us" in the main navigation bar), they will not be able to find it on the "Contact Us" page.

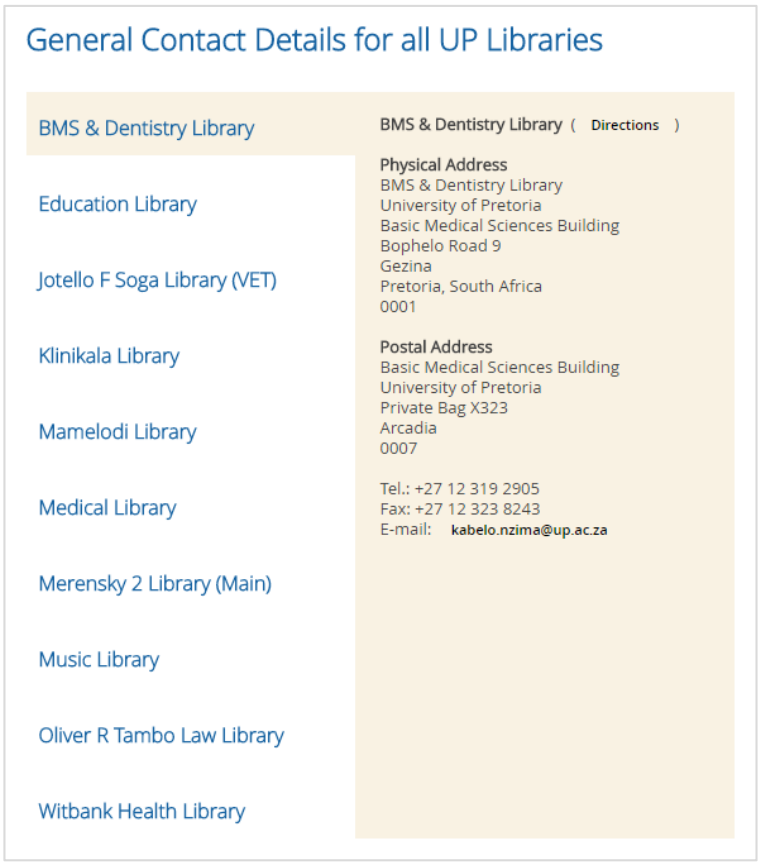
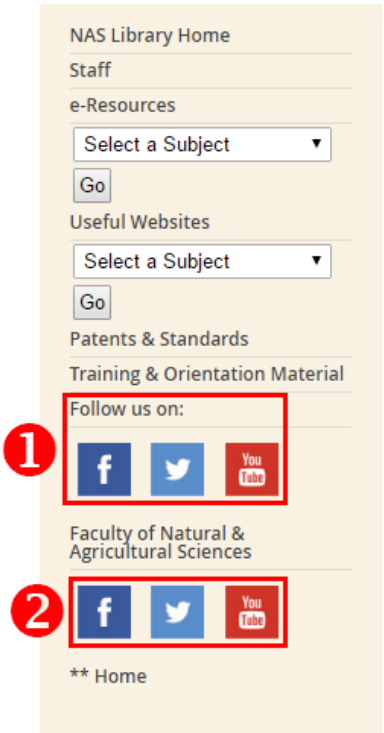


Figure 5.1-18: UP "Contact Us" page

Recommendation 41

The "Contact Us" page should be subdivided into appropriate categories, for example, using a tabbed interface. The first tab can contain the contact numbers that are currently listed on the "Contact Us" page, i.e., library buildings, and should be labelled as such. An additional tab with the label "Library services/Service units" should contain the contact details for library management, interlending, open scholarship, etc.

Finally, there should be a "Faculty units" tab, which contains the contact details of the faculty units that are listed in the main navigation bar. This contact details page should also make it clear that some of the faculty units have their own library buildings, while others do not and are located within the Merensky 2 library building.

5.1.3.4.3 Clutter	There are redundant social media links in the local navigation menus on some pages that cause clutter and some of the submenus in the local navigation menus are too long. *5.1.3.4.3.1 Clutter problem 1: Redundant social media links* There are social media links available at the bottom of all the local navigation menus (indicated with the number 2 in Figure 5.1-19). These links are also available in the header of all the webpages; therefore, their presence in the local navigation menus is redundant. It does not make sense to have these links in the *local navigation menus* since the links that are in the structure should be related to the content of the current section. It makes sense to have these links in the header instead. In the local navigation menus on some pages, there is more than one set of social media links because some faculties have their own social media accounts. For example, NAS (Figure 5.1-19), has three additional social media links (indicated with the number 1 in Figure 5.1-19), because the faculty has its own Facebook page. It does not have a Twitter or YouTube account; therefore, the other two links link to the main library social media pages (and the behaviour is unexpected since the assumption is that they do have Twitter and YouTube pages).  **Figure 5.1-19: UP local navigation menu social media links** ***Recommendation 42*** If there are social media links in the local navigation menus that link to

	the library's social media networks, they should be removed. The text before the Faculty's social media network links can be more descriptive with the label "Follow the Faculty" instead of "Follow us". These links should only be present if the faculty has its own social media networks, and only the networks on which the faculty actually has an account should appear, i.e., if the faculty only has a Facebook account, there should only be a Facebook link and no YouTube and Twitter links. Therefore, on the NAS local navigation menu, there must be a single social media link to the faculty's Facebook page. *5.1.3.4.3.2 Clutter problem 2: Long submenus* Some of the local navigation menus on some of the pages are too long because they contain too many links. For example, the local navigation menu on the humanities page contains eight links including a subheading "Select a Subject related database", which can be expanded. The expandable menu contains 38 links. Therefore, when the menu is expanded, the local navigation menu consists of 46 links, and as a result, it is too long and cluttered. ***Recommendation 43*** Make the expandable link a link to a page that contains all the links so that the links are not listed in the local navigation menu, but rather on a separate page.
5.1.3.4.4 Novice user guidance	There is a useful section for novice users of the website on "training" that provides training sessions for all registered students and staff, and the training sessions timetable is accessible via the website. This section can be located by clicking on the "Training" link in the drop-down menu under "Services" in the main navigation bar. There is an interactive Flash tutorial in the training section (that can be accessed by clicking on "Library orientation tutorial") that novice users can use to learn more about the library. However, there is a lack of guidance for novice users in the form of tooltips. *5.1.3.4.4.1 Novice user guidance problem 1: Flash is an outdated technology* Flash is no longer supported for interactive web technologies and no longer works on all platforms or devices.

	Recommendation 44 Update the Flash tutorial ("Library orientation tutorial") to a supported technology that works on all platforms and devices. *5.1.3.4.4.2 Novice user guidance problem 2: No tooltips* There are no tooltips on internal pages to guide novice users. ***Recommendation 45*** Provide tooltips that explain link destinations. If a link navigates away from the library, for example, "Faculty Home", the tooltip should make this clear, i.e., with tooltip text "Go to faculty page on main university website".
5.1.3.4.5 Help documentation	There is a lack of help documentation or it is difficult to locate. This problem is discussed in "Help Documentation" in the "Main navigation bar" dialogue element in Section 5.1.2.4.5.1. There is also a lack of supplemental navigation systems, such as a sitemap. The "Training, Tutorials & User Guides" page is confusing. This section can be located by clicking on the "Training" link in the drop-down menu under "Services" in the main navigation bar. *5.1.3.4.5.1 Help documentation problem 1: Confusing help section* The "Training, Tutorials & User Guides" page that can be accessed by clicking on the "Training" link under services in the main navigation bar can cause confusion. The main page in the section contains the contact details of the various libraries, and all of the links in the local navigation menu open PDFs. Having the contact details on the page does not help. It is unnecessary since the contact details are all available under "Contact Us" and the libraries' and faculties' individual pages. ***Recommendation 46*** Create a "help" section and list "Training, Tutorials & Users Guides" as a single link (among other help documentation links) in the local navigation menu of this section. The link should open a page that contains all the links to the PDFs. Therefore, the local navigation menu should not contain PDF links. *5.1.3.4.5.2 Help documentation problem 2: Lack of supplemental navigation systems* A supplemental navigation system for this website, such as a sitemap,

	could not be located in the internal webpages of this website. ***Recommendation 47*** Create a usable sitemap and include a link to it in an easily accessible location on the homepage or in a help section.
5.1.3.4.6 Efficiency features	There is a lack of shortcut links that can make users more efficient. *5.1.3.4.6.1 Expert user features problem 1: Back to top links* Long pages do not provide a shortcut link back to the top of the page; therefore, if users are at the bottom of a long page, they have to scroll all the way to the top before they can navigate somewhere else. On long webpages, it is always useful to provide users with a link at the bottom of the page that allows them to go back to the top of the page more easily. ***Recommendation 48*** Provide "Back to top" buttons at the bottom of long pages.
5.1.3.4.7 Consistency	There are various consistency issues on the local navigation menus on various internal pages, as discussed below. *5.1.3.4.7.1 Consistency problem 1: Inconsistent features in menus* The various local navigation menus in the faculty libraries provide three different methods for accessing resources, making it inconsistent. In some of the local navigation menus, there are submenus that can be revealed or hidden by clicking on the "+" or "-" icon next to them (indicated with number 1 in Figure 5.1-20). In others, there are submenus listed without the functionality to hide or reveal (indicated with number 2 in Figure 5.1-20). The third variance is a drop-down menu with a "Go" button (indicated with number 3 in Figure 5.1-20).

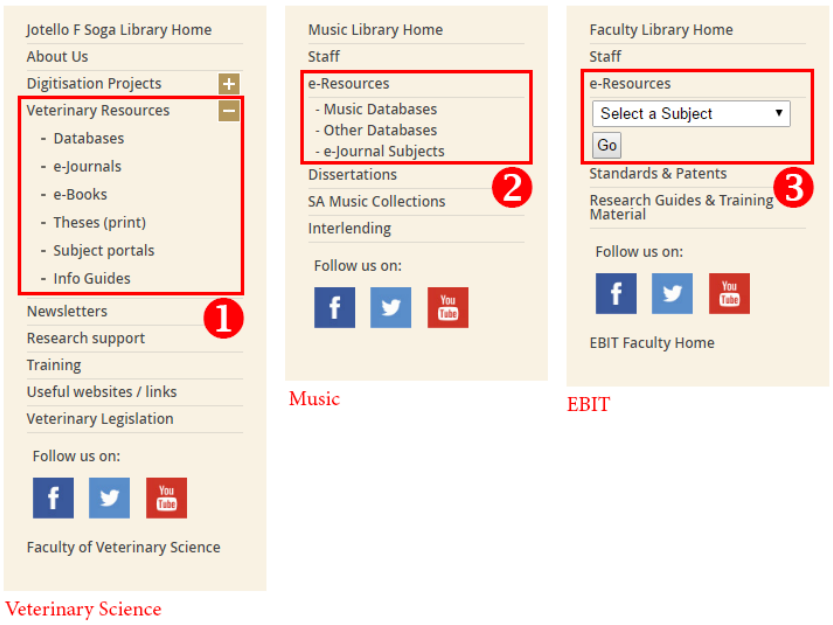


Figure 5.1-20: UP internal pages – local navigation features

Recommendation 49

Choose one method for providing e-Resources options and use it consistently in all the local navigation menus. The last option (indicated with number 3 in Figure 5.1-20) is the least user-friendly because it requires more clicks. The first option (indicated with number 1 in Figure 5.1-20) appears to be the best option (as opposed to the option indicated with number 2 in Figure 5.1-20), because the list is hidden by default, making the local navigation menu less cluttered. It is very easy to see that it can be expanded to reveal a list of resources.

5.1.3.4.7.2 Consistency problem 2: Inconsistent link labels

The top link of most of the local navigation menus is a link to the homepage of the section and the bottom link is a link to the faculty webpage on the main library website. Many of these links are inconsistently named as shown in Figure 5.1-21.

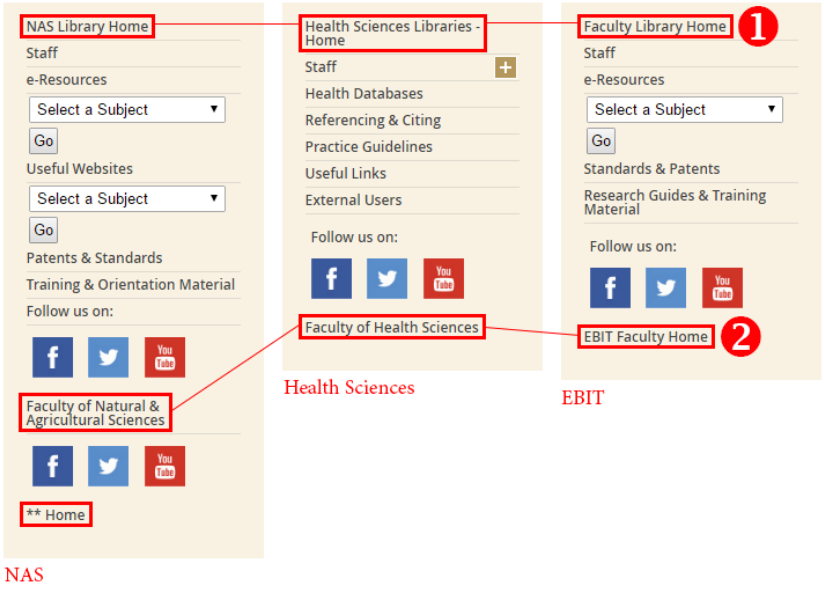


Figure 5.1-21: UP internal pages – local navigation menu labels

Recommendation 50

As recommended in "Context" (Section 5.1.3.4.9.1), a section title should be provided above all the local navigation menus, as the "home" link is currently the only way to know what the current section is. The home links can then consistently be named "Home" because the section title gives it context.

Naming conventions should be followed for the bottom link as suggested in "Labelling" (Section 5.1.3.4.1.2) and implemented across pages consistently.

Rename the links to the faculties' name followed by the keyword "webpage" e.g. "EBIT faculty webpage" and include a logo, such as a university crest, to indicate that the link goes to the main university website.

5.1.3.4.8 Predictable behaviour

Some links have unpredictable behaviour.

5.1.3.4.8.1 Predictable behaviour problem 1: Incorrect link destination

There are links in local navigation menus that link to unexpected destinations. For example, in the local navigation menu of the EBIT faculty page, the "e-Resources" link (see Figure 5.1-22) takes the user to the faculty homepage (while on the NAS page it does not have a hypertext reference).

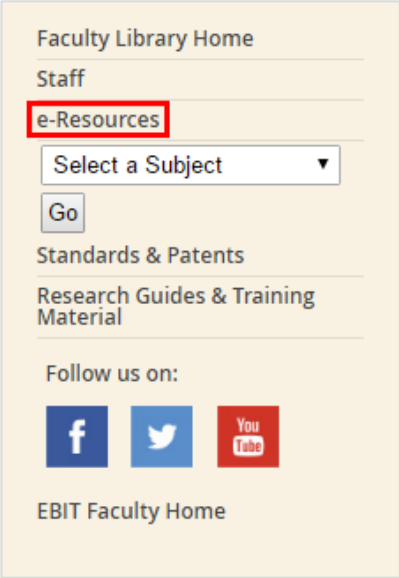


Figure 5.1-22: UP internal pages – predictable behaviour

Recommendation 51
Headings should not be clickable. For example, the "e-Resources" item in the local navigation menu on the NAS page, should not be clickable because it is a heading for the drop-down menu below it.

5.1.3.4.9 Context

Context is not sufficiently provided on internal pages. There is a lack of elements that can be used to provide context. Additionally, the page titles do not sufficiently provide the user with context.

5.1.3.4.9.1 Context problem 1: Local navigation headings

The local navigation menus do not have section headings. Therefore, users can get confused about where they are within the website.

Recommendation 52
Include the heading of the section above each of the local navigation menus to provide context for the menu.

5.1.3.4.9.2 Context problem 2: Current links

Local navigation menus do not provide users with context by changing the style of current links. The same problem was addressed in the global navigation menus "Context", in Section 5.1.2.4.9.1.

Recommendation 53
In the navigation menu of the current page, the link label of the corresponding link must be visually distinct to indicate the current page.

5.1.3.4.9.3 Context problem 3: Breadcrumbs

There are no breadcrumbs that indicate to the user where they are in the website.

	Recommendation 54 Breadcrumbs can provide additional context by showing the user where they are in the website hierarchy. Breadcrumb links that are clickable allow the user to navigate easily to any section in the hierarchy.
5.1.3.4.10 Task completion support	Support for task completion is lacking in local navigation menus. **Positive comment**: The authentication system is simplified with a single sign-on feature, which is a task completion support feature. UP website users now only have to remember one password to access different parts of the system. *5.1.3.4.10.1 Task completion support problem 1: Visited links* There is no visual distinction between visited and unvisited links in local navigation menus. Styling visited links in local navigation menus can help reduce users' memory load. ***Recommendation 55*** Style visited links differently than unvisited links in the internal pages.
5.1.3.4.11 Controllability	External and PDF links open in a new tab. This increases the website's controllability because users do not lose their position in the library website when they click on an external link or PDF. There are no additional navigation aids such as breadcrumb trails on any of the internal pages. *5.1.3.4.11.1 Controllability problem 1: Lack of interactive "breadcrumbs"* There are no breadcrumb trails on the internal pages. Breadcrumb trails are useful for showing a user's position within a hierarchy and also help them navigate to any page within the hierarchy. ***Recommendation 56*** Include a breadcrumb trail component on the internal pages for additional functionality.
5.1.3.4.12 Error recovery	This heuristic and its sub-criteria do not apply to the components in this dialogue element.
5.1.3.4.13 Error prevention	This heuristic and its sub-criteria do not apply to the components in this dialogue element.

5.1.3.4.14 Feedback	This heuristic and its sub-criteria do not apply to the components in this dialogue element.

Table 5.1-4: Heuristic evaluation of dialogue element 4: UP internal pages structure

5.1.4 Search systems

The only search feature that the UP library website has is a resource search feature that is located on the homepage only. The old version of the library website had a site search feature that was removed in the redesign.

5.1.4.1 Dialogue element 5: Site search feature

There is no site search feature in the new version of the library website.

A site search feature is a useful efficiency feature that users can use to find information faster or to search for information if they cannot find it through browsing.

Recommendation 57

Provide a site search feature in the header of the website.

5.1.4.2 Dialogue element 6: Resource search interface

The location of this dialogue element on the website is outlined in Figure 5.1-3 of the homepage with the number 6, and the detail (the components in this dialogue element) is outlined in Figure 5.1-23.

The resource search feature contains the following five components. The numbers in the list correspond to the numbers in Figure 5.1-23:

1. Caption "Search"
2. Tabs ("Everything", "Books", "Journals", "e-Reserves", "Exam Papers", "UPSpace", "Google Scholar")
3. Search Field with placeholder text
4. "Advanced Search" link
5. Submit button

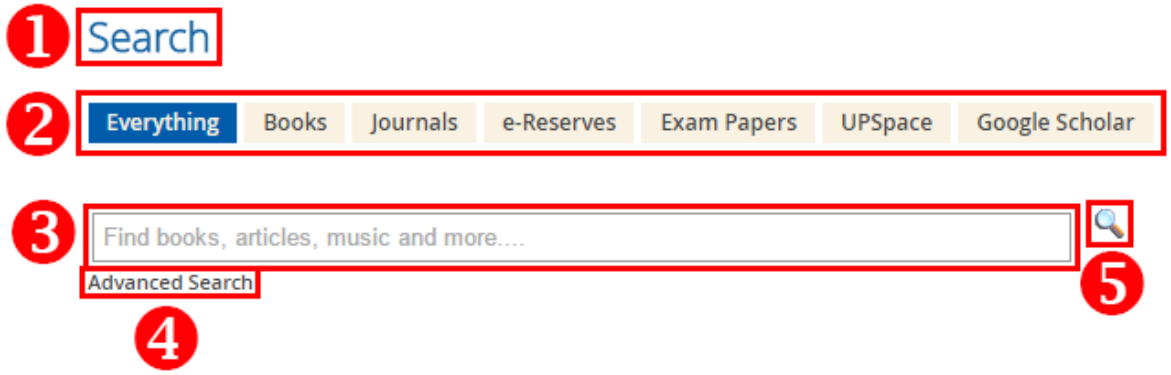


Figure 5.1-23: UP resource search box

The search interface has tabs that users can select to choose the type of resource that they want to search for. The different tabs are also shown in Figure 5.1-24. The numbers in the image correspond to the numbers in the following list:

1. “Everything”
2. “Books”
3. “Journals”
4. “e-Reserves”
5. “Exam Papers”
6. “UPSpace”
7. “Google Scholar”

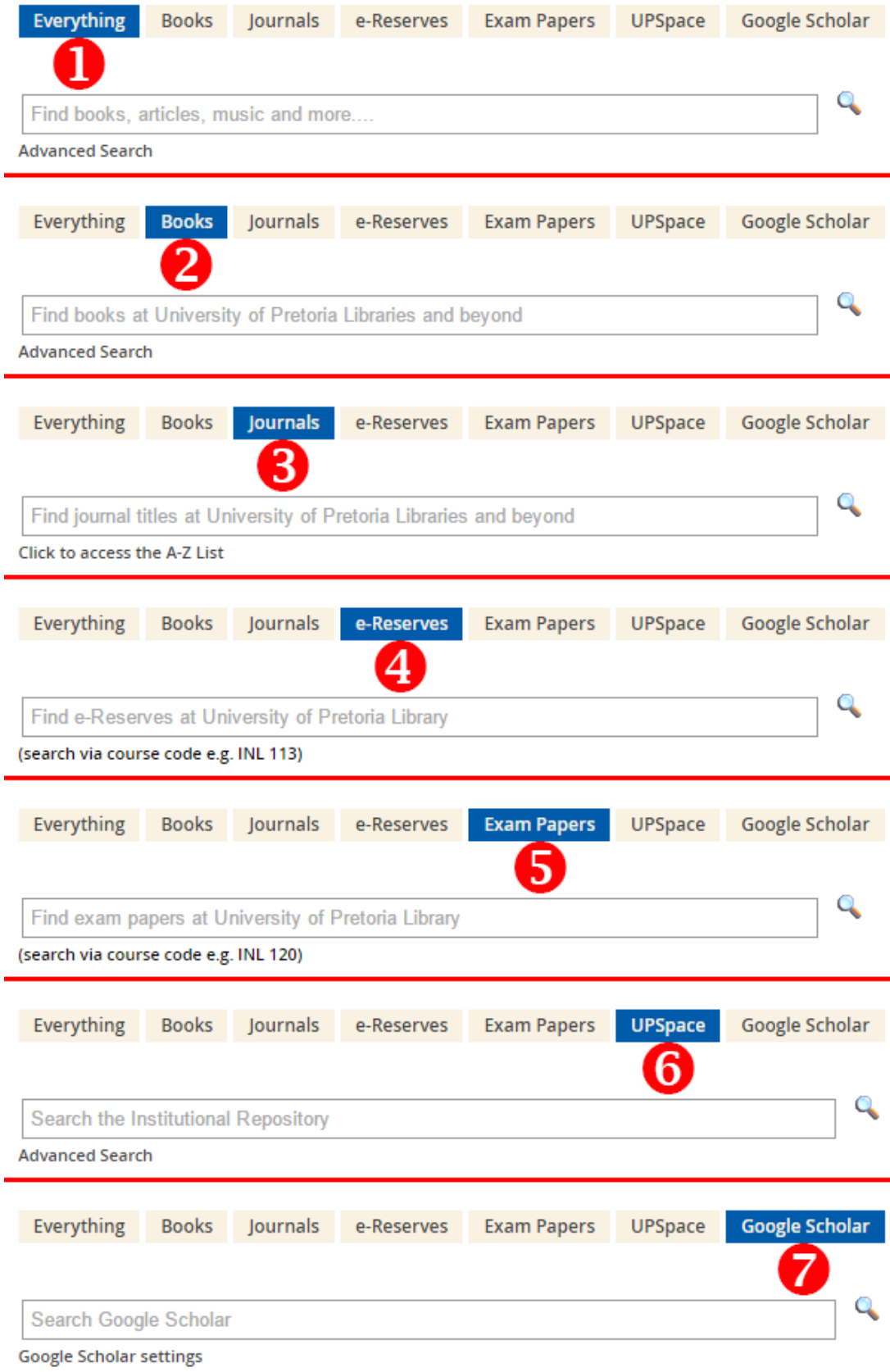


Figure 5.1-24: UP resource search tabs

All of the tabs open the search results in a new browser tab.

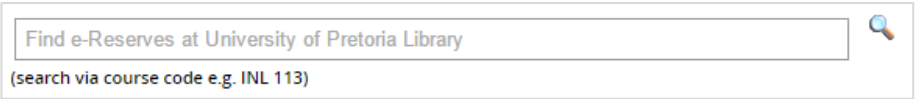
1. The first tab, “Everything”, contains a search box with the placeholder text: “Find books, articles, music and more…” and a link with the text “Advanced search”. When a search query is submitted in the search box, the query string is sent to the “search” section of the WorldCat website and the search results are displayed there.
2. The “Books” tab contains a search box with the placeholder text: “Find books at University of Pretoria Libraries and beyond” and a link with the text “Advanced search”. The search query is also directed to the “search” section in WorldCat. It performs the same search as the “Everything” tab, except that the results are limited to books only.
3. The “Journals” tab contains a search box with the placeholder text: “Find journal titles at University of Pretoria Libraries and beyond” and a link with the text “Click to access the A-Z List”. The search query is also directed to the “search” section in WorldCat. It performs the same search as the “Everything” tab, except that the results are limited to journal titles only.
4. The “eReserves” tab contains a search box with the placeholder text: “Find e-Reserves at University of Pretoria Library” and a level four heading below it with the text “(search via course code e.g. INL 113)”. The search query is also directed to the WorldCat website but in the “atoztitles” section. It provides different search results to search queries in the previous tabs.
5. The “Exam Papers” tab contains a search box with the placeholder text: “Find exam papers at University of Pretoria Library” and a level four heading below it with the text “(search via course code e.g. INL 120)”. The search query is also directed to the “atoztitles” section in the WorldCat website. It returns exactly same search results as the “eReserves” tab.
6. The “UPSpace” tab contains a search box with the placeholder text: “Search the institutional repository” and a link below it with the text “Advanced Search”. The search query is directed to UP’s institutional repository website.
7. The “Google Scholar” tab contains a search box with the placeholder text: “Search Google Scholar” and a link below it with the text “Google Scholar Settings”. The search query is directed to Google Scholar, where the results are displayed.

The options that are provided in this “Search” component are inconsistent with the features provided in the “Search” component on the main navigation bar. The problems that are caused by this inconsistency are addressed in the heuristic evaluation of the main navigation bar in Section 5.1.2.4.2.1.

5.1.4.3 Heuristic evaluation of dialogue element 6: UP resource search feature

The table below contains the discussion of each of the problems that were found with the components in this dialogue element. The problems are summarised in the case summary in Section 5.1.5.

Heuristic	Evaluation
5.1.4.3.1 Labelling	Some of the labels in the tabs are unclear or might be unfamiliar to novice users. The placeholder text in the search box is not used according to its intended purpose. *5.1.4.3.1.1 Labelling problem 1: Unfamiliar labels* Some of the labels in the tabs might be unfamiliar to novice users. The purposes of the tabs are further explained in the placeholder text in the textboxes inside the tabs, but in others, this information is not provided. For example, if the user is not familiar with the term "UPSpace", they can read the placeholder text to get a better understanding, i.e., "Search the Institutional Repository". The purpose of "e-Reserves" is not further explained, however, because the placeholder text in the tab is "Find e-Reserves at University of Pretoria Library", which is not descriptive of the term "e-Reserves". It is not clear what the label "Everything" refers to. The assumption might be that it is a federated search that encompasses all the tabs. If users are not sure which one to pick, this assumption, however, is incorrect. The tab navigates to WorldCat; therefore, one can assume that "Everything" only encompasses the first three tabs. This means that the use of this tab will lead to failed searches if users try to use it to find other resources. ***Recommendation 58*** Ensure that the purpose of each of the tabs is further explained inside the tab if the label in the tab is not explanatory enough. Placeholder text is not the best option; however, an alternative solution is discussed in the next problem in Section 5.1.4.3.1.2. Use a more descriptive label than "Everything" for the first tab, depending on what "Everything" refers to. *5.1.4.3.1.2 Labelling problem 2: Placeholder text* Placeholder text should not be used to describe the purpose of a search box. The purpose of placeholder text is to provide an example of the type of input that is expected if there are specific requirements for the format. In the "Exam Papers" tab, the format of the module code is important, i.e., there should be a space in the module code between the letters and the numbers, for example, "INL 120", as shown in the example text below

	the search box. Placeholder text can be used to convey this information. ***Recommendation 59*** Do not put the descriptions inside the textboxes in the form of placeholder text. It should rather be marked up as a label above the textbox. Conversely, the example input that appears below some of the search boxes should be placed inside the search box in the form of placeholder text.
5.1.4.3.2 Organisation	The order and categorisation of the information in the resource search feature are logical.
5.1.4.3.3 Clutter	The interface is clutter free.
5.1.4.3.4 Novice user guidance	There is a lack of explanations which specify where the search will be performed and some of the examples that are provided are incorrect. *5.1.4.3.4.1 Novice user guidance problem 1: Search destination* Each of the search boxes in the different tabs searches in a different location, for example, the search box in the first tab searches in "WorldCat". It is not specified anywhere in the tab, however. ***Recommendation 60*** The search features can further be explained for novice users by specifying where the query will be searched, for example, "WorldCat". Users should be aware that the "Everything" tab does not mean they can search the entire website, as this will lead to failed searches. *5.1.4.3.4.2 Novice user guidance problem 2: Incorrect examples* In the e-reserves tab, there is a suggestion for an example of search input, i.e., "INL 113", but when you try searching using the example text, it gives 0 results. Therefore, the example is not accurate.  **Figure 5.1-25: UP resource search feature – search box in "e-Reserves" tab.** ***Recommendation 61*** If examples are provided, they should be accurate and they should be placed in the search box as placeholder text, as recommended under "Labelling" in Section 5.1.4.3.1.2.

5.1.4.3.5 Help documentation	No help documentation could be located for the search box. *5.1.4.3.5.1 Help documentation problem 1: Lack of help documentation* There is a lack of help documentation for the search boxes in the various tabs. Users might be interested in help documentation that explains what symbols, options, and operators can be used to perform a search. It can also be useful for further explaining the purpose and outcome of each of the search boxes. ***Recommendation 62*** Provide users with help documentation for using the search feature. The documentation can further explain the various search tabs with examples and information on advanced or simple searches.
5.1.4.3.6 Efficiency features	The search box can be seen as a shortcut to resources. However, based on results in related studies, experienced users tend to ignore federated search features. Related studies suggested that federated search features are more likely to be used by novice users. A useful efficiency feature of this dialogue element is that search buttons can be activated using the enter key on the keyboard, which speeds up user interaction.
5.1.4.3.7 Consistency	All the tabs within the search feature are consistent and all the search results consistently open is a new tab.
5.1.4.3.8 Predictable behaviour	The recommendation in "Novice user guidance", Section 5.1.4.3.4.1 to inform the user where each of the tabs will search can help improve the predictability of the feature's behaviour.
5.1.4.3.9 Context	The feature sufficiently provides the user with context by making the current tab a different colour than the inactive tabs. More context can be provided by showing the user where each of the search boxes will conduct the search. This is recommended in "Novice user guidance", Section 5.1.4.3.4.1.
5.1.4.3.10 Task completion support	The search boxes can reload previous search terms, which further supports task completion.
5.1.4.3.11 Controllability	The search interface facilitates controllability by making the search results open in a new tab. This allows users to come back to the search interface more easily by switching between browser tabs.

5.1.4.3.12 Error recovery	This heuristic and its sub-criteria do not apply to the components in this dialogue element.
5.1.4.3.13 Error prevention	This heuristic and its sub-criteria do not apply to the components in this dialogue element.
5.1.4.3.14 Feedback	Search results take a long time to load, for example, when searching for exam papers. This is not necessarily an issue on the library website, but it is worth investigating. It is possible that the search query is searching against an unfiltered number of results that can possibly be limited in order to increase the speed of the search.

Table 5.1-5: Heuristic evaluation of dialogue element 6: UP resource search feature

5.1.5 Case summary

A total of 55 usability problems were found on the library website of the University of Pretoria. The problems that were found are summarised below and divided into the fourteen heuristics. The abbreviation "DE" is used to show in what dialogue element the problem was identified.

5.1.5.1 Labelling

1. Some of the labels in the main navigation bar (DE2) are confusing or unfamiliar.
2. The homepage (DE3) title is too long and does not contain all the necessary information.
3. Some of the labels on the homepage (DE3) are unclear.
4. The page titles of the internal pages (DE4) do not contain all the appropriate information and are too long.
5. Some of the labels in local navigation menus in the internal pages (DE4) are confusing or redundant.
6. Some of the labels in the tabs of the resource search feature (DE6) are unclear or might be unfamiliar to novice users.
7. The placeholder text in the resource search feature's search box is not used according to its intended purpose.

5.1.5.2 Organisation

8. The University's name in the header (DE1) can cause confusion.
9. The telephone number in the header (DE1) can cause confusion.
10. The grouping and categorisation of the links in the drop-down menus of the main navigation bar (DE2) can cause confusion.
11. The use of different ordering schemes used in the drop-down menus of the main navigation bar (DE2) is confusing.

12. There is a discrepancy with the term "libraries" between the use of the term in the main navigation bar and on the "Contact Us" internal page (DE4).
13. The "Contact Us" internal page (DE4) lacks essential contact details of various library units such as management and faculty units.

5.1.5.3 Clutter

14. Some of the drop-down menus in the main navigation bar (DE2) are too long and contain redundant links.
15. There are redundant social media links in the local navigation menus on some internal pages (DE4).
16. Some of the submenus in the local navigation menus on the internal pages (DE4) are too long.

5.1.5.4 Novice user guidance

17. There is a lack of descriptive tooltips in the header and footer (DE1).
18. There is a lack of descriptive tooltips in the main navigation bar (DE2).
19. There is a lack of tooltips to guide novice users on the homepage (DE3).
20. The training internal page (DE4) contains a "Flash" tutorial which is an outdated technology.
21. There are no tooltips on internal pages to guide novice users.
22. There is a lack of explanations in the resource search feature (DE6) which specifies where the search will be performed.
23. Some of the examples of search terms that can be used in the resource search feature are incorrect.

5.1.5.5 Help documentation

24. Help documentation is difficult to locate via the header and footer (DE1).
25. Help documentation is difficult to locate via the main navigation bar (DE2).
26. Help documentation is difficult to locate via the homepage (DE3).
27. The "Training, Tutorials & User Guides" internal page (DE4) is confusing.
28. There is a lack of help documentation in the internal pages (DE4).
29. A supplemental navigation system for this website, such as a sitemap, could not be located in the internal webpages (DE4).
30. No help documentation could be located for the resource search feature (DE6).

5.1.5.6 Efficiency features

31. There is no site search feature in the header (DE1).
32. There is a lack of shortcut links to the top of the page on long internal pages (DE4).

5.1.5.7 Consistency

33. The partial implementation of the redesign makes the header (DE1) seem inconsistent.

34. Links that have changed in the main navigation bar (DE2) have not been changed on all pages.
35. The partial redesign of the website makes the main navigation bar (DE2) inconsistent.
36. The contents of the "Search" drop-down menu in the main navigation bar do not correspond with the components on the homepage (DE3) that have the same identifying label.
37. The labels of contents in the "My Library Space" drop-down menu do not correspond exactly with the components on the homepage (DE3) that have the same identifying label.
38. The various local navigation menus in the faculty libraries' internal pages (DE4) provide three different methods for accessing resources.
39. The homepage links for the various faculties are named differently on different internal pages (DE4).
40. The list of "libraries" listed on the "About Us" internal page (DE4) is different to the list of "libraries" under the "Libraries" category in the "Libraries & Units" drop-down menu in the main navigation bar.

5.1.5.8 Predictable behaviour

41. The link to the main university homepage in the header (DE1) can be mistaken as the website's identifier and therefore as a link to the library website homepage.
42. The library website main heading in the header (DE1) is not marked up as a link to the library homepage.
43. When hovering over the main categories in the main navigation bar (DE2), a pointer cursor appears, even though they are not clickable.
44. The behaviour of the "Ask / Chat to a librarian" links on the homepage is unexpected because it consists of two links on one line.
45. Some subheadings are incorrectly marked up as links in the local navigation menus on internal pages (DE4) and link to unexpected locations.

5.1.5.9 Context

46. The user's position relative to the web is not properly provided in the header (DE1).
47. Context is not provided in the main navigation bar (DE2).
48. The favicon next to the homepage (DE3) title does not provide context as it is a "Google" logo and not an appropriate UP logo.
49. The local navigation menus on the internal pages (DE4) do not have section headings.
50. The local navigation menus on the internal pages (DE4) do not provide users with context by changing the style of current links.

51. There are no breadcrumbs on the internal pages (DE4) that indicate to the user where they are in the hierarchy.

5.1.5.10 Task completion support

52. There is no visual distinction between visited and unvisited links in local navigation menus on the internal pages (DE4).

5.1.5.11 Controllability

53. The website's name in the header (DE1), which is not a link to the homepage, limits controllability.
54. Contextual links on the homepage (DE3) are difficult to identify as links.
55. There are no breadcrumb trails on the internal pages (DE4).

5.1.5.12 Error recovery

No problems were identified.

5.1.5.13 Error prevention

No problems were identified.

5.1.5.14 Feedback

No problems were identified.

The number of problems that were found under each of the heuristics is summarised below in Table 5.1-6. They are sorted from the largest number of problems to the smallest number of problems.

Number of problems	Heuristic
8	Consistency
7	Labelling
7	Novice user guidance
7	Help documentation
6	Organisation
6	Context
5	Predictable behaviour
3	Clutter
3	Controllability
2	Efficiency features
1	Task completion support
0	Error recovery
0	Error prevention
0	Feedback

Table 5.1-6: Number of problems that were found in the UP library website

5.2 Chapter 5 summary

This chapter consists of an evaluation of the library website of the University of Pretoria. Based on the analysis, it is clear that there are various problems that need attention.

The problems that were found can have a significant impact on the usability of the website.

The recommendations that were made can be used to improve the usability of the IA of the library website. After the implementation of the recommendations, it is suggested that the usability of the library website should be evaluated with user-based tests. This is further discussed in the next chapter, in which recommendations for further research are discussed.

The website redesign that was partially implemented during the time when the website was being evaluated had a negative impact on the usability evaluation. As a result, the evaluation is limited to only the pages that were implemented at the time of the evaluation. For example, all the faculty library pages could not be evaluated. As mentioned in the scope of the study, the evaluation was limited to the redesigned pages, since the old pages are to be replaced and an evaluation on them would therefore be irrelevant.

The next chapter contains the conclusion of the study. In the conclusion, the researcher also explains how the main research question was answered with the sub-questions, with reference to where the various sub-questions were answered.

Chapter 6 – Conclusion

This chapter presents a summary of the study, a discussion of the main research question and the sub-questions that were used to answer the main question, as well as the contributions that this study made and recommendations for further research.

6.1 Summary of the study

There is a lack of usability studies on academic library websites in South Africa. Additionally, the University of Pretoria released a new version of its library website in 2016 that had not yet been evaluated. Therefore, the library websites of the top three universities in South Africa, and the library website of the University of Pretoria were evaluated in this study using the heuristic evaluation method.

In order to find the best way to evaluate these websites, it was determined that the IA of the website is the most important aspect of an academic library website, and that there is a lack of specific principles that can be used for the evaluation of the IA of academic library websites. Therefore, a set of principles that is appropriate for the heuristic evaluation of academic library websites was compiled and used to evaluate the library websites of the chosen universities.

6.2 Findings

The findings of this study aim to answer the main research question and sub-questions as presented in Section 1.5 in Chapter 1.

This study has attempted to answer the main research question: *To what extent does the library website of the University of Pretoria comply with an integrated set of usability heuristics, compiled specifically for the evaluation of the IA of academic library websites?* To answer this question, the following sub-questions needed to be answered first.

6.2.1 Sub-questions

The following list of sub-questions was used to help the researcher answer the main research question. The findings for each of the research questions are summarised in this section.

6.2.1.1 Sub-question 1: What is usability?

This sub-question was answered in part one of the literature review in Chapter 2, Section 2.1.

Usability can be defined as the degree to which an interface can be considered usable with regards to the seven usability measures — effectiveness, efficiency, learnability, memorability, safety, satisfaction, and utility.

These usability measures were determined based on an integration of various definitions and perspectives of usability by authorities in the field. In order to define usability, authorities identified various usability measures as quality components (Nielsen 2012), usability measures (ISO 9241-11 1998), usability goals (Preece, Rogers & Sharp 2015), and human factors (Shneiderman et al. 2016).

Usability can be achieved through the UCD process, in which the fourth (and final) phase is to evaluate the user interface. Therefore, the evaluation of a user interface is one of the phases that helps contribute to achieving a usable product.

6.2.1.2 Sub-question 2: How can usability be evaluated?

This sub-question was answered in part one of the literature review, in Chapter 2, Section 2.1.2.

Usability can be evaluated using various methods that can involve one or a combination of users, expert evaluators, or tools. Usability evaluation methods that involve experts are referred to as usability inspection methods or expert evaluations.

The most appropriate method depends on the type of interface. The most effective results come from including a variety of evaluation methods. According to various usability experts, usability testing involving users is the most appropriate method for evaluating the usability of websites. However, this does not take into account the evaluation of the usability of its IA. Although user testing is a valuable method to get users' opinions on the usability of a product, users might not necessarily be able to comment on the usability of its IA. The IA of a website can effectively be evaluated using the expert-based method called heuristic evaluation. Therefore, heuristic evaluation was used in this study.

Heuristic evaluation involves one or more evaluators that independently inspect the dialogue elements in an interface with reference to a set of usability principles.

The main dialogue elements that academic library websites consist of were determined based on IA theory (as discussed in the next sub-question, in Section 6.2.1.3) using a set of integrated heuristics that were created in this study for this purpose.

The researcher was the sole expert evaluator in this study. The principles used were compiled in the literature review in two phases. Phase one involved an integration of established lists of usability principles (by authorities in the field) in order to create an integrated list of established principles. Phase two involved the evaluation of usability problems that were found in twenty related studies with reference to the integrated list of heuristics compiled in

phase one. The purpose of the second phase was to supplement the list of heuristics and sub-criteria with usability recommendations that apply specifically to academic library websites.

6.2.1.3 Sub-question 3: What is IA and how can it be evaluated?

This sub-question was answered in part one of the literature review in Chapter 2, Section 2.1.3.

In the context of websites, IA can be defined as the component that makes up the structure of the websites in order to facilitate the findability of information, as opposed to the visual design of the website. Both the IA and visual design aspects of a website affect its usability.

The success of an academic library website greatly depends on its IA. Therefore, a method that is applicable to the evaluation of IA is essential when an academic library website is to be evaluated.

In this study, the components that make up the structure of a website were divided into the four IA component categories: organisation systems, labelling systems, navigation systems, and search systems.

Expert evaluations, as opposed to user-based tests, are ideal for evaluating the IA of websites. Experts are able to specifically judge interfaces on their IA, while users are only able to comment on how easy or difficult it was for them to complete a set of tasks, without being aware of how IA contributed to task completion.

There are no specific guidelines that dictate how one should perform a heuristic evaluation. General usability principles can be adapted to apply specifically to IA components. The definition of heuristic evaluation specifies that the evaluator should inspect various dialogue elements of the interface with reference to each of the principles.

In this study, six dialogue elements were identified that can be found on academic library websites. These dialogue elements were defined based on the IA components that users can use to move through an interface, i.e., navigation systems and search systems.

An academic library website can be divided into the following dialogue elements, based on IA theory, as discussed in the Methodology chapter (Chapter 3) in Section 3.3.3.2:

Global navigation structures

1. Dialogue element 1: Header and footer
2. Dialogue element 2: Main navigation bar

Local navigation structures

3. Dialogue element 3: Homepage content

4. Dialogue element 4: Internal page content

Search systems

5. Dialogue element 5: Site search feature
6. Dialogue element 6: Resource search feature

These dialogue elements are represented in Figure 6.2-1 and Figure 6.2-2, with numbers that correspond to the numbers in the list. These images are repeated from Section 3.3.3.2 in Chapter 3 for ease of reference.

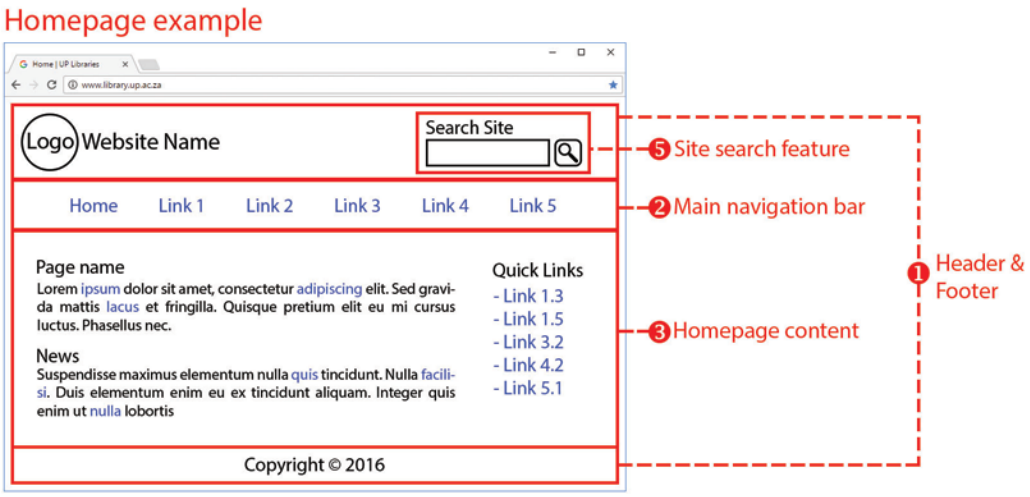


Figure 6.2-1: Example of dialogue elements that can be found on an academic library website homepage

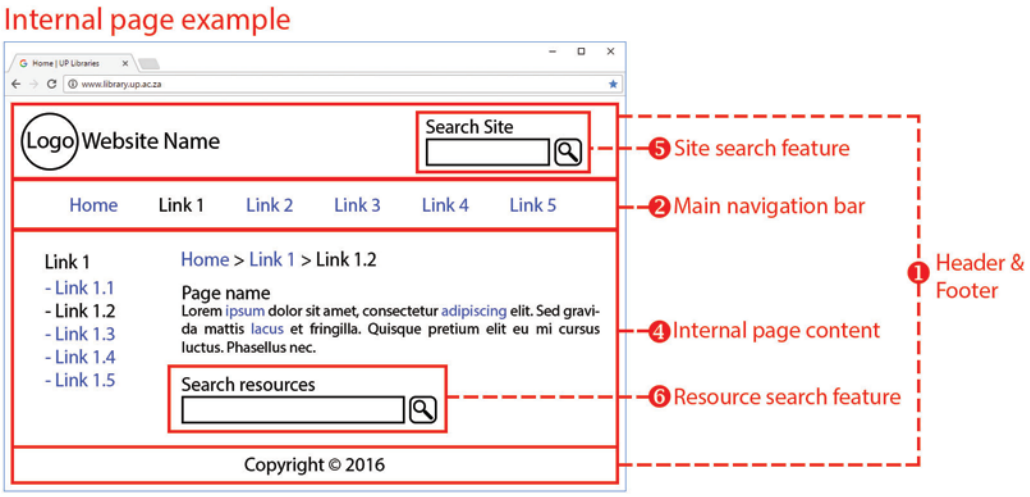


Figure 6.2-2: Example of dialogue elements that can be found on an academic library website internal page

These systems are facilitated by well-implemented organisation and labelling systems. These two IA systems are evaluated using the usability heuristics that were compiled in the literature

review. The heuristics are supplemented with sub-criteria that apply specifically to IA components.

6.2.1.4 Sub-question 4: What usability principles are appropriate for evaluating the usability of the IA aspects of academic library websites?

This sub-question was answered in part two of the literature review in Chapter 2, Section 2.2.

There are various existing sets of principles that can be used for heuristic evaluations. However, a set of principles that applies specifically to the evaluation of academic library websites could not be found; therefore, a specific set of principles was compiled for this purpose. The set of heuristics was compiled from an integration of existing lists of principles.

There are three general lists of principles from authorities in the field of usability that can be adapted and used for heuristic evaluations. The three lists that were used are:

- 10 Usability heuristics for user interface design (Nielsen 1995a)
- Eight golden rules of interface design (Shneiderman et al. 2016)
- ISO 9241 Part 110: 7 dialogue principles (ISO 9241-110 2006)

These lists were analysed and combined in order to compose an integrated set of heuristics.

They were made applicable to IA by supplementing them with sub-criteria that are specifically applicable to IA components, based on an integration of the original set of heuristics in Section 2.2.1.5. They were further modified to make them applicable to academic library websites. This was done by evaluating problems that were found in related studies with reference to the integrated set of heuristics in Section 2.2.2.3. The problems that were found were used to supplement the sub-criteria with recommendations specifically applicable to academic library websites.

A separate heuristic evaluation was done for each of the dialogue elements presented in Section 6.2.1.3.

6.2.1.5 Sub-question 5: To what extent are the library websites of the top universities in South Africa usable?

This sub-question was answered in the case studies in Chapter 4.

In order to test the usefulness of the integrated set of heuristics, the library websites of the top universities in South Africa were evaluated in separate case studies. In each of the cases, the website was divided into the six dialogue elements, and each of the elements was evaluated separately in order to determine how usable the dialogue element is on its own and how it contributes to the usability of the website as a whole.

The main problems that were discovered in the case studies were that the library websites consist of a large number of external links and that some of the library websites lacked some of the core dialogue elements that were defined in the literature review. The full discussion is in the summary of Chapter 4, in Section 4.5.

Even though library websites have gone through a history of redesigns and evaluations they are still not being designed and implemented with IA principles in mind. It was found that common web development conventions are still being ignored.

6.2.1.6 Sub-question 6: How can the integrated list of principles be improved?

This sub-question was answered in the case studies in Chapter 4.

During the heuristic evaluations, the researcher found some problems that were not applicable to any of the sub-criteria under any of the heuristics. These problems were discussed and added to the heuristics at the end of Chapter 4, in Section 4.4.

Based on this finding, the heuristics can be improved to include the following two criteria:

1. ***New sub-criterion for Controllability***
   External links and search results should open in a new tab.

2. ***New sub-criterion for Labelling***
   The page title should contain information about the page and the website, separated by a pipe (|).

The following set of heuristics was compiled and revised in this study to evaluate the usability of the IA of academic library websites. This list is repeated from Section 2.2.3 with the addition of the new sub-criteria that were discussed in Section 4.4.

6.2.1.6.1 Labelling

- The system uses comprehensible terminology and concepts that the intended user is familiar with (based on the user's existing knowledge).
- The system avoids using system-oriented terms but the terms are familiar within the context of the task.
- Terminology in labels corresponds to the content it represents.
- The page title contains information about the current page and the website, separated by a pipe (|).

- Recommendations:
    - The use of library jargon that is specific to the library should be avoided (for example, the name of the library's catalogue).
    - Common everyday language that users are likely to be familiar with, should be used where possible and additional explanations should be provided in the form of tooltips where necessary, according to the "Novice user guidance" heuristic.
    - The language used in labels should be clear, concise, comprehensible, and meaningful.
    - Terms that are ambiguous, vague, redundant, or misleading should be avoided.
    - Long labels should start with an identifying keyword.
    - Different labels that overlap in meaning should be renamed to be more distinguishable.

6.2.1.6.2 Organisation

- Information appears in a natural and logical order.
- Information is grouped and classified logically.
- Documents or categories that are grouped together fit well with each other.
- The degree of overlap between categories is low.
- Child content objects represent parent content objects.
- Recommendations:
    - The system should be organised to reflect the way users look for information.
        - Important links should appear in noticeable locations or main sections.
        - Important information should be accessible from the homepage.
        - A link to the homepage should be easy to find and listed first if it is in a list of links.
        - Help links should be prominent and easily accessible.
    - The website should use clear organisation and categorisation.
        - A small number of main navigational categories should subdivide information into logical sections.
        - Multiple pathways to general content areas should be provided.
        - Content should be structured and grouped correctly.
        - Content should be sorted according to possible user goals.
    - The layout and navigation should be simple.
        - The website should be easy to navigate.
        - The layout structure should be intuitive.

6.2.1.6.3 Clutter

- The system does not provide the user with irrelevant information or information that is not needed for the successful completion of tasks.
- There is nothing that takes the user's attention away from important information.
- Links in main navigation bars are limited to eight links.
- Recommendations:
    - All pages should have simple layouts and should be clutter free.
    - Pages should not contain too many links.
    - Links should not contain too many words.
    - Duplication of information on a page should be eliminated.
    - Non-essential information should not appear in multiple locations on a page.
    - There should be a good balance between breadth and depth.
    - Pages should not be too long, requiring users to scroll too much.
    - The system should not make a user feel lost.

6.2.1.6.4 Novice user guidance

- Additional explanations, rules, and underlying concepts that assist the user in gaining a conceptual understanding of the interactive system are provided.
- Guidance and support are provided to help the user learn how to use the system.
- Recommendations:
    - Descriptions for unfamiliar terms should be provided for clarification.
    - Additional explanations should be provided for basic library terms (instead of changing the labels).
    - Tooltips should be used to reveal additional explanations for terms or the target destination of links.
    - New users should be provided with clear navigational choices that guide them to the right resources.
    - Information about expected search results as well of the scope of a search box should be provided so that users will know what search boxes to use.
    - Primary search tools should be emphasised.
    - Search results should be annotated automatically to help users distinguish between the different types of results.
    - Novice users should be provided with web forms that allow them to communicate with library staff.
    - Users should be able to differentiate between different resources.

6.2.1.6.5 Help documentation

- Help documentation is provided.
- Help documentation can be located easily when the need arises.
- Help documentation is searchable.
- Help documentation is easy to use.
- Help documentation does not contain too much information.
- Recommendations:
    - Help documentation provides help and instructions on using library resources and services.
    - Instructional help should be provided on how to search for other libraries' resources.
    - Tutorials should be accessible from a "Help" link.
    - A sitemap should be included as a supplemental navigation system.

6.2.1.6.6 Efficiency features

- Shortcuts are available that enable users to speed up the interaction with less frequent actions.
- Frequent actions are customisable.
- The user can modify their interaction with and the presentation of information.
- Recommendations:
    - A site search feature should be provided for users who prefer not to navigate through browsing.
    - Search tools should support the ways users search for information, i.e., if they prefer to search for journal articles directly, the system should allow it.

6.2.1.6.7 Consistency

- Situations that are similar should require similar sequences of actions.
- The same conventions (for example, terminology, and layout) should be followed throughout the interface.
- The system should behave consistently within tasks and across similar tasks.
- Recommendations:
    - The website should have a consistent global navigation structure.
    - There should be consistency in the placement and labelling of navigational elements.
    - The order of links should stay the same on every page.
    - Terminology should be consistent throughout the website.
    - The search box should stay in the same location on each of the webpages.

6.2.1.6.8 Predictable behaviour

- The system makes the user feel as if they are in control at all times.
- The system responds how the user expects it to respond.
- The system does not change familiar behaviour.
- The system uses commonly accepted conventions from related systems.
- Formats follow appropriate cultural and linguistic conventions.
- Recommendations:
    - Users should know how search boxes will behave before they use them.
    - Search boxes should not cause confusion.
    - Search boxes should make use of web searching conventions.
    - Information that users expect to find on an academic library website, such as the library's address, telephone number, and library calendar, should be provided.
    - Intuitive icons should be used.

6.2.1.6.9 Context

- The system informs the user of where they are in a dialogue.
- Users always know what they can do next.
- In a dialogue that consists of a range of steps/sub-pages, users' progress is indicated, i.e., they know where they are, and how many steps they are away from the end.
- A user's context within the web and the website is indicated.
- Recommendations:
    - Breadcrumb trails should be provided to assist users with navigation and context.
    - Labels should be grouped under subcategories if main categories are too broad.

6.2.1.6.10 Task completion support

- Simple tasks require simple interactions.
- All objects, actions, and options are visible.
- All the information that a user needs to perform a task is visible.
- The system does not require a user to remember information from one screen to use it on a different screen.
- The system helps the user to complete the task effectively and efficiently.
- The technology used to perform the task does not distract the user.
- The system does not require a user to re-enter information that was entered previously.

- The system provides default values where applicable, for example, where typical input values are required.
- Recommendation:
    - The authentication system should be simplified with a single sign-on feature so that users are not required to use a different password to access different parts of the same system.

6.2.1.6.11 Controllability

- The system provides the user with a simple and efficient way to go back to where they came from if they landed in an unwanted situation.
- Users have control over the sequence of their interaction with the system.
- Recommendation:
    - The website should provide functionality that allows a user to go back to previous pages, such as an interactive breadcrumb trail.
    - External links and search results should open in a new tab.

6.2.1.6.12 Error recovery

- The system can detect if a user has made an error.
- The system clearly indicates what the problem is when the user encounters one.
- The system uses plain language to communicate what the problem is.
- The system provides clear instructions to a simple solution.
- Users are still able to complete their task after recovery.
- The system validates input before processing it.
- The system can correct some errors automatically, informs the user of the correction, and provides the user with an opportunity to override the correction.
- Recommendation:
    - A search system should make users aware if it has corrected misspelt search terms.

6.2.1.6.13 Error prevention

- The system eliminates conditions where users are likely to make errors.
- The system asks for confirmation before taking serious actions.
- The system warns the user about what might happen when certain actions are taken.
- The system prevents users from clicking on inappropriate links (i.e., inappropriate links are disabled).
- Recommendation:
    - A visual cue should be provided next to external links to warn users that they will navigate away from the website.

6.2.1.6.14 Feedback

- The system provides feedback for every user action.
- The system provides informative feedback.
- The system provides appropriate feedback (i.e., ranging from modest to substantial, depending on the severity of action taken by the user).
- The system provides feedback within a reasonable period of time when users expect it.
- The system provides status information and shows that input has been received.

6.2.2 Main research question

The answers of the various sub-questions assisted the researcher in answering the main research question, as discussed below. Therefore, the answer of the main research question is an integration of the work that was done in chapters 2 – 5. Additionally, the answer of the main research question leads to the answer of sub-question 7 in the following section, Section 6.2.2.1.

To what extent does the library website of the University of Pretoria comply with an integrated set of usability heuristics, compiled specifically for the evaluation of the IA of academic library websites?

The results of the usability inspection of UP's library website reveals various usability flaws. The fact that the website has only partially been redesigned causes some major usability problems with regard to consistency.

Based on the heuristic evaluation, it is evident that there is a need for improvement. A recommendation for improvement was provided below the description of each of the usability problems that were found in Chapter 5.

A total of 55 usability problems were found on the library website of the University of Pretoria. The problems that were found are summarised below and divided into the fourteen heuristics. The abbreviation "DE" is used to show in what dialogue element the problem was identified.

This list is repeated from Section 5.1.5 in Chapter 5 for ease of reference.

6.2.2.1 Labelling

1. Some of the labels in the main navigation bar (DE2) are confusing or unfamiliar.
2. The homepage (DE3) title is too long and does not contain all the necessary information.
3. Some of the labels on the homepage (DE3) are unclear.
4. The page titles of the internal pages (DE4) do not contain all the appropriate information and are too long.

5. Some of the labels in local navigation menus in the internal pages (DE4) are confusing or redundant.
6. Some of the labels in the tabs of the resource search feature (DE6) are unclear or might be unfamiliar to novice users.
7. The placeholder text in the resource search feature's search box is not used according to its intended purpose.

6.2.2.2 Organisation

8. The University's name in the header (DE1) can cause confusion.
9. The telephone number in the header (DE1) can cause confusion.
10. The grouping and categorisation of the links in the drop-down menus of the main navigation bar (DE2) can cause confusion.
11. The use of different ordering schemes used in the drop-down menus of the main navigation bar (DE2) is confusing.
12. There is a discrepancy with the term "libraries" between the use of the term in the main navigation bar and on the "Contact Us" internal page (DE4).
13. The "Contact Us" internal page (DE4) lacks essential contact details of various library units such as management and faculty units.

6.2.2.3 Clutter

14. Some of the drop-down menus in the main navigation bar (DE2) are too long and contain redundant links.
15. There are redundant social media links in the local navigation menus on some internal pages (DE4).
16. Some of the submenus in the local navigation menus on the internal pages (DE4) are too long.

6.2.2.4 Novice user guidance

17. There is a lack of descriptive tooltips in the header and footer (DE1).
18. There is a lack of descriptive tooltips in the main navigation bar (DE2).
19. There is a lack of tooltips to guide novice users on the homepage (DE3).
20. The training internal page (DE4) contains a "Flash" tutorial which is an outdated technology.
21. There are no tooltips on internal pages to guide novice users.
22. There is a lack of explanations in the resource search feature (DE6) which specifies where the search will be performed.
23. Some of the examples of search terms that can be used in the resource search feature are incorrect.

6.2.2.5 Help documentation

24. Help documentation is difficult to locate via the header and footer (DE1).
25. Help documentation is difficult to locate via the main navigation bar (DE2).
26. Help documentation is difficult to locate via the homepage (DE3).

27. The "Training, Tutorials & User Guides" internal page (DE4) is confusing.
28. There is a lack of help documentation in the internal pages (DE4).
29. A supplemental navigation system for this website, such as a sitemap, could not be located in the internal webpages (DE4).
30. No help documentation could be located for the resource search feature (DE6).

6.2.2.6 Efficiency features

31. There is no site search feature in the header (DE1).
32. There is a lack of shortcut links to the top of the page on long internal pages (DE4).

6.2.2.7 Consistency

33. The partial implementation of the redesign makes the header (DE1) seem inconsistent.
34. Links that have changed in the main navigation bar (DE2) have not been changed on all pages.
35. The partial redesign of the website makes the main navigation bar (DE2) inconsistent.
36. The contents of the "Search" drop-down menu in the main navigation bar do not correspond with the components on the homepage (DE3) that have the same identifying label.
37. The labels of contents in the "My Library Space" drop-down menu do not correspond exactly with the components on the homepage (DE3) that have the same identifying label.
38. The various local navigation menus in the faculty libraries' internal pages (DE4) provide three different methods for accessing resources.
39. The homepage links for the various faculties are named differently on different internal pages (DE4).
40. The list of "libraries" listed on the "About Us" internal page (DE4) is different to the list of "libraries" under the "Libraries" category in the "Libraries & Units" drop-down menu in the main navigation bar.

6.2.2.8 Predictable behaviour

41. The link to the main university homepage in the header (DE1) can be mistaken as the website's identifier and therefore as a link to the library website homepage.
42. The library website main heading in the header (DE1) is not marked up as a link to the library homepage.
43. When hovering over the main categories in the main navigation bar (DE2), a pointer cursor appears, even though they are not clickable.
44. The behaviour of the "Ask / Chat to a librarian" links on the homepage is unexpected because it consists of two links on one line.

45. Some subheadings are incorrectly marked up as links in the local navigation menus on internal pages (DE4) and link to unexpected locations.

6.2.2.9 Context

46. The user's position relative to the web is not properly provided in the header (DE1).
47. Context is not provided in the main navigation bar (DE2).
48. The favicon next to the homepage (DE3) title does not provide context as it is a "Google" logo and not an appropriate UP logo.
49. The local navigation menus on the internal pages (DE4) do not have section headings.
50. The local navigation menus on the internal pages (DE4) do not provide users with context by changing the style of current links.
51. There are no breadcrumbs on the internal pages (DE4) that indicate to the user where they are in the hierarchy.

6.2.2.10 Task completion support

52. There is no visual distinction between visited and unvisited links in local navigation menus on the internal pages (DE4).

6.2.2.11 Controllability

53. The website's name in the header (DE1), which is not a link to the homepage, limits controllability.
54. Contextual links on the homepage (DE3) are difficult to identify as links.
55. There are no breadcrumb trails on the internal pages (DE4).

6.2.2.12 Error recovery

No problems were identified.

6.2.2.13 Error prevention

No problems were identified.

6.2.2.14 Feedback

No problems were identified.

6.2.2.15 Sub-question 7: What recommendations can be made to improve the usability of the library website of the University of Pretoria?

Based on the answer of the main research question, sub-question 7 can be answered as follows. The following recommendations were made to improve the problems listed in Section 6.2.1.6.1. These recommendations were provided in Chapter 5 Section 5.1.2 to 5.1.4, and are repeated here for ease of reference.

6.2.2.15.1 Recommendations for dialogue element 1: Header and footer

1. Emphasise the name of the library website by placing it in a more prominent position and move the main library website link to a less prominent position (not in the top-left corner). The name of the website can also be emphasised with a custom logo.
2. The telephone number in the header can be replaced with a more essential library website element that is commonly found in the header of academic library websites. For example, a site search feature or a link to the website's help documentation. The telephone number is not essential in the header, since it can easily be accessed from the "Contact Us" link in the main navigation bar.
3. Add tooltips to links (that might not be intuitive) in the header and footer to explain where they will take users.
4. The telephone number in the header can be replaced with a more useful feature, such as a "Help" link as discussed in recommendation 2.
5. A well-implemented site search feature in the header can improve the efficiency for both novice and expert users. The telephone number in the header can be replaced with a more useful feature, such as a site search feature as discussed in recommendation 2.
6. The redesign of all the library pages should be prioritised. For future redesigns, make sure that all webpages have been redesigned before publishing the website. Alternatively, if circumstances force an institution to roll out an implementation of the redesigned website over a certain period of time, a note should be visible on the website which clarifies this and possibly includes dates that specify when it will be completed.
7. Make the link to the main university website less prominent and make it clear that it navigates away from the current website, for example, with tooltip text, as suggested in recommendation 3.
8. Make the name of the website more prominent (as discussed in recommendation 1) and mark it up as a link to the library homepage.
9. Make the user's position relative to the web as a whole more prominent. See "Organisation" in Section 5.1.2.2.2.1 for suggestions.
10. Mark the name of the website up as a link to the homepage.

6.2.2.15.2 Recommendations for dialogue element 2: Main navigation bar

11. The "Libraries & Units" category should be split into two separate categories and the "Units" category should be renamed using a more appropriate label. See "Organisation" in Section 5.1.2.4.2.1 for a detailed discussion of the categorisation problem. Links should not be labelled according to the organisational structure of an

institution. The labels under the "Units" category should rather represent the purpose they serve.

12. The first two links in the drop-down menus "Catalogue" and "WorldCat Discovery" should be renamed to reveal the difference between the two. For example, "Catalogue" can be renamed to "WorldCat Catalogue Basic Search" and "WorldCat Discovery" can be renamed to "WorldCat Catalogue Advanced Search". Alternatively, to reduce clutter, the link to the advanced search feature can be removed. See "Clutter" in Section 5.1.2.4.3.1 for a discussion and recommendation. EBSCO discovery can be renamed to "EBSCO Discovery Basic Search" and a tooltip should be added to make its purpose clear.
13. Add more information to the "MakerSpace" link to add meaning to it. Additionally, a tooltip can be added to explain its purpose.
14. The labelling of the two links, "Log in" and "My TUKS login" should be changed so that the difference between the two links is clear. Label suggestions: "Library Account Login" and "My TUKS Login (UP Portal)".
15. Remove the "Chat to a librarian" link. Rename the "Ask a Librarian" link to "Ask / Chat to a Librarian". This way, the user can have access to both features by clicking on a single link, and if they land on the page during inactive hours, they can simply use the "Ask a Librarian" feature.
16. Remove the category "Units" and rearrange the links under more appropriate categories, such as "Services". Additionally, a new, more suitable category can be added to the main navigation bar for items that do not fit under the "Services" category — for example, "Library Help", a useful category that is missing from the main navigation bar. Some of the links that are listed under "Units" are services that provide help and can be categorised under "Library Help". Conduct a card sorting exercise to find out what the most appropriate categories would be.
17. There should be a clear distinction between the *library building* and *faculty unit* links in the "Libraries" category. For example, the drop-down menu under the "Libraries" link can contain the sub-headings "UP library buildings" and "Faculty units".
18. The search label in the navigation bar can be renamed to "Locate/Find resources". Additionally, a site search feature can be provided with the label "Search website" and the search feature on the homepage can be renamed to "Search library resources", to avoid confusion.
19. Links in the "Services" drop-down menu that are not services should be removed and listed in a different category, for example, "Library Help". This is also suggested in recommendation 6.

20. In order to determine how the main navigation should be organised, a card sorting exercise should be performed. This is also recommended in recommendation 6, to find more appropriate categories for the links under "Units". An open card sorting exercise allows the participants to create new categories. All of the links that were categorised under "Units" and "Services" should be sorted.
21. The lists should be sorted according to the purpose of the items in the list, i.e., for known item searching, lists should be sorted alphabetically. However, it should be clear what ordering scheme is used and there should not be any errors. Lists that use a combination of ordering schemes can cause confusion. When a combination is necessary, aids or additional subcategories could be provided. The only list that makes sense with an alphabetical sorting scheme is the "faculty units" (listed under "Libraries"). An alphabetical arrangement under "About Us" is not an optimal organisation scheme. The "Contact Us" link should be listed first (since it is a common link that should be easy to find) and "Hours", "Facilities", and "Management" should be listed together with "Contact Us", because the information is related. The "Code of Conduct", "Service Pledge", and "Vision and Mission" links should be grouped together and listed underneath each other.
22. Choose between renaming the first two links in the "Search" drop-down menu to make the distinction clear (as recommended in Section 5.1.2.4.1.1) or removing the second link "WorldCat Discovery", and renaming the "Catalogue" link to "WorldCat Catalogue Search".
23. The addition of useful tooltips to links that are not obvious in the navigation bar and drop-down menus can greatly contribute to making them more useful for novice users.
24. Provide more visible help features from the main navigation bar. A "Help" category can be included that contains links that were previously available under "Units" or "Services".
25. Ensure that when link labels in the main navigation bar are updated that they are changed on all the pages. A simple solution that can be implemented in this website is to have a single HTML file that contains the main navigation bar that is referenced in all the pages. This way, when the navigation bar needs to be updated, it only needs to be updated in a single file and the change will appear on all the pages.
26. The redesign of the entire website needs urgent attention. As recommended in Section 5.1.2.2.7.1, a note can be added.
27. All links that have drop-down menus should not have a hypertext reference as well. Users often click on such links by accident when they want to see the options in the drop-down menu. Therefore, the "About us" link should not have a hypertext

reference. When a user hovers over a link that does not have a hypertext reference (i.e., it is not clickable), the cursor must not change to a pointer, as discussed in "Predictable behaviour", in Section 5.1.2.4.8.1. Only the homepage link should be clickable because it does not have a drop-down menu. It must also be visually distinct in order to convey this difference, for example, with a text underline.

28. Change the markup of links that do not have hypertext references so that a cursor pointer will not appear when users hover over them. Their only purpose must be to reveal their drop-down menus. The links that are interactive, however, namely "Library Home" and "About Us", should indicate that they are interactive with a pointer cursor and should be visually distinct (for example, with an underline) since they have different functionality.
29. Provide context in the main navigation bar by making the link label of the current link look visually distinct.

6.2.2.15.3 Recommendations for dialogue element 3: Homepage content

30. Rename the homepage title so that it contains the name of the website followed by the name of the page. The name of the website should also be shortened, for example, "UP Libraries | Home".
31. Change the labels in the two "My Library Space" components so that they correspond to each other since the links link to the same locations. As recommended Section 5.1.2.4.1.1, "Log in" should be changed to "Library Account Login". As recommended in Section 5.1.2.4.1.1, remove the "Chat to a Librarian" link and change the label of the "Ask a Librarian" link to "Ask / Chat to a Librarian".
32. Provide tooltips for all the links on the homepage that further explain where they navigate.
33. Provide users with a link labelled "Help" on the homepage to provide access to a collection of help documentation sources. If the website does not have sufficient help documentation, additional documentation should be added, for example, documentation that informs users about the different search features or how to use advanced search features. A "help" category can be useful in the main navigation bar, as suggested in Section 5.1.2.4.2.1.
34. Make the labels the same across the two components. Links that are the same should have the same labels. Make the changes according to the recommendation in Section 5.1.2.4.1.1.
35. In a list of links, there should not be list items that consist of more than one link. The link to the "chat" feature can safely be removed, as discussed in Section 5.1.2.4.2.2, because the "Ask a librarian" page contains both the "ask" and the "chat" features. This would leave only a single link, which would solve the problem. The whole label

"Ask / Chat to a Librarian" should be marked up as a single hyperlink to the "Ask a Librarian" page.

36. Change the favicon in the title to the university's emblem and the text to "UP Libraries | Home" as suggested in "Labelling", Section 5.1.3.2.1.1.
37. Use web development conventions to style links, for example, instead of making the links bold, underline them or make them blue.

6.2.2.15.4 Recommendations for dialogue element 4: Internal page content

38. Change all of the titles of all the internal pages to contain a short version of the name of the page and the website. In this case, the name of the website is "Department of Library Services" but it can be shortened to "UP Libraries". For example, the title on the "About Us" page can be renamed to "About Us | UP Libraries". A pipe (|) is used instead of a dash because it uses less horizontal space.
39. Rename confusing labels so that it can be easy for users to distinguish between them, and remove duplicate/redundant labels. For example, on the NAS page shown in Figure 5.1-17, remove the link with the label "**Home" at the bottom since it is a duplicate link with a confusing label. Rename the second link "Faculty of Natural & Agricultural Sciences" to "NAS Faculty homepage" and include a visual indication, for example, the university crest, to indicate that the link goes to the main university website. A tooltip should also be provided — see "Novice user guidance" in Section 5.1.3.4.4.2.
40. Make sure that when *libraries* are listed at two different places that both lists correspond to each other. If they do not, either the lists should be changed or the label should be changed. In the case of "libraries" in the drop-down menu, it was recommended in Section 5.1.2.4.2.1 "Organisation" to change the heading to "Faculty Units" instead of libraries. This way, when "libraries" are listed, it specifically refers to library buildings.
41. The "Contact Us" page should be subdivided into appropriate categories, for example, using a tabbed interface. The first tab can contain the contact numbers that are currently listed on the "Contact Us" page, i.e., library buildings, and should be labelled as such. An additional tab with the label "Library services/service units" should contain the contact details for library management, interlending, open scholarship, etc. Finally, there should be a "Faculty units" tab, which contains the contact details of the faculty units that are listed in the main navigation bar. This contact details page should also make it clear that some of the faculty units have their own library buildings, while others do not and are located within the Merensky 2 library building.
42. If there are social media links in the local navigation menus that link to the library's social media networks, they should be removed. The text before the faculty's social

media network links can be more descriptive with the label "Follow the Faculty" instead of "Follow us". These links should only be present if the faculty has its own social media networks, and only the networks on which the faculty actually has an account should appear, i.e., if the faculty only has a Facebook account, there should only be a Facebook link and no YouTube and Twitter links. Therefore, on the NAS local navigation menu, there must be a single social media link to the faculty's Facebook page.

43. Make the expandable link a link to a page that contains all the links so that the links are not listed in the local navigation menu, but rather on a separate page.
44. Update the Flash tutorial ("Library orientation tutorial") to a supported technology that works on all platforms and devices.
45. Provide tooltips that explain link destinations. If a link navigates away from the library, for example, "Faculty Home", the tooltip should make this clear, i.e., with tooltip text "Go to faculty page on main university website".
46. Create a "help" section and list "Training, Tutorials & Users Guides" as a single link (among other help documentation links) in the local navigation menu of this section. The link should open a page that contains all the links to the PDFs. Therefore, the local navigation menu should not contain PDF links.
47. Create a usable sitemap and include a link to it in an easily accessible location on the homepage or in a help section.
48. Provide "back to top" buttons at the bottom of long pages.
49. Choose one method for providing e-Resources options and use it consistently in all the local navigation menus. The last option (indicated with number 3 in Figure 5.1-20) is the least user-friendly because it requires more clicks. The first option (indicated with number 1 in Figure 5.1-20) appears to be the best option (as opposed to the option indicated with number 2 in Figure 5.1-20), because the list is hidden by default, making the local navigation menu less cluttered. It is very easy to see that it can be expanded to reveal a list of resources.
50. As recommended in "Context" (Section 5.1.3.4.9.1), a section title should be provided above all the local navigation menus, as the "home" link is currently the only way to know what the current section is. The home links can then consistently be named "Home" because the section title gives it context. Naming conventions should be followed for the bottom link as suggested in "Labelling" (Section 5.1.3.4.1.2) and implemented across pages consistently. Rename the links to the faculties' name followed by the keyword "webpage" e.g. "EBIT faculty webpage" and include a logo, such as a university crest, to indicate that the link goes to the main university website.

51. Headings should not be clickable. For example, the "e-Resources" item in the local navigation menu on the NAS page, should not be clickable because it is a heading for the drop-down menu below it.
52. Include the heading of the section above each of the local navigation menus to provide context for the menu.
53. In the navigation menu of the current page, the link label of the corresponding link must be visually distinct to indicate the current page.
54. Breadcrumbs can provide additional context by showing the user where they are in the website hierarchy. Breadcrumb links that are clickable allow the user to navigate easily to any section in the hierarchy.
55. Style visited links differently than unvisited links in the internal pages.
56. Include a breadcrumb trail component on the internal pages for additional functionality.

6.2.2.15.5 Recommendations for dialogue element 5: Site search feature

57. Provide a site search feature in the header of the website.

6.2.2.15.6 Recommendations for dialogue element 6: Resource search feature

58. Ensure that the purpose of each of the tabs is further explained inside the tab if the label in the tab is not explanatory enough. Placeholder text is not the best option; however, an alternative solution is discussed in the next problem in Section 5.1.4.3.1.2. Use a more descriptive label than "Everything" for the first tab, depending on what "Everything" refers to.
59. Do not put the descriptions inside the textboxes in the form of placeholder text. It should rather be marked up as a label above the textbox. Conversely, the example input that appears below some of the search boxes should be placed inside the search box in the form of placeholder text.
60. The search features can further be explained for novice users by specifying where the query will be searched, for example, "WorldCat". Users should be aware that the "Everything" tab does not mean they can search the entire website, as this will lead to failed searches.
61. If examples are provided, they should be accurate and they should be placed in the search box as placeholder text, as recommended under "Labelling" in Section 5.1.4.3.1.2.
62. Provide users with help documentation for using the search feature. The documentation can further explain the various search tabs with examples and information on advanced or simple searches.

6.3 Contributions of this study

This study made various contributions in the fields of usability and IA. Each of the contributions is discussed below.

6.3.1 Integrated heuristics for the evaluation of academic library websites

Before this study, no exhaustive list of heuristics could be found that can be used for the evaluation of the usability of the IA of academic library websites. Such a list was compiled from the literature review, and evaluated and revised in this study. This list can be reused and applied for the evaluation of any academic library website. Additionally, as discussed in recommendations for future research (Section 6.4), this list can also be adapted to apply to other websites.

6.3.2 A framework for evaluating IA

There are no specific guidelines on how to do a heuristic evaluation. The definition by Nielsen (1995b) states that each dialogue element on a website should be compared to a list of usability principles during a heuristic evaluation. However, it does not specifically define the dialogue elements that should be evaluated, only that complicated interfaces can be divided into separate dialogue elements that each focus on a different part of the interface. This study provided a framework that can be used to divide an academic library website into six dialogue elements based on IA theory. Each of the dialogue elements is well-defined and can be evaluated separately.

6.3.3 Relationship between universities' QS rankings and the usability of their library websites

The heuristic evaluation of the top universities in South Africa shows that these universities' library websites only satisfy the heuristics that were compiled in this study to a limited degree. This finding reveals that there is no correlation between the quality of a university's library website and the university's ranking in the QS world university rankings. This statement is made based on the conclusion that these universities had the highest rankings in South Africa, even though their library websites are not optimally designed according to usability heuristics that apply specifically to the IA of academic library websites.

6.3.4 Usability evaluation of the library website of the University of Pretoria

As discussed in the background of this study, Section 1.1 in Chapter 1, the University of Pretoria launched a partial implementation of their redesigned website in 2016, and no usability studies were conducted on it before this study. Therefore, the heuristic evaluation that was done in Chapter 5 is the first usability study that was conducted on the library website of the University of Pretoria after it was redesigned in 2016.

6.3.5 A usability expert's role in academic library website development teams

This study proves that a usability expert, specifically an information architect, can be an essential part of a web development team and can make a substantial contribution to the usability of academic library websites. A web development team that consists of library staff and technical experts/developers only can have various negative effects on the usability of the website. A library website can benefit greatly from a UCD process that includes expert evaluation and user-based testing throughout the design process.

6.3.6 Recommendations for improving the University of Pretoria library website

The library website of the University of Pretoria was redesigned in 2016 and was not evaluated yet at the time of this study. One of the main contributions of this study is that the website was evaluated using heuristic evaluation, and 62 recommendations were provided for improving the problems that were identified.

6.4 Recommendations for further research

This study sets the groundwork for a variety of related studies that can be done in the field. The following recommendations for further research arose from the findings of this study.

6.4.1 The methods used in this study can be replicated

The methods that were used in this study to evaluate the usability of the IA of academic library websites can be used, as presented in Section 6.2.1.4, to evaluate other academic library websites. Other academic library websites can also be sub-divided into the six dialogue elements as defined in the methodology chapter of this study, Chapter 3. See Appendix A for an evaluation framework for the procedures to be undertaken by the heuristic evaluator(s).

These heuristics can also be used for the evaluation of *other* large websites that are not academic library websites. They can be used as presented in Section 6.2.1.4 with the sub-criteria but without the recommendations.

Additionally, the heuristics can also be adapted to specific interfaces by creating specific recommendations that target other types of websites. This can be done using the same method that was used in this study to adapt the heuristics to academic library websites in the literature review, in Section 2.2.2.3. The integration of the various problems that were found in the related studies was used to create recommendations that supplement the sub-criteria of the heuristics. These adapted heuristics can then be applied to these types of websites. For

example, the heuristics can be adapted to apply to academic websites (as opposed to academic library websites).

Therefore, the heuristics and criteria that were presented in this study can be applied to any other websites and, optionally, they can be adapted with recommendations to be more specific.

6.4.2 User-based testing to improve the UP library website further

User-based testing is appropriate for detecting task-related problems (Lazar, Feng & Hochheiser 2010:256). This study consisted of expert evaluation only; therefore, task-related problems were beyond the scope of the study. However, many task-related problems were also found throughout the evaluation but were not discussed because they are beyond the scope of this study.

As mentioned in the literature review, user testing is a core component of the UCD process. Therefore, after an academic library website undergoes an evaluation using the methods described in this study, the next step should involve methods to evaluate the usability, and this step should involve users to get their perspective.

The most common method that involves users is a task-based method using the think-aloud protocol. This method was used in the majority of related studies to get the perspectives of users. The core problems that were observed when using this method are a lack of planning and a lack of appropriate users. Therefore, future research should involve well-planned usability testing. None of the related studies focussed on getting the different perspectives of novice versus expert users, which can provide vastly different results and valuable insights.

6.4.3 Standard task-based usability tests for academic library websites

The majority of the related studies that involved task-based testing provided similar tasks that users can perform during the test. An integration of the tasks in these studies can be used to create a standard task-based test that can be applied for the testing of any academic library website. A standardised test such as this can be used when there is a need to compare the usability of academic library websites.

6.4.4 Creation of a standardised template for academic library websites

From the findings of this study, it can be deduced that all library websites have a specific set of services that they should provide to users, which mostly involve providing access to resources. This can vary on a detailed level between libraries, but in general, they should all have more or less the same features.

It is also clear from the related studies and the findings of the case studies and analysis of this study that library websites are not developed with the user in mind. Therefore, the majority of websites that were evaluated were not developed to support user tasks.

Based on these findings, a standardised template for academic library websites and guidelines for the development of academic library websites can be compiled that can be used and adapted by various institutions to ensure that they have usable academic library websites.

6.5 Chapter 6 summary

This chapter concludes the dissertation. This study presented a clear framework and heuristics that can be used for the evaluation of academic library websites, and the library websites of the top universities in South Africa were evaluated.

The findings indicate that the top universities (according to the QS rankings) do not necessarily have good library websites. It is also clear from this research that a well-designed IA is essential for the success of an academic library website.

Based on the findings of the heuristic evaluation of the library website of the University of Pretoria, it is clear that a partial implementation of a redesigned website has great negative effects on the usability of a website. Additionally, the recommendations for improvement can be followed to improve the usability of the IA of the redesigned pages.

References

Battleson, B., Booth, A. & Weintrop, J. 2001. Usability testing of an academic library web site: A case study. *The Journal of Academic Librarianship* 27(3):188–198.

Becker, D.A. & Yannotta, L. 2013. Modeling a library website redesign process: Developing a user-centered website through usability testing. *Information Technology & Libraries* 32(1):6–22.

Blatter, J.K. 2008. Case study. In Lisa Given, ed. *The SAGE Encyclopedia of Qualitative Research Methods*. Thousand Oaks: SAGE Publications, Inc. [Online] Available at: http://methods.sagepub.com/reference/sage-encyc-qualitative-research-methods [Accessed 13 August 2016].

Brinck, T., Gergle, D. & Wood, S.D. 2001. *Designing websites that work: Usability for the Web*. 1st ed. San Francisco: Morgan Kaufmann. [Online] Available at: http://proquestcombo.safaribooksonline.com/book/web-design-and-development/9781558606586 [Accessed 16 April 2016].

Burmester, M. & Machate, J. 2003. Creative design of interactive products and use of usability guidelines – a contradiction? In *Proceedings of HCI International*. 10th International Conference on Human - Computer Interaction. Crete: Lawrence Erlbaum Associates:43–47. [Online] Available at: http://hcibib.org/HCII03-1.

Chase, D., Trapasso, E. & Tolliver, R. 2016. The perfect storm: Examining user experience and conducting a usability test to investigate a disruptive academic library web site redevelopment. *Journal of Web Librarianship* 10(1):28–44.

Chisman, J., Walbridge, S. & Diller, K. 1999. Usability testing: A case study. *College & Research Libraries* 60(6):552–69.

Danino, N. 2001. Heuristic evaluation - a step by step guide article. *SitePoint*. [Online] Available at: https://www.sitepoint.com/heuristic-evaluation-guide/ [Accessed 17 October 2016].

Dix, A., Finlay, J., Abowd, G.D. & Beale, R. 2004. *Human-Computer Interaction*. 3rd ed. Harlow: Pearson.

Dominguez, G., Hammill, S.J. & Brillat, A.I. 2015. Toward a usable academic library web site: a case study of tried and tested usability practices. *Journal of Web Librarianship* 9(2–3):99–120.

Dougan, K. & Fulton, C. 2009. Side by side: What a comparative usability study told us about a web site redesign. *Journal of Web Librarianship* 3(3):217–237.

Duckett, J. 2011. *HTML & CSS: Design and Build Websites*. 1st ed. Indianapolis: Wiley. [Online] Available at: http://catdir.loc.gov/catdir/enhancements/fy1306/2011932082-t.html [Accessed 19 September 2016].

Duncan, J. & Holliday, W. 2008. The role of information architecture in designing a third-generation library web site. *College & Research Libraries* 69(4):301–318.

Emde, J.Z., Morris, S.E. & Claassen-Wilson, M. 2009. Testing an academic library website for usability with faculty and graduate students. *Evidence Based Library and Information Practice* 4(4):24–36.

Fernando, D. 2014. 15 Title tag optimization guidelines for usability and SEO. *Woorank*. [Online] Available at: https://www.woorank.com/en/blog/15-title-tag-optimization-guidelines-for-usability-and-seo [Accessed 9 October 2016].

Flick, U. 2014. *An Introduction to Qualitative Research*. 5th ed. Los Angeles: SAGE Publications.

Garrett, J.J. 2011. *The Elements of User Experience: User-Centered Design for the Web and Beyond*. 2nd ed. Thousand Oaks: New Riders. [Online] Available at: http://proquestcombo.safaribooksonline.com/9780321688651 [Accessed 19 March 2015].

George, C.A. 2005. Usability testing and design of a library website: An iterative approach. *OCLC Systems & Services* 21(3):167–180.

Gorman, G.E., Clayton, P., Shep, S.J. & Clayton, A. 2005. *Qualitative Research for The Information Professional: A Practical Handbook*. 2nd ed. London: Facet. [Online] Available at: http://swbplus.bsz-bw.de/bsz114708150inh.htm [Accessed 4 October 2016].

Greenemeier, L. 2009. Remembering the day the World Wide Web was born. *Scientific American*. [Online] Available at: https://www.scientificamerican.com/article/day-the-web-was-born/ [Accessed 2 November 2016].

Gube, J. 2009. Breadcrumbs in web design: examples and best practices. *Smashing Magazine*. [Online] Available at: https://www.smashingmagazine.com/2009/03/breadcrumbs-in-web-design-examples-and-best-practices/ [Accessed 9 October 2016].

Gullikson, S., Blades, R., Bragdon, M., McKibbon, S., Sparling, M. & Toms, E.G. 1999. The impact of information architecture on academic web site usability. *The Electronic Library* 17(5):293–304.

Hasan, L. 2013. Heuristic evaluation of three Jordanian university websites. *Informatics in Education* 12(2):231–251.

Henry, S.L. 2012. WCAG overview. [Online] Available at: https://www.w3.org/WAI/intro/wcag.php [Accessed 13 October 2016].

Hollingsed, T. & Novick, D.G. 2007. Usability inspection methods after 15 years of research and practice. In *Proceedings of the 25th annual ACM international conference on Design of communication*. ACM:249–255. [Online] Available at: http://dl.acm.org/citation.cfm?id=1297200 [Accessed 12 January 2015].

Information Architecture Institute 2013. What is IA? [Online] Available at: http://iainstitute.org/en/learn/resources/what_is_ia.php [Accessed 4 May 2014].

Iqbal, M. & Warraich, N.F. 2012. Usability evaluation of an academic library website: A case of the University of the Punjab. *Pakistan Journal of Library & Information Science*. [Online] Available at: http://pu.edu.pk/images/journal/pjlis/pdf/pjlis-13-iqbal.pdf [Accessed 17 February 2015].

ISO 9241-11 1998. Ergonomic requirements for office work with visual display terminals (VDTs) -- Part 11: Guidance on usability. [Online] Available at: https://www.iso.org/obp/ui/#iso:std:iso:9241:-11:ed-1:v1:en [Accessed 3 October 2014].

ISO 9241-110 2006. Ergonomics of human-system interaction -- Part 110: Dialogue principles. [Online] Available at: https://www.iso.org/obp/ui/#iso:std:iso:9241:-110:ed-1:v1:en [Accessed 8 October 2015].

Jasek, C. 2004. How to design library web sites to maximize usability. [Online] Available at: http://digital.csic.es/bitstream/10261/2926/1/howtodesign[1].pdf [Accessed 25 August 2014].

Joo, S. 2010. How are usability elements-efficiency, effectiveness, and satisfaction-correlated with each other in the context of digital libraries? *Proceedings of the American Society for Information Science and Technology* 47(1):1–2.

Joo, S., Lin, S. & Lu, K. 2011. A usability evaluation model for academic library websites: Efficiency, effectiveness and learnability. *Journal of Library and Information Studies* 9(2):11–26.

King, H.J. & Jannik, C.M. 2005. Redesigning for usability: Information architecture and usability testing for Georgia Tech Library's website. *OCLC Systems & Services* 21(3):235–243.

Kitalong, K.S., Hoeppner, A. & Scharf, M. 2008. Making sense of an academic library web site: toward a more usable interface for university researchers. *Journal of Web Librarianship* 2(2–3):177–204.

Krug, S. 2014. *Don't Make Me Think, Revisited a Common Sense Approach To Web Usability*. 3rd ed. Berkeley: New Riders. [Online] Available at: http://proquestcombo.safaribooksonline.com/book/web-design-and-development/9780133597271/firstchapter [Accessed 17 March 2015].

Lazar, J., Feng, J.H. & Hochheiser, H. 2010. *Research Methods in Human-Computer Interaction*. 1st ed. Chichester: John Wiley & Sons. [Online] Available at: http://books.google.co.za/books?hl=en&lr=&id=H_r6prUFpc4C&oi=fnd&pg=PT17&ots=xYZ9Hk9eIH&sig=2oA_F4qnTxmZwXZ6HXXVNoTp7uM [Accessed 28 August 2014].

Leedy, P.D. & Ormrod, J.E. 2014. *Practical Research: Planning and Design*. 10th ed. Harlow: Pearson Education.

lipsum.com n.d. *Lorem Ipsum - All the facts*. [Online] Available at: http://www.lipsum.com/ [Accessed 22 July 2016].

Lynch, P.J. & Horton, S. 2009. *Web Style Guide: Basic Design Principles for Creating Web Sites*. 3rd ed. London: Yale University Press. [Online] Available at: http://webstyleguide.com/wsg3/3-information-architecture/index.html [Accessed 23 March 2015].

Macefield, R. 2012. The Monty Python guide to user experience design. [Online] Available at: http://www.userfocus.co.uk/articles/python_guide_to_ux.html [Accessed 24 January 2017].

Macefield, R. 2014. An overview of expert heuristic evaluations. *UX matters*. [Online] Available at: http://www.uxmatters.com/mt/archives/2014/06/an-overview-of-expert-heuristic-evaluations.php [Accessed 4 May 2016].

Machi, L.A. & McEvoy, B.T. 2012. *The Literature Review: Six Steps to Success*. 2nd ed. Thousand Oaks: Corwin Press.

MacMillan, D., McKee, S. & Sadler, S. 2007. Getting everyone on the same page: A staff focus group study for library web site redesign. *Reference Services Review* 35(3):425–433.

Manzari, L. & Trinidad-Christensen, J. 2006. User-centered design of a web site for library and information science students: Heuristic evaluation and usability testing. *Information Technology & Libraries* 25(3):163–169.

Mifsud, J. 2011. 15 Title tag optimization guidelines for usability and SEO. *Usability Geek*. [Online] Available at: http://usabilitygeek.com/15-title-tag-optimization-guidelines-for-usability-and-seo/ [Accessed 9 October 2016].

Mouton, J. 2001. *How to Succeed In Your Master's and Doctoral Studies: A South African Guide and Resource Book*. 1st ed. Pretoria: Van Schaik.

Mustafa, S.H. & Al-Zoua'bi, L.F.S. 2008. Usability of the academic websites of Jordan's universities: An evaluation study. *Yarmouk University, Faculty of Information Technology*. [Online] Available at: http://www.academia.edu/197079/Usability_of_the_Academic_Websites_of_Jordans_Universities_An_Evaluation_Study [Accessed 22 April 2014].

Mvungi, S.H., de Jager, K. & Underwood, P.G. 2008. An evaluation of the information architecture of the UCT Library web site. *South African Journal of Libraries & Information Science* 74(2):171–182.

Nielsen, J. 1994a. Enhancing the explanatory power of usability heuristics. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. CHI '94. SIGCHI Conference on Human Factors in Computing Systems. New York: ACM:152–158. [Online] Available at: http://dl.acm.org/citation.cfm?id=191729&CFID=827627267&CFTOKEN=95213811 [Accessed 14 June 2015].

Nielsen, J. 1994b. Heuristic evaluation. In *Usability Inspection Methods*. New York: John Wiley & Sons:25–62.

Nielsen, J. 1995a. 10 Usability heuristics for user interface design. *Nielsen Norman Group: Evidence-Based User Experience Research, Training, and Consulting*. [Online] Available at: https://www.nngroup.com/articles/ten-usability-heuristics/ [Accessed 12 January 2015].

Nielsen, J. 1995b. How to conduct a heuristic evaluation. *Nielsen Norman Group*. [Online] Available at: https://www.nngroup.com/articles/how-to-conduct-a-heuristic-evaluation/ [Accessed 1 October 2016].

Nielsen, J. 1995c. Usability problems found by heuristic evaluation. *Nielsen Norman Group*. [Online] Available at: https://www.nngroup.com/articles/usability-problems-found-by-heuristic-evaluation/ [Accessed 22 January 2017].

Nielsen, J. 1999. *Designing Web Usability*. Indianapolis: New Riders.

Nielsen, J. 2011. Top 10 mistakes in web design. *Nielsen Norman Group*. [Online] Available at: https://www.nngroup.com/articles/top-10-mistakes-web-design/ [Accessed 25 February 2017].

Nielsen, J. 2012. Usability 101: Introduction to usability. *Nielsen Norman Group*. [Online] Available at: http://www.nngroup.com/articles/usability-101-introduction-to-usability/ [Accessed 1 August 2014].

Nielsen, J. 2013. Converting search into navigation. *Nielsen Norman Group*. [Online] Available at: https://www.nngroup.com/articles/search-navigation/ [Accessed 13 October 2016].

Nielsen, J. 2016. Using the title attribute to help users predict where they are going. *Nielsen Norman Group*. [Online] Available at: https://www.nngroup.com/articles/title-attribute/ [Accessed 24 February 2017].

Nielsen, J. & Mack, R.L. 1994. *Usability Inspection Methods*. New York: John Wiley & Sons.

Oldham, B.W. 2008. Focus groups and usability testing in redesigning an academic library's web site. *Journal of Web Librarianship* 2(2–3):219–246.

Pant, A. 2015. Usability evaluation of an academic library website: Experience with the Central Science Library, University of Delhi. *The Electronic Library* 33(5):896–915.

Patton, M.Q. 2014. *Qualitative Research & Evaluation Methods: Integrating Theory and Practice*. 4th ed. Thousand Oaks: SAGE Publications.

Petrie, H. & Bevan, N. 2009. The evaluation of accessibility, usability, and user experience. In *The Universal Access Handbook*. Human Factors and Ergonomics. CRC Press:1–16. [Online] Available at: http://www.crcnetbase.com/doi/abs/10.1201/9781420064995-c20 [Accessed 7 March 2017].

Pickard, A.J. 2013. *Research Methods in Information*. 2nd ed. Chicago: Facet Publishing. [Online] Available at: http://cds.cern.ch/record/1513638 [Accessed 12 September 2014].

Preece, J., Rogers, Y. & Sharp, H. 2015. *Interaction Design: Beyond Human-Computer Interaction*. 4th ed. Chichester: John Wiley & Sons Ltd.

QS Intelligence Unit 2016. QS Intelligence Unit. [Online] Available at: http://www.iu.qs.com/university-rankings/ [Accessed 15 May 2016].

Quacquarelli Symonds 2016a. QS University Rankings: BRICS 2016. *Top Universities*. [Online] Available at: http://www.topuniversities.com/university-rankings/brics-rankings/2016 [Accessed 9 September 2016].

Quacquarelli Symonds 2016b. QS World University Rankings 2016. *Top Universities*. [Online] Available at: http://www.topuniversities.com/university-rankings/world-university-rankings/2016 [Accessed 9 September 2016].

Race, R. 2008. Literature review. In Lisa Given, ed. *The SAGE Encyclopedia of Qualitative Research Methods*. Thousand Oaks: SAGE Publications, Inc. [Online] Available at: http://methods.sagepub.com/reference/sage-encyc-qualitative-research-methods [Accessed 13 August 2016].

Rogers, R. & Preston, H. 2009. Usability analysis for redesign of a Caribbean academic library web site: A case study. *OCLC Systems and Services* 25(3):200–211.

Rosenfeld, L., Morville, P. & Arango, J. 2015. *Information Architecture: For the Web and Beyond*. 4th ed. Sebastopol: O'Reilly Media. [Online] Available at: http://proquestcombo.safaribooksonline.com/book/web-development/9781491913529 [Accessed 8 June 2016].

Rubin, J., Chisnell, D. & Spool, J. 2008. *Handbook of Usability Testing: How to Plan, Design, and Conduct Effective Tests*. 2nd ed. Indianapolis: John Wiley & Sons. [Online] Available at:

http://proquestcombo.safaribooksonline.com/book/software-engineering-and-development/software-testing/9780470185483 [Accessed 1 April 2017].

Sherwin, K. 2016. University websites: Top 10 design guidelines. *NNGroup*. [Online] Available at: https://www.nngroup.com/articles/university-sites/ [Accessed 22 February 2017].

Shneiderman, B. 1986. *Designing the User Interface: Strategies for Effective Human-computer Interaction*. 1st ed. Boston: Addison-Wesley Longman.

Shneiderman, B., Plaisant, C., Cohen, M., Jacobs, S., Elmqvist, N. & Diakopoulos, N. 2016. *Designing the User Interface: Strategies for Effective Human-Computer Interaction*. 6th ed. Boston: Pearson.

Shukla, A. & Tripathi, A. 2010. Establishing content awareness evaluation criteria for library websites: A case study of Indian academic library websites. *Annals of Library and Information studies* 57(4):403–416.

Stake, R. 2003. Case studies. In N. K. Denzin & Y. S. Lincoln, eds. *Strategies of Qualitative Inquiry*. London: Sage:134–164.

Stewart, T. & Travis, D. 2003. Guidelines, standards, and style guides. In J. A. Jacko & A. Sears, eds. *The human-computer interaction handbook*. London: Lawrence Erlbaum Associates:991–1005.

Swanson, T.A. & Green, J. 2011. Why we are not Google: Lessons from a library web site usability study. *Journal of Academic Librarianship* 37(3):222–229.

TecEd 2016. Heuristic evaluation. [Online] Available at: http://teced.com/services/usability-testing-and-evaluation/heuristic-evaluation/ [Accessed 1 October 2016].

Tidal, J. 2012. Creating a user-centered library homepage: A case study. *OCLC Systems & Services* 28(2):90–100.

Tognazzini, B. 2014. First principles of interaction design (revised & expanded). *askTog*. [Online] Available at: http://asktog.com/atc/principles-of-interaction-design/ [Accessed 15 June 2015].

Toub, S. 2000. *Evaluating information architecture*. Ann Arbor: Argus Associates. [Online] Available at: http://argus-acia.com/white_papers/evaluating_ia.pdf [Accessed 17 February 2015].

Travis, D. 2012. *Bluffers' Guide to ISO 9241*. 8th ed. [Online] Available at: http://www.userfocus.co.uk/resources/iso9241/part110.html.

Turnbow, D., Kasianovitz, K., Snyder, L., Gilbert, D. & Yamamoto, D. 2005. Usability testing for web redesign: A UCLA case study. *OCLC Systems & Services* 21(3):226–234.

Usability.gov 2013. Visual design basics. [Online] Available at: http://www.usability.gov/what-and-why/visual-design.html [Accessed 27 January 2015].

VandeCreek, L.M. 2005. Usability analysis of Northern Illinois University Libraries' website: A case study. *OCLC Systems & Services: International digital library perspectives* 21(3):181–192.

Ward, J.L. 2006. Web site redesign: The University of Washington Libraries' experience. *OCLC Systems and Services* 22(3):207–216.

Wodtke, C. & Govella, A. 2009. *Information Architecture: Blueprints for the Web*. 2nd ed. Berkeley: New Riders. [Online] Available at: http://proquestcombo.safaribooksonline.com/9780321591999 [Accessed 23 March 2015].

Wu, J. & Brown, J.F. 2016. Website redesign: A case study. *Medical Reference Services Quarterly* 35(2):158–174.

Yin, R.K. 2013. *Case Study Research: Design and Methods*. 5th ed. Los Angeles: SAGE Publications.

Zahran, D.I., Al-Nuaim, H.A., Rutter, M.J. & Benyon, D. 2014. A comparative approach to web evaluation and website evaluation methods. *International Journal of Public Information Systems* 10(1). [Online] Available at: http://www.ijpis.net/ojs/index.php/IJPIS/article/view/126 [Accessed 2 November 2016].

Appendix A

An evaluation framework for the procedures to be undertaken by heuristic evaluators who are to evaluate the usability of the IA of academic library websites.

Step 1: Identify project participants

The first step involves identifying all of the participants that will take part in the evaluation process. Firstly, the researcher (i.e., the project manager) and evaluators must be identified. The project manager oversees the project while the evaluators perform the heuristic evaluations according to the instructions provided by the researcher. The researcher can also be one of the evaluators or the sole evaluator. More evaluators will result in a greater variety of problems discovered; however, according to Nielsen (1995b), three to five evaluators is optimal.

The evaluators are not required to be usability experts or information architects. In the context of academic library websites, the team of evaluators can include librarians. Librarians need to be aware of usability studies so that they can collaborate with information architects in library website design and redesign projects. The collaboration between librarians and information architects is a key factor in the success of the academic library websites.

Step 2: Identify dialogue elements

The researcher is to identify the dialogue elements that will be evaluated so that the evaluators evaluate the same dialogue elements. The IA framework presented in Section 6.3.2 can be used for this purpose. There needs to be consensus between the evaluators with regards to what dialogue elements are to be inspected, in order to gain comparable evaluation reports.

An academic library website can consist of the following dialogue elements, based on IA theory, as discussed in the Methodology chapter (Chapter 3) in Section 3.3.3.2:

Global navigation structures

1. Dialogue element 1: Header and footer
2. Dialogue element 2: Main navigation bar

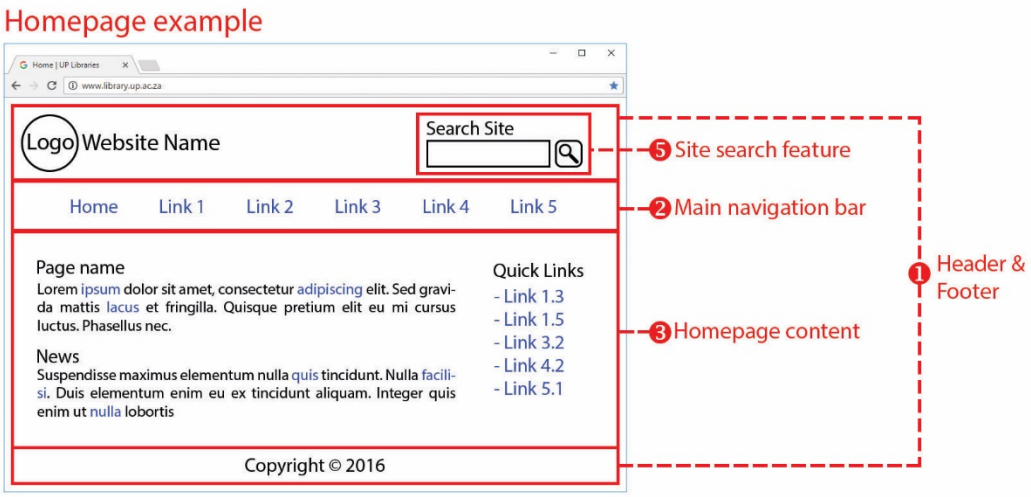
Local navigation structures

3. Dialogue element 3: Homepage content
4. Dialogue element 4: Internal page content

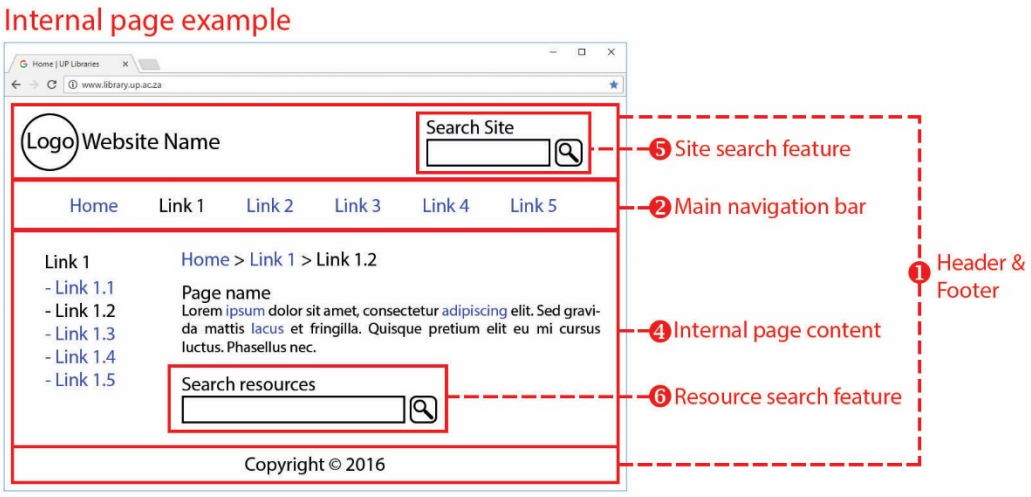
Search systems

5. Dialogue element 5: Site search feature
6. Dialogue element 6: Resource search feature

These dialogue elements are represented in Figure 1 and Figure 2, with numbers that correspond to the numbers in the list. These images are repeated from Section 3.3.3.2 and Section 6.3.2 for ease of reference.



Appendix A - Figure 1: Example of dialogue elements that can be found on an academic library website homepage



Appendix A - Figure 2: Example of dialogue elements that can be found on an academic library website internal page

Step 3: Commence the first pass through the system

Each evaluator is to evaluate the system independently. The heuristic evaluation comprises two passes through the system.

The first pass is when the evaluators familiarise themselves with the system and the various dialogue elements that they are to evaluate.

Step 4: Evaluate each of the dialogue elements independently

The evaluators are to perform a complete heuristic evaluation using the heuristics presented in Section 6.2.1.6 for each of the dialogue elements identified in step 2. Therefore, the evaluators are to start with the first dialogue element, e.g., header and footer, and compare it to the full set of criteria and sub-criteria, before moving on to the next dialogue element.

Throughout the evaluation, the evaluators should note down all the problems and possible recommendations for improvement, and present this in the form of an evaluation report.

The following set of heuristics was compiled and revised in this study to evaluate the usability of the IA of academic library websites. This list is repeated from Section 2.2.3 and Section 6.2.1.6 with the addition of the new sub-criteria that were discussed in Section 4.4.

1. Labelling

- The system uses comprehensible terminology and concepts that the intended user is familiar with (based on the user's existing knowledge).
- The system avoids using system-oriented terms but the terms are familiar within the context of the task.
- Terminology in labels corresponds to the content it represents.
- The page title contains information about the current page and the website, separated by a pipe (|).
- Recommendations:
    - The use of library jargon that is specific to the library should be avoided (for example, the name of the library's catalogue).
    - Common everyday language that users are likely to be familiar with, should be used where possible and additional explanations should be provided in the form of tooltips where necessary, according to the "Novice user guidance" heuristic.
    - The language used in labels should be clear, concise, comprehensible, and meaningful.
    - Terms that are ambiguous, vague, redundant, or misleading should be avoided.
    - Long labels should start with an identifying keyword.
    - Different labels that overlap in meaning should be renamed to be more distinguishable.

2. Organisation

- Information appears in a natural and logical order.
- Information is grouped and classified logically.

- Documents or categories that are grouped together fit well with each other.
- The degree of overlap between categories is low.
- Child content objects represent parent content objects.
- Recommendations:
    - The system should be organised to reflect the way users look for information.
        - Important links should appear in noticeable locations or main sections.
        - Important information should be accessible from the homepage.
        - A link to the homepage should be easy to find and listed first if it is in a list of links.
        - Help links should be prominent and easily accessible.
    - The website should use clear organisation and categorisation.
        - A small number of main navigational categories should subdivide information into logical sections.
        - Multiple pathways to general content areas should be provided.
        - Content should be structured and grouped correctly.
        - Content should be sorted according to possible user goals.
    - The layout and navigation should be simple.
        - The website should be easy to navigate.
        - The layout structure should be intuitive.

3. Clutter

- The system does not provide the user with irrelevant information or information that is not needed for the successful completion of tasks.
- There is nothing that takes the user's attention away from important information.
- Links in main navigation bars are limited to eight links.
- Recommendations:
    - All pages should have simple layouts and should be clutter free.
    - Pages should not contain too many links.
    - Links should not contain too many words.
    - Duplication of information on a page should be eliminated.
    - Non-essential information should not appear in multiple locations on a page.
    - There should be a good balance between breadth and depth.
    - Pages should not be too long, requiring users to scroll too much.
    - The system should not make a user feel lost.

4. Novice user guidance

- Additional explanations, rules, and underlying concepts that assist the user in gaining a conceptual understanding of the interactive system are provided.

- Guidance and support are provided to help the user learn how to use the system.
- Recommendations:
    - Descriptions for unfamiliar terms should be provided for clarification.
    - Additional explanations should be provided for basic library terms (instead of changing the labels).
    - Tooltips should be used to reveal additional explanations for terms or the target destination of links.
    - New users should be provided with clear navigational choices that guide them to the right resources.
    - Information about expected search results as well of the scope of a search box should be provided so that users will know what search boxes to use.
    - Primary search tools should be emphasised.
    - Search results should be annotated automatically to help users distinguish between the different types of results.
    - Novice users should be provided with web forms that allow them to communicate with library staff.
    - Users should be able to differentiate between different resources.

5. Help documentation

- Help documentation is provided.
- Help documentation can be located easily when the need arises.
- Help documentation is searchable.
- Help documentation is easy to use.
- Help documentation does not contain too much information.
- Recommendations:
    - Help documentation provides help and instructions on using library resources and services.
    - Instructional help should be provided on how to search for other libraries' resources.
    - Tutorials should be accessible from a "Help" link.
    - A sitemap should be included as a supplemental navigation system.

6. Efficiency features

- Shortcuts are available that enable users to speed up the interaction with less frequent actions.
- Frequent actions are customisable.
- The user can modify their interaction with and the presentation of information.

- Recommendations:
    - A site search feature should be provided for users who prefer not to navigate through browsing.
    - Search tools should support the ways users search for information, i.e., if they prefer to search for journal articles directly, the system should allow it.

7. Consistency

- Situations that are similar should require similar sequences of actions.
- The same conventions (for example, terminology, and layout) should be followed throughout the interface.
- The system should behave consistently within tasks and across similar tasks.
- Recommendations:
    - The website should have a consistent global navigation structure.
    - There should be consistency in the placement and labelling of navigational elements.
    - The order of links should stay the same on every page.
    - Terminology should be consistent throughout the website.
    - The search box should stay in the same location on each of the webpages.

8. Predictable behaviour

- The system makes the user feel as if they are in control at all times.
- The system responds how the user expects it to respond.
- The system does not change familiar behaviour.
- The system uses commonly accepted conventions from related systems.
- Formats follow appropriate cultural and linguistic conventions.
- Recommendations:
    - Users should know how search boxes will behave before they use them.
    - Search boxes should not cause confusion.
    - Search boxes should make use of web searching conventions.
    - Information that users expect to find on an academic library website, such as the library's address, telephone number, and library calendar, should be provided.
    - Intuitive icons should be used.

9. Context

- The system informs the user of where they are in a dialogue.
- Users always know what they can do next.
- In a dialogue that consists of a range of steps/sub-pages, users' progress is indicated, i.e., they know where they are, and how many steps they are away from the end.

- A user's context within the web and the website is indicated.
- Recommendations:
    - Breadcrumb trails should be provided to assist users with navigation and context.
    - Labels should be grouped under subcategories if main categories are too broad.

10. Task completion support

- Simple tasks require simple interactions.
- All objects, actions, and options are visible.
- All the information that a user needs to perform a task is visible.
- The system does not require a user to remember information from one screen to use it on a different screen.
- The system helps the user to complete the task effectively and efficiently.
- The technology used to perform the task does not distract the user.
- The system does not require a user to re-enter information that was entered previously.
- The system provides default values where applicable, for example, where typical input values are required.
- Recommendation:
    - The authentication system should be simplified with a single sign-on feature so that users are not required to use a different password to access different parts of the same system.

11. Controllability

- The system provides the user with a simple and efficient way to go back to where they came from if they landed in an unwanted situation.
- Users have control over the sequence of their interaction with the system.
- Recommendation:
    - The website should provide functionality that allows a user to go back to previous pages, such as an interactive breadcrumb trail.
    - External links and search results should open in a new tab.

12. Error recovery

- The system can detect if a user has made an error.
- The system clearly indicates what the problem is when the user encounters one.
- The system uses plain language to communicate what the problem is.
- The system provides clear instructions to a simple solution.
- Users are still able to complete their task after recovery.

- The system validates input before processing it.
- The system can correct some errors automatically, informs the user of the correction, and provides the user with an opportunity to override the correction.
- Recommendation:
    - A search system should make users aware if it has corrected misspelt search terms.

13. Error prevention

- The system eliminates conditions where users are likely to make errors.
- The system asks for confirmation before taking serious actions.
- The system warns the user about what might happen when certain actions are taken.
- The system prevents users from clicking on inappropriate links (i.e., inappropriate links are disabled).
- Recommendation:
    - A visual cue should be provided next to external links to warn users that they will navigate away from the website.

14. Feedback

- The system provides feedback for every user action.
- The system provides informative feedback.
- The system provides appropriate feedback (i.e., ranging from modest to substantial, depending on the severity of action taken by the user).
- The system provides feedback within a reasonable period of time when users expect it.
- The system provides status information and shows that input has been received.

Step 5: Writing the reports

The format and structure of the evaluators' reports are to be decided by the researcher conducting the research. Each evaluator is to use the same format as this will facilitate the comparison of reports.

It is recommended that comments are made for each of the heuristics, even if there are no problems, to state this observation.

Both problems that have a negative effect on the dialogue element itself and the effect that it has on the overall usability of the site should be noted.

If all of the dialogue elements do not exist in the website, this is to be included in the evaluation report, as missing dialogue elements has a great negative effect on the usability of an academic library website.

The evaluators should not feel limited by the set of heuristics and sub-criteria. If a problem is found that cannot easily be categorised into any of the heuristics, it is to be reported as an uncategorised problem.

Step 6: Consolidation of the reports

Finally, after the independent evaluations have been completed by the heuristic evaluators, the researcher is to compare the reports in order to create a single report that encapsulates the findings from all of the evaluators.