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**Department of Computer and Information Sciences**



# **Social interfaces to digital libraries**

**By**

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# Abstract

This thesis describes the design, development, and evaluation of a social digital library to support users in finding information from a user-based point of view. This particular research project has been motivated by the fact that there has been very little research on the social features in digital library interfaces.

This research aims to design a novel digital library interface by applying the concepts of social features to digital libraries. Also, the thesis investigates whether the functionalities in the social digital library help participants to accomplish different task types with minimum effort. Social features here refers to clustering users' interacting in a virtual community along with social information such as reviews, the number of recommendations and items/ viewed items by other people.

In order to gain an insight into the social features that are useful for users to complete search tasks, I began with the development of The Victorian Times Digital Library by using PHP & MySQL. Initial design interfaces were tested by usability tests in order to overcome usability problems. Based on participants' feedback, the chosen features were presented in the social digital library and represented in different screens. These interfaces were then evaluated by several usability tests using an iterative design approach. Also during an iterative phase of design, the interfaces were revised based on Information Foraging Theory in order to increase strong information scent. The final version of the social digital library was then evaluated against a conventional interface in an effectiveness test.

I performed an experimental study to examine the use of features in digital libraries to perform the tasks. A total of twenty four participants were recruited to perform various

tasks on both interfaces and to rate their preferences. The outcomes of the effectiveness test were positive, with half of participants (12 out of 24) preferring the social interface and the rest of participants preferring the traditional one. Also, the results showed that the social digital library was able to help participants to accomplish different types of task with minimum time and effort. This was considered as a good result given the quality feedback from the participants. Also, some of findings emphasized the importance of social activities and look and feel over a set of social features.

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# Chapter 1

## Introduction

### 1.1 Background and motivation

The World Wide Web (WWW) and advances in digitized technology have rapidly increased the amount of accessible information. Users may have difficulty in dealing with the amount of information and feel overwhelmed in trying to discover the desired information. Since users' time is limited, it is impossible for users to read and examine every document to decide whether it is relevant to their needs. Sometimes a user is incapable of identifying exact words or phrases to find relevant information or users may not explicitly state their needs in queries, especially when the user does not have sufficient knowledge about the subject matter (Myaeng and Korfhage 1990). A lack of adequate knowledge to perform the task can cause "an anomalous state of knowledge" (Belkin et al. 1982, p. 62). Asking for assistance from other people or facilitating tools for communication or cooperating with other individuals could be helpful for resolving their anomalous state of knowledge (Pomerantz 2006, Herget et al. 2007, Loh et al. 2004). For example, people are interested in watching movies and they probably would like to know more about what movies are interesting or popular now. Another example in daily life is that people would like to buy a heater online and they may not be sure in selecting which heater is the best suit for their needs. They might need more suggestions or help from other people who have experience using the product. Like in a traditional

library, even if Online Public Access Catalogue (OPAC) provides searching and browsing functions for users to find books, sometimes they would like to ask librarian for advice or ask colleagues or lecturers for good books worth reading. In case of finding information in digital libraries, users may need to have guidance of other people as well. Providing search and browsing information in digital libraries are not enough for completing complicated tasks. The digital libraries should take into account communication and collaboration facilities to support users for task accomplishment (Hansen et al. 2007).

Following Ackerman (1994), social interaction is essential in providing mechanisms for seeking information. The existing user interfaces of digital libraries require social tools to support interaction and social exchange between users and allow them to capture, structure and share knowledge (Smeaton and Callan 2005). I believe that social features and social information can be useful and reduces users' effort to find relevant information to their tasks. Furthermore, users would like to have more enjoyable and social features to support them (Kani-Zabihi et al. 2006). Most digital libraries focus on developing systems to support finding information as a solitary user, for example, Alexandria Digital Library Project (<http://www.alexandria.ucsb.edu/>), PERSEUS Digital Library (<http://www.perseus.tufts.edu/hopper/>), Missouri Digital Heritage (<http://www.sos.mo.gov/mdh/>) etc.

The advent of Web 2.0 technologies makes it possible to offer social facilities for supporting information seeking activities. Web 2.0 technologies allow people to interact with each other. It provides collaborative approaches with opportunities to create, exchange knowledge and experiences, known as “user-generated content” using Web 2.0 services such as blogs, wikis, social annotations, RSS feeds etc. (Chakraborty 2010). The Web 2.0 technologies can incorporate to traditional libraries through Library 2.0 for encouraging library users to cooperative with others (Maness 2006). It also offer individuals the opportunity to communicate and contribute their knowledge for enabling

social interaction in digital libraries via Web 2.0 services such as Rich User Interactions, Blogs, Wikis, Really Simple Syndication (RSS) feeds, Multimedia Sharing, Social Networking, Bookmarking and Tagging (Sastry and Reddy 2010). Searchers can have advantage of social interactions to enhance information searching (Evans and Chi 2008).

With respect to the benefits of social approaches, I decided to focus my work on digital library user interfaces for supporting access and knowledge creation among individuals rather than isolation from each other. I believe that providing the social tools in digital libraries seems to be a good way that is useful for users to accomplish the task types with minimum effort. Consequently I integrated social features which allow users to comment, share ideas and to use search results from past users who have similar interests in a virtual community. The hope is that the social digital library could be effective for assisting users for different work tasks rather than a conventional digital library.

In the past ten years, there have been some previous researches attempt to integrate social features into digital libraries such as sharing bookmarks of favourites lists (i.e., Puspitasari et al. 2007), providing personalized and recommendations (i.e., Avancini et al. 2007), social semantic digital library (i.e., Kruk et al. 2007). Related works on social features in digital libraries is described in Chapter 2. However, most of these previous digital libraries have focused primarily on evaluating system performance, rather than user-based evaluation (i.e., evaluation of algorithm to carry out tasks such as search effective algorithms, for example, Kruk et al. 2005). There has been very little study in evaluating the use of social features in digital libraries, particularly on user interaction in different work tasks from a user perspective. More research is needed about how social features in digital libraries may support various types of tasks. Additionally, a major challenge of developing the social digital library is “what would the social digital library look like?” and “how to design the interface which ensures the user experience is

efficient, easy and enjoyable?” The study here aims to design a novel social digital library and evaluate the use of social features for assisting users to achieve the tasks.

## **1.2 Background of research collection**

Victorian Times was funded by the New Opportunities Fund (NOF) for the digitized historical material of politics, economy and society. This project was run and by the Centre for Digital Library Research (CDLR), University of Strathclyde; The Library of the London School of Economics; the Stationery Office, LTD; and Tim Coates (affiliated to the Stationery Office). The first funding period carried out for two years starting from December 2001. At present the Victorian Times Digital Library still provides free services focusing on lifelong learning for various users that are students, teachers, researchers and individuals interested in history.

The parliamentary papers include bills, Select Committee Proceedings, Royal Committee proceedings and Royal Commission reports which were gathered for a prime source and digitized by Macromedia Ltd and BOPCRIS project. The London School of Economics’ pamphlet collection, the second main source, was scanned by this school and CDLR. Most documents were written by experienced people who would like to discuss specific subjects. Some were written by people who worked in politics and government.

Victorian historical photographs and texts were chosen and categorized on a variety of different Library of Congress Subject Headings (LCSH) terms by a subject specialist. The Victorian Times Digital Library comprises of about 345 photographs and 780 text documents, covering six key areas of social development: ('Victorian Times')

“

- Health (Progress in understanding health and disease);



- Education (The beginnings of a national system);
- Housing (Improvements in housing in towns and countryside);
- Transport (The development of the railways);
- Work and Industry (Changing work conditions for adults and children);and
- Trade Unions (The start of organised labour)”<sup>1</sup>.

### **1.3 Research scope**

This thesis seeks to apply the concept of social interaction incorporated into a digital library in order to see whether it supports users on their search tasks.

Three main issues are studied within the thesis:

First of all, I study what additional functionalities are helpful and assist participants to find information. Secondly, the redesigned Victorian Times Interface was evaluated as an iterative design process by usability tests. Multiple interfaces were designed according to the concept of Information Foraging Theory. Also, these interfaces were conducted in order to examine which the social interface is the best. Finally, I study how the social Victorian Times Interface supports participants in different work tasks.

The scope of this research is how to design user interface digital library by integrating the concept of social information or social features which support users to accomplish the tasks, especially background information, decision making and fact finding tasks. The proposed solution implemented in this thesis is not concentrated on system-based ideas. This research focuses on evaluating the social digital library interface in dealing with how well user interaction with the system and how the users use the features available in the social digital library to complete different tasks. This thesis does not focus on evaluating system performance. Therefore, the technical solutions concerning

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<sup>1</sup> <http://victoria.cdli.strath.ac.uk/about.php>. Accessed date 4 March 2011.

system-based are excluded in this study. The research aims, research questions and hypotheses are described in the following section.

## **1.4 Research Aims, Research Questions and Hypotheses**

### **1.4.1 Research Aims**

The purpose of this study was to evaluate a redesigned Victorian Times Digital Library from a user perspective. The research aims for this study are:

- To develop new interfaces to the Victorian Times Digital Library.
- To evaluate the Victorian Times interfaces covering the user-system interaction in terms of efficiency, effectiveness, helpfulness, ease of learning, ease of use and to examine participant satisfaction of overall the systems;
- To evaluate the usefulness of basic and advanced features together with the social features to support users seeking information in the systems.
- To evaluate how participants interact with the social digital library in order to investigate the use of features for supporting them to find information in different types of task and to provide valuable insight into how future the social digital library should be designed.

### **1.4.2 Research Questions and Research Hypotheses**

The primary goal of the evaluation study was to investigate participant interaction with the system and to assess participant satisfaction with the features afforded for completing the tasks. This leads to the following research aims, which are discussed in this thesis.

- 1) How the features are employed by participants to accomplish on task types.

- 2) How the social features and social information can help participants to accomplish the tasks.

The basic hypothesis is that the social digital libraries would support participants to accomplish the tasks. Based on the basic hypothesis, I formulate these more specific hypotheses and test them in the experimental test (Chapter 6):

- Social digital library interface supports participants to accomplish search tasks.
- Social features and social information reduces participants' effort to find relevant information to the tasks.
- Social features increase participant satisfaction with the social interface for the Victorian Times Digital Library.
- Overall, participants prefer the social interface rather than the traditional one.

I derive these hypotheses from the following assumptions. First, a well-designed social digital library based on the concept of Information Foraging Theory provides various features such as basic, advanced and social features to support participants in different tasks. Participants might perceive different scent carriers regarding to different task types. Second, social features and social information would assist participants to find relevant information with the least effort. Participants can save time and energy to explore useful information. Finally, participants would feel more satisfied with the social digital library and prefer to use it to explore information.

## **1.5 Overview of the Proposed Approach**

To reach the research aims, I integrated three key features for support users performing the tasks to the social digital library. First, the virtual community should provide popular topics and groups of people with similar interests. Furthermore, the social

interface should provide social features that allow users to create and share information or experiences such as reviews and item lists. The social information also should be visible to assist users to locate relevant information such as shared item lists, items viewed by past users, reviews and the number of recommendation.

Secondly, search and browse features are available as basic features could be found in a traditional digital library. Finally, the advanced features such as filtering information should offer to help users to access information quickly. This can be considered as a form of information enrichment in terms of Information Foraging Theory (Pirulli and Card 1999).

All of features can be used to help users to explore information in the Victorian Times Digital Library. Specially, social information could help users for making decisions when they feel uncertain (Dieberger et al. 2000). Users are more likely to investigate potentially useful items that was examined by people with same interests (Dourish and Chalmers 1994). The virtual community would allow users to explore popular topics or popular categories without having to go through all documents, therefore saving their time and effort as they can rely on the judgement of “The wisdom of crowds” (Surowiecki 2004) in order to find out which item is valuable to read or which item is recommended by most people.

In order to validate the usability and usefulness of the three features mentioned above, the interface was evaluated using the questionnaires, note-taking, think-aloud, video screen captures, and my observation and log files. The design and development of the social digital library employs on an iterative user interface design approach, using usability tests in order to eliminate the usability problems. Overall responses from the initial study participants confirmed the usefulness of social features. Qualitative feedbacks from participants were gathered in order to identify usability problems in the Victorian Times Digital Library interface. Chapter 4 discusses this study in detail. Following the iterative design, the interface was revised by applying the Information

Foraging Theory concept in order to increase high scent. I designed and developed four different representations of the social Victorian Times interface and tested with a set of usability tests to find out whether which interface is the best. Chapter 5 discusses this in detail.

The chosen interface needed to be tested in the experimental study in order to examine further whether the features in the social interface can assist participants in different work tasks: background information; decision making and fact finding tasks and how well the features support participants in a variety of tasks. Both of quantitative and qualitative provide some evidences to support the research hypotheses. The results showed that the social features and social information seemed to assist participants to accomplish different task types and to reduce participants' effort for finding relevant information to the tasks. The results are described in Chapter 6. Chapter 7 presents the discussion of the results of the experimental study. Also, implications for future design of the social digital library are presented in Chapter 8.

## **1.6 Outline of the thesis**

The remainder of this thesis is structured as follow.

The next chapter presents related work for my research, consisting of overview of Digital Libraries, theories of information seeking and foraging, features for supporting information seeking in Digital Libraries. For features, I discuss four functionalities: search and browsing; social information access features; the supplementary features; and personalization and recommendation. The chapter concludes with evaluation methods for digital libraries.

**Chapter 3** elaborates the research methods in order to evaluate the usability and usefulness of the Victorian Times Digital Library. Both quantitative and qualitative approaches for gathering data are described.

**Chapter 4** presents three features afforded in the Victorian Times Digital Library: the basic features; advanced features; and social features, as well as social information. This chapter discusses usability studies on an initial interface design based on an iterative user interface design approach, using research methods defined in **Chapter 3**.

Based on the participants' feedback and recommendation described in **Chapter 4**, the Victorian Times Digital Library interface was revised by applying the idea of Information Foraging Theory in order to increase high information scent. **Chapter 5** describes these revisions of the interface. Also, four different representations of the social Victorian Times interfaces were designed and tested with usability tests according to an iterative design process in order to remove the usability problems and find out whether which interface is the best. The findings from the usability studies are addressed.

Based on the results of an iterative design in **Chapter 5**, the chosen interface required to test in the experimental study in order to examine whether the features in the social interface can support participants in different work tasks. Therefore, I conducted the effectiveness test to investigate the use of the social digital library and the traditional one to accomplish different task types. The results are presented in **Chapter 6**.

**Chapter 7** discusses the results of the experimental study described in **Chapter 6**. This chapter presents the discussion of findings which consist of features support for different task types and participant behaviours to accomplish the tasks.

Finally, **Chapter 8** reflects on the entire research. First, an overview of this study is presented. The research questions are answered based on the findings of the study. This chapter concludes with some limitations of my research and implications for future design of the social digital library.

# Chapter 2

## Related works

### 2.1 Introduction

In order to reach the research goals and to solve the research problems described in Chapter 1, it is necessary to investigate the basic of digital libraries, information seeking behaviours, features for finding information in the digital library interface and evaluation of digital libraries.

The chapter seeks to help readers understand what digital libraries are, the benefit of digital libraries. It identifies associated challenges basic, complementary, social tools and techniques that can take into account digital libraries in order to support social activities. In addition, the chapter provides examples of evaluating digital libraries.

The remainder of this chapter is organized as follows. Section 2.2 introduces relevant background of Digital libraries in general and the benefit of digital libraries. In Section 2.3 presents the information seeking models and Information Foraging Theory, along with the key related of models of information seeking—models that have strongly influenced the design of digital library technology. Tools for support information access in digital libraries are discussed in Section 2.4. Section 2.5 describes evaluation of digital libraries. The conclusions are presented in Section 2.6.

## 2.2 Overview of Digital Libraries

This section provides relevant background on digital libraries including the definition of digital libraries, as well as introduces the concept of social digital libraries.

The increasing availability of digital information creates “information overload”. It is impossible for users to inspect all documents in a collection even with search and browse functions provided. As a result, users may require time and effort to consider which documents are useful and relevant to their goals. They might anticipate more sophisticated digital library services to support their goals in order to minimize time and effort. Therefore, the provision of effective tools for accessing vast amount of information has become a vital concern for digital libraries. Also of equal importance is enhancing the learning environment for users.

A digital library was earlier defined by Lesk (1997, p.xix) as “Digital libraries are organized collections of digital information. They combine the structuring and gathering of information, which libraries and achieves have always done, with the digital representation that computers have made possible”.

The advantage of digital libraries over traditional libraries are that users can access digitized information from anywhere at any time easily and conveniently. Many early conventional digital libraries provide basic services as single-user systems. Some examples of the traditional digital libraries include Alexandria Digital Library Project (<http://www.alexandria.ucsb.edu/>), PERSEUS Digital Library (<http://www.perseus.tufts.edu/hopper/>), Water in the Earth System (WES) project(<http://www.ametsoc.org/amsedu/wes/home.html>), World Digital Library(<http://www.wdl.org/en/>), Missouri Digital Heritage (<http://www.sos.mo.gov/mdh/>) etc.

Over the last decade, the social facilities integrated to traditional digital libraries have been seen. Users not only can access information by basic features but also they would



need more advanced services from digital libraries (Kani-Zabihi et al. 2006). As Arm (2000) pointed out digital libraries will extend various services in order to support for knowledge sharing between users. An extended definition of a digital library from a workshop based on the social aspects is given by Borgman et al., 1996 cited in Borgman (1999, p.234).

“1.Digital libraries are a set of electronic resources and associated technical capabilities for creating, searching and using information

2. Digital libraries are constructed, collected and organized by (and for) a community of users, and their functional capabilities support the information needs and uses of that community.”

In this view, digital libraries can be considered as “meeting places” where users can exchange ideas and experience, discussions, annotations of material based on rights permission (Smeaton and Callan 2005, Fleischmann 2007). Digital libraries could be “online communities” for users to interact within the digital library society (Fleischmann 2007). Users not only interact with the systems but also can possible engage with other people.

In recent years, the emergence of the Internet and Web 2.0 technologies makes it possible for digital libraries to offer user collaboration between people. Digital libraries emphasis involving social aspects by providing social facilities, I call them, “social digital libraries”. The social tools enable users to easily share ideas or results found. Users can benefit from the sharing of information to serve their goals. In the past, many digital libraries have been added social features to support users. Most researches have been focused to technical issues of systems. In the other words, they emphasised on the system’s perspective rather than the user’s perspective. For instance, evaluation of the search algorithm in JeromeDL (Kruk et al. 2005), developing document image retrieval techniques in the Automatic Indexing of Document Images System (Marinai et al.

2007), evaluation of the efficiency and effectiveness of source selection methods in CYCLADES Personalized Digital Library (Candela and Straccia 2004) etc.

However, there are few studies focus on well-designed social digital libraries, which included social facilities, as well as a lack of appropriate evaluation methods in order to assess the usable and usability of the systems.

This research aims at designing a useful and usable social digital library interface, which assimilates the idea of social mechanisms to traditional digital libraries, for sharing experiences in the Victorian Times community in an effective and enjoyable way. The focus is mainly on the interaction evaluation rather than system evaluation, which is out of scope of this study. I believe that users may take advantages from social features and social information to complete their tasks.

The redesigned Victorian Times Digital Library provides traditionally standard digital library services such as full text documents with metadata, search and retrieval documents, augmented with social features for sharing knowledge and a virtual community in an innovative design. Hence, the Victorian Times Digital Library's services support both an individual and other individuals.

The big challenge in designing the Victorian Times Digital Library is to provide useful and usable interactive interface in order to accommodate different stages of information seeking process by using social facilities in a virtual community, as well as to enhance information seeker's success.

## **2.3 Information seeking and Information Foraging**

Information seeking models and Information Foraging help better understand how users interact with systems for finding information. This section presents the definition of Information Seeking (Section 2.3.1), followed by Information Foraging Theory (Section

2.3.2.). These models have been influential in developing information access tools and designing interfaces of the Victorian Times Digital Library.

### **2.3.1 Information seeking**

Information seeking can be defined as “a conscious effort to acquire information in response to a need or gap” (Case 2007, p. 5). This section presents Information Seeking models (Section 2.3.1.1), followed by Social engagement in information seeking models (Section 2.3.1.2.).

#### **2.3.1.1 Information Seeking Model**

There have been several approaches proposed in the information seeking and behaviour fields. Each model is described in detail as follows.

Kuhlthau (1991, p. 366) proposes the model of the information search process related to three areas: “the affective (feelings); the cognitive (thoughts); and the physical (actions)”. Moreover, she classifies information seeking model into six stages: (1) **initiation**. Users have insufficient background knowledge in the given topic and thus make them feel unconfident. They seemed to relate information needs for the task with personal knowledge and experiences. (2) **selection**. Users have broad ideas in their mind and prepare for starting a search. They still have ambiguity. They assess the topic based on their preference and restricted condition like time and resources; (3) **exploration**. In this stage, users even have a vague feeling. They examine information in a wide area and associated information in order to gain more knowledge; (4) **formulation**. Users are decreasing doubtful and they have increasing confidence. Then, users can specify the particular topic; (5) **collection**. Users have more confidence and collect relevant information on the topic; and (6) **presentation**. Users relax and show information found if they satisfy in the outcome or they dissatisfy with contrast results.

According to a study by Choo et al. (1999), they described how users find information through the Web by using four scanning modes identified by Aguilar (1967): (1) **undirected viewing**. Users examine various materials for a general idea; (2) **condition viewing**. Users determine information they found based on their interests; (3) **informal search**. Users identify particular topics by the search function; (4) **formal search**. Users explore further in additional detail.

In addition, six categories of information seeking behaviours were identified by Ellis (1989): (1) **starting**. Users begin with initiating pages and sites; (2) **chaining**. Users follow the links on initial pages; (3) **browsing**. Users browse pages; (4) **differentiating**. Users add items into bookmarks or go to known sites; (5) **monitoring**. Users bookmark a site if it provides additional information; and (6) **extracting**. Users investigate resources in order to identify interesting materials. They stated that behavioural framework regarding modes of scanning (Aguilar) and literature search move (Ellis) may be helpful in analysing patterns of information seeking on the Web. Undirected viewing was mainly identified by starting and chaining. Conditioned viewing was identified by differentiating, browsing, and monitoring. Informal search was established by differentiating, monitoring and extracting. Formal search was recognized by monitoring and extracting.

Bates (1989, p. 410) proposed a model named “berrypicking” for designing powerful user interfaces. Users initially issue basic terms on the general issue in order to find information. As the results they found, they come up with a new idea and justify the new terms in order to get a better correspond results for a single query. In the other words, users gradually collect information they met from several search techniques associated with diverse resources rather than assembling the output set of a single search. This search type is called “an evolving search”. Bates proposes six strategies in designing interfaces for searching: (1) **Footnote chasing** or **backward chaining**. Users investigate attached footnotes of interesting material. Users can decide to read text or the full texts

of documents with references; (2) **Citation searching**. Users examine a citation index, lists of citing references or full text documents; (3) **Journal Run**. Users examine the documents in a particular area in a sequential order; (4) **Area scanning**. Users can browse documents within the classification scheme; (5) **Subject searches in bibliographies and abstracting and indexing (A&I) services**. Users can search documents by controlled vocabulary or browse subject terms in a predictable order. Also, they can issue keywords within the Title or Abstract fields; (6) **Author searching**. Users can explore more documents written by the same author.

Bates (1990, pp. 577-578, 581, 587) studied about using online and automated information system of users and presented the “Levels of system involvement” and “type of search activity”. There are four levels of system involvement (SI) in searching: **at level 0**, Help from the system is not available in this level; **at level 1**, the suggestions are supported users when they need; **at level 2**, the system can accomplish search task by query search without the complicated search capability; **at level 3**, the availability of advanced features related to artificial intelligence helps users for more flexibility in the search process. This support emerge when users request for assistant and when they are in difficulty; **at level 4**, the system presents detail on what the system have done for users when they issue search terms. Moreover, Bates describes four level types of search activities (SA), namely: the “move”; “tactic”; “stratagem”; and “strategy”. Bates also presents the levels of system involvement (SI) combined with the types of search activities (SA): **at level1 system involvement**, the system provides help on how to employ word command; **at level 2 system involvement**, users can type a single command. The thesaurus is facilitated for appropriate suggestions based on Artificial Intelligence; **at level3 system involvement**, Artificial Intelligence is powerful in the search process by recognizing misspelling words or text recommended; **at level 4 system involvement**, users can inform their needs and the system obtains the best solution for users automatically. The more system involvement, the less the user has to do in the actual search process.

Bates (2002a) presents cascade model of interactions in the information system regarding the user-centred design without technical aspect. The cascade layer model consists of four areas; (1) **technical infrastructure** can support or limit the capability of information retrieval; (2) **information** or **content** is provided with metadata for accessibility in the system; (3) **information in searching form** or **interface design** is supported by technical infrastructure and contained the structure of information; and (4) **user searching activities** and **user understanding and motivation** presents user roles in the system. It also reflects users' needs and features employed in the system. Furthermore, the author concluded that changing at information design layer can also have influence the other layers.

Information access activities may involve in the resources sharing of others. This led to social activities in digital libraries (Marshall and Bly 2004).The next section I describe social activities that may require during information seeking process. Some social information models are also included in the section.

### **2.3.1.2 Social engagement in information seeking models**

Social interaction between users can be involved in the stages of information seeking. Some studies reported that during information seeking, users probably require other help to complete a task. For example, Hertzum (2000) reported the finding from two studies in information behaviour of engineers. The results found that the participants seem to search both documents and people. Additionally, they accomplish the task by gaining benefit from social interaction with experts without using search strategies. Ackerman (1994) proposes four issues regarding social interaction that can assist information seeking: (1) users may want to know some valuable resources. Therefore, other help may be requested for material selection; (2) engaging with others aid the search process; (3) most information seekers often have particular needs for finding information; and (4)

digital libraries should provide tools for facilitating social interaction with the digital library community.

According to Levy and Marshal (1995, p. 80), there has been a dramatic increase in dealing with social interaction or communication for solving a task, such as seeking guideline and suggestions or brainstorming with other individuals or the work done by previous users. The same authors stated that “support for communication and collaboration is as important as support for information-seeking activities and that, indeed, support for the former is need to support the latter”. As Twidale et al. (1997) noted, users not only confer with others, but also they can explore the related subject areas that match with their goals. Bates noted that during the search process in Berry picking model, users may ask guideline or consult with their colleagues, as well as in early stages of Kuhlthau’s model.

There are some proposed models with elaborate other help engaging during the search process. Chi (2009, p. 43) proposes the “canonical model” consists of three stages in the search process: (1) Before searching, users probably need help from other people in selecting material such as convey or consult others; (2) during search, users may conduct the search or occasionally benefit of other searchers that have been done in the past like suggested terms; (3) after search, users consolidate the results and then share them in community. Shah (2008) proposes a models of a Collaborative Information Seeking (CIS) environment that are: **level 1 information** consists of diverse information sources and a range of virtual aspects; **level 2 tools** are used to access data in layer 1; **level 3 users** employ the tools in layer 2 to explore information in layer 1, including organizing information in layer 4. Also, users’ demographic and personal information would be collected in order to provide personalized services; and **level 4 results**. The users have compiled resources found based on their needs. This allows users to save the desired documents with written reviews. Moreover, Buchanan and Hinze (2008) purposes the

architectures for Social Information Seeking. Community creation and social facilities should be taking into account in digital libraries in order to support information seeking activities. This allows users to share options or discussion and exchange experience. For example, recommendation service can refine relevant documents that users may like. Furthermore, alert service notifies users of the recent publication or modified items.

### 2.3.2 Information Foraging Theory

Information Foraging Theory, the concept is similar to Bates' Berrypicking (described in Section 2.3.1.1) model. Users adapt their strategies to collect valuable information gradually as they goals from a variety of sources (Bates 2002b). Information Foraging Theory involves finding and determining resources by adapted searching strategies. A user's behaviour changes when a new source is discovered based on decision between the user' needs and limited time and cost (Pirolli and Card 1995).

Users' information behaviour is similar to hunting behaviour of animal for food. The animals have decided to catch preys by balancing energy spent and the benefit they get. Energy in hunting preys is pursuit depending on different sources. Some valuable sources provide less energy to catch than other ones. Optimal Information Foraging comes up with the maximum of valuable resources within a limited cost. Information environment can be considered like a patch structure. A patch can be a page, a section of page, a document etc. Users can go to a patch by following the link. Patch consists of two issues: (1) **within-patch**. Users can continue the same patch until the valuable information depletes and switch to other patches; (2) **between-patch**. Users go to another patch or start a new search (Pirolli and Card 1999).

According to limited time and cost, users will adjust their strategies regarding conditions encountered. The appropriate environment with adapted strategies is called



“enrichment”. The “environmental enrichment” involves two aspects: minimizing the cost of between-patch and supporting for return to the “valuable information”. Diet mode is the state of hunting preys of animals. Predators may have difficulty in hunting by preys differently. Animals choose whether to capture the preys based on “profitability”, which is measured by energy spent per unit of time. They ignore to lower profitability of prey. In the other words, they follow the preys easy to get rather than spend more time and energy for other ones (Pirolli and Card 1999, p.10).

At the point of Information Foraging Theory view, users assess whether relevant information via “information scent”. Information scent can be defined as “the (imperfect) perception of the value, cost, or access path of information sources obtained from proximal cues, such as bibliographic citations, WWW links, or icons representing the sources” (Pirolli and Card 1999, p. 10).

Every patch contains a different amount of information scent. Users can perceive high scent if the link provides clear indication and thus, they can reach the goal by following the link with confidence. On the contrary, users can perceive low scent in ambiguous contextual description. The information scent of a patch influences the decision of users whether they will follow the patch or switch to other patches, which contain a stronger scent.

According to economic aspects, “resource cost” and “opportunity cost” are considered for choosing strategies. “Resource cost” includes monetary and non-monetary cost such as time and energy, while “opportunity cost” is lost opportunity cost from gain benefit in other activities instead of spending the cost on the selected event (Pirolli 2003).

Web designers can consider throughout the Web site design with Information Foraging Theory in order to increase information scent, for example, adding a detailed description

accompanying the link on the page. Perceiving high scent in information leads users to the right information as their goals (Pirolli et al. 2001). It also can be beneficial for providing “enhanced thumbnails”, which consists of text summaries and plain thumbnails, rather than facilitating only text summaries or plain thumbnails (Woodruff et al. 2002).

Collaborative foraging can involve in the design of interfaces and tools in order to help an individual forager. Schultze (2002) presented the concept of collaborative foraging in order to increase the value of enrichment in within-patch. The author has developed Web collaborative foraging system, called Web Waggle. The system allows users to create and share personal lists with others. Furthermore, the related pages according to the current page viewed are provided by following “you might also like” links. The collaborative foraging provides the opportunity for users to collaborative with people who have similar interests by employing collaborative filtering. The author concluded that users seem to appreciate the benefit of collaborative materials. See another well-known system, Wexelblat and Maes (1999) have developed Footprints, the “history-rich tools”, in order to support Information Foraging. A solitary forager can benefit from Historical data of previous users interacting with the Web, “social bookmark”, “favourite” and recommended pages to accomplish a task.

The next section, I present a set of features to enhance information seeking process, namely search, browse, social and supplementary features.

## **2.4 Features for supporting information seeking in digital libraries**

In conventional digital libraries, users can access, recover and store information as an individual user. Occasionally, they would like to consult their colleagues or friends as individuals consult other individuals or distribute the useful material found among

several individuals. Therefore, digital libraries should provide several information access features, as well as social facilities for information seekers during different information-seeking stages. In this section, I describe a set of features that support finding information in digital libraries. These features are presented in detail below, along with a brief explanation in which stage of information seeking activities they support. Section 2.4.1 identifies basic search and browse features to support users for finding information in digital libraries. Section 2.4.2 presents social features to support collaboration and knowledge sharing between users. Section 2.4.3 presents supplementary features that provide more comfortable for users. Section 2.4.4 describes personalization and recommendation in digital libraries.

### **2.4.1 Searching and browsing features**

Shen et al. (2006) noted that searching is a powerful feature for finding information rapidly in digital libraries. Browsing function is valuable when users do not know the keyword to issue in a search box. Both features are elaborated with “browsing and searching” stage of information seeking model (Lee et al. 2003).

In this section I describe search (Section 2.4.1.1) and browse features (Section 2.4.1.2) as the basic functions for users to discover relevant documents in digital libraries.

#### **2.4.1.1 Search features**

Search features allow users to identify information needs by query issues. Smith (2000) noted that various search features can support searching in digital libraries including Boolean logic, which allows users to combine logical OR, AND between terms; Phrase and Proximity Searching enables users to find exact words occurring in the same order or associated words; Relevancy ranking enables search systems to retrieve documents ordered by “relevancy” to the user’s query. A set of search results can be represented according to “relevancy”; Browsing of indexes allows users to explore documents by

choosing alphabetical lists of index terms; Truncation provides more diversity in the form of words and spelling; Field searching offers the searchable fields, such as title, author etc.; Extent of searching offers specific data in searching in a special case; Case sensitive searching enables users to search case sensitive text; Date/range searching allows users to limit search according to date range; Refining of the initial search; Advance and basic search facilities supports for expert and novice searchers. Moreover, controlled vocabulary, language translation, related items and multimedia searching can be incorporated into the search interface.

#### **2.4.1.2 Browsing features**

Chang and Rice (1993, p. 258) defined browsing as “the process of exposing oneself to a resource space by scanning its content (objects or representations) and/or structure, possibly resulting in awareness of unexpected or new content or paths in that resource space.”

Cove and Walsh (1988) identified three categories in browsing behaviour: (1) **search browsing**. Users know their goals and what information they need; (2) **general purpose browsing**. Users possibly would like to view interesting information; (3) **Serendipity browsing**. Users browse to explore information in a random way. Thus, they do not follow a definite pattern.

Rosenfeld and Rosenfeld (2007) noted that classification scheme can be used for organizing information. In the context of libraries, a collection can be classified by arranging in the Dewey Decimal Classification (DDC). Users can access the sub-hierarchical levels by drilling down through hierarchical levels. Moreover, they can use thesaurus to enhance finding information. Thesaurus is related to synonyms, homonyms, antonyms, and broader, narrower and related terms. For example, PubMed is “a service

of the National Library of Medicine”, which provides thesaurus, preferred terms and “main subject headings” for users to navigate information.

Another example of a digital library applied hierarchical structure or browse alphabetically or using the “Dewey subject tree” is Agriculture and agri-food Canada ([http://www.agr.gc.ca/agriweb/index\\_e.cfm](http://www.agr.gc.ca/agriweb/index_e.cfm) accessed on 19 October 2010) (see Figure 2.1).

Witten (2000) noted that users can browse indexes which are derived from various metadata such as title, author, date etc. The author also investigated the design of user interfaces for “subject index-style” from creating phrases and keyphrases. He also suggested that text mining technology can identify phrases from documents automatically.

Rather than extracting metadata from documents automatically, metadata such as Dublin core metadata 15 elements allow non-experts in cataloguing rules to identify and discover items in a collection easily (Weibel 1997). A number of metadata allow the user to search and browse on several fields such as “Title”, “Creator”, “Subject”, “Description”, “Publisher”, “Contributor” etc., for example Alberta Folklore and Local History Collection (<http://folklore.library.ualberta.ca/> accessed on 19 October 2010) see Figure 2.2.

According to Lee et al. (2003, p. 406), the titles of document lists, subject classification of documents and metadata links can support the “chaining of information sources” stage of information seeking activities.



Figure 2. 1 The screenshot of Agriculture and Agri-Food Canada offering access to the collection by Dewey

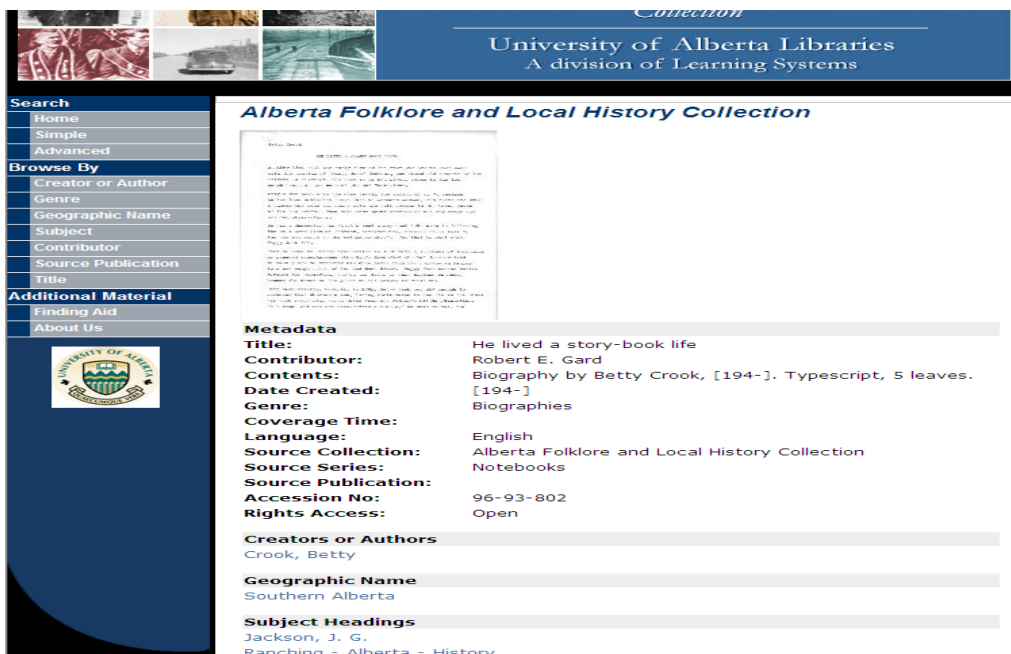


Figure 2. 2 The screenshot of Alberta Folklore and Local History Collection offering access to the collection by metadata

### **2.4.2. Social information access features**

Searching and browsing, as basic functions are often not adequate for solving complex tasks. In this situation, collaborative work and exchanging knowledge are relatively important to accomplish such a task.

Choo et al. (1998) stated that bookmarks and other reviews for further usage can support information seeking in the Differentiating stage of Ellis' model. Moreover, Lee et al. (2003, pp. 403, 405-407) noted that alerting services, sharing interesting items and consulting with colleagues between users also support information seeking in the "Monitoring and extracting for illumination" stage.

Hansen et al. (2007) stated that the system should provide tools for facilitating communication and sharing knowledge among user community in order to support collaborative practices. Shah (2008) noted that collaborative activities can involve in several stages of seeking information: (1) during conducting queries; (2) while relevant documents encountered; and (3) when manipulating the outcome. Moreover, O'Day and Jeffries (1993) propose four levels in sharing results encountered within user community: sharing interesting items encountered; sharing advice and opinions; suggested queries; and organized result collection. Brusilovsky et al. (2010, p. 117) stated that social information access techniques can be classified into three facets: "(1) which kind of past user behavior it collects; (2) how these traces are processed to form 'community wisdom'; and (3) how this information is used to enhance user information access".

Social features may allow users to store and organize the information encountered into their space and control access to them in order to support sharing information among users, as mentioned above. Furthermore, it may provide users with shared facilities that can contribute their experience to others, such as reviews.

The examples of digital libraries that have integrated social functions are given below.

- **Social Bookmarking** allows users to save and organize documents found with meaningful “tagging” in order to reuse in the future. The bookmark can also be shared among end-users and may be valuable information resources during information search (Lomas 2005). For example, Jerome Digital Library has been developed based on semantic web and social networking services. With JeromeDL’s social and semantic services, users can bookmark interesting resources, annotate them by using controlled vocabularies. Also, they can share knowledge within a social network. Users can also comment the content and send response messages with other people (Kruk et al. 2007). Puspitasari et al. (2007) have developed a geography digital library, called G-PORTAL, combined with free software social bookmarking, called SCUTTER. The aim of G-PORTAL was to build and share digitized collection with metadata among users, while social bookmarking enables users to build and maintain bookmark lists.
- **Social Annotation** allows users to tag detailed description with items in a collection without being experts. The benefit of such tool helps users to support information seeking process (Gazan 2008). For example, DiLAS, the Digital Library Annotation Services, facilitates collaboration information access (Hansen et al. 2007). Nichols et al.’ (2000) DEBORA project offers collaborative activities by focusing on social annotations in the Renaissance book digital collection. The system enables users to identify access rights for controlling the visibility and operations performed by others in three levels: private; group; and public.

### 2.4.3 The supplementary features

The supplementary features enable users to store and manipulate encountered items in order to locate the documents quickly for later use. It also noted that users can keep the



previously viewed items into “bookmark”, “favourite”, or “history list” for further usage (Wexelblat and Maes 1999, Theng et al. 1999). Furthermore, preview, zooming, or display data in various formats such as PDF and Image file can be incorporated in digital libraries in order to support the search process.

Although supplementary features are not a vital part of the information seeking, these features can provide prove comfortable for users to use digital libraries, such as filtering options. This related to “differentiating” in information seeking process (Lee et al. 2003). Also, the filtering options can support “enrich information patches” in terms of Information Foraging Theory (Pirolli and Card 1999). The following examples demonstrate possible approaches.

- **Zoom feature** enables users to zoom into a selected area of a document in order to view specific detail, for example, ZEUS provides searching, browsing, zooming and panning techniques for enhancing user navigation in the interface (Gundelsweiler et al. 2007).
- **Preview and overview features** can help users for decision-making in information seeking process. The users can differentiate the desired items from a large amount of information quickly (Greene et al. 2000), for example, Greene et al. (2000) have developed LC’s National Digital Library program, American Memory collection by facilitating previews and overviews features. Previews represent as the thumbnail image while overviews represent all items in the collection with optional attributes.

#### **2.4.4 Personalization and Recommendation**

In the previous section, I described various tools, namely search, browse, social and supplementary features that can be employed during information seeking process. However, rather than having a digital library provides such features, personalization and

recommendation may be incorporated in a social digital library. These services may help users to overcome the information explosion by suggesting a set of relevant documents. This enables users to minimize their time to more productive results. Personalization and recommendation functions may help users in the first stage, namely “preparation for stating information seeking” of information seeking models (Lee et al. 2003).

As Smeaton and Callan (2005, p. 302) stated that “Digital libraries that support a broader range of information-seeking activities, build detailed models of users and user communities, and can tailor information for a wide range of uses will enable new types of software applications designed to support a variety of information-seeking, building, and sharing activities”. According to information seeking process, Choo et al. (1998) stated that other recommendations and review alerting services can support information seeking in Condition Viewing of Aguilar’s modes or the Differentiating stage of Ellis’ model. Also, alerting services can support information seeking in the Monitoring stage of Ellis’ model.

I start with the definition of community and virtual community, and then I describe the definition of personalization and recommendation, followed by the widely known approaches for making personalization and recommendation including examples of personalized recommendation in digital libraries. Also, it is possible to include historical data from past users’ searching and browsing behaviour that may be useful for later users to get the findings of previous users’ trails.

According to Hill et al. (1995, p. 194), the term of community can be defined as “a group of people who share characteristics and interact”. The definition of virtual community is given by Baim (2006, p. 145) as “a group(s) of individuals who come together through computer-aided communications mechanisms to share information of interest”.

In addition, Brusilovsky (2008) stated that, with the advancement of Web technology, users can obtain advantages from “community wisdom” to support information seeking for accomplishing a task. The history data of previous users can be useful for later searchers.

Smeaton and Callan (2005) defined personalization as services that accommodate relevant information in order to satisfy an individual’s needs or group’s demands regarding users’ profiles and background. Also, it offers the opportunity for users to identify their own context of the Web (Eirinaki and Vazirgiannis 2003).

Terveen and Hill (2001) defined recommendation as services of recommending a set of relevant documents based on users’ interests. Detailed descriptions can complement recommended documents for users to judge such documents quickly. Moreover, recommendation services may suggest a set of similar users who have same interests in a given topic, as well as including tools for communication among them.

Franke et al. (2008) noted that recommendation systems can be classified into two forms: implicit and explicit. Implicit or “behaviour-based or content-based” recommendation generates recommendation by captured data when users interact with documents in a collection such as customer purchase history etc. In case users were asked to express their options by rating or reviewing on items, these data would be used in explicit recommendation. Schafer et al. (2006) stated that implicit rating can infer users’ interests while users interact with the system or access the associated links facilitated on the page.

Amazon ([www.amazon.com](http://www.amazon.com)) is a well-known example that integrates personalization and recommendation in e-commerce Web site. Amazon has provided both explicit and implicit recommendation. Implicit recommendation (“Customer Who Bought This Item Also Bought”) was generated by analysing similarity of documents (item-to-item Collaborative Filtering) from history of interaction data such as users’ previous

purchase, while explicit recommendation required users to rate items on a scale from 1 to 5 (Franke et al. 2008).

ACM portal (<http://portal.acm.org>) has incorporated two types of recommending system, namely Content-based and Behaviour-based. Content-based was based on analysing the content of documents and provided a recommending feature via “Find Similar Articles” link for associated documents, while Behaviour-based provide the link “Peer to Peer Readers of this Article have also read”, which is derived from history data (Franke et al. 2008).

There have several approaches to build personalization and recommendation systems:

### **Content based filtering**

According to Eirinaki and Vazirgiannis (2003), Neuhold et.al. (2003), content based filtering serves as analysing an individual user profile in order to suggest unobserved items that are similar to the documents users like in the past; Pazzani and Billsus (2007) stated that recommended documents would be introduced to a user regarding user profile and descriptive detail of objects. User profile information may include: (1) “A model of user preferences”, where users can identify detailed information of items that the user has interested in; (2) history data, which was derived from user interaction with the system such as items have been viewed by the user and related information such as rating items and saved queries.

Lekakos et al. (2009) noted that normally, content-based approach emphasises on various domains such as items with textual descriptions, for example, books, TV programme etc. and those items accompanied with metadata such as title, author, description, summary, types of TV programme etc.

The limitations of content-based filtering are as follows (Balabanović and Shoham 1997):

- (1) Restricted to certain types of contents. Some domains are not appropriate for this approach such as multimedia data. Although those multimedia objects are attached to textual description;
- (2) Problem of over-specification. The system suggests documents that exactly match the user profile. This limits the user to view other similar documents that have already been rated.

### **Collaborative filtering**

Boertjes and Nijholt (2007) noted that collaborative filtering can be defined as an approach for recommended items by using the experience of users with the same interests rather than an individual experience. Examples may be found in daily life such as recommended interesting movies from friends. A set of users who have interests similar to the active user would be explored on which documents are considered the most interesting but the active user has not seen. Then it recommends such documents to the active user. In other words, the items are recommended based on the similarity of users instead of the similarity of items.

Content-based filtering analyses the similarity documents by content features, while collaborative features required users to rate items (Schafer et al. 2007). Lekakos et al. (2009) noted that gathering user's rating can consist of two ways: (1) **explicit data**. The system provides a set of scales for users to assess in terms of numerical data; and (2) **implicit data**. The system records user's interaction such as navigational patterns or purchase transactions.

The limitations of collaborative filtering are as follows (Balabanović and Shoham 1997):

- (1) New items: new documents would not be recommended until such documents are rated by users;
- (2) Sparse problem: when the system has a massive number of documents but a small number of users rates documents. Rating documents are very sparse. This provides low quality recommendations due to lack of adequate data for determining similar users; and
- (3) If a user has a unique style and nobody is similar to the user, this will create inefficient recommendations;

### **Hybrid filtering**

Both content-based filtering and collaborative filtering can be combined for avoiding the problems mentioned above (Balabanović and Shoham 1997). Torres et al. (2004) proposed hybrid algorithm which is merged content-based filtering and collaborative filtering. TF-IDF is used to analyse the similarity of text in content-based filtering, while a K-nearest neighbour algorithm is used to analyse the reference lists of the active paper. The results of both approaches were aggregated and displayed in a ranking score. Geisler et al. (2001) have developed iLumina Digital Library, which provides recommendation services by multiple resources, namely user profiles, usage data, “resource quality judgement” and “resource characteristics”. Hybrid filtering was based on a combination of collaborative filtering and content-based filtering. Evaluations showed that the hybrid filtering approach was effective in recommendation services.

On the other hand, Yang and Li (2005, p. 41) argued that “similarity analysis” from content-based filtering, collaborative filtering and the hybrid approach are not sufficient to establish effective recommendation services, for example, in case two documents with the same contents have discovered by different sources. The other document with the

same content would be recommended to the user again, or the book has several editions. If a user has read the latest version, which contains more updated contents than the older version of book, recommendation services will advise the previous versions of the book to the user. In the other case is that two documents have identical names but different length documents. If the shorter length document is coincidentally similar to documents that the user has read, the shorter length document would be recommended to the user. In contrast, the user would like to read the long document with more details. The authors further proposed the concept of “degree of interest” regarding three factors, namely “similarity between resources, information amount, and information novelty”. Additionally, the authors concluded that “interest-based approach” obtains more precise recommendation.

However, Hwang et al. (2003, p. 171) argues that the typical recommendation approaches are not appropriate for recommending items in digital libraries. Users’ rating scores in the document are required for analysis if data in content-based and collaborative methods. In digital library context, users may not need to rate some documents before recommendation provided. Even though, some of digital libraries have a policy, which allows member users to access digital collection, anonymous users can find some of desired documents available on the internet. The authors propose “a-task focus approach” instead of “the long-term interest profile” for facilitating the recommendation service.

Web usage mining can lead to a better understanding of user patterns which reflect user needs and interests by applying data mining technology. Personalization and recommendations can be found in numerous Web sites. Web usage mining can make recommendation according to users’ profiles and usage behaviour (Srivastava et al. 2000).

Eirinaki and Vazirgiannis (2003) has focused on web usage mining. The valuable model of user behaviour interacting with the Web was created by applying statistical methods and data mining techniques with Web log. The various approaches of data mining can be used such as association rule mining, sequential pattern discovery, clustering, and classification. The useful outcome from data analysis using data mining can apply to make personalization service regarding users' personal information and navigation.

Examples of digital libraries have incorporated personalization and recommendation services as follows.

MyLibrary offers personalized library services to university members. The service composes of tools for storing and organizing the valuable information found, called MyLink; and another tool for notifying the new materials that correspond with their interests, called MyUpdate (Cohen et al. 2000).

Theobald and Klas (2004) have developed a personalized digital library by a combination of BINGO, which creates bookmark lists and DAFFODIL, which can apply to obtain metadata of items. The personalized service allows users to store information including "query formulation" within their folders.

CYCLADES, a collaborative digital library, offers personalization service, sharing work area and alerting services, notifying a series of similar people to users. The system enables users to manage results found into their area based on "folder paradigm". Users can define rights authorization for accessing their folders in two levels: private, available for the owner; and community folder, available for all users. Users can also exchange their ideas through discussions on community folders. The community folders keep the items to demonstrate users' interests in the subjects. Hence, a community of CLYCADE represents with the community of folders (Avancini et al. 2007).



From a different method to create user community, a study carried by Papatheodorou et al. (2003) aims to exploit “user community models” in order to reflect users’ querying behaviour and user needs by using implicit data recorded in the log file. The authors suggested that this data can be utilized to improve for the better services such as “query expansion” and personalization.

The results from clustering data can be represented in various formats, for example, Kim et al. (2006, p. 115) have developed VUDM (Visual User model Data Mining tool). Usage patterns and user models are formulated from search and browse activities according to their interests by using unsupervised learning method. The authors also suggested that considerate issues for personalization can be classified in three broad groups: “user characteristics and relationships, virtual interest groups and relationships, and usage trends.”

With the benefit of Web 2.0 tools, it helps to gather information from user interaction with the system such as bookmarking, rating etc., which indicate the interests of users. Moreover, these data can be used to create personalization services (Carmel et al. 2009). Social search can create communities of users who have similar interests by using search history. This also can lead to provide “a personalized search service” (Freyne and Smyth 2004). With social navigation or social browsing, the system allows the traces of past users visible for the subsequent users to facilitate finding information (Brusilovsky et al. 2010). Both social search and social browse gather previous users’ behaviour data based on explicit and implicit feedback, which can be used to improve information access for the later users by creating “community wisdom” (Brusilovsky 2008). There are some digital libraries applied social search and social browse in order to assist users to achieve their goals. For example, social search and navigation features were combined in order to facilitate “a community-based access” to the system by using the ACM Digital Library Data. This helps users to find information related to their goals (Freyne et al. 2007). Brusilovsky (2010) has integrated social navigation into Ensemble, the

Computing Portal in the US National Science Digital Library. Also, “wisdom of user community” is derived from the tracks of the navigation behaviour of the information seekers using the Portal.

The issue of personalization is out of scope of this thesis since I focus specifically on the novel design of an interface of the social digital library. Also, the research aims to study how participants interact with the features provided to achieve their goal based on user oriented rather than system oriented. However, the concept of other people’s recommendations is incorporated in the Victorian Times Digital Library. In this research, recommended items are defined as a set of documents saved to item lists by people who have interested in a specific subject. When they repeatedly viewed or saved the same document to their item lists, this is an even stronger indication that such documents might be good or interesting in that subject area. In other words, the frequency of which document is viewed or saved to item lists over a population of Victorian Times users corresponds to the strength of the popularity of these documents (more details in Chapter 5).

Also, data transactions of previous users in the Victorian Times Digital Library are clustered by K-Means clustering techniques formed and represented as popular categories in the virtual community (more details in Chapter 4). The community of Victorian Times Digital Library’s users will be grouped according to existing subject classification, namely LCSH (Library of Congress Subject Headings) in order to avoid overlapped subject areas since Victorian Times resources have been divided upon such classification system. For example, User X has viewed and may be save documents in “Barge” category. The user X would be appeared in “Barge” popular category.

Popular categories were generated and contained documents that have been viewed or saved to item lists. Each popular category was denoted by a detailed description of that category associated with a set of documents it contained. The popular categories reveal

how the interests of Victorian Times Digital Library. User community can be grouped according to the given subject area.

Once the interface was designed, the evaluation methods are employed to measure the usability of the system, as present in the next section.

## **2.5 Evaluating digital libraries**

Evaluation of digital libraries becomes critical concerns in order to understand user interaction with the system, as well as enhance the Victorian Times interface. This section presents the evaluation approaches in digital libraries including examples of the evaluating digital libraries.

For several decades, there have various approaches and methods to evaluate digital libraries. The following evaluation frameworks and techniques are presented:

Fuhr et al. (2001) noted that evaluation of digital libraries requires considering what developers can measure, how to assess them, who need the results and when the system will be evaluated.

Saracevic (2004) proposed the overview of the digital library evaluation, which consists of four aspects: construct; context; criteria; and method. Construct covers the evaluation of a domain area, a particular digital library, functionalities, services, procedures and the users' interaction with the system. Context refers to the evaluation approach, objectives, levels and preferences. The evaluation approaches applied depend upon the goals of evaluation. Criteria are required to determine in the evaluation of digital libraries. Methodology involves a number of methods to collect data for the analysis phase.

Fuhr et al. (2001) propose a Holistic approach for evaluating digital libraries based on “a broad view of the subject area”. Four related issues emerged: users; data/collection; system/technology; and usage. **Users and use** consider user types, purposes of using the

system, how users use the system in the subject area available by using functionality provided. Data/Collection is concerned to the detailed information, management, quality/reliability and accessibility. Technology composes of four issues: user technology; information access; system structure technology; and document technology.

Tsakonas et al. (2004) propose the triangle model for evaluating digital libraries that considers the relationship between user-system, user-content and content-system. User-system is related to usability, which measures effectiveness, efficiency and user satisfaction. Moreover, user-content involves assessing usefulness according to relevance and users' achievement, while content-system is related to performance.

Saracevic and Covi (2000) pointed out that the evaluation of the system can be classified into two broad types: user-centred and system-centred. User-centred is consisted of three layers: **social level** aims to assess a digital library's services for facilitating the needs of users in society; **institutional** attempts to measure a digital library's services for supporting organization or the ease to combine with organizational materials; and **individual** works for measuring a digital library's services to support a solitary user in an individual task. System-centred is consisted of three layers: **engineering** intends to evaluate hardware and network infrastructure; **processing** aims to assess the operation of software; and **content** attempts to assess organization and presentation of information in a collection. From the information retrieval point of view, precision, recall and user's satisfaction involve for successful development systems and support users' needs (Su 1992).

Four types of evaluation can evolve in various stages of developing digital libraries: formative evaluation; summative evaluation; iterative evaluation and comparative evaluation. Formative evaluation is conducted at the beginning of developing digital libraries in order to identify goals, procedures and the results. Summative evaluation carries out at the final stage of the project in order to examine whether the project reach the goals. Iterative design can conduct and re-test during the design and developing

digital libraries. Comparative evaluation can apply to compare and measure more than one system (Borgman 2002).

Moreover, the evaluation can be classified into three main approaches: usability testing; field studies; and analytical evaluation. The various methods can involve such approaches, namely field observations, interviews, questionnaires, asking experts, user testing, etc. (Sharp et al. 2007).

As can be seen, user interfaces have become more increasing vital than ever before. Usability is an important part in designing system to meet the needs of users and bring the success of the system (Nielsen 1993). Furthermore, Bailey (1993) stated that iterative design can enhance usability of a system, for example, House et al. (1996) have incorporated user-centred and iterative design in Cypress. The study emphasised on the query form and information representation. Moreover, Marchionini et al. (2001) noted that the development of digital library must be process-oriented and iterative design rather than productive and summative. Need assessment from users and a set of work tasks concern to design and evaluate digital libraries based on a human-centred approach.

Norberg et al. (2005) carried out a usability study and iterative design in the Documenting the American South Digital Library in order to assess the interface. The participants were asked to perform the task. Interviews, field observations, recording devices and think- aloud protocol are employed in this study. Additionally, several studies focus on the evaluation of usability of digital libraries. For example Roda et al. (2005) conducted a usability test by using comparative studies, field observations, interviews, paper prototypes and mock-up interactive systems in order to gather users' feedback in the development of digital image libraries. Clark (2004) conducted a task-oriented field test and focus group for the development of the Belgian-American research collection for improving the interface. Multiple methods were employed to assimilate data for improvements such as note-taking, videotapes recording, think-aloud

protocol. Sullivan and Ochoa (2009) conducted a usability testing method, emphasizing on user-centred design in the development of Digital Library of the Caribbean project. Scenario-based and focus group were used in evaluating the digital library. Additionally, users' feedback and comments for the redesigned interface were collected based on questionnaires and think-aloud protocol.

Several criteria and numerous numbers of measures have been proposed and applied for the assessment digital libraries. In general, there are three usability attributes underlying measures: effectiveness, efficiency and user satisfaction (Jeng 2005). Moreover, Nielsen (1993) identified five keys attributes of usability: learnability, efficiency, memorability, errors, and satisfaction. Booth (1989) purposed four factors related to usability, namely usefulness, effectiveness (ease of use), learnability and attitude (likeability).

Blandford et al. (2004, p. 31) investigated four techniques to evaluate digital libraries: Heuristic Evaluation, Cognitive Walkthrough, Claims analysis and Concept-based Analysis of Surface and Structure Misfits (CASSM). Heuristic Evaluation assesses the usability of interfaces by "checklist-based approach". The shortcoming of this method is restricted solely on specific pages. Cognitive Walkthrough aims to measure deeply the difficulty of usability by identifying users, the order of each task including the sequential steps to achieve the task. The limitation of this method is a lack of identifying query formulation and evaluating the results. Claims analysis can be defined as "statements about the positive and negative effects of a design on the user within a particular context of use (a 'scenario')". This method carries out "user scenarios" with system functions. This involves information seeking theory, as well as "positive and negative analysis". CASSM technique focuses on the concept. The concept considers entity, attribute and the relationship between entities. Additionally, interviews, field observations, think-aloud and other methods can use to gather data for analysis interactivities in the system. This method investigates at broad view of the system rather than the detail level.

Kassim and Kochtanek (2003) evaluated the development of Project i-DLR in learning purpose by combining various techniques, namely focus group reviews, Web log analysis, database transaction log, a Web based-questionnaire and a remote usability evaluation. Comments and suggestions from users have insight on how users interact with the Project i-DLR Web site. The results can be used for enhancing usability for the site.

Hansen et al. (2007) evaluated DiLAS, the Digital Library Annotation Services, which provides “collaborative information access”. The study aims to examine the interface to support collaboration among users by Annotation provided. The evaluation emphasizes on a formative work and user-centred evaluation. There are three individual methods employed in three separate experiments: A Cognitive Walkthrough; A Participatory Group Evaluation; and An evaluation of DiLAS annotations in collaborative work. Users’ suggestions and needs related to the desired functionality, as well as problems encountered were accumulated in order to improve for better facilitating collaboration in the revision interface.

The evaluation of semantic and social technology digital library, Jerome, is conducted by Kruk et al. (2008). The authors have applied three usability attributes, namely time to learn, rates of errors and subjective satisfaction. The usability study examined the design interface which was established like an online Web, as well as captured data from the users’ interaction with the system. The study evaluated the classic digital library compared to the semantic one and adopted a questionnaire in order to assess user satisfaction. The questionnaire consists of the following sections: pre-evaluation questionnaire are used to collect demographic users; initial tasks. Users assess how they appreciate the system at the first time; post evaluation questionnaire was gathered data for assessment of the overall feelings of the system. Also, the Jerome users were asked to assess the most and the least favourite and useful features, as well as suggestions regarding social and semantic features for improvements. This study has involved 26

postgraduate and undergraduate students in informatics and computer science. From total 3 answering tasks, the results revealed that users appreciated DSpace for the overall user satisfaction in the first answering task while users were more pleased with JeromeDL in the second and third question answering tasks. Recommendations were identified as the most useful feature, followed by the social/collaborative function.

The evaluation of DAFFODIL, a personal library, was conducted based on efficiency, effectiveness, quality, and user satisfaction criteria by using a free search on given tasks and a questionnaire. Two groups of participants involved in this study (total 28 participants): Librarian and professors were asked to perform the free search for evaluating various DAFODIL services, while students and research staff in computer science were asked to complete questionnaires for assessing efficiency and effectiveness. Moreover, video recording, protocol, systems log were employed to gather data. The finding concluded that both efficiency and effectiveness in information retrieval process were perceived relatively high (Klas et al. 2004).

Kengeri et al. (1999) carried out evaluation of four digital libraries, namely ACM, IEEE-CS, NSCTRL, and NDLTD with 48 participants in order to examine user interaction with the system by using features available in each digital library to accomplish tasks. The authors concluded that the “best overall” is IEEE-CS while “the best search time” is NDLTD. They also suggested user recommendation and taxonomy features are important to incorporate in the next generated digital libraries.

Theng et al. (1999) conducted the evaluation of the Networked Computer Science Technical Reference (NCSTR), the New Zealand Digital Library (NZDL) and the ACM Digital Library (ACMDL) with ten students and staff in computer science. The aim of the study is to examine valuable functions that should be incorporated in digital libraries regarding satisfaction and effectiveness criteria. The participants were asked to perform search and browse tasks. The study was based on the Questionnaire for User Interface Satisfaction (QUIS). The finding found that the participants have completed



search tasks successfully by using the NCSTRL. Also, it seems that they appreciated in the ACMDL, even though they did not accomplish the search tasks. For browse tasks, the participants have completed tasks successful when using the ACMDL and NCSTRL. Additionally, the results of investigating three digital libraries showed that the search function in the NCSTRL found easy to use for broad and particular searching. The NZDL provides result sets with sufficient textual information and abstract of documents; nevertheless, users may get difficult when using the browse function in the NZDL. The participants seemed pleased with the ACMDL based on screen layout, terminology, learning, Information Retrieval and search features. However, Lostness problems also were found in three digital libraries.

Hill et al. (2000) conducted the evaluation of the Alexandria Digital Library to deal with different user groups, namely Earth Scientists, Information Specialists, and Educators. The Alexandria Digital Library is composed of geographic materials for support various users such as specialist fields, researchers, teachers, and other people who have interested in. Informal and formal approaches carried out three distinguish user interface: (1) the web prototype collected data and feedback from the user experience in the earlier version; (2) Ethnographic studies. Audio tape recordings were used to capture the reference interviews; (3) the java interface in classroom study. Students were asked to complete assignment by using the Alexandria Digital Library interface. Those user interfaces were evaluated by different user groups. Users were asked to register for using the system. Moreover, session log was used to store tracking of users' interaction with the system, as well as Exit poll employed for gathering both qualitative and quantitative data. The results found that users' background knowledge has influenced users to achieve their objectives successfully. Also, commenting, users' requirements and feedback were collected to improve the system in order to support user community.

## 2.6 Conclusions

The research aims to design the novel interface of social digital library that can support participants' information seeking.

This chapter describes the background of digital libraries, the social digital libraries, the information seeking models and Information Foraging Theory, the tools for accessing information, personalization and recommendation. All have some potential to transform traditional digital libraries to social ones. The Victorian Times Digital Library combined a set of features to support search and browse, as the basic functionality. The supplementary features are taken in to account in order to facilitate more convenient for participants. With a great benefit of social activities, a virtual community and social features are included in order to provide sharing facilities and exchanging ideas with others as well as applied the concept of recommendation (for Victorian interface' features and a virtual community, as described in more detail in Chapter 4-5). Those features are provided in order to assist participants' information seeking strategies. Additionally, I designed the Victorian Times Digital library in order to enhance the interface and to minimize participants' time and effort based on Information Foraging Theory (more detail in Chapter 5). Finally, to achieve the goal of making a better user interface, it is necessary to evaluate the Victorian Times interface in the stages of development. The evaluation of an initial study will be explained in Chapter 4. The evaluation from an iterative design will be described in Chapter 5. Finally, the evaluation of the final design will be reported in Chapter 6.

In the next chapter, I will describe the methods of gathering and analysis data in this research in order to investigate the research goals and research questions.

# Chapter 3

## Research Methods

### 3.1 Introduction

The evaluation methods were chosen in order to answer the research questions as described in Chapter 1. The chapter describes research methods used in the studies reported in the following chapters. The studies conducted several usability tests according to an iterative design approach. Furthermore, questionnaires, logging system, think-aloud protocol, field observation, note-taking and interviews were used in the studies.

This chapter is organized as follows. I discuss evaluation approaches, methods to collect both quantitative and qualitative data are presented in Section 3.3. An iterative design is presented in Section 3.4. Analysis data is presented in Section 3.5. Ethical constraints are described in Section 3.6, followed by conclusions of the research and future plans.

## 3.2 Evaluation

In this research, I used formative evaluation in order to enhance and to improve the Victorian Times Digital Library continually. Ahmed et al. (2006) describes that formative evaluation allows actual users to be involved in an early phase of a developing system. Also, usability problems are discovered during the test.

There have been some studies that propose the evaluation of digital libraries as I described in Chapter 2. A variety of usability evaluation techniques such as usability inspections, usability testing, prototyping, field methods/observation, interviews and Web-based methods can be used in order to evaluate the use and usage of Web sites (Zhu et al. 2005). In this research, the usability testing technique was used to assess the redesigned Victorian Times Digital Library instead of other ones. When this technique is employed, actual users can be involved in digital library development. This also relates to the user-centred design in order to ensure that the system can meet users' requirements. Zhu et al. (2005) stated that one advantage of usability testing is that usability problems can be identified by real users. The disadvantage of this technique is that it is time consuming and costs.

Moreover, content, functionalities and interface are the main elements with respect to evaluation as identified by House et al. (1996). The interface relates to how the interface or an overall system can help users to accomplish the corresponding users' needs. Content relates to how well information organization and representation (Saracevic 2000). Functionalities relate to how the tools provide to help users accomplish their tasks. Following these ideas, participants' reaction to the functionality and content of the Victorian Times Digital Library was evaluated during various information seeking states.

It is important to take into account usefulness in the usability evaluation. As can be seen from some studies, attribute usefulness has been consolidated into the usability testing,

for example, (Booth 1989). The significant effects on perceived the usefulness and ease of use comprise of interface characteristic, organization context and individual references (Thong et al. 2002). There are many studies including usefulness criteria in evaluating user interfaces. For example, Buchanan (2009) combined usability and usefulness used to evaluate user satisfaction and interaction with a digital library. The questionnaire and observation used to gather data in the pilot test. The finding was reported that the further test required with a large sample size and different conditions.

In this study, the usability and usefulness were integrated to investigate interface, content and functionality as described above. The following sections I will describe details of evaluating the Victorian Times Digital Library, starting with the usability testing and usefulness, followed by methods to collect data, iterative design, analysis data, ethical constrains, ending with summary.

### **3.2.1 Usability testing**

It is necessary to involve usability test in every phase of user interface design (Ferreira and Pithan 2005). The aim of usability testing is to improve the system. Some faults in a program are revealed and fixed before releasing to real users (Rubin 1994). As Shackel (1991, p. 24) stated about the usability of a system, “The capability in human functional terms to be used easily and effectively by the specified range of users, given specified training and user support, to fulfil specified range of tasks, within the specified range of environmental scenarios.” Usability test was widely used in many evaluation digital libraries, for example, (Kengeri et al. 1999, Zhang et al. 2008, Zhang et al. 2009, Kruk et al. 2008). Usability problems were uncovered and further solutions were identified. Enhanced features can also be suggested to digital libraries. In this thesis, the usability tests were measured regarding “subjective usability measure” recommended by Hornbæ (2006). Hornbæ suggested that “The interface, interaction and outcome” were assessed based on “users’ perception and attitudes”. To measure usability in this research, I opted

three from four usability criteria from the usability evaluation model proposed by Jeng (2005), namely efficiency, effectiveness and user satisfaction. The usability criteria are as follows:

#### I. Effectiveness

In this study, effectiveness was used to measure participants' perception if the system can provide information and features as they can accomplish their goals. The effectiveness could be measured by the number of tasks completed.

II. Efficiency was used to measure the efficiency of documents retrieved by the system. The efficiency could be measured by time taken to complete the task.

#### III. Participant satisfaction

This part measures participant satisfaction about usability of the Victorian Times interface. Of statements used in this research are as follows:

- **Ease of use.** A digital library must be easy to use.
- **Interface characteristics.** The interface should support users to find desired things that they need without spending too much time. Also, good web site navigation should be provided (Thong et al. 2004).
- **Screen design.** Design of content, font format including graphics in a digital library should be displayed in a suitable information presentation, well organization and consistent layout throughout the entire site (Thong et al. 2004).
- **Terminology used.** The interface should provide non-technical terms and unambiguous words in order to avoid getting frustrated (Thong et al. 2004).

- **Visual attractive.** Users must feel pleasure using a digital library.

The research follows two ways for assessing user satisfaction suggested by Hornbæk (2006), namely preference and specific attitudes.

(1) Preference

The participants were asked to rank the interfaces they flavoured based on preferences, for example, “which interface do you like the most to accomplish the task?” They also express their ideas on each interface including given reasons why they preferred one of them (Hornbæk 2006).

(2) Specific attitudes

Attitude can be measured in depth by 5-point or 7-point semantic differentials rather than traditional scales (Hayes 2000). In this thesis, after participants complete using each interface, they were asked to rate a set of semantic differentials (see Figure 3.1).

Using the interface						
Stressful	—	—	—	—	—	Relaxing
Frustrating	—	—	—	—	—	Satisfying
Useless	—	—	—	—	—	Useful
difficult	—	—	—	—	—	Easy
standard	—	—	—	—	—	Novel
slow	—	—	—	—	—	Fast
Complex	—	—	—	—	—	Simple

Figure 3. 1 A set of semantic differential used in the usability tests

In this study, when participants have used the interfaces, they were asked to rate the ease of use, well organization, terminology clearly used, visual attraction and overall reaction to the system by a five-point scale, where “1” means “The worst and “5” means “The best” (see Figure 3.2).

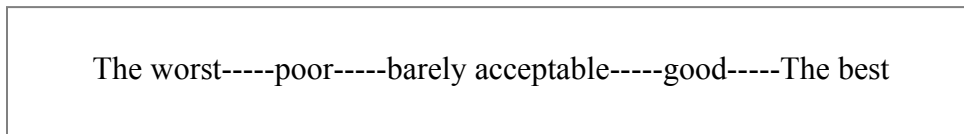


Figure 3. 2 A set of a five-point scale ranging from the worst to the best

### **3.2.2 Usefulness**

The users considered usefulness of the system if they found relevant information as they accomplished their goals without effort and spent too much time (Thong et al. 2002).

The usefulness in this study is defined as participants expected that using the Victorian Times interface will assist them for finding information. The usefulness was measured through a five-point scale, where 1 = “Not useful” and 5 = “Very useful”.

### **3.3 Methods to collect data**

To examine the research problems and research questions (described in Chapter1), data collection involves both quantitative and qualitative approaches. This will lead to gain benefits and overcome the deficiencies of both methods. A number of techniques can be used to collect both quantitative and qualitative data, such as questionnaires, logging system, think-aloud protocol, field observation and note-taking, the software screen record and interviews. I described each technique in more detail below.



### 3.3.1 Questionnaires

Questionnaires can be utilized for gathering users' background and the users' interaction with the system including measuring of "users' subjective opinions such as satisfaction and preferences" (Zhu et al. 2005, p. 332).

The questionnaire is a simple way to collect data with a small budget. In addition, the quality data from the questionnaire are adequate for investigating the results against hypotheses (Breakwell et al. 2006). The questionnaire composed of close and open ended questions. For close-ended questions, a range of limited answers is provided. This made data coding easy to gather, analyse statistically (Hayes 2000). A number of studies showed that feedback and user satisfaction with the interface can be gathered and assessed by questionnaires methods (Some examples can be seen in Chapter 2). Open-ended questions allow participants feel free to express comments and suggestions about the system. In this study, a questionnaire comprises of the following sections:

1. A pre-test questionnaire, the first part of the questionnaire, aims to collect demographic information, which includes participants' profiles. Participants were requested to indicate their ages, number of years of working/studying in Strathclyde University, the first language, experience with digital libraries and Internet.
2. A set of tasks. The participants were asked to perform the tasks by using the features provided in the interfaces in order to examine participant interaction with the system, as well as to measure participants' perception and satisfaction. In detail for the tasks described in the later chapters. Once the participants have performed each task. They were asked to assess the level of task difficulty.
3. A post-test questionnaire. Participants were asked to assess or compare the features and interfaces according to participants' preference , such as the ease of

use, organization of information, terminology used, virtual attraction, the best features of the site, the worst features of the site, overall reaction, some desired functions needed to include in the site and the ease of navigation that are adapted from a post-test questionnaire in usability test proposed by Jeng (2005). In terms of usefulness of features, the post-task questionnaire particularly used in the usability tests in Chapter 4 are adapted from Kengeri et al. (1999).

4. Interview questions, the last part of the questionnaire, gather participants' feedback concerning recommendations and additional comments to the systems. This section consists of three open-ended questionnaires. All the questionnaires can be found in Appendix A.3-A.8.

For close-ended questions, a five-point scale was applied in order to state participants' thoughts identifying a degree of attitude measurement in a given topic.

### **3.3.2 Logging system**

Logging data, which were recorded by PHP (Hypertext Pre-processor) scripts, consists of detailed data based on participant requests such as whether a user logs in or is anonymous, date and time of transactions, Uniform Resource Locator (URL) paths to request a page (see Figure 3.3). This is composed of information of previous users who interact with the system. In addition, the logging data is a complementary way employed to record statistics on the use of functions in order to manipulate them (Nielsen 1993). However, the shortcoming of Web log data is that it cannot indicate the reasons of unused pages or unutilized functions. Other methods such as usability test should be supplemented with the Web log in order to contribute our understanding in this point (Zhu et al. 2005).

```

27/08/2010 14:14:13 anonymous //test3/pattern1/?module=user&action=collection
27/08/2010 14:14:16 anonymous //test3/pattern1/?module=user&action=simple
27/08/2010 14:14:19 anonymous //test3/pattern1/?module=user&action=listResult&letter=8
27/08/2010 18:28:40 anonymous //test3/pattern1/?module=user&action=listResult&letter=8&limit=10&page=2
27/08/2010 18:28:45 anonymous //test3/pattern1/?module=user&action=collection
27/08/2010 18:28:51 anonymous //test3/pattern1/?
module=user&action=showItem&category_name=Architecture&user_id=&count_item=37
27/08/2010 18:28:58 anonymous //test3/pattern1/?module=user&action=collection
27/08/2010 18:29:23 anonymous //test3/pattern1/?module=user&action=show_track_user&user_id=Amie
27/08/2010 18:29:27 anonymous //test3/pattern1/?module=user&action=show_save_user&user_id=Amie
06/09/2010 17:25:53 anonymous //test6/pattern2/?module=user&action=collection
06/09/2010 17:25:58 anonymous //test6/pattern2/?module=user&action=show_view_document&category_name=Barges
08/09/2010 16:36:55 anonymous //test6/pattern2/?module=user&action=collection
08/09/2010 16:37:25 nuch //test6/pattern2/?
module=user&action=info_item_list&user_name=nuch&folder_id=14&folder_name=architecture%20house
08/09/2010 16:38:21 nuch //test6/pattern2/?module=user&action=collection&user_id=
08/09/2010 16:38:24 nuch //test6/pattern2/?module=user&action=show_view_document&category_name=Bridges
08/09/2010 16:40:43 nuch //test6/pattern2/?module=user&action=info_author&gal_item_photographer=Illustrated%
20London%20News&user_id=nuch&gal_category_id=36&gal_item_title=The%20Queen%27s%20return%20from%20the%20Highlands%20
(engraving)%20&group=The%20Queen%27s%20return%20from%20the%20Highlands%20(engraving)&group=
08/09/2010 16:42:32 nuch //test6/pattern2/?module=user&action=collection&user_id=
08/09/2010 16:42:36 nuch //test6/pattern2/?module=user&action=show_view_document&category_name=Cholera

```

Figure 3. 3 An example of logging system containing a user name login, date and time, URL paths for the requested page

### 3.3.3 Think-aloud protocol

Think-aloud protocol is used to capture users' thoughts, any comments or perhaps, problems they might encounter during performing the task and study how they solve the problems. This can discover how users feel about the system (Rubin 1994).

### 3.3.4 Field observation and note-taking

Field observation and note-taking are used to record the users' interaction with the systems such as the steps of users performing the task. The benefit of note-taking is that cost less and does not disrupt participants during the test. These data are valuable for analysis in the early stage. However, the limitation of this method is the difficulty in simultaneous writing and listening, the difficulty in reading handwriting and limited speed of handwriting (Sharp et al. 2007). Additionally, this method can be incorporated with logging data in order to provide more corroborative information (Lindgaard 1994).

### 3.3.5 The software Screen Record.

In this study, CamStudio was used to capture all interaction on a screen between users and the system. Also, sound files were recorded. This can create video files and allow the researcher to follow all steps the use of the system from start to finish the task ('Cam

Studio Open Source Free Streaming Video Software'). The videos captured can be used for analysis in subsequent time along with logging data in order to check for the validity of findings. This method aims to investigate the difficulty identified by participants but it requires a lot of time.

### **3.3.6 Interviews**

The objective of interviews is to gather users' feedback including suggestions and the users' perception about the best and worst features of the system. Interview is the best way to obtain detailed information from users. Also, "Walk through" technique and "recall" can be employed during interviews. Users will be asked for the previous steps they have done. This includes details of reasons how and why they worked in the past (Zhu et al. 2005). Open-ended interviews allow users to express their full opinions on the given issue. The data enable an interviewer to gain insights in deep details for improving user system usability and might be covered the topic that the interviewer has not realized (Sharp et al. 2007).

## **3.4 Iterative Design**

The development of the system is required to test in order to fix the problem and test repeatedly with the redesigned interface until it has attained an acceptable level (Lindgaard 1994). Typically, the most powerful method for evaluating the site is usability testing. Usability problems can be discovered in the early phase from one usability test. However, it is necessary to incorporate an iterative testing in order to gain the most benefit of improving system usability (Zhu et al. 2005).

The usability evaluation can be involved during the development of digital libraries. Ahmed et al. (2006) suggested that an iterative approach with prototypes on the early phase can detected usability problems in designing interfaces. This can reduce time and

effort. The redesigned of interface can be re-tested in order to examine the progress made.

In this study, it is beneficial to carry out a literally formative usability on early prototypes before launching to the test with actual users. A well designed interface of the Victorian Times Digital Library is challenging. It is related to getting feedback from users initially in the development and iterating through a number of versions of the system. Badre (2002) presents lists of the key concerns needed to plan before starting Web usability testing as I can apply in evaluating the Victorian Times Digital Library. The lists are as follows:

### **3.4.1 Type of users to test**

The original Victorian Times Digital Library aims to support learning purposes for various users (described in Chapter 4). Users may be teachers, researchers or students, who might have some or deep knowledge, may need historical documents that relevant to their studies or their works. These users may need the advanced functions that led them to achieve the desired information quickly. On the other hand, there may be users from different background who are simply curious about the Victorian Times and may like to use the Victorian Times Digital Library. These users are likely to have a wide range of domain knowledge from low to medium and they may feel unconfident when searching the collection.

Participants who participate in the test should come from real users. Selecting participants tested depends on the purpose of the test (Zhu et al. 2005). Recruiting real users as the participants was infeasible for this study. I instead recruited the participants who were experienced with online information searching or people in academic, having general computer experience or experience with digital libraries rather than real users. Therefore, the participants being met the following criteria would be included in the tests:

- Postgraduate students, who are studying for a master's degree or PhD degree in Computer and Information Sciences.
- Staff, who are working in Computer Science and Information Sciences area.
- Undergraduate students, who are studying in Bachelor degree in Information Management or Library Sciences.
- People, who have interested in history or people, who have experience with digital libraries.

### **3.4.2 Number of participants**

A small set of usability tests were conducted in this research in order to test a usability plan and improve interface design. “ (a) the desired confidence level of the results, and (b) the cost-benefit ratio” are required to take into consideration in order to specify the number of participants in a usability test (Zhu et al. 2005, p. 326). Jakob (2000) recommended that five users would be sufficient to report most problems encountered in a usability test.

Brinck et al. (2002) suggested that testing using a small number of people is able to provide rich results. The authors also pointed out that the number of participants from eight to ten can be divided into two sessions. The first session, four or five participants required to involve in the test. The results derived from this session will help to specify the weakness and users' impressions of the interface. The interface is improved for better usability. And then the revised versions of the system will be tested by the rest of participants. Except in the case of a greatly complicated system, this can identify error and areas of improvement from users in the development of interfaces. Moreover, testing with eight to ten participants is valuable after a majority of usability problems are eliminated. Iterative testing and evaluation are necessary for enhancing the interfaces.

The small amount of users helps in discovering major usability problems before conducting the bigger test in order to prevent the same usability problems.

Additionally, Zhu et al. (2005) stated that five to seven people are enough for usability testing in order to identify problems. The recruitment for participants can be done several ways such as Web site announcement, word of mouth etc. The participants should be voluntary and should be received gifts or compensation for their endeavour and time.

### 3.4.3 Location in testing

Usability tests took place in a simple single room setup at the Department of Computer and Information Sciences at Strathclyde University. The test monitor sits nearby the participants in the simple single room setup (see Figure 3.4). This can help the test monitor notices clearly all steps that each participant interacts with the system. Also, the participant may be reminded to speak out loud if s(he) forgot (Rubin 1994).

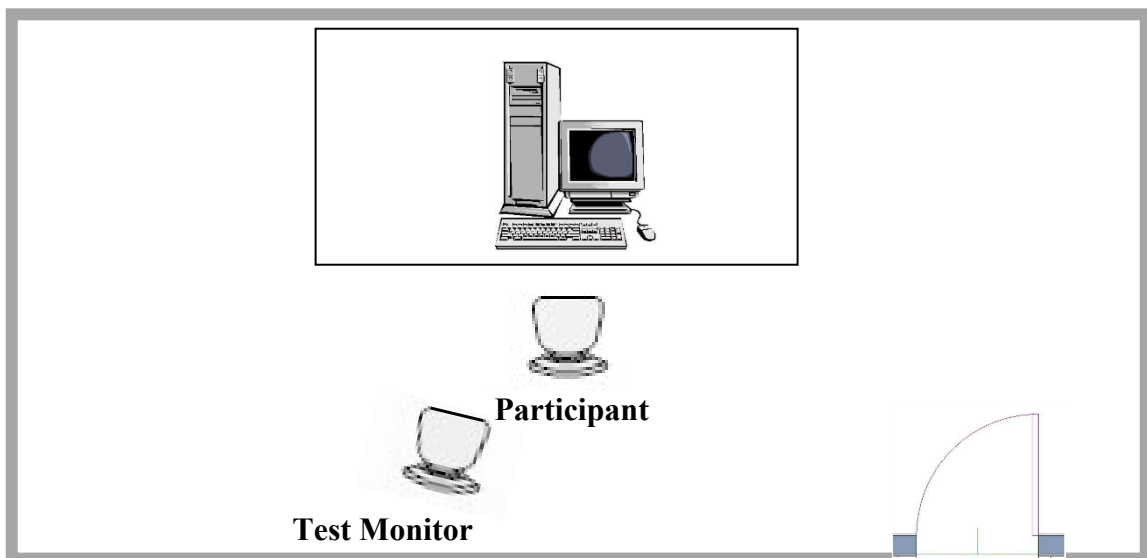


Figure 3. 4 Simple Single-Room Setup

### **3.4.4 Tasks to use in testing**

Developing user task scenarios is the first step in the formative evaluation. Furthermore, total tasks have to be considered in the user task analysis (Ahmed et al. 2006).

In this study, there was not only search and browse tasks in given specific topics. It requires various tasks in real life situations that are presented in the study (see more detail in Chapter 5). The insufficient tasks may restrict the generalization of the outcome. Furthermore, the quality and all tasks covered are influence the success of the usability tests. The interface problems may not identified in the tasks (Ahmed 2008).

There are many kinds of tasks, such as “finding specific information (‘what is the price of ... ’), finding something you like (‘Find an article of interest to you’), comparing items (‘Which product is the best value?’), performing a transaction (‘Purchase this product’), and entering information (‘Fill out the feedback form’)”. Such tasks are aimed and detailed. With these tasks, users have experience with the system as “goal-directed users” that can be found in typical use in e-commerce Web sites. Sometimes users may browse for more information in interesting topics (Brinck et al. 2002, p. 426).

In this research, participants were given a various type of tasks, namely specific and general tasks. For specific tasks, the participants were asked to find information in known objects , for example, find the document entitled “The conditions required for the healthy house”, while general tasks, were asked to find information on broad subject, for example, “I would like to know about what water transportation people use in The Victorian Time period”.

In addition to specific and general tasks, simulated work task situations were used in order to provide realistic situations (See more detail in Chapter 5). A simulated work task situation can be defined by Borlund (2003) as “a short ‘cover story’, serves two main functions: 1) it triggers and develops a simulated information need by allowing for



user interpretations of the situation, leading to cognitively individual information need interpretations as in real life; and 2) it is the perform against which situational relevance is judged.”<sup>2</sup> An example of a simulated work task situation used in the usability tests is displayed in Figure 3.5. The participants also were requested to give answers approximately one page paper a task. Each task consists of sub-tasks required the participants to complete.

You are investigating your family tree and have learnt that your great-grandmother was a servant in Victorian Times. You are interested to learn more information about what kinds of jobs women performed in Victorian Times. What jobs were popular in Victorian Times in women, what kind of jobs might you have done if you were a women in Victorian Times.

Figure 3. 5 Example of a simulated work task situation used in the usability tests

### **3.4.5 Simulating the conditions of use**

Environment and conditions of system testing should be the same as the actual use where people find information on the Web site by themselves. In this study, a personal computer is simulated as a web server. Participants can explore and compare the interfaces of the Victorian Times Digital Library by running on Mozilla Web browser. According to the permission rights of the Victorian Times collection, this restricts them to access in public. With respect to this reason, the redesigned Victorian Times Digital Library is unavailable online. However, conducting the usability test is possible by

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<sup>2</sup> <http://informationr.net/ir/8-3/paper152.html>. Accessed Dated: 25 December 2011.

creating a virtual community based on simulated users' transactions. Even these data come from simulation but it may be sufficient to conduct the test.

In this research, I go through six major iterative usability tests in order to revise the Victorian Times interface. After each round of evaluating the Victorian Times Digital Library, the interfaces were modified within the iterative design process described in Section 3.4. The initial design of the Victorian Times interface is described in Chapter 4. From the results obtained in initial study, I designed various versions of The Victorian Times Digital Library and performed a comparative evaluation. The iterative approach is used to identify usability problems and possible suggestions in the interfaces. The detail of the iterative design is described in Chapter 5.

### **3.5 Analysis data**

For quantitative data obtained from questionnaires, such as participants' profiles, background experience, as well as the data presented on a five and seven-point scale were analysed by descriptive statistics. Also, the numerical data from participants' responses regarding a set of semantic differentials were calculated mean value by the Statistical Package for Social Sciences (SPSS). To investigate for significant differences between the interfaces, I used non-parametric statistics test based on data collected from participants.

Interview data can be represented in audio recording and writing scripts. Once having finished interviews, the interviewers should write the scripts immediately due to their good and fresh memory. Also, audio recording may be helpful and written scripts can be used to clarify deepen understanding. Qualitative approach can analyse data from observer's notes, think-aloud protocol transcriptions. Also 'contextual information' can be derived from photographs. Furthermore, quantitative approach can analyse data from data log and some of the observer's note (Sharp et al. 2007).

### **3.6 Ethical constraints**

As the ethical constraints aspect, I follow these issues suggested by Breakwell(Breakwell et al. 2006):

1. Consent forms (see Appendix A.1)

Participants were asked to complete the consent forms if they agree to participate in the usability test. They were informed about the aim of a study and the methods used to capture data. The participants can withdraw the test any time without reasons given and any of their rights being affected.

2. Confidentiality and anonymity

To ensure confidence and anonymity, the participants were affirmed that their data would be handled confidentially. No person name and personal information would be indicated in the research report. However, the research report would be displayed data calculated from statistics.

### **3.7 Conclusions**

In this chapter I described the research methods for the Victorian Times Digital Library interfaces. A well designed and user-friendly interface for the Victorian Times Digital Library is important in order to support information seeking process (described in the previous chapter). The usability tests and the iterative design process can help to ensure that digital libraries provide effectiveness and usefulness for users. The results from formal usability tests by using techniques (described in Section 3.3) for gathering data are potential improvement in the redesigned of the Victorian Times Digital Library. Also, it can determine whether usability goals have been achieved.

In the next chapter, I will present a set of pilot tests. The usability tests were used to examine the participant interaction with the interfaces and to measure participants' perception and satisfaction based on a various criteria as mentioned before.

# Chapter 4

## Experiments on initial interface design

### 4.1 Introduction

Our objective is to evaluate the usefulness of basic and advanced features together with social features to support participants seeking information in the systems. In this chapter, I designed two interfaces: the traditional interface refers to the baseline interface and the social interface refers to the experimental interface. The baseline interface provides traditional features such as search and browse, as well as advanced features.

On the contrary, the experimental interface is accomplished by integrating social features to support social interaction in a virtual community along with basic and advanced features. To encourage users to interact with others, this interface should provide a variety of social features such as shared wish lists, shared histories, comment etc. I believe that this will increase the feeling of social experience and I expected that users might be achieved the benefit to these features for finding information. The functionalities of the baseline and experimental interfaces are presented in Section 4.3 and 4.4 respectively.

In addition, I have designed usability studies to evaluate the effectiveness and participant satisfaction of the interfaces, as well as to assess the usefulness of interface features. The study was completed in two stages based on the experimental method described in Chapter 3. The first usability study involved 5 participants using the baseline interface for specific search tasks. In this study, the participants were allowed to use any features as they liked. To be able to assess the usefulness of interface features, I need to determine a larger scale and restrict participant to use the particular feature to perform the task. Also, I would like to investigate how participants interact with the interface if the system provides social features. Therefore, the second study was conducted with two interfaces, new tasks and 24 new participants thus allow me to analyse the usefulness of all features. I provide the results of the first and second study in Section 4.5.1.4 and Section 4.5.2.4, respectively. Discussion of the results is presented in Section 4.6. This chapter ends in Section 4.7 with conclusions where future work is also given.

## **4.2 Victorian Times System**

The Victorian Times Digital Library was designed and developed by Centre for Digital Library Research (CDLR). The screenshot of the main page of the original Victorian Times interface is presented in Figure 4.1. For all pages of screenshots of the original Victorian Times interface can be seen in Appendix B.



Figure 4. 1 The main page of the original Victorian Times Digital Library

The original Victorian Times interface provides basic: search and browse functions for finding information. The interface allows users to explore LCSH categories by progressive drilling-down through clicking groups on the main page. Lists of categories are displayed in Figure 4.2. Furthermore, the search function enables users to enter keywords in a search box. The search results are shown in Figure 4.3.

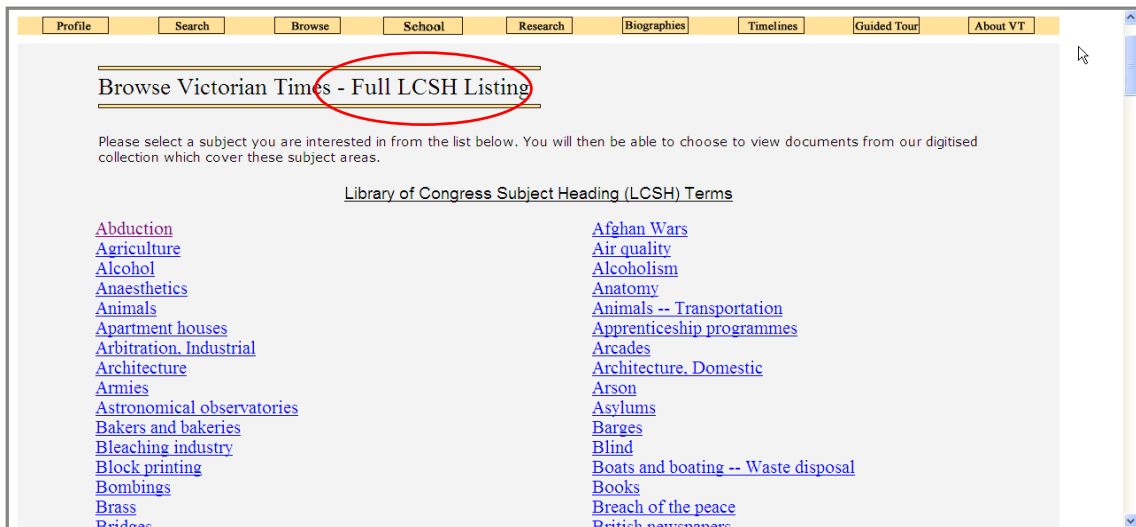


Figure 4. 2 Full LCSH Listing

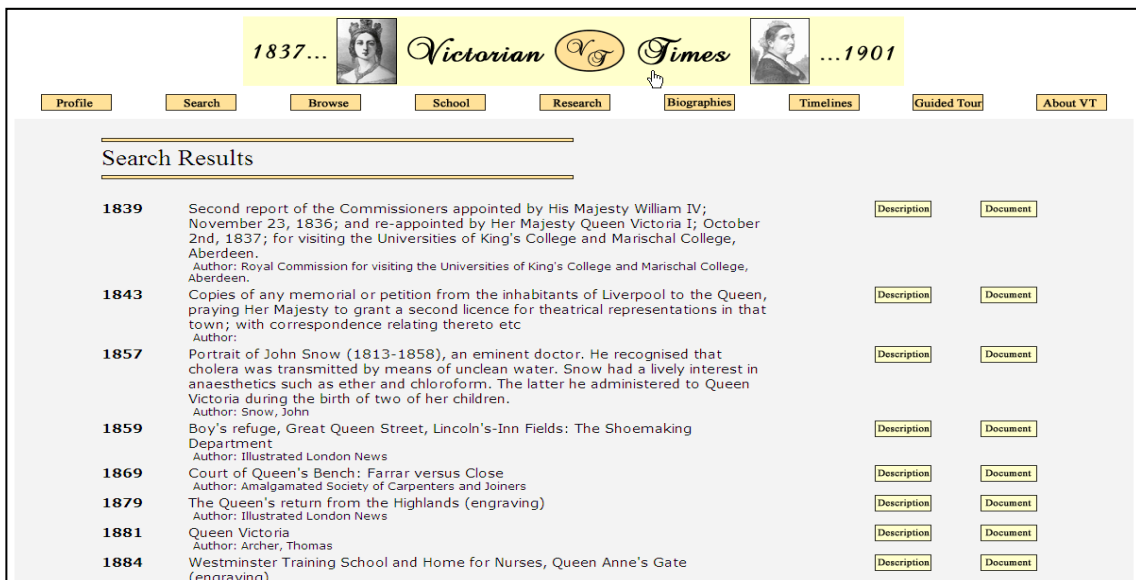


Figure 4. 3 Search results



### 4.3 The baseline interface

The baseline system was designed to be similar to the original Victorian Times interface, which only provides search and browse features. Advanced features were also included in the baseline interface in order to support users during the search.

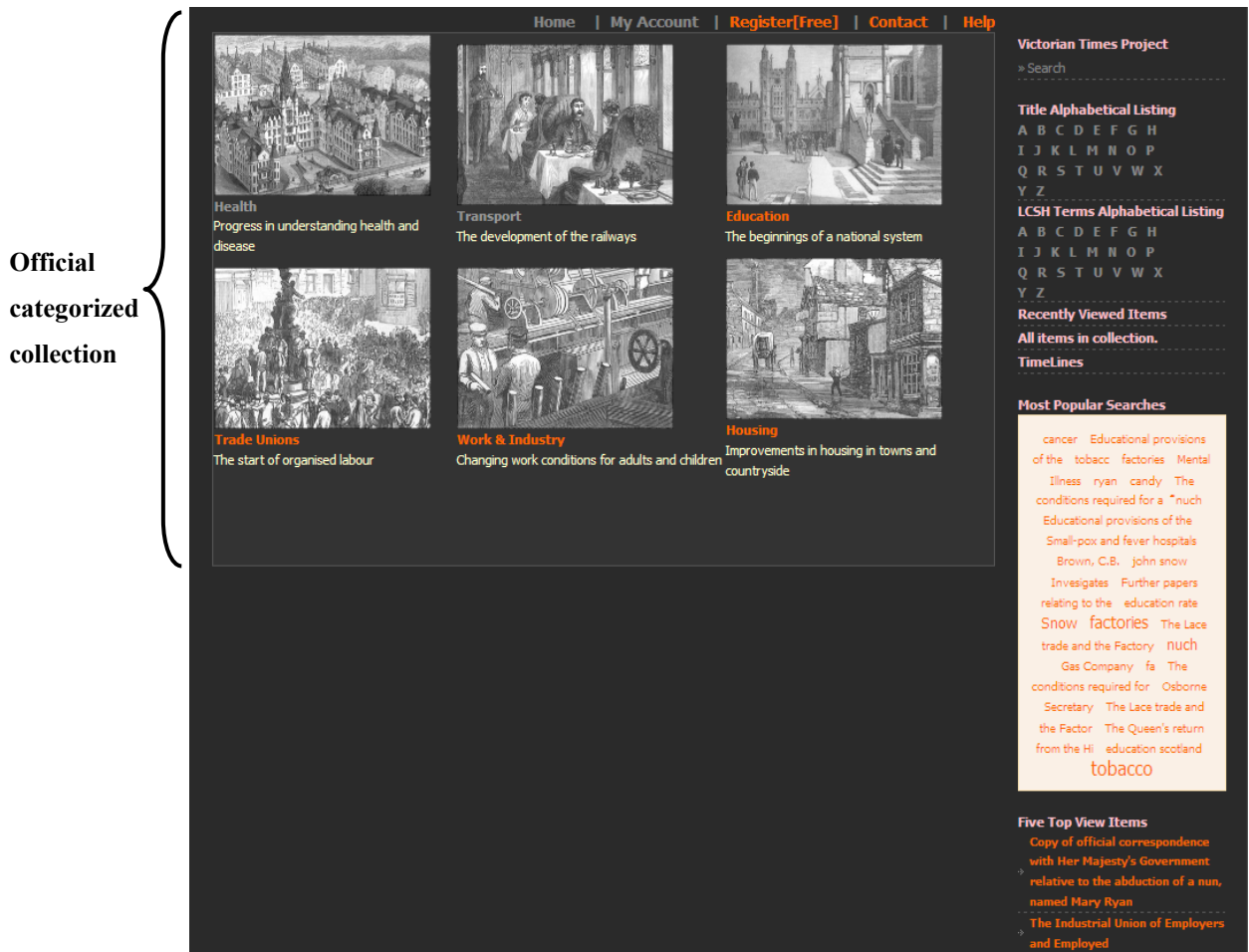


Figure 4. 4 Screenshot of the main page of the baseline Victorian Times user interface

Figure 4.4 shows that the baseline interface comprises of two main components: basic and advanced features. I will now outline the details for each feature.

### 4.3.1 The basic features

The basic features consist of search and browse that can be found in traditional digital libraries. I have designed some parts of the basic features by following issues of suggested search and browse features in digital library in Smith (2000).

Users might navigate information in the Victorian Times Digital Library in different ways of browsing features; the systems provide numerous options to access information as follows:

- **Browsing by groups & sub-groups (Official categorized collection):** The system allows users to navigate information by groups and sub-groups, which are categorized and displayed in The Library of Congress Subject Heading (LCSH) terms.
- **All items in the collection:** All items in the collection can be retrieved and displayed.
- **Title alphabetical lists:** All items in collection can be divided up into pre-set classes according to an initial letter of title.
- **LCSH Terms alphabetical lists:** All items in collection can be divided up into pre-set classes according to an initial letter of LCSH Terms.

Or users possibly simply go through searching features which are provided two options:

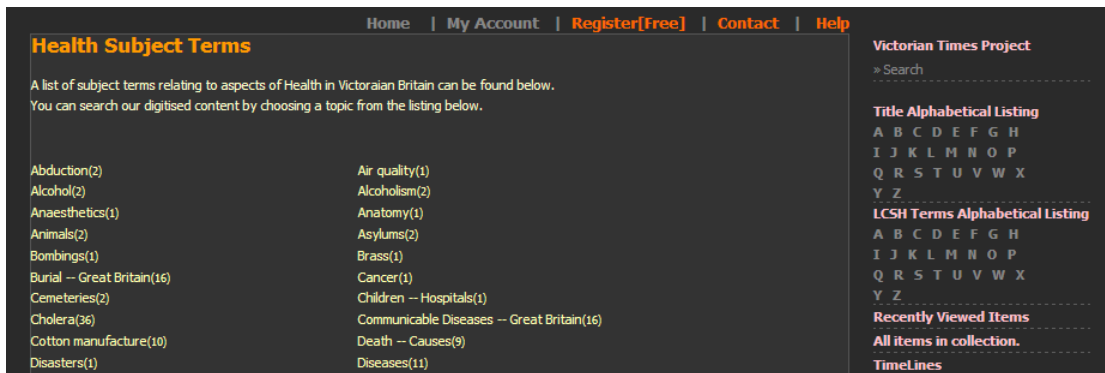
- **Search documents:** Using search function designed specifically for finding information about items.
- **Search by timeline:** This tool let users find information by group name and year.

Next, I will explain more detail for each feature of the basic features.

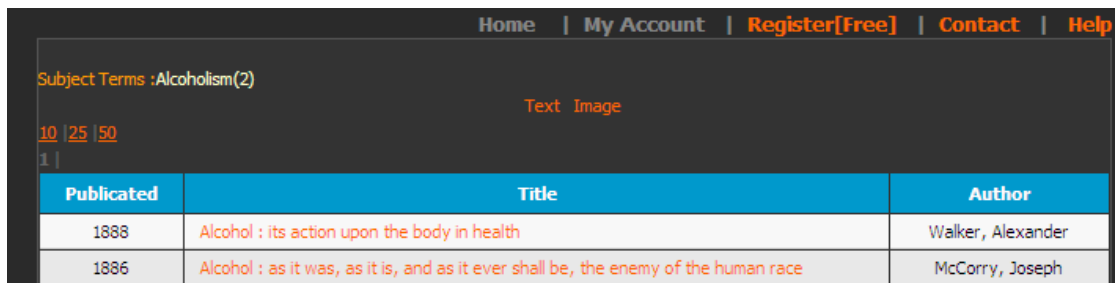
#### 4.3.1.1 Browsing by groups & sub-groups or browsing in official categories

Information organized by subject category can be found in Web sites and online references in order to assist users to explore and to know more the area collection (Tidwell 2005).

Users can view groups & sub-groups by progressive drill-down clicking. The sub-groups were represented in LCSH Terms (see Figure 4.5).



(a) Sub-groups represented in LCSH Terms. This section being viewed is sub-groups in Health.



(b) Item lists from a sub-group of the collection. This section being viewed is item lists in Alcoholism.

Figure 4. 5 The classification of Victorian Times.

### 4.3.1.2 All items in this collection

This feature enables users to look at all items in this collection in order to determine the entire document viewing. Users can use pagination to go through several pages (Wodtke and Govella 2009) and click the particular item to see more detail (Figure 4.6). It also provides two different filters: text and image types. Text type is used to filter and display text documents. Likewise, clicking on image type can launch photograph documents.

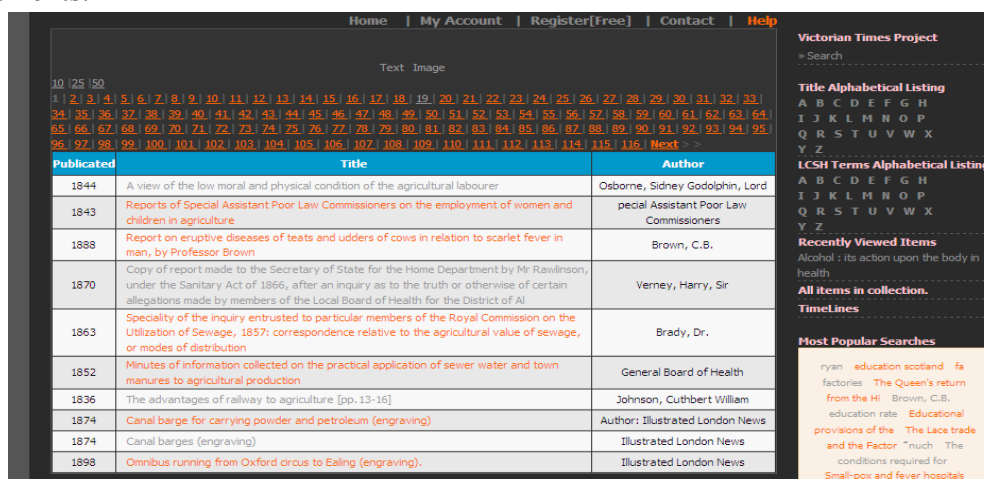


Figure 4. 6 The interface for All items in this collection

### 4.3.1.3 Title alphabetical lists

An A-Z alphabet can lead to the investigation of the content of a web site (Kalbach and Gustafson 2007). Alphabetical lists display A-Z alphabet titles. The way how to use this feature is similar as LCSH Term alphabetical lists (see Section 4.3.1.4). First, users click the first letter of a title (Figure 4.7), and then the page shows all lists of titles that begin with the first alphabet chosen by users (Figure 4.8). Finally, they can click to explore the title they need.

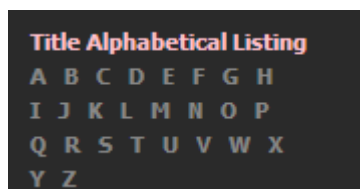


Figure 4. 7 The interface for Title alphabetical lists

Home | My Account | Register[Free] | Contact | Help

Title list by Alphabet :C (139 Records)

Text Image

10 | 25 | 50

1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | Next >>

Published	Title	Author
1870	Copy of report made to the Secretary of State for the Home Department by Mr Rawlinson, under the Sanitary Act of 1866, after an inquiry as to the truth or otherwise of certain allegations made by members of the Local Board of Health for the District of Al	Verney, Harry, Sir
1874	Canal barge for carrying powder and petroleum (engraving)	Author: Illustrated London News
1874	Canal barges (engraving)	Illustrated London News
1841	Consideration on advantages of steam navigation on canals	Livius, Barham
1856	Copy of the report and estimate of General Williams, Royal Engineers, regarding the harbour of Ramsgate, presented to the Board of Trade	Williams, S.
1856	Copy of the last report of Sir William Cubitt, on Ramsgate Harbour, recently submitted to the Board of Trade	Cubitt, William
1851	Copies of any reports made to the Lords Commissioners of the Admiralty, in reference to the state of Ramsgate Harbour, during the years 1850 and 1851	Walker, James
1904	Children going to school by ambulance	Philpott, Hugh
1865	Copy of official correspondence with Her Majesty's Government relative to the abduction of a nun, named Mary Ryan	-
1845	Copy of the letter addressed by the Secretary of State for the Home Department to Mr Wray, the Receiver-General of Metropolis Police, in consequence of the report of a committee of this House upon the South Eastern Railway Company's Petition; and, also, a	Secretary of State of Home Department

Victorian Times Project

> Search

Title Alphabetical Listing

A B C D E F G H  
I J K L M N O P  
Q R S T U V W X  
Y Z

LCSH Terms Alphabetical Listing

A B C D E F G H  
I J K L M N O P  
Q R S T U V W X  
Y Z

Recently Viewed Items

Alcohol : its action upon the body in health

All items in collection.

TimeLines

Most Popular Searches

Small-pox and fever hospitals  
Snow tobacc Women and  
doctors: or, medical Educational  
provisions of the Educational  
provisions of the Investigates  
Mental Illness \*nuch ryan fa

Figure 4. 8 Title alphabetical listing menu, the section being viewed is item lists displayed according to initial letter “C”

#### 4.3.1.4 LCSH Terms alphabetical lists

To provide users with “associative navigation with metadata” and to show them about the subject headings found throughout a collection (Wodtke and Govella 2009, p. 209), LCSH Term alphabetical lists display A-Z alphabet LCSH lists.

First, users click the first alphabetic of LCSH term (Figure 4.9), then the page shows the lists of LCSH terms in alphabetic order (Figure 4.10).

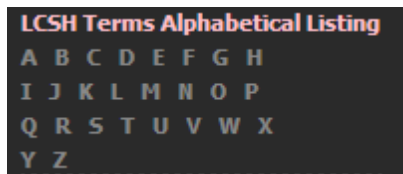


Figure 4. 9 The interface for LCSH Terms alphabetical lists

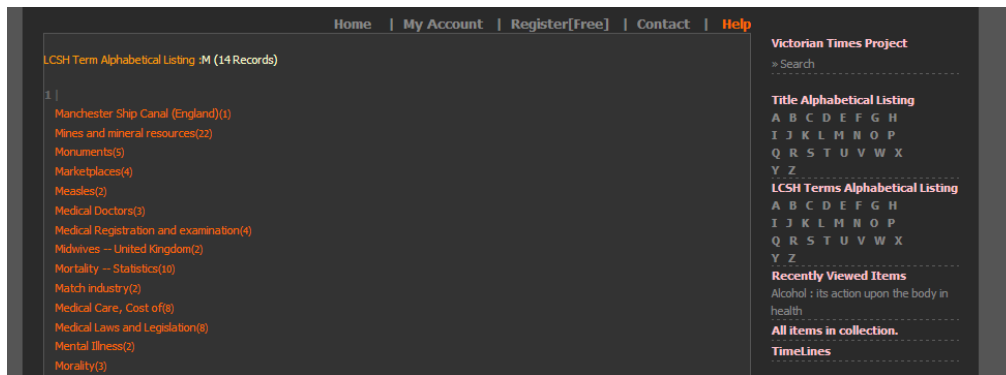


Figure 4. 10 LCSH Term alphabetical listing, the section being viewed is LCSH Terms displayed according to initial letter “M”.

#### 4.3.1.5 Search documents

The system allows for issuing simple and complex queries in basic and advanced search features. The search box let users input search term-specific criteria such as title, author, description, and year (see Figure 4.11).

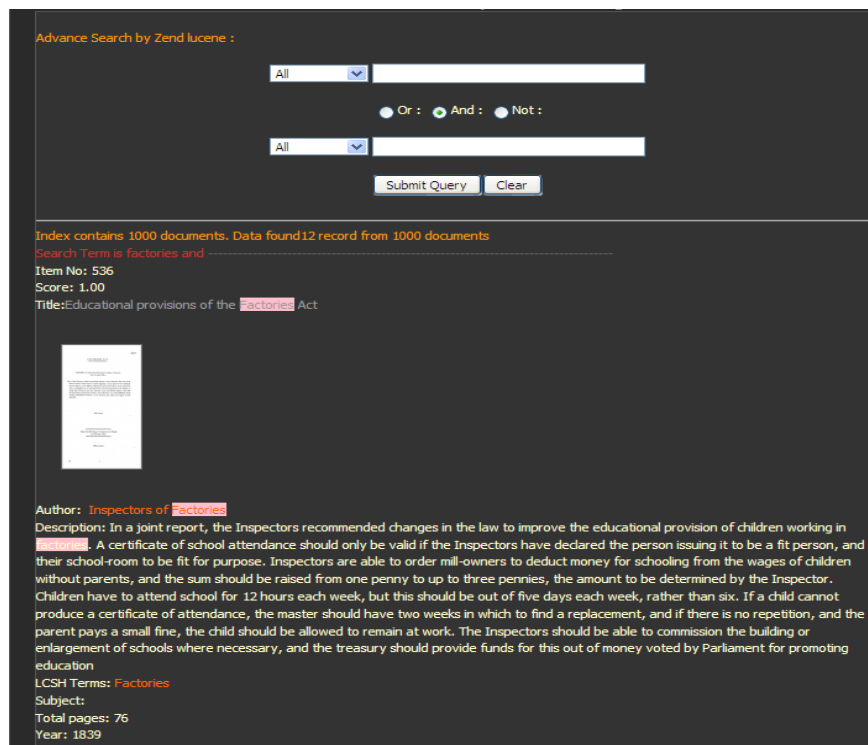


Figure 4. 11 Search features; the section being viewed is the results of “factories”.

### 4.3.1.6 Search by Timeline

The collection in Victorian Times is historical materials from the Victorian Era. It is helpful if the system provides search by date range (Smith 2000). The interface allows users to select group (from six groups in the collection) and choose period time (from year one to year two) to search. Then, the results are displayed ordering by year (see Figure 4.12).

Victorian Britain Timelines :

Many of the events described in Victorian Times can be better understood when viewed in a wider context. The boxes below allow you to select timelines relating to particular topics. Some entries include links to further information on the events. By default, the timelines cover the reign of Queen Victoria, but you can choose to view events which occurred in the years immediately prior to view events which occurred in the year immediately prior to, and after the Victorian era.

Transport From 1810 To 1950

View Timeline

Text Image

Group : Transport From 1810 To 1950(270)

Publicated	Title	Author
1816	Report from Committee on Estimate for Highland Roads and Bridges.	Committee on Estimate for Highland Roads and Bridges
1819	Report from the Committee on Darlington and Stockton Railway Petition	Select Committee on Darlington and Stockton Railway Petition
1819	Report from the Select Committee on steam engines and furnaces	-
1820	Report from the Select Committee on steam engines and furnaces	House of Commons. Select Committee on Steam Engines and Furnaces

Figure 4. 12 The interface for Search by Timeline

### 4.3.2 The advanced features

In accordance with Paepcke (1996) who states that only search features are not enough in Digital Libraries. Digital Libraries should provide facilities to capture information for using in subsequent time. Furthermore, digital libraries should provide appropriate display information for being used for different people. I have designed the advanced features, the supplementary tools, which are available for users to use along with the basic ones.

The purposes of advanced features are as follows:

1. To support users to manage the results they found in easy and convenient ways, for example, keep track of the items they looked in the past or store interesting items for re-use in the future (Wodtke and Govella 2009).
2. To facilitate visualization tools and various display styles, for example, zooming image, display in PDF file, display in slideshow and display in each page.
3. To observe the reputation of topics, for example, which was the most viewed item? , What were the most popular search terms?

I believe these advanced features might be helpful for users for better navigate the Victorian Times collection.

The advanced features comprise the following features:

- **Recently viewed item:** This feature dynamically keeps track of all items which are user looking at currently.
- **Wish lists:** Users can create their own wish lists when they would like to keep a list of items they desire to reuse in the future.



- **Tag cloud:** A tag cloud or most popular search menu in the baseline user interface is a visual depiction of the popularity of users' search terms.
- **Five top view items:** This tool displays items were ordered by counting viewed when users view on the item.
- **Zooming image:** Thumbnail can be zoomed for a bigger image.
- **Display slide show:** All pages of a document can be showed like a slideshow.
- **Display in each page of document:** Users can see all pages or each page of a document; they can jump into the specific page easily.
- **Display in Portable Document Format (PDF) file:** Images of the item can be displayed in PDF file.

I will explain in further detail below.

#### 4.3.2.1 Recently viewed items

The system allows users to re-visit the items they like but may have forgotten by clicking the links on recently viewed items. This feature (Figure 4.13) can keep only the last five viewed items. These lists will not appear if users have not visited the web site for a long time, or they log out the system. To ensure items of interest can be viewed next time, users should keep the interesting items to their wish list (details in Section 4.3.2.2).

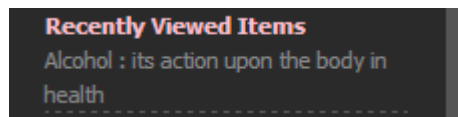


Figure 4. 13 Interface for recently viewed items

### 4.3.2.2 Wish lists

To help users collect, organize and keep track of things they want, the feature let users keep the things that may be re-use in the future (Wodtke and Govella 2009). Wish list feature let users keep the items for later use in their folders (see Figure 4.14).



No.	Folder Name	Who are looking at this folder	Right	Del.	Edit.
1	transportation	Click	Public	Del	Edit
2	ship	Click	Private	Del	Edit
3	doctor	Click	Public	Del	Edit
4	heath	Click	Public	Del	Edit

Figure 4. 14 Interface for wish lists

### 4.3.2.3 Tag cloud

The interface provides Tag cloud, which demonstrates the popularity of search terms in a visual presentation (see Figure 4.15). Users can click the link of the tags that lead them to items that are related with a tag. Display size of text is depended on the popularity of the search term (Kalbach and Gustafson 2007).



Figure 4. 15 Interface for tag cloud

#### 4.3.2.4 Five top viewed items

I felt that information about the reputation of items, in this case five top viewed items might be useful for people. In daily life, sometimes people would like to know "which movies should I watch?", "What are 10 books well worth reading?" Possibly, they come to see top ten movie lists in the box office or check for the 13 great sales books. The five top view items are displayed together with links to their corresponding pages (Figure 4.16).

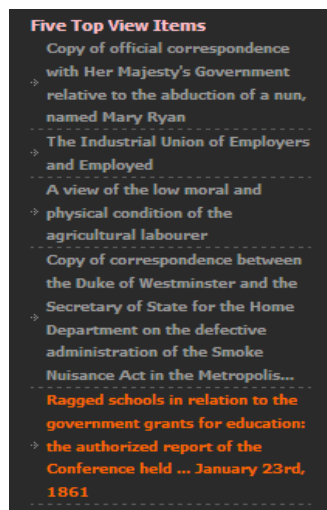


Figure 4. 16 Interface for five top viewed items

#### 4.3.2.5 Zooming image features

The zoom feature enables users to enlarge the image in order to help them to see for more detail. This feature is accessed by clicking on the desired thumbnail which is represented the first page of a document (Figure 4.17).

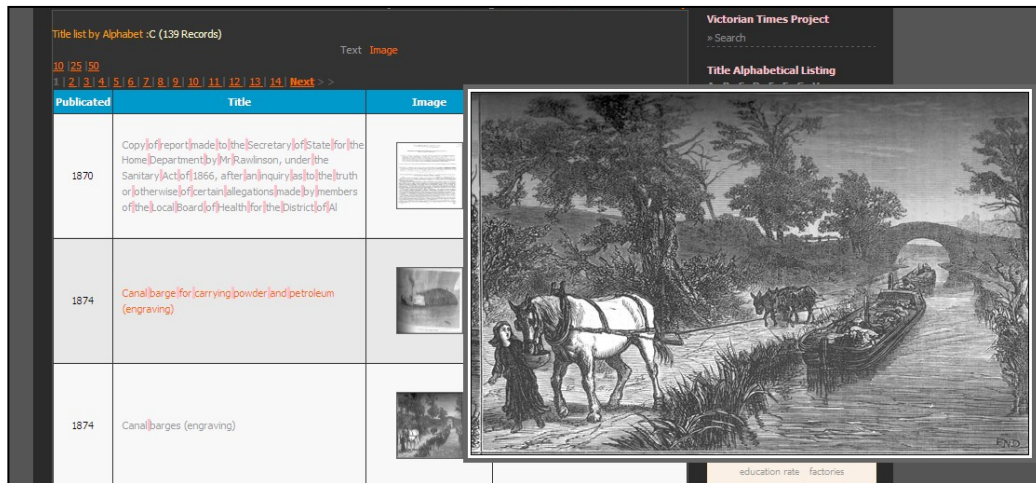


Figure 4. 17 Interface for zooming image feature

#### 4.3.2.6 Display slide show

In order to help users to view all pages of a document without browsing page by page, Display slide show is another representation that might be appealing. Users can set up the time delay for showing images continuously (Figure 4.18). Also, they can download all pages of document in a single ZIP image file with one mouse-click.

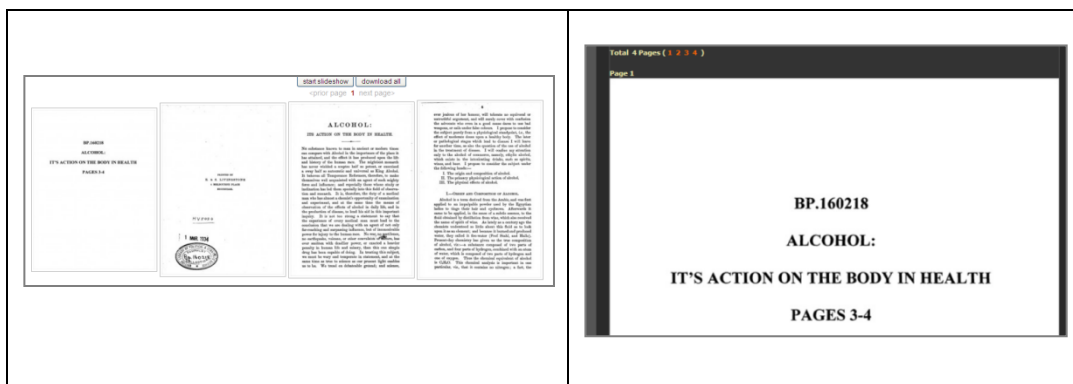


Figure 4. 18 Interface for display slideshow

### 4.3.2.7 Display in each page of a document

This feature let users see all pages of a document in image format (Figure 4.19). They can browse the document each page by using a scrollbar or jump to the page they want by clicking page number.

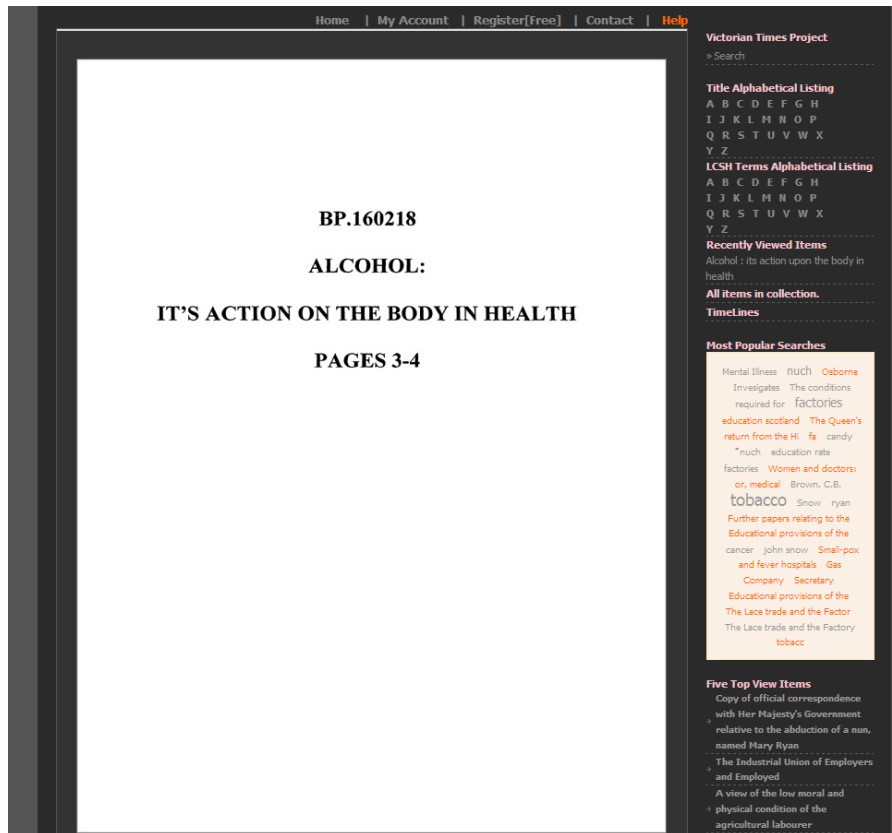


Figure 4. 19 Display in each page, the section being viewed is the first page of a document which is entitled “Alcohol: it’s action on the body in health”

### 4.3.2.8 Display in PDF file

The PDF is a digital version of materials that can keep fonts, texts and images in an accurate display without considering platforms. When users click at “Display in PDF file” of the desired item, it shows an entire document in PDF format (Figure 4.20).



Figure 4. 20 Interface for display in PDF file

#### **4.4 The experimental interface**

I have integrated social features to the standard interface (the baseline interface) referred to as “The experimental interface”. The experimental interface consists of three main components: the basic, advanced and social features. This interface allows users to manage their search results and share with others in the virtual community.

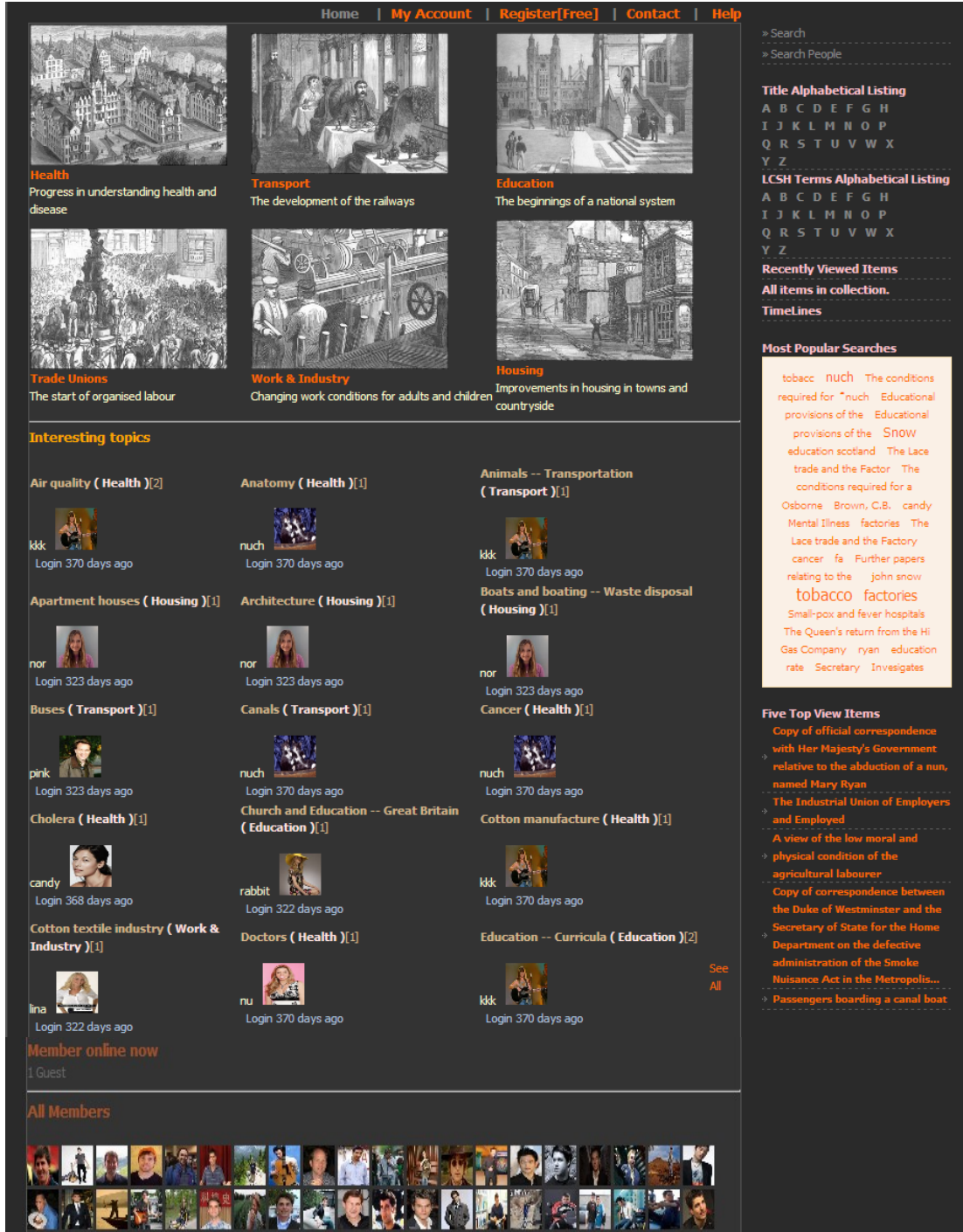
“Web 2.0 is mostly a social revolution in the use of Web technologies, a paradigm shift from the Web as a publishing medium to a medium of interaction and participation” (Lassila and Hendler 2007, p. 91). Web 2.0 technologies enhance the ability of community wisdom by the integration of social networks, and social navigation, users can get benefits from others to help them to find materials they need (Freyne et al. 2007).

I have applied social and Web 2.0 technologies to the experimental system. In order to encourage exchange ideas and to share knowledge between users, the interface provides shared item lists, shared histories and users’ comments. It also allows users to find others who have a similar interest by searching for people.

On the main page (Figure 4.21), it shows six main areas (described in Section 1.2) of digital collection at the top of this page which is marked by “Official categorized collection”. At the bottom of page, the virtual community was represented with interesting topics. Users can explore who looked at or interested in this topic. They can also recognize what the documents have been viewed by those people. The experimental system also had an option of “see all” in order to view the remaining interesting topics.

Official categorized collection

Social features



Basic features  
Social features

Basic features

Advanced features

Basic features

Advanced features

Figure 4. 21 The experimental interface with the three main components that are: Basic features (Search & Browse); Advanced features; and Social features in a virtual community.



## **The social features**

The social features are the tools to provide mechanism for social exchange and interaction in the interface. It is my belief that this will increase the feeling of social experience in the Victorian Times Digital Library.

The purposes of social features are as follows:

1. To help users to share knowledge and discussion ideas between them;
2. To allow users to create their lists of favourite objects and share with others;
3. To allow users for finding people who might have the same interests.

I have designed some parts of all features in social interfaces by following the issues of suggestions in Crumlish and Malone (2009). There are five main features of social tools currently implemented in the experimental user interface:

- **Searching people:** Using a search feature designed specifically for finding people who are interested in a specific subject.
- **Shared wish lists:** Users can create folders to keep items for re-use in the future.
- **Shared histories:** Users can track item lists that they navigated or looked at in the past. They also can share their histories if they want.
- **Comments:** The system let users comment about items, as well as read comments from others.
- **Interesting topics:** Users can look at people who might have the same interests as them and which items they have been looking in the past.

I will explain for more details for each feature as below.

#### 4.4.1 Searching people

Offering the capability of interaction with others is an important issue to fulfil social experience. To find people and make a connection with them should be included in a social web (Crumlish and Malone 2009).

The search text box let users input such subject-specific criteria or person's name (see Figure 4.22). For example when users entered "factory" search term in 'search by interesting topic' box, the search results present all information of people who are interesting in 'factory' topic, as well as other people's comments related to "factory" (see Figure 4.23). Users also search by people name like *candy*. The system then provides List of Subject Terms (LCSH Terms) that *candy* was interested in and *candy*'s comment (see Figure 4.24).

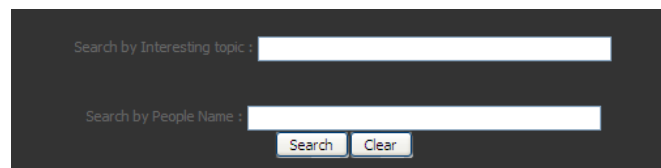


Figure 4. 22 Interface for Searching for people



Figure 4. 23 The results: searching for people; users enter search term in search by Interesting topics text box

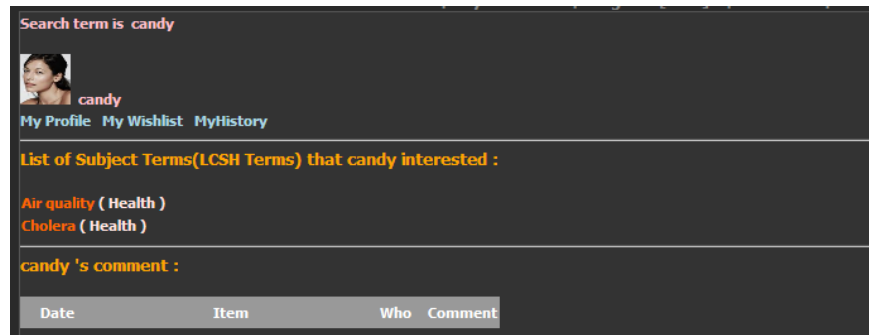


Figure 4. 24 The results: searching people; participants enter person’s name in search by people name text box

#### 4.4.2 Shared Wish lists

Sharing might be useful as it provides users with views of others’ activities and interests. The system should permit users to store, annotate and share items as well as define the rights of access to this information (Crumlish and Malone 2009, Kimani et al. 2005). The number of people who have kept items in lists should be displayed (Crumlish and Malone 2009). It should also be possible for users to view another user’s profile and wish lists.

As a result of this, “Shared wish list” feature let users keep the items for later use in folders. In addition, folders can be deleted, annotated and defined rights (private or public) and shared with other users if they want (see Figure 4.25).



Figure 4. 25 Interface for shared wish lists

### 4.4.3 Share histories

Interaction histories recorded between users and a system can frequently contribute to others and support their information seeking (Komlodi et al. 2007). The system records all browsing items of users. This data can be shared with others if they want. Figure 4.26 shows “My history” option for each user. When “My history” is clicked, it shows all items the user browsed in the past (Figure 4.27).



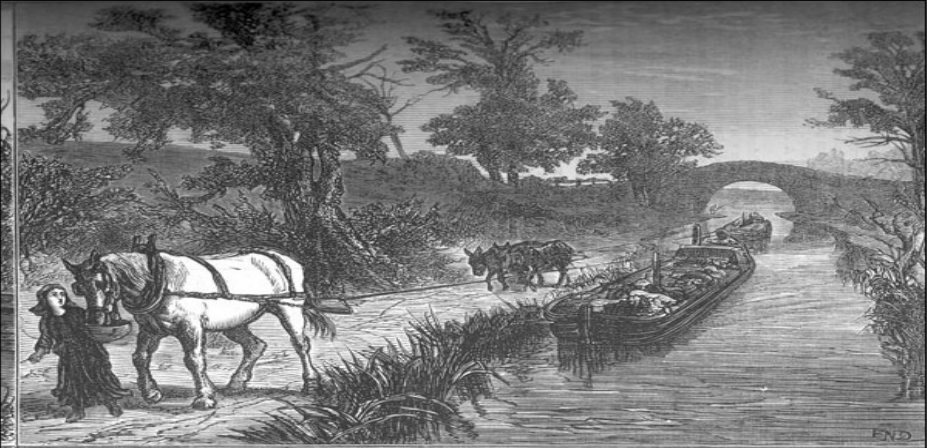
Figure 4. 26 Interface for shared histories

nuch 's history (52)				
Date	Item	Image	Author	Year
21/05/2010	Prince Albert's model lodging house (engraving)		Illustrated London News	
18/05/2010	Prince Albert's model lodging house (engraving)		Illustrated London News	
18/05/2010	Old Houses, Fish-Street ,Dundee (engraving)		Illustrated London News	1867

Figure 4. 27 All items user looked at in the past

## 4.4.4 Commenting

One of the easy tool that let users take part and exchange their thoughts on an item is comments (Crumlish and Malone 2009). Users can fill in a comment text box (Figure 4.28). They can also read other comments and perhaps discuss about the item.



Please click at image to see all pages

- Image title: Canal barges (engraving)
- Views count: 15
- Author: [Illustrated London News](#)
- Category: [Transport](#) » [Canal-boats](#)
- Date of entry: 00/00/0000, 00:00
- Published: 1874
- Rights: Victorian Times Project
- LCSH Terms: [Canal-boats](#)
- Source: 0000-00-00 00:00:00
- Doc. Code: IAGI
- total pages: 1
- Description:  
-

- [Add to wishlist \[ to use this function, Login required \]](#) IAGI
- [Print this page](#)
- [Display slide show](#)
- [Display each page](#)
- [PDF Files](#)

Collection : Comment.

- Name: \*
- Email:
- Message: \*
- Enter characters as you see. It will help to protect for registration automatically.: \*  
 << 21732

Figure 4. 28 Interface for commenting

#### 4.4.5 Interesting topics

Information from users' interaction with the system is assimilated into what they already viewed and commented, then represented through a series of popular categories (Shah 2008).

Interesting topics provides users with views of user groups according to their interests, which is represented by LCSH terms. To create the virtual community, I used K-mean clustering to create user groups according to their interests and represented user groups with LCSH terms, for example, Air quality, Apartment houses etc.

Figure 4.29 shows 9 interesting topics by alphabetic order. The main page also had an option of "See all" in order to view the remaining interesting topics. The figure also indicates a thumbnail of the user last logged in each topic. The number following each topic indicates how many other users who have interesting in this subject. When the number is clicked on, a list of users who provides, the lists included their profiles, wish lists and histories (see Figure 4.30) so that they can browse the user's profile, wish list and history of others who share his/her interests.

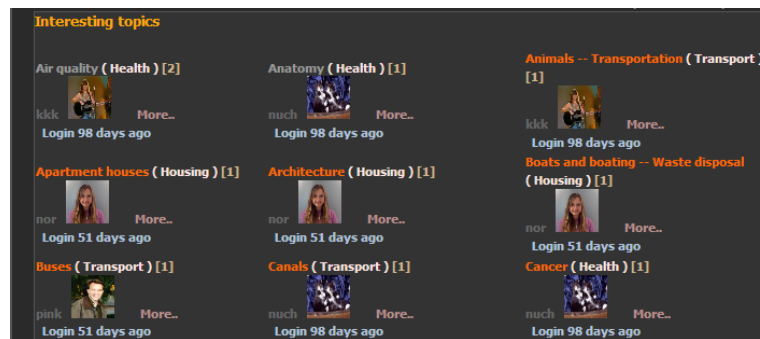


Figure 4. 29 Display interesting topics (On the main page)



Figure 4. 30 Interface for Interesting topics

## 4.5 Evaluation of user interfaces

After implementing two Victorian Times interfaces, I conducted the two usability studies. The first study was done with the baseline interface to examine how participants interact with this interface without any social features, how easy it is to browse information in the collection, and which features that they used or liked to support them for finding the general information and specific subjects. The second study was done to compare participant satisfaction of the baseline interface to the experimental one. I expected that all feedback, recommendations and performance data gathered from participants would be helpful for redesigned the next interface.

### 4.5.1 Usability study 1 with the baseline interface

In the usability study, participants were asked to use the interface shown in Figure 4.4.

The aim of this study is as follows:

- (i) To evaluate the baseline interface covering the user-system interaction in terms of effectiveness and to examine participant satisfaction with the overall system;

- (ii) To evaluate the usefulness of different advanced features together with the basic features to support participants seeking information in the systems.

The usability sessions were conducted in July 2009. The testing was carried out in an office setting research student's room at the Department of Computer and Information Sciences, Strathclyde University.

The instruments in this study consider both usability (effective, satisfaction including feelings and thoughts during the action) and usefulness. In terms of participant satisfaction, I evaluated from terminology of ease of use, navigation, aesthetic appearance, and layout of the user interface.

The data collected during the study consists of quantitative study from the questionnaire and qualitative study from interview, note-taking the participants' comments and actions during the test. The participants were asked and motivated to speak out loud (think-aloud) to express their thoughts, the problems they might encounter, their feelings during perform tasks. The usability study was conducted to enable me to identify suggestions for usability improvements to the Victorian Times Digital Library interface.

#### **4.5.1.1 Participants & Apparatus**

The first usability test was conducted on a small set of participants (5 in total: 4 female, 1 male). Nielsen (2000) have demonstrated that the usability test with 5 people provides a reliable results regarding a high probability (85%) to find problems. 5 PhD students at the Department Computer & Information Sciences, University of Strathclyde, who have experience in various fields: 2 participants from computer sciences, 1 from the library and information sciences, 1 from information technology, and 1 from software engineering, were invited to compose the sample of this study. Two participants aged range from 20 to 30. 3 participants aged range from 31 to 40. Two participants have



been studying at Strathclyde University less than 1 year while the rest has been studying at Strathclyde University more than 1 year. In particular, I found that the duration for studying in Strathclyde University of international students is the same as the duration to stay in the UK. 1 participant was a native English speaker and four participants were non-native English speakers.

All participants have experience in heterogeneous digital libraries. Most participants have used Association for Computing Machinery (ACM) and Science Direct. Some participants have used Springer link and other digital libraries such as Institute of Electrical and Electronic Engineers (IEEE), Education Resources Information Center (ERIC). At the last six months, approximately most participants dealt with Digital library web sites at least once a month.

Most participants usually use Mozilla Firefox and Internet Explorer. A few participants used Netscape and others like Google Chrome. None use Opera.

No participant had used the Victorian Times Digital Library before doing this study.

This study was run using HP Pavilion Core Duo Processor 1.83 Ghz; 1GB DDR2 RAM 80 GB hard disk and Windows XP. The interface display was 14.1 inch 1280x800 resolution. The interface was opened in Firefox web browser. Each participant was asked to accomplish the tasks by on a local host computer which simulates as a web server. Participants interacted with the computer using a standard keyboard and mouse.

#### **4.5.1.2 Tasks**

In order to study how participants interact with the system for finding both general and specific information, participants were asked to perform six search tasks using the baseline interface described above. I prepared six search tasks: three known/specific topics (i.e. participants were asked to find documents from a given topic) and three background search tasks (i.e. find documents about “education rate in Great Britain

during Victorian Times era”) as can be seen in Table 4.1. A maximum time was set for all tasks in order to limit time spent on the study. This was 3 minutes for each task.

The system allowed participants to utilize any features as many as they wanted. This made it possible to study about which features the participants like to use for completing tasks.

### **4.5.1.3 Procedure**

A computer was provided for participants who were tested one participant at a time. The processes of this usability test were as follows:

- They were welcome and explained the overall aim of the study. (see Appendix A.2 for greeting and introductory script);
- They signed the consent form when they agree to participate in this study. (see appendix A.1);
- They were asked to fill in a pre-test questionnaire (see Appendix A.3) to capture their profiles and experience of computer and digital library background;
- They were asked to perform six search tasks with no prior training. (see Section 4.5.1.2) ;
- They were asked to fill in a post-test questionnaire to rate the usefulness of features provided in the baseline interface as well as assess overall of the system; and
- The participants were invited to interview to capture their perception of the experimental interface about “What is the best feature(s) of the site?”, “What is the worst feature(s) of the site?”, “What features from other digital libraries would you like to see included on new user interface Victorian Times Digital Library?”;

The total time for one session was 30 minutes.

After testing, it was suggested that a training tutorial should be provided on the next test.

#### 4.5.1.4 Results

The first objective of the usability study was to evaluate the baseline interface according to their effectiveness. It involved six search tasks. The analysis based on data obtained through the questionnaire, note-taking and think-aloud.

##### (a) Participant perception of Task performance of the baseline interface

I had a total of 30 search sessions per system in the analysis. After participants had finished each task, they were asked if they considered they had success in their performance of the task and also assess the level of difficulty in each task. I performed data analysis by SPSS version 18 based on frequency counts from quantitative data of this study. The results are shown in Table 4.1.

Table 4. 1 Participant perception of task performance of the baseline user interface (n=5)

Tasks	Number of participants who selected:	
	completed task	found it easy
1a) find images of John snow	5	5
1b) Find the document entitled “The conditions required for a healthy house”	5	4
1c)find the more documents written by the same author of (1b)	5	4
1d) Find the document about “Education rate in Great Britain during Victorian times era.”	4	1
1e)Find documents about health from 1838 to 1950	3	1
1f) find documents about “ <i>gas company</i> ”	5	3

As can be seen from Table 4.1, for all questions, one of five participants could not complete the task (1d), and two of five participants could not complete the task (1e).

For participants who can complete both task types used average time within 2 minutes or fewer.

For (1a), (1b), (1c), and (1f) questions, the participants were asked to find a specific collection. These tasks were considered easy. Most of the participants tended to choose search options (title, author, description, year and all fields) to search, then entered keyword search. A majority of participants were likely to be satisfied with the results which provided both text and image format.

- To find an answer for “*The conditions required for a healthy house*”(1b): Two of five participants utilized different tools; one used Title Alphabetical Listing menu by browsing alphabet “*T*”; and the other decided to browse tag cloud (says “*The condition*”).
- As question (1c), of the 5 who were participants in this study: one preferred to use tag cloud and also interested to look at the five top view items; two clicked at author’s name on the item’s metadata page which provides links to retrieve more related items by the same author, and two copied the author’s name and pasted into search box followed by choosing author search field. Average time for (1a), (1b), (1c) and (1f) is within 1 minute or fewer.

Only one participant considered task 1d) and 1e) easy. This indicates that these tasks are probably more difficult than other tasks or the design interface may not support participants as it should be. Based on my observation, I noticed that participants seemed to apply a several types of searching techniques and supporting tools to help for doing the tasks. The details are as follows:

- For question (1d), of the 5 who were participants: two compared the combination results in different ways that are: one entered “*Education rate great Britain Victorian*” into the search box, followed by browsing at a subject term in “*Education*” group; one used tag cloud says “*education rate*”, followed by

entered “*education rate*” into search box by choosing description search field. One of five participant applied Boolean logical operators when using the search menu, took time to consider the results, tried to play around with the advanced features that is “*see all pages of document*”, looked at the more details, then tried again by changing search terms; and

- For question (1e), of the 3 who can complete this task, two entered “*health 1838 1850*” into search box and also browsed by “*Heath*” subject term, followed by utilizing the search features again, and one decided to use the timeline menu for finding the answers.

**(b) The usefulness of the baseline interface features**

The second objective of the study is to judge the usefulness of basic features together with the advanced ones of the baseline interface. The participants were asked to rate the usefulness of these features from a five-point scale, 1= “Useless” and 5 = “Very useful”. The statistical results are demonstrated in Table 4.2.

Table 4. 2 Participant assessment of selected the baseline user interface features

The baseline interface	Number of participants who selected:					
	Useless	Of Little use	Moderately useful	Useful	Very Useful	Did not use
<i>The basic features:</i>						
Browsing			1	2	1	1
Search documents			1	1	3	
Search by Timeline				1		4
Title Alphabetical Listing					3	2
LCSH Terms Alphabetical					2	3
All items in this collection				1	1	3
<i>The advanced features:</i>						
Recently Viewed Items					1	4
Wish lists						5
Tag cloud					1	4

The baseline interface	Number of participants who selected:					
	Useless	Of Little use	Moderately useful	Useful	Very Useful	Did not use
Five Top View Items			1	1		3
Zooming & Preview			1	2	1	1
Displaying slideshow				2	1	2
Display in PDF File				2	1	2
Display in each page				1	1	3

As can be seen, all participants used search. Four participants used browsing, Zooming and Preview features. On the other hand, wish list was not used in this study. Also, four participants did not use “Search by timeline”, “Recently viewed items”, “Tag cloud”.

After the participants had finished the usability test, informal interviews were conducted to ask why they did not use all of system’s features. Two reasons come to light:

- (1) They were not familiar with the system. Some features they did not use during the test session because they don’t know what features the system provides and how many features for supporting them to find information. They also said “*The system provides a lot of valuable Features and it’s useful, I probably use them in the future, but currently I am not aware of these features, and I can’t recognize them because of position of the menu in the bottom of the damn screen such as Timeline and Five top view items*”. The participant also said, “*I missed the top five viewed items; I can’t see tag cloud properly without scrolling down.*” One participant also noted about the design for the main page “*Right hand site menu bar is too long and goes off screen. I would prefer the layout of web site (see Figure 4.31)*”; and

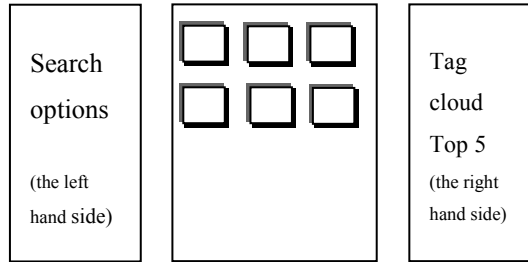


Figure 4. 31 The layout of web site

(2) The behaviour of web users may affect using the baseline Victorian Time Digital Library: one participant who was very familiar with web search engines and like to enter search terms into a search box without trying other features.

One participant suggested that some features he/she did not use in these tasks, but it might be useful in the future.

### (c) Participant Satisfaction

After having completed tasks, the participants were given questionnaires to assess the usefulness of the baseline interface features. Participants were asked to rate the baseline interface according to a five-point scale with ranging from “Not at all” to “Extremely”.

Table 4. 3 Web site satisfaction of the baseline user interface (scored 1 to 5, higher=better).

Statement	Number of participants who selected:				
	Not at all	Slightly	Some-what	Very	Extremely
Ease of use				3	2
Organization of information easy to understand				3	2
Terminology used in the site would be well organized				4	1
Interface would be virtually attractive			1	3	1
Overall reaction of the system would be Satisfied			1	1	3

As can be seen in Table 4.3, it appears that most participants were impressed with ease of use, organization of information and terminology used in the site. Also, four participants may seem to appreciate the visually attractive interface and satisfied with the overall reaction of the system. Participants did not feel lost while using the site and also commented the site was easy to navigate.

After the results obtained from the first usability study with the baseline interface, it seems to be not clear since most of the participant did not realized how many features the system provide and they can't assess the usefulness of the interface features. In the next usability study, the changes made were:

- The usability test was conducted on the baseline interface with the bigger scale, as well as on the experimental one.
- A new set of tasks were prepared. I felt that more tasks were needed and participants were restricted to using particular features to perform each task. Also, training sessions for both systems were provided before doing the tasks. I believe this way might be help them to know all features in the systems and they could express their thoughts on each feature.

#### **4.5.2 Usability study 2: the comparison between the baseline and experimental interfaces**

In this section, I present and discuss results of usability study done in the baseline and experimental interfaces.

The aim of this usability study is as follows:

- (i) To evaluate both interfaces (the baseline and the experimental interfaces) covering the user-system interaction in terms of effectiveness and participant satisfaction of overall the systems;



- (ii) To evaluate the usefulness of different basic features (search and browse) together with the advanced one to support participants seeking information in the systems; and
- (iii) To evaluate the usefulness of the social features for enhancing search in the interface.
- (iv) To compare the baseline and experimental interfaces based on ease to use, browse, access document, organization, attractive interface and useful features.

The hypothesis in this study was that the experimental interface would lead to a more sustainable system or increased participant satisfaction than the baseline one.

In this usability study, I adopted a within-subject design (repeat-measures), in which 24 searchers used two interfaces. The independent variable was interface types; two sets of values of a variety of dependent variable indicative of acceptability or participant satisfaction were to be determined through the questionnaire (see Appendix A.4), interview, think-aloud and note-taking.

The usability sessions were tested in the early mornings and afternoons in six days period, 7<sup>th</sup>, and from 10<sup>th</sup>, to 14<sup>th</sup> August 2009. The testing was conducted in an office setting lecturer's room in School of Informatics, at Walailak University, Thailand. A laptop was provided for the participants were tested one by one within an hour.

To avoid biasing the participants by the naming of the baseline and experimental interface in the second study, the baseline interface was referred to "Interface A" and the experimental interface was referred to "Interface B".

### **4.5.2.1 Participants & Apparatus**

24 participants were recruited for this usability test, 11 females and 13 males. Staff and undergraduate students were recruited from Schools of Informatics, Walailak University.

16 were staff who have worked or studied at Schools of Informatics, Walailak University. The rest were students who were studying a bachelor's degree in Information Management field at Schools of Informatics, Walailak University, Thailand.

Thirteen staff graduated with a bachelor degree and three graduated with a master degree. Of the remaining sixteen staff: three were lecturers; three were assistant lecturers; and the rest were programmers. While 23 participants ranged from twenty to thirty years old, 1 of the participants was thirty one to forty years old. All participants are Thais.

All of the 24 participants: 21 participants have used digital libraries and 3 have never used digital libraries. Most of the participants have used Science Direct, followed by Springer Link and ACM, respectively. None use Emerald. Most participants dealt with digital library web sites at least once a month.

For Internet usage survey, a majority of participants (75% of 24 participants) brought substantial Internet and website experience in emailing, reading news, chatting or MSN etc. and 42% of 24 participants like to access social web sites. Also, 21 (88% of 24 participants) participants are social network web site's member such as [www.hi5.com](http://www.hi5.com) and [www.facebook.com](http://www.facebook.com).

Most participants (95% of 24 participants) usually use Internet Explorer, followed by Mozilla Firefox (54% of 24 participants). None use Opera.

I could also safely assume that they had no prior experience in the baseline and the experimental interfaces.

Similarly as the previous study, this study was run using HP Pavilion Core Duo Processor 1.83 Ghz; 1GB DDR2 RAM 80 GB hard disk and Windows XP. The interface displays were 14.1 inch 1280x800 resolution. The Victorian Times interfaces were opened in Firefox web browser. Each participant was asked to accomplish the tasks by on a local host computer which simulates as a web server as similar as the previous study. Participants interacted with the computer using a standard keyboard and mouse.

#### **4.5.2.2 Tasks**

In order to study how participants interact with the system for finding both general and specific information, Participants were asked to perform 13 tasks in total (sub-tasks included) using the baseline and experimental interfaces. The participant was given 3 minutes to complete each task. To prevent misunderstanding and misinterpretation in the tasks that might happen with Thai participants, the questionnaire was translated to Thai language. The order of interface and tasks was rotated to minimize learning effect from one system to the other according to a Latin square design (Field and Hole 2003).

To provide an opportunity for participants to know all features of both interfaces, the participants were restricted to using particular features to perform each task.

Seven tasks were set on the baseline interface: three to search for specific topics (i.e. participants were asked to find the documents from a given topic.); three by browsing feature for background search (i.e. participants were asked to find *any documents about cotton textile industry*); one task that need participants to log-in by username/password given and save the desired item to their wish lists.

The other six tasks were set on the experimental interface: two by search features for specific search tasks. Specifically, after the results were displayed on the page, the participants were asked to utilized “Display slide show”, “Display each page”, “PDF file”; one by looking at interesting topic section; one by searching for people. Once the

participants had completed this task, they were asked to investigate “My wish list”, “My history”; one task by “Top view items”; and one resembling searching for people (i.e. The participants were asked to find about what interesting topics of *Candy* (person’s name)).

#### **4.5.2.3 Procedure**

The processes of this usability test were as follows:

- They were welcome and explained the overall aim of the usability study (see Appendix A.2);
- The participant signed consent form when they agreed to participate (see Appendix A.1);
- They had a training session on the first interface for 10 minutes and allowed asking any questions before doing the tasks;
- They were asked to fill in an entry questionnaire (see Appendix A.4) to capture their profile and experience in computer and digital library background (Pre-test questionnaire);
- They were performed the first search tasks by using the first interface;
- They had a training session on the second interface within 10 minutes and allowed asking any questions before doing the tasks;
- They performed the second tasks;
- They were asked to fill in a questionnaire comparing the two interfaces;
- They were asked to rate for the usefulness of each feature and rank the ten most useful features of the baseline interface and the eight most useful features of the experimental one (Post-test questionnaire);
- They were asked to rate for ease of use, ease of navigation, information organization, terminology used, attractive web site and overall of the system in exit questionnaire;

- The participants were invited to interview to capture their perception of the experimental interface about “What is the best feature(s) of the site?”, “What is the worst feature(s) of the site?”, “What features from other digital libraries would you like to see included on new user interface Victorian Times Digital Library?”; and
- The participants were given souvenirs from the UK for their participation after the usability study.

The total time for one session was 60 minutes.

#### **4.5.2.4 Results**

This section presents the results of the usability study in order to evaluate both interfaces in terms of effectiveness and participant satisfaction, as well as to examine the usefulness of interface features.

##### **(a) Participant perception of task performance of the baseline interface**

The participants were asked to complete the tasks using the particular features. They were also limited to 3 minutes per tasks because this study was interested in interaction with the system rather in accuracy. After participants had finished each task, they were asked if they considered they had success in their performance of the task and also assessed the level of difficulty in each task. I accumulated quantitative data from the questionnaire and analysed by SPSS version 18. Task completion of the baseline interface (including time/ task success) is displayed in Table 4.4

Table 4. 4 Participant perception of task performance of the baseline user interface (n=24,  $\overline{SD}$  = Standard Deviation)

No	Tasks	%Task completed	Average time in minutes and seconds	% found it easy
1a	Use search menu to find image	92	1.23 $\overline{SD}$ =0.71	79
1b	Use search menu to find text document	96 Partial successful:4*	1.16 $\overline{SD}$ =0.56	92
2	Use Title Alphabetical Listing menu	79	1.51 $\overline{SD}$ =0.81	33
3a	Use browsing feature	100	1.03 $\overline{SD}$ =0.62	88
3b	Use LCSH Terms Alphabetical	100	0.65 $\overline{SD}$ =0.53	83
4	Use Timeline menu	83	1.72 $\overline{SD}$ =0.82	50
5	Use wish list feature	100	0.77 $\overline{SD}$ =0.43	92

\*time over more than 3 minutes

Overall, participants performed relatively well on completing the tasks, but nine participants could not complete three of seven tasks (sub-tasks included). Out of 7 tasks, five of tasks took more than 1 minute to complete, and only two were under 1 minute.

For the usability test of the baseline user interface identified a number of problems from participants who cannot complete the tasks. The probable causes are as following details:

- Two participants could not locate information for task 1a) that asked them to find an image by using the search menu. They chose only description search field. This suggested that they were not trying searching by other fields;
- One participant confused about the meaning of “LCSH” in task 1b) and took time over three minutes;
- For task 2), a majority of participants consider this task more difficult. Five participants could not complete the task although they took time over three

minutes. Four participants suggested that item lists should be displayed alphabetically up to participants browse the initial letter in title alphabetical listing menu.

- One participant suggested that some display pages were difficult to see. Font is too small, and font colour blends with the background; and
- Four participants could not complete task 4) because they got the problem about the English language.
- For task 5) the participants were asked to use the wish list by logging-in to the system, then create a folder and add items they found from this task to wish list. This ensured that the participants utilizing the shared wish lists can also contribute their own lists to the interface.

Our findings suggested that the baseline interface Victorian Times Digital Library should be revised about font colour and font size. For Title alphabetical listing menu, the results should be ordered by alphabetic, and participants can sort by fields such as year, title and author.

#### **(b) Participant perception of task performance of the experimental interface**

Similarly, the participants were asked to complete the tasks using the particular features in the experimental interface. After participants had finished each task, they were asked if they considered they had success in their performance of the task and also assessed the level of difficulty in each task. The participants judged whether they are satisfied with the results or not. Six task completion (sub-tasks included) of the baseline interface is displayed in Table 4.5.

Table 4. 5 Participant perception of task performance the experimental interface (n=24)

No	Tasks	%Tasks completed	Average time in minutes and seconds	% found it easy
1a	Use search menu to find image	96	1.25 $\overline{SD}$ =0.72	83
1b	Use search to find the document”	96	1.28 $\overline{SD}$ =0.83	83
2	Use interesting topic section	75	1.59 $\overline{SD}$ =0.74	33
3	Use searching people menu	100	0.65 $\overline{SD}$ =0.28	96
4	Find the most popular search terms	88 Partial successful= 12**	0.54 $\overline{SD}$ =0.44	83
5	Find out what subjects is <i>candy</i> interested?	100	0.71 $\overline{SD}$ =0.35	96

\*\*participants misunderstand about most popular search terms.

In general, participants performed relatively well on completing the tasks, but seven participants could not complete four of six tasks (sub-tasks included). Out of six tasks, three of tasks took more than 1 minute to complete, and three were under 1 minute. The usability test of the experimental interface identified a number of problems from participants who cannot accomplish the tasks. The probable causes are as following details:

- One participant could not locate information for task 1a). The participant was not familiar with the system and confused about search features. The participant also commented that the search system should provide search for the image field type.
- Task 1b) Finding the document entitled “*The Lace trade and the Factory Act*”, one participant could not complete this task in 3 minutes. After the participant had entered a search term, he/she ignored highlighting of the search term which appeared on metadata of the result set. The participant viewed only the first item of the result set. The participant also suggested that the system should support to use wildcards in search terms; and



- Six participants could not complete in task 2. They said, “It is difficult to locate the specific group in this case looking for factories because font size too small and font colour blend with the background”.

**(c) Comparison between the baseline and experimental interfaces**

To test the hypothesis is that the experimental interface would lead to a more sustainable system or increased participant satisfaction than the baseline one. Each participant was asked to evaluate and compare the baseline and the experimental interfaces in terms of these criteria: easy to find info, easy to browse, more attractive features, more useful features, better organized, and easy to access documents.

After the 24 participants had completed usability tasks, the data were combined to provide statistics for each user interface. These data are distribution-free tests and do not assume a normal distribution. I have opted to use a nonparametric test for related samples by using SPSS version 18.

The Wilcoxon test produces a ‘different score’ of each participant (repeat-measures), with each participant’s vote in the baseline interface taken from the same person’s vote in the experimental one. The Wilcoxon signed-rank test for statistical difference given where  $p \leq .05$ , unless otherwise stated.

Table 4. 6 The comparison of the baseline and experimental interfaces based on user preference (n=24)

Statements	Wincoxon –Test P-Value	Scores		
		Exp	Base	Both
easy to find information	<b>0.034</b>	7	1	<b>16</b>
easy to browse	0.705	4	3	<b>17</b>
provided attractive interface	0.074	<b>14</b>	6	4
provided useful features	<b>&lt;=0.001</b>	<b>20</b>	0	4
well organization	0.157	6	2	<b>16</b>
easy to access information	0.083	9	3	<b>12</b>

Note: Exp= experimental interface, Base=baseline interface, and Both=both interfaces

The results are shown in Table 4.6. As can be seen, in terms of ease of finding information, most participants preferred both interfaces. A significant difference was found between the baseline and experimental interfaces ( $Z=-2.121$ ,  $N=8$ ,  $p=0.034$ ,  $p<.05$ ).

In terms of ease to browse, most participants seemed to choose both interfaces. No significant difference was found ( $Z=-0.378$ ,  $N=7$ ,  $p=0.705$ ,  $p>.05$ ). In terms of attractive features, most participants identified the experimental interface being more attractive interface than the control one. No significant difference was found between interfaces ( $Z=-1.789$ ,  $N=20$ ,  $p=0.074$ ,  $p>.05$ ).

The experimental interface was perceived as providing more useful features by most participants. Because of asymp sig value ( $Z=-4.472$ ,  $N=20$ ,  $p=0.000$ ,  $p<.05$ ) is less than the p-value of 0.05, I conclude that there is a significant difference of satisfaction level among the criteria under provided useful features.

In terms of well organization, most participants preferred both interfaces. No significant difference was found in both interfaces ( $Z=-1.000$ ,  $N=8$ ,  $p=0.157$ ,  $p>.05$ ).

Once again, in terms of ease to access information, both interfaces were perceived as ease to access information by most participants. No significant difference was found in both interfaces ( $Z=-1.732$ ,  $N=12$ ,  $p=0.083$ ,  $p>.05$ ). Please note that N is reported as the total number of participants minus the ties ranks.

#### **(d) The usefulness of the baseline interface features**

The second objective of the study is to judge the usefulness of different basic and advanced features in helping participants to complete their tasks.

The participants were asked to rate the usefulness of each feature. The data were combined to provide statistics for each interface on a five-point scale, where 1= “Useless” and 5 = “Very useful”.

Table 4. 7 Rating of the usefulness of the baseline user interface features

The baseline interface	Percentage of participants who selected:				
	Useless	Of little use	Moderately useful	Useful	Very useful
<i>The basic features:</i>					
Browsing& displaying item format and details				33%	<b>67%</b>
search documents & displaying the result search format including detailed			4%	17%	<b>79%</b>
Search by Timeline			21%	<b>79%</b>	
Title Alphabetical Listing			21%	12%	<b>67%</b>
LCSH Terms Alphabetical Listing			12%	21%	<b>67%</b>
All items in this collection menu		4%	13%	25%	<b>58%</b>
<i>The advanced features:</i>					
Recently Viewed Items			4%	25%	<b>71%</b>
Wish lists			8%	29%	<b>63%</b>
Tag cloud		8%	13%	29%	<b>50%</b>
Five Top View Items			8%	17%	<b>75%</b>
Zooming & Preview features			12%	25%	<b>63%</b>
Displaying slideshow			8%	25%	<b>67%</b>
Display in PDF File				17%	<b>83%</b>
Display in each page of a document			4%	33%	<b>63%</b>

As the results in Table 4.7, “Display in PDF file” might be the feature voted for the most usefulness (83% of 24 participants), followed by “Search documents” (79% of 24 participants).

**(e) The usefulness of the experimental interface features**

The third objective of the study is to judge the usefulness of social features in the experimental interface.

Again, the participants were asked to rate the usefulness of each feature. The data were combined to provide statistics for each interface from 5-point scales with 1 representing “Useless” and 5 representing “Very useful”.

Table 4. 8 The rating of the usefulness of the experimental user interface features

The experimental interface	Percentage of participants who selected:				
	Useless	Of little use	Moderately useful	Useful	Very useful
<i>The basic features:</i>					
Browsing			4%	33%	<b>63%</b>
search documents				25%	<b>75%</b>
<i>The social features:</i>					
Searching for people& displaying the results			12%	21%	<b>67%</b>
Share wish list			8%	33%	<b>59%</b>
Commenting		4%	4%	<b>50%</b>	42%
Interesting topics			13%	33%	<b>54%</b>
Shared History		4%	13%	29%	<b>54%</b>
Display interesting topics(On the main page)		4%	21%	29%	<b>46%</b>

As can be seen from Table 4.8, searching documents might be the feature voted by most participants for the most usefulness (75% of participants), followed by searching for people & displaying the results (67% of 24 participants).

### Ranking features

In the post-test questionnaire, participants were asked to rank the features of both interfaces.

The participants were asked to rank the baseline interface features for the most usefulness. 16 out of 24 participants placed search document for the first place. 10 out of 24 participants placed browsing feature for the second place. On the other hand, I also investigated which features did not rank to ten most usefulness. The results found that of

24 participants, 14 did not rank “display slideshow” followed by “zooming” feature (13 participants) and “all item in this collection” (12 participants) , respectively.

Again, the participants were asked to rank the experimental interface features for the most usefulness. 14 out of 24 participants placed search documents for the first place. 11 out of 24 participants placed browsing feature for the second place and 7 out of 24 participants placed searching for people for the third place.

**(f) Participant satisfaction**

Again, the participants were asked to rate the experimental interface according to a five-point scale with 1 representing “Not at all” and 5 representing “Extremely”. The results are shown in Table 4.9 (scores from 1 to 5, higher=better).

Table 4. 9 Web site satisfaction of the experimental user interface (n=24)

Statements	Number of participants who selected:				
	Not at all	Slightly	Somewhat	Very	Extremely
Ease of use			4%	46%	<b>50%</b>
Organization of information easy to understand			12%	13%	<b>75%</b>
Terminology used in the site would be well organized			4%	46%	<b>50%</b>
Interface would be virtually attractive	3%		13%	<b>67%</b>	17%
Overall reaction of the system would be Satisfied				<b>54%</b>	46%

As Table 4.9 demonstrated above, it can be gathered that most participants perceived that the experimental interface is easy to use, good organization, understandable terminology used, site visually attractive site, and satisfy with overall reaction of the system.

In terms of feeling lost during using the web site, six participants (25% of 24 participants) agreed that they did not feel lost while eighteen participants (75% of 24 participants) felt lost sometimes. When asked about the reasons, they feel a little of confuse about English language, and they did not use to the system. In addition, 96% of 24 participants agreed that the interface is easy to navigate.

#### **(g) Qualitative data**

Given a better feeling how the baseline and the experimental interfaces were used through interviews. In two usability studies, after completing the tasks, finally, total 29 participants were asked about the best features, the worst features, suggestions, or any other comments for improvement to enhance the Victorian Times Digital Library User Interface. For the first study, 5 participants were asked to express their opinions on the baseline interface, whereas 24 participants in the second study were asked the same questions on the experimental one.

The best features (note that the participant can indicate more than one feature) for the basic and advanced features, including design theme. Out of 29 participants (from both studies), the comments are as follows:

- Sixteen participants liked search features to find items. The results are relevant and highlight;
- Seven participants liked various options provided to access information: browsing from groups and sub-groups, title alphabetical listing;
- Seven participants liked most popular search (tag cloud) which is relevant with Library 2.0 and social network technology trends;
- Four participant said, “*very well categorization*”;
- Two participants liked thumbnails and PDF file format. They also liked browse page by page of the document; and
- Two participants liked five top viewed items and recently viewed items.

The best features (note that the participant can indicate more than one feature) for the social features. Out of 24 participants (only the second study), the comments are as follows:

- Six participants liked shared wish lists;
- Five participants liked an interesting topic and users' comments, which is similar to a web board; they can exchange knowledge and ideas with each other;
- Four participants liked searching for people, in case they would like to know what the item lists that professional people looked at or recommended;
- Two participants liked shared histories; and
- One participant liked the comment feature.

The worst features (note that the participant can indicate more than one feature) for the basic and advanced features, including the design theme. Out of 29 participants (from both studies), the comments are as follows:

- Six participants said, "*font size is too small; it is difficult to read*";
- Six participant commented that sometimes they confused with navigation system and the system is needed to improve navigation system (without clicking the back button);
- Five participants said, "*The interface should be improved for more attractive and aesthetic design, to create an attractive look to users*". Participants also suggested enhancing flash scripts or graphics to create animations;
- Five participants commented about font colour, for example, it hard to read titles of item lists in red letters with the black background;
- Four participant commented that the theme of the site looks solemn and sacred;
- Four participants suggested that the system should provide sorting item lists by published year, title and author;

- For search document, three participants suggested that it should provide search by types of documents: image or text, and keywords; and
- For timeline menu, two participants commented that it should provide an additional search box to enter search terms.

The worst features (note that the participant can indicate more than one feature) for the social features. Out of 24 participants (only the second study), the comments are as follows:

- Seven participants agreed that the section of interesting topics was a cluttered and disorganized display. One participant suggested that participants can find groups of people quickly, if the interface could provide a search tool into this section or accommodate browsing groups of people by an alphabetic character.

The participants also recommended for designing this section as following:

- The first alternative is to demonstrate group lists by the alphabet shown in table;
- The second is to show group lists by login date;

29 participants were asked about what features from other digital libraries they would like to see included on the experimental interface. The results are as follows:

- One participant suggested that the search text box should be appeared at the right menu, on a page; it should not be necessary to click the search menu for opening a new page. In case of wish list, participants can invite friends both groups or individual to look at their wish lists, and also let friends comment their wish lists; and
- One participant wants the system to include importing file by an email feature like Science Direct. As [www.hi5.com](http://www.hi5.com) is an example; the participant described the blog's features to me. Members can allow friends to look at their spaces.



They also can define rights for individual permission, creating topics, discussing ideas, and sharing knowledge among people.

## **4.6 Discussion**

In the previous sections, I outlined two usability studies. In this section, I discuss results of the usability studies done in order to evaluate the baseline and experimental interfaces, as well as to examine the usefulness of interface features to enhancing search in Victorian Times Digital Library.

### **4.6.1 The first usability study**

In order to measure task completion of the baseline interface, I found that most participants tend to use the search features for finding specific topics. This might assume that they may use this way to get the results they need quickly. Also, the results found that some participants were likely to use advanced features together with the basic ones to judge the results for finding the background search tasks.

To examine the usefulness of the baseline features, I found that search, browse, zooming and preview seem to be very useful. A few other features were used in this study. Two possible explanations for this finding might be that the screen of the main page is not fit in one screen. As this reason, most participants could not find the tools and did not know how many tools the system provides. Also, one participant mentioned that he/she get used to use only search to find information in search engine web sites. However, most participants seemed to appreciate the overall the system.

### **4.6.2 The second study**

In order to measure task completion of the baseline interface, I found that most participants performed tasks fairly well. Some participants suggested about display fonts and contents. Similarly, for the experimental interface, most participants performed the

tasks relatively well. The comments from participants in the experimental interface are similar as the baseline one because both interfaces were designed based on the same theme (same colour, font size and display format). They suggested that the font colour, font size and display contents should be improved.

Since the hypothesis expected that the experimental interface has a better assessment than the baseline one, I performed the comparative study and analysed using the Wilcoxon-Signed Rank test. The results indicate that the experimental interface might be easier to find information than the baseline one. Also the experimental interface appears to be provided more useful features than the baseline one. This result let me conclude that the experimental interface is would lead to a more sustainable system or increased participant satisfaction than the baseline one in terms of ease to find information and providing useful features.

On the other hand, in terms of ease to browse, attractive interface, well organization and ease to access information, no significant difference was found in both interfaces. One possible explanation is that browse feature, organized information, and the interface theme of the experimental and baseline interfaces are the same.

I have also considered the usefulness of the experimental features. I found that searching documents might be the most usefulness feature, followed by searching for people. These results are in substantial agreement with those of Gross (2005). CYCLADES system provides community support, search functions, collections and recommendations. He found that most users considered most functions very useful and useful. Of all functions, the best rating is the search function, followed by the community support. Moreover, they appreciated in the overall of CYCLADES.

The reasons why people did not use those functions for their tasks also relevant with Gross (2005). Most users assessed these features useful for them but they did not use

the features during perform the tasks. Two reasons mentioned are: (1) there's not enough time; (2) they did not realize these features and did not know how to use them.

Providing a search text box on the menu in every page, avoiding clicking a back button in the browser and designing the main page fit to one screen are some of recommendations from participants that agree with BGSU (2005), Catography Associates (2004), Luna Imaging (2004), New York Public Library (2004) and Virginia Tech (2004) (cited in Roda et al. (2005).

## **4.7 Conclusions and future work**

The usability tests help to understand participant interaction. Feedback from participants and recorded notes during test sessions provide a great insight into the strengths and weakness of both user interfaces. The numerous recommendations, such as changing font colour and font size, re-formatting display information on pages and editing some confused terminology were used to improve and redesigned the user interface.

Although the results indicate that participants tended to like the most of features in the system, it seems not to be clear that the participants may benefit actually from the social features.

In the next chapter, I used this findings to design better the Victorian Times interface. I also conducted usability studies to investigate how participants perform different types of search tasks using the redesigned interface.

# Chapter 5

## Iterative Design

### 5.1 Introduction

In the previous chapter, I conducted usability tests in which I asked participants to perform search tasks by using the Victorian Times Digital Library. This provided both quantitative and qualitative data for improvement of the interface.

In this chapter, I present usability studies to investigate how participants interact with the re-designed interfaces, particularly focusing on how social features and popular categories on the virtual community aids participants performing search tasks.

The following section describes the redesigned interface, an overview of each of the three usability studies and systems that I used. The general methodology that I used in all three usability studies is presented in Section 5.5. Also, I describe the procedures that I conducted in these studies. In Section 5.5.1-5.5.4, each study was described for the system goals, participants and results, ending with how the results affected what I investigated in the next study. I then discuss the results of the three studies. The conclusion and future work for the design and evaluation of the Victorian Times Digital Library are presented in Section 5.6.

## **5.2 Re-designing the interfaces**

This section describes the redesigned of the Victorian Times interface upon the results from the initial study in Chapter 4. I considered improving the overall interface, information presentation, some features, together with different display formats of the main page.

### **5.2.1 Redesigned of overall design**

I improved the overall design, not related to interface features, in order to increase ease of use. The following changes are:

- The interface colour and font size were changed in order to help users read text easily;
- The main page was designed fit to one screen in order to avoid scrolling; and
- Navigation system is provided on every page, so that users can traverse the interface without getting lost.

### **5.2.2 Redesigned display information presentation and features**

In this section, I describe the redesigned of Victorian Times interface based upon Information Foraging Theory. Information Foraging provides valuable information seeking theory insights on how users interact with the system. Information Foraging argues that people find useful information based on considering the costs of time spent and resources (Pirolli and Card 1999).

In term of patches in Information Foraging Theory, a patch can be a document, a set of documents, collection of documents, a page, or a section of a page. Users can explore the patch by following links. User navigation of patches is dependent on the perception

of the amount of scent— scent carriers. If users perceive a poor scent in the patch, they will stop following the link and switch to other patches which provide a stronger scent.

To increase the strong information scent according to Information Foraging in the Victorian Times interfaces and to support navigational decisions, I made some changes on information presentation. These intend to help users to scan information quickly. This can reduce time spent. Also, other changes related to the features issued included:

- Various search and browse features (e.g. advanced search, title alphabetical lists, LCSH terms alphabetical lists) were located on a single page. This page provides search and browse patches in one place in order to minimize the cost of moving between patches;
- When the number of documents in a patch is too many, it should be possible to refine the results to create smaller patches in order to minimize the cost and time to scan information. With this reason, the browse and title alphabetical listing features allow users to filter the document type by clicking on either image or text. Also, a set of given options (e.g. Publication: Old-New; Publication: New-Old; Title: A-Z; Title: Z-A; Author: A-Z; and Author: Z-A) is accommodated to specific an ordering for browsing results;
- The interface offers a simple search text box on the main page and appears every page. Users can create a new patch by issuing keyword queries into the search text box. This leads users to the result patch quickly and efficiently;
- Some features such as All items in this collection, Search by timeline, Recently viewed items, Tag clouds, Five top viewed items that might not essential for participants during performing the task, were removed on the page in order to avoid participants getting confused;

- Comments on items were presented on every browse page and search results pages. The content in comments might contain enough scent for users to make decision on whether they go through or leave a document;
- A brief description of each item was provided in browse and result pages. Users can then read this text to help them decide whether that document elaborate with their goals and move to that patch. This probably can lead scent to the users; and
- For the main page, the new terms were selected to be increased clearly strong scent. In particular, “Interesting topics” was replaced by “Popular”. The name of each popular category was represented with LCSH (Library Congress Subject Heading) terms. “Wish list” was replaced by “Item list”.

### **5.3 Interfaces**

The Victorian Times Digital Library was redesigned based on ideas from Information Foraging Theory. Zhang et al. (2008, p. 441) stated that “the issue of ‘how to get there’ is closely related to how browsing interface is designed. Different designs may lead to different ways of reaching the desired information and may result in different user performance”. It’s difficult to know what the most desirable interface for users is. Therefore, four interfaces were implemented by focusing on four different scent carriers in popular categories, but the overall design and information presentation of those interfaces were identical.

The popular categories provide scent carriers in terms of the “Who”, “What” and “When” represented by users’ activities dealing with the items in a collection, such as browsed or saved items in the past. Consequently, users can explore popular items and people who have been looking for these items.

I designed the popular categories according to two views:

- (1) “**Documents based**” means a set of documents that have been viewed by people. A set of viewed documents might be provided strong scent relevant with users’ goals.
- (2) “**User based**” means a set of users who have been viewed the document in the particular topic, indicating they might be interested in this area.

Also, I included social data (see Figure 5.1 and Figure 5.4), a textual description accompanied with a popular category. Social data presents scent carriers with information on how much information is within a popular category. This may help them make a decision whether to continue this patch or leave to a new one. The decision was based on the consideration of the perceived cost of scanning given information within that subject. The following scent carriers are as follows:

- **Shared articles**—the number of documents saved in people’s item lists defined rights as public, may help users to find the related documents that might be relevant with their interests;
- **Total shared folders**—the number of shared folders that keep items which belong to this category; this allows users to go through all items kept in such folders;
- **Group**—a group name that popular category belongs to;
- **Total users**—the number of users who have interested in this topic, this allow users to know about people by clicking at their profiles, shared histories and shared item lists; and
- **User online**—the numbers of users currently are online.



In this chapter, I refer to the four interfaces by naming four Victorian Times interfaces: the interface with one user view and social data referred to “Social User Interface”; the interface with one document view and social data was referred to “Most Viewed Item Interface”; the interface with three documents view was referred to “Multiple Items Interface” and the interface with users view was referred to “Most Recent Users Interface” (see Table 5.1).

Table 5. 1 Overview of four interfaces, providing different popular categories section

<b>Interface</b>	<b>Popular categories section</b>
Social User	One user view with social data
Most Viewed Item	One document view with social data
Multiple Items	Three documents view
Most Recent Users	Users view

### **5.3.1 Social User Interface**

The primary goal of Social User Interface is to represent each category by the most recent user, as well as proving social data about the particular category. The combination of the most recent user, represented in a popular category and social data may carry more scent for users to follow the link.

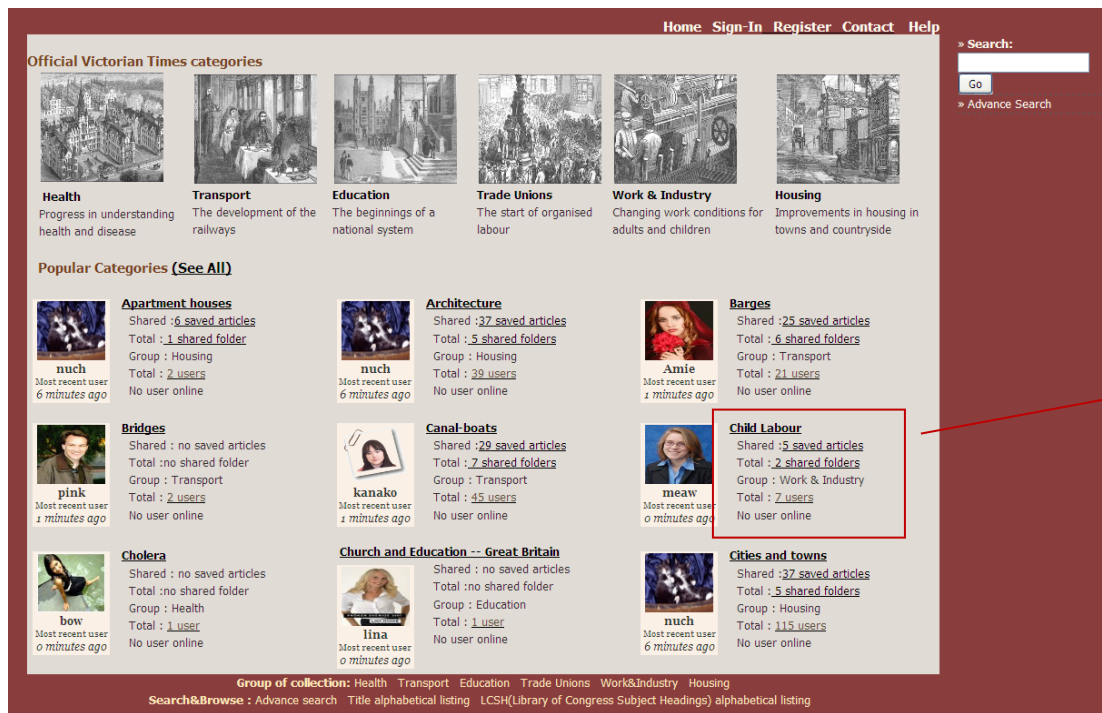


Figure 5. 1 Screen shot of the main page of Social User Interface

Figure 5.1 is a screen shot of the main page of Social User Interface, which consisted of nine popular categories displayed in popular categories section. This page also had an option of “see all” in order to view the remaining popular categories.

Users can lead to a set of people who have an interest in the desired subject by clicking on the user image or the popular category name. For example, users click on “Barge” popular category, they get a screen similar to the one in Figure 5.2, which displays people who have an interest in the “Barges” category.



Figure 5. 2 The screen that appears in response to choosing the “Barges” popular category

In addition, by clicking people’s activities link on the page in Figure 5.2 can lead users to discover documents that they never possibly viewed, participants may found the documents relevant with their goals. The result page is displayed in Figure 5.3. “If I found user X, Y, Z have interested in subject “Barges” then if I click to see documents viewed by those people, probably I may also find the other related documents which I did not view yet.”



Amie's activities				
		<a href="#">Watched item lists</a>	<a href="#">Saved item lists</a>	
No.	Date	Wached Items	Details	Commented by Amie
1	16/04/2010, 10:12		<b>Title</b> :Passenger barge and freight barge on a canal, near a village <b>Author</b> :Croal, Thomas. A. <b>Published</b> :1877 <a href="#">More details</a>	 <a href="#">add to my item list</a>
2	16/04/2010, 10:11		<b>Title</b> :Canal barges (engraving) <b>Author</b> :Illustrated London News <b>Published</b> :1874 <a href="#">More details</a>	 <a href="#">add to my item list</a>

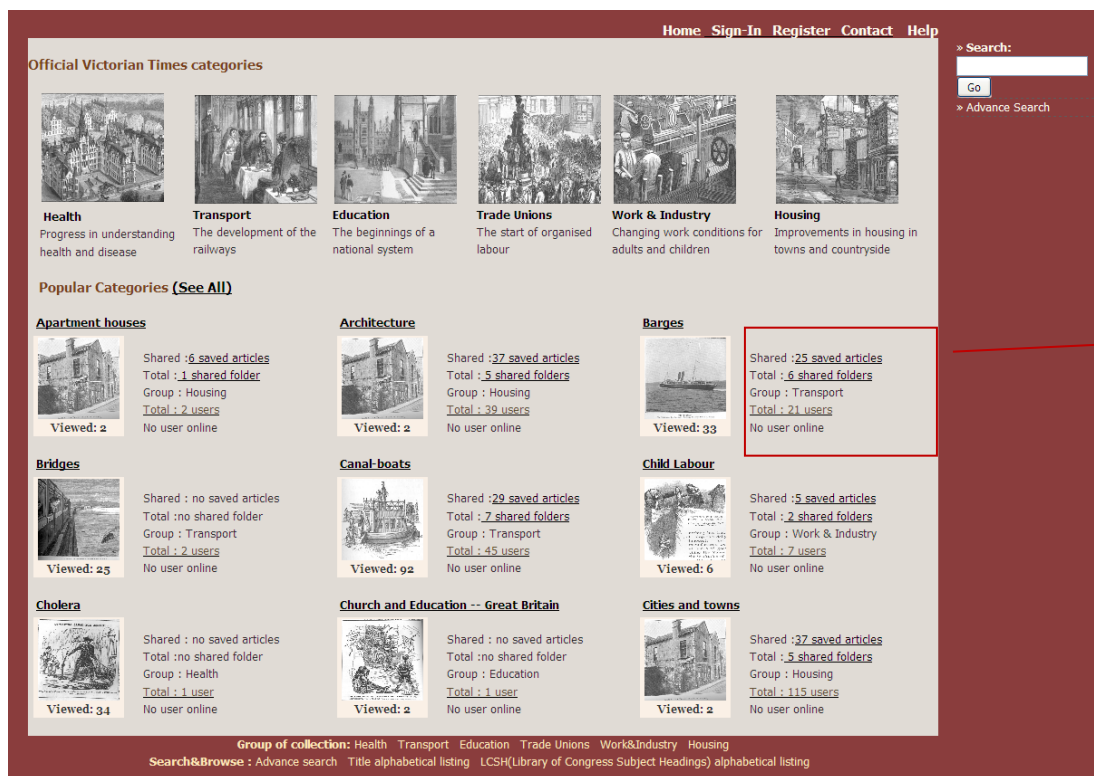
Figure 5. 3 Example of people’s activities with items (viewed and saved items)

This page in Figure 5.3 provides two patches: watched item lists and saved item lists. It may carry scent and the users can follow the links to the lists of documents viewed or saved in people’s item lists. Several carriers are displayed for each document within the patch: date accessed, document thumbnails, title, more details (a brief description), PDF document and comments. All the image and textual information may influence the scent of documents.

### 5.3.2 Most Viewed Item Interface

The goal of Most Viewed Item Interface is to represent each category by one document, as well as providing social data about the particular category (see Figure 5.4). The most viewed document thumbnail was selected to be a representation of each popular category. “I found document X is the most viewed document in this subject, perhaps I

will find something relevant.” The combination of a document thumbnail with social data may greatly increase the efficiency of the scent.



Social Data

Figure 5. 4 Screen shot of the main page of Most Viewed Item Interface

Within the popular categories section, nine popular categories are shown in order to fit in one screen design. Users can explore the remaining popular categories by clicking at “See all”.

The interface provides many ways to presents scent carriers:

- By clicking the document thumbnail, it leads users directly to document content.
- By following social data: the number of shared articles, the number of shared folders, group name, the number of people and the number of online users. Users can follow scent of these links depending on their interests.

- By clicking the category name, it leads to a patch of documents based, of which an example is shown in Figure 5.5.







Barges			
Item Lists : articles			
No.	Item	Item's details	Activites by
1		<p><b>Title</b> :<a href="#">Photograph of the "Roebuck" - Great Western Railways new twin screw steamship</a></p> <p><b>Author</b> : -</p> <p><b>Published</b> :1897</p> <p><a href="#">More details</a>  <a href="#">add to my item list</a></p>	 watched this items on date: 16/04/2010, 10:10 <b>Amie</b>
2		<p><b>Title</b> :<a href="#">Canal barge for carrying powder and petroleum (engraving)</a></p> <p><b>Author</b> :Author: Illustrated London News</p> <p><b>Published</b> :1874</p> <p><a href="#">More details</a>  <a href="#">add to my item list</a></p>	 watched this items on date: 16/04/2010, 10:11 <b>Amie</b>

Figure 5. 5 Example of displayed all items viewed by people in the popular category “Barges”

Figure 5.5 displays a variety of information about a set of document in the selected popular category. Several scent carriers are displayed for each document within a patch: document thumbnail, title, author, published year, more details (a brief description of a document), PDF document, user image and date viewed document. A user image link leads directly to the patch of this person.

### 5.3.3 Multiple Items Interface

The Multiple Items Interface is similar to Most Viewed Item Interface but different by representing with three thumbnails of document sets viewed by people in the popular category (see Figure 5.6). Three thumbnails of documents may carry more scent and users may get quick ideas about the popular content within a subject.

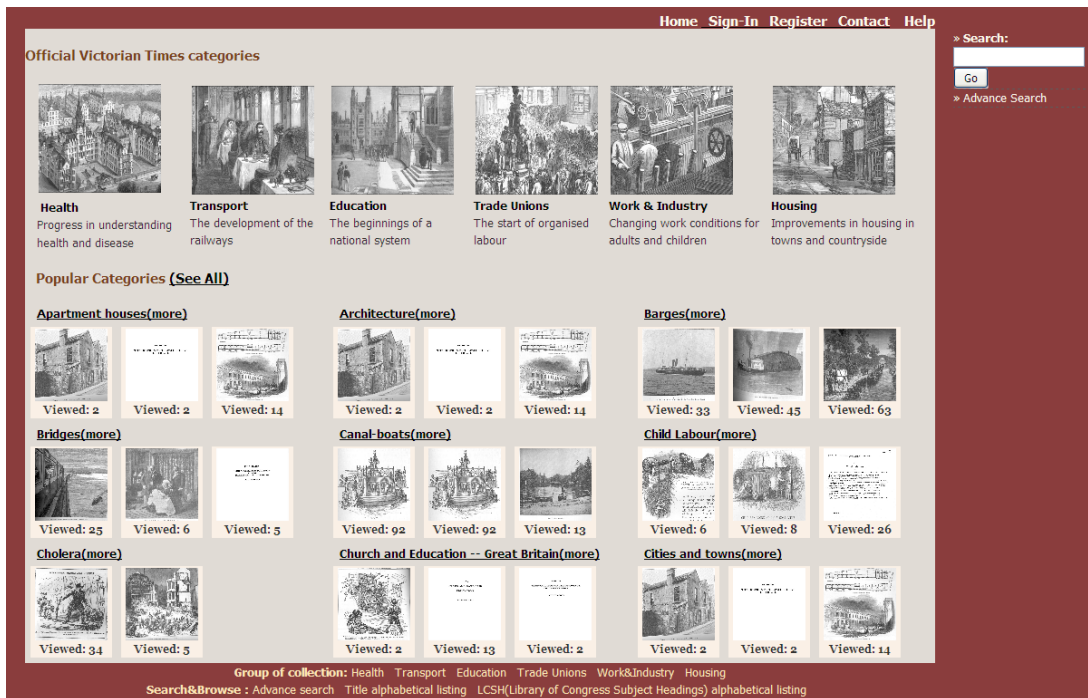


Figure 5. 6 Screen shot of the main page of Multiple Items Interface

In popular category section provides document patches that lead users toward to a set of documents by clicking the desired category name, of which an example of the page is similar to that of Most Viewed Item interface as can be seen in Figure 5.5. This page also provides access directly to the particular document content by clicking the document thumbnail.

### 5.3.4 Most Recent Users Interface

The primary goal of Most Recent Users Interface is to provide a user view of the particular category. The most recent user's image is represented in each popular category. Popular categories can be ordered by "popular topic" or "topic", depending on the interests of users. For "popular topic", the popular categories are ordered by the number of people who looked at information in LCSH terms, while "topic" the popular categories are ordered by alphabetical lists.



Figure 5. 7 Screen shot of the main page of Most Recent Users interface

To design the interface fit to one screen, all popular categories are provided in the one frame slider (see Figure 5.7). The frame slider is a visual presentation of people based and is capable of carrying scent. The small arrow both right and left is used to scroll the patch to see all popular categories. Also the textual descriptive detail under the user image such as person name, number of people and group name may provide scent to users. If users detect a scent in one of popular categories, clicking the image user, it

leads them forward to a set of people who have interested in the particular subject. The result page is similar as that of Social User interface as can be seen in Figure 5.2.

## **5.4 Study goals**

I have done a set of two small usability tests with two people and another one study with eight participants. I used an iterative design approach to re-test usability in order to get rid of as small usability problems as possible (Lauesen 2005).

The study goals of the studies are as follows:

- (i) To analyse how participants interact with the new interfaces in order to investigate the use of features for supporting them to find information, as well as to determine which interface is the best; and
- (ii) To determine the interfaces based on effectiveness and participant satisfaction.

The hypothesis is that the popular categories in the virtual community and social features are helpful for users to complete their tasks.

## **5.5 The general methodology**

All usability studies reported in Section 5.5.1-5.5.4 were conducted using the redesigned user interfaces. Table 5.2 displays for a summary overview of an iterative design of Victorian Times Digital Library.



Table 5. 2 Overview of the Victorian Times Digital Library studies

Usability test	Goals	Design	Subjects	Tasks(time)
1	Effectiveness and usability of four interfaces	Experimental, within-subject, 4 systems	2 PhD students	Both general and specific information (10 minutes per task) Total tasks: 8 Total time: 60 minutes
2	As Usability test 1, and effect of <b>task changes</b>	Experimental, within-subject, 4 systems	2 PhD students	Simulated tasks (10 minutes per task) Total tasks: 4 Total time: 60 minutes
3	Effectiveness and usability of <b>two interfaces changing</b>	Experimental, within-subject, 2 systems	<b>8 PhD students</b>	Simulated tasks (20 minutes per task) Total tasks:2 Total time: 60 minutes

The instruments in this study consider the effectiveness and participant satisfaction. For all usability tests, I have conducted in similar patterns. The details are as follows:

The data gathered during the study composed of quantitative and qualitative study from questionnaires (For a usability test 1 see Appendix A.5; a usability test 2 see Appendix A.6;and a usability test 3 see Appendix A.7), interviews, video recorded by CamStudio software and note-taking of the participants' comments and actions during the test. The participants were asked and motivated to speak out loud (think-aloud) for expressing their thoughts, the problems they might encounter, and their feelings during performing tasks. The usability studies were conducted to enable participants to determine the best interface, as well as suggestions for usability improvements to the Victorian Times Digital Library interface.

Participants were welcomed and explained the overall aim of the study. They signed consent forms and then they were asked to fill in a pre-set questionnaire to record their profiles and Internet experience including digital library experience. Next, a training session was provided within 10 minutes (Note that the training-session was set up before participants start to use each system).

Then, participants were asked to perform the first search task by using the first interface. When the first task was completed, they were asked to rate the ease of use in the interface by a five-point scale. Also, they were asked to assess the first interface by a set of semantic differentials. Then, participants were asked to perform the second task by using the second interface. This repeats 4 times. After completed all tasks, they were asked to fill in a post-test questionnaire which is ranking four interfaces from 1 (the best) to 4 (the worst) according to ease of finding information, attractiveness, usefulness and overall reaction to the system including the reasons given.

Finally, interview session was collected to answer following questions:

- (1) What two things work well while searching the digital library interface?
- (2) What two things need improvement to help you more easily search the digital library web sites
- (3) What features from other digital libraries would you like to see included on the new user interface Victorian Times Digital Library?

Participants were rewarded a big box of chocolate per person for their participation after the study.

The systems allow participants to use any features as many as they like. This made it possible to study about which tools they like to use for completing tasks.

The order of interface and tasks was rotated to minimize learning effect from one system to the other according to a Latin square design.

### 5.5.1 The usability test 1

In this study, participants were asked to accomplish tasks using the four interfaces shown in Figure 5.4 - Figure 5.7. The usability sessions were conducted on 15<sup>th</sup>-16<sup>th</sup> February 2010. The testing was carried out in an office setting meeting room at the Department of Computer and Information Sciences, University of Strathclyde.

#### 5.5.1.1 Participants

To conduct the study, I invited two participants (1 male, 1 female). One participant is a PhD student in the Department of Computer and Information Sciences at Strathclyde University and one participant is a PhD student in the Department of Mechanical and Design Engineering at University of Portsmouth. One participant is Japanese, while a different participant is Thai. Two participants have used digital libraries. They are very interested in History. One participant has a little knowledge about the Victorian period in the UK history, while another one has moderate knowledge about the Victorian period in the UK. Also, they are interested in a topic in History.

#### 5.5.1.2 Tasks

In order to study how participants interact with the systems for finding specific (the first task for each of the interfaces) and general information (the second task for each of the interfaces), each participant performed eight search tasks (see Table 5.3), with two of each interface. Participants were given 10 minutes to complete each task.

Table 5. 3 Task assigned to participants in the usability test 1

Interface	Task	Description
Social User	1	Find an image of "Queen Victoria"
	2	I would like to know what the house style looks like in the Victorian time era.
Most Viewed Item	1	Find out if the digital library has the document entitled "The Metropolis Water Supply Bill"

Interface	Task	Description
	2	I would like to know are there have any revolutions in Great Britain in Victorian period.
Multiple Items	1	Find out if the digital library has the document entitled “Lock hospitals and lock wards in general hospitals”
	2	I would like to know about what water transportation people use in the Victorian time period? Moreover, you would like to see what the transportation looks like.
Most Recent Users	1	Find only images about “Leicester Town Hall”.
	2	You would like to know about accidents and injures which have occurred on all the railway in Great Britain. Moreover, you like to find out the causes of accidents.

### 5.5.1.3 Results & analysis

After completed search tasks in each interface, participants were asked to assess the level of difficulty of each task. In addition, they were asked to give opinions for the interfaces by semantic differentials, a five-point scale and open-ended questions.

#### (a) Participant perception of task completion in the interfaces

The first objective of the usability test 1 is to analyse participant interaction with these interfaces to accomplish the task. In order to examine participant perception in term of effectiveness, two participants involved in eight search tasks. The results of the Usability test 1 based on questionnaires and my observation are displayed in Table 5.4.

Table 5. 4 Participant perception of task performance and the features participants used during performing the task (n=2)

Interface	Task	Average time	The number of participants				The level of task
			Basic		Advanced	Social	
			Search	Browse			
Social User	1	1.00	2	-	-	-	Easy(2)
	2	2.00	1	2	-	-	Cannot complete the

Interface	Task	Average time	The number of participants				The level of task
			Features		Advanced	Social	
			Basic				
			Search	Browse			
Most Viewed Item	1	1.00	2	-	-	-	task (1) Med (1) Easy (2)
	2	2.50	2	1	-	2	Cannot complete the task (1) Hard(1)
Multiple Items	1	1.50	2	-	-	-	Easy(2)
	2	2.50	1	1	-	1	Cannot complete the task (1) Hard (1)
Most Recent Users	1	1.00	2	-	-	-	Easy (2)
	2	2.00	1	1	-	-	Hard (1) Med (1)

(Advanced = advanced features; Social = social features and popular categories)

For finding document on specific topics such as Task 1 of each interface (Total: 4), they considered these tasks easy. Two participants easily accomplished the tasks using the search functions. One reason for this might be that people use much direct search and few other features to complete a specific task (Bates 2002b).

For general questions such as Task 2 of each interface (Total: 4), as can be seen, one participant could not complete three tasks. Based on my observation, I found that participants used search and browse features without using the social features to complete the tasks as I expected. One participant seemed to use the search features for specific and general tasks. She felt that search may be the sole way to get information quickly. The same participant also stated about browsing feature that persons' skills for scanning information are different. This participant might be one of dominant searchers who often issue terms into a search box without intent to utilize other functions or look

at information on the site. They like to get the information they need as soon as possible (Nielsen and Loranger 2006).

For searching, I noticed that the participant only slightly modified the terms and tended to avoid trying other terms. No results appear on the result page, the participant felt these might be no information on the collection. This indicates that personal search skills might be important for participants' behaviours while they were performing their search activities.

In addition, the participant seemed to type the terms as exact words in the task description into a search box or to scan sub-categories to looking for such words. One possible explanation for this finding might be that the tasks might be extremely directed. This may be made participants tended to issue the same keywords as those in the tasks.

**(b) Comparison of interfaces**

The second objective of this usability test was to determine participant satisfaction of four interfaces. After completed all tasks on four interfaces, the participants were asked to assess the interfaces. I used 7-point semantic differentials; a five-point scale with 1 representing “the worst” and 5 representing “the best” and open-ended questions. I compared the results of a questionnaire regarding various aspects of interfaces using Friedman test. An alpha level of .05 was used. The results for rating scales and semantic differentials are depicted in Table 5.5 and Table 5.6, respectively.

Table 5. 5 A five-point scale of easy to use interface (score from 1 to 5, high=better)

Statement	Social User (Median)	Most Viewed Item (Median)	Multiple Items (Median)	Most Recent Users (Median)	P-value
Easy to use	4.0	2.0	3.0	3.5	.163

Table 5. 6 Semantic differentials for four interfaces (score from 1 to 7, high=better)

Differential	Social User (Median)	Most Viewed Item (Median)	Multiple Items (Median)	Most Recent Users (Median)	P-value
Beautiful	4.0	5.0	<b>5.5</b>	4.5	.392
High quality	4.5	5.0	4.5	5.0	.572
Unique	<b>5.5</b>	3.0	3.5	3.5	.145
Fast	6.0	6.0	6.0	6.0	-
Pleasant	5.5	5.0	5.0	<b>6.0</b>	.514
Smart	5.0	4.5	4.5	<b>5.5</b>	.733
Formal	5.0	<b>6.0</b>	5.5	5.5	.261
Reliable	4.5	5.5	5.0	5.5	.572
Fun	<b>4.0</b>	3.5	3.0	3.5	.392

As can be seen in Table 5.5 and Table 5.6, Social User Interface was considered significantly more unique, easy to use and slightly more fun, while Most Viewed Item Interface is slightly more formal. In addition, the participants considered slightly more beautiful in Multiple Items Interface whereas slightly more pleasant and smart in Most Recent Users Interface. However, all of these differences were insignificant, suggesting that participant satisfaction of those interfaces is similar.

In addition, participants were asked to rank four interfaces regarding to each statement with 1 representing “the best” and 4 representing “the worst”. Table 5.7 summarizes the participants’ responses for ranking four interfaces based on ease of finding information, attractiveness, usefulness and overall reaction to the system.

Table 5. 7 Ranking four interfaces (low=better)

Statements	Social User (Median)	Most Viewed Item (Median)	Multiple Items (Median)	Most Recent Users (Median)	P-value
Easier to find information	<b>1.0</b>	3.0	3.0	3.0	.308
More attractive	<b>1.0</b>	2.0	3.0	4.0	.112
More useful	<b>1.5</b>	2.5	2.5	3.5	.494
Overall reaction to system	<b>1.0</b>	1.5	2.5	2.0	.392

As can be seen in Table 5.7, Social User Interface was considered the best of four interfaces in terms of ease of finding information, attractiveness, usefulness and overall reaction to system. However, using the Friedman test indicates that these differences were insignificant, suggesting participant satisfaction of those interfaces is similar.

One participant felt lost some times because when (s)he typed misspelled words; no results appear on the result page, while one participant did not feel lost. One participant preferred Social User Interface due to the beautiful design, while another one preferred Most Viewed Item Interface because the items that (s)he would like to know were shown on the page.

### **(c) Qualitative data**

According to comments collected from open-ended questions, one participant liked search features, while a different one appreciated organized categories. None identified potential improvement in the interfaces.

### **(d) Summary**

Based on the results obtained from usability test 1, I found that participants tended to use search strategy for specific tasks. They also tended to use a lot of browsing in official categories for general tasks and possible to further searching, indicating that they tended to avoid using popular categories and social features for both tasks. From an Information Foraging Theory, this suggests that participants perceived strong scent in searching and browsing (official categories) patches to perform those tasks. It is challenging to investigate whether they perceive scent in social patches or further to create a new search patch in different tasks.

For the next study, the usability test was conducted an experimental design as the same as this study, but different in a new set of simulated work tasks (Borlund 2003) that informed participants to carry out a given task in realistic situations.



## 5.5.2 The usability test 2

Following the study 1, this was an experimental study (within-subject), but different tasks. I used simulated work tasks (realistic tasks). Participants were asked to perform tasks using the four interfaces shown in Figure 5.1, 5.4, 5.6 and 5.7. Each participant conducted four searches on four systems (one search per system), within 10 minutes a task. The usability sessions were conducted on 1<sup>st</sup>-2<sup>nd</sup> March 2010. The testing was carried out in an office setting meeting room at the Department of Computer and Information Sciences, Strathclyde University.

### 5.5.2.1 Participants

The study was carried out with two female. They are PhD students in the Department of Computer and Information Sciences at Strathclyde University. Two participants are Malaysian. One participant was from the e-learning field while another participant was from Computer Science. None had used four interfaces or tasks before.

### 5.5.2.2 Tasks

Each participant conducted four search tasks with four interfaces. For each task, it consists of sub-tasks with different search tasks: two tasks compose of background and specific tasks and other two compose of background search and the decision to find a good picture. Simulated search tasks are illustrated in Table 5.8.

Table 5. 8 Task assigned to participants in the usability test 2

Task	Scenario
1	You are investigating your family tree and have learned that your-great-grandmother was a servant in Victorian Times. You are interested to learn more information about what kinds of jobs women performed in Victorian Times. What jobs were popular in Victorian Times for women, what kind of

Task	Scenario
	jobs might you have done if you were a women in Victorian Times?
2	Imagine you are architecture and work for the “Modern House Company”. John Brandy, your customer, who likes traditional British styles, asked you to design his home similar to the Victorian house. You have no knowledge about this and design to explore information for the characteristics of houses in the Victorian era with Victorian Times digital library. You are also interested in good pictures of house in Victorian Times.
3	You are helping your friend’s son write a school report on water transportation in Victorian Times. You would like to find different types of transportation and examples of what such transportation looked like. You are particularly interested in good pictures of people using water transport in Victorian Times.
4	Imaging you are studying a master’s degree in History. Your advisor asks you to prepare a seminar about “the lives of poor children in Victorian Times”. Based on your basic knowledge, you know that very young children were often forced to work very long hours. You would like to find documents about this topic. Your task is to collect information on how the poor children work? How many hours do they work a day, and where? You may also to put some pictures of them on your presentation.

### 5.5.2.3 Results & analysis

As in the usability test 2, both quantitative data from a questionnaire and qualitative data from interview and the questionnaire, note-taking from observation were collected and analysed as described in the following section.

**(a) Participant perception of task completion in the interface**

In order to investigate participant interaction with the interfaces, the participants were asked to perform four simulated tasks by using four interfaces. After finished each task, participants were asked to rate the level of task difficulty. Interface features used also included. These results are summarized in Table 5.9.

Table 5. 9 Participant perception of task performance and the features participants used during performing the task (n=2)

Interface	Task	Average time	The number of participants				The level of Task difficulty
			Features		Advanced	Social	
			Basic				
			Search	Browse			
Social User	1	5.50	-	2	-	-	Med(1) Easy(1)
Most Viewed Item	2	7.00	-	2	-	-	Can't complete task(1) Easy(1)
Multiple Items	3	5.50	1	2	-	-	Easy(2)
Most Recent Users	4	8.00	-	2	-	-	Med(2)

(Advanced = advanced features; social = social features and popular categories)

For all tasks, two participants tended to browse categories/sub-categories. One participant seldom used the search features like task 3 in Multiple Items Interface.

I noticed that they did not use any social features during the tasks. They were unwilling to look at popular categories section even as a second or third choice, suggesting that participants failed to learn that these popular categories might be helpful. I analysed the data from the post-search interview based on the concept of Information Foraging

Theory, The finding sheds some light on the causes of unused popular categories are as follows:

- For Social User Interface, two participants were not interested to know who did the activities, but they liked to know what the documents people watched. One participant said, “This interface provided a few users”. The same participant also recommended, “More users, more useful”. This suggests that perceived scent can be increased by displaying higher the number of users.
- For Most Viewed Item Interface, one participant said, “It’s nice interface”. The participant preferred this interface because it would support official categories (the second view). Another participant said, “It shows details on how many users have viewed the documents in this category, what group is under? It does not show the title of a document”. The participant suggested that the document title should be displayed when mouse over a document thumbnail. This suggests that participant might get frustration due to lack of enough information. This indicates that only a document thumbnail does not contain enough strong scent.
- For Multiple Items Interface, one participant commented that many document thumbnails in each popular category that made (s)he confused how to order the documents. Another participant also confused which group the document belongs in. The participants also recommended that the document title should be displayed when mouse over a document thumbnail. Similarly as suggestion in Most Viewed Item Interface, providing necessary information might be help participants to avoid frustration and perhaps to increase clearly strong scent.
- For Most Recent Users Interface, one participant tends to ignore to use popular categories because there has a few people in this section. If there have a lot of users, it may be more interesting to look at. Another participant did not interested in people and the user image which is representative of each popular category

since it is not relevant with the contents in categories. For example, the most recent user who is represented of “Child Labour” popular category wore a sexy dress in a shown picture. This suggests that the most recent user does not contain enough information scent. Therefore, the participants selected to follow other patches.

### (b) Comparison of interfaces

In order to investigate participant satisfaction of four interfaces, again, the participant was asked to describe various aspects of four interfaces by scoring each system on the same set of 8 5-point semantic differentials. I compared the results of a questionnaire regarding various aspects of interfaces using Friedman test. An alpha level of .05 was used. The results of semantic differentials are shown in Table 5.10.

Table 5. 10 Semantic differentials for four interfaces (score from 1 to 5, high=better)

Differential	Social User (Median)	Most Viewed Item (Median)	Multiple Items (Median)	Most Recent Users (Median)	P-Value
Relaxing	5.0	4.5	4.5	3.5	.295
Satisfying	4.5	3.0	5.0	3.5	.204
Useful	5.0	4.0	5.0	4.0	.392
Easy	5.0	4.5	5.0	3.5	.145
Novel	3.0	2.5	4.0	3.0	.295
Fast	4.5	4.5	4.0	4.5	.733
Simple	4.0	4.0	5.0	4.0	.112
Effective	4.0	4.0	5.0	3.5	.522

As can be seen in Table 5.10, differently from previous studies, I found that Social User Interface was considered slightly more relaxing. On the other hand, Multiple Items Interface was considered significantly more satisfying, novel, simple and effective. However, it was insignificant in differences, meaning participant satisfaction among those interfaces is similar.

In order to determine which interface is the best, participants were asked to rank four interfaces according to ease of finding information, attractiveness and usefulness. Table 5.11 summarizes the participants' responses.

Table 5. 11 Ranking four interfaces (low=better)

Statements	Social User (Median)	Most Viewed Item (Median)	Multiple Items (Median)	Most Recent Users (Median)	P-value
Easier to find information	3.0	<b>1.0</b>	2.0	3.0	.180
More attractive	3.0	<b>1.0</b>	2.5	4.0	.180
More useful	3.5	<b>1.0</b>	2.0	4.0	.120

Out of four interfaces, two participants tended to like Most Viewed Item Interface, followed by Multiple Items Interface (see Table 5.11). One possible cause is that they would like to know what are some interesting items viewed by most people rather than who did activities. Especially in popular categories, this suggests that document view would be preferred over user view; perhaps participants thought this view as valuable. However, all of these statements were insignificant ( $p > .05$ ), meaning there was no difference among interfaces in terms of ease of finding information, attractiveness and usefulness. In addition, two participants did not feel lost during all tasks.

### (c) Qualitative data

According to qualitative interview data, two participants mentioned that they liked the organization including the number of documents shown in each sub-category, as well as the clear navigation interfaces. One participant felt quite strongly that those popular categories would have been motivated more if there have many people viewed the documents. This suggests that the high number of people in the popular category might be attractive to participants to further explore items.

A different participant suggested that the title should be shown when a participant moved the mouse over the document thumbnail on Most Viewed Item and Multiple

Items interfaces. This suggests that lack of enough information made participants frustrated and confused to consider how relevant of material.

#### **(d) Summary**

By comparing two usability tests, when I changed the tasks from specific and general tasks in the previous test to simulated work task situation in this study, I found that participants tended to use a lot of browsing in official categories. This result is different from that of the previous study that is participants in previous study tended to use search strategies in all tasks.

As described above, from a point of Information Foraging Theory view, participants did not follow the patches in popular categories or social features to complete simulated work task situation as I expected. This suggests that participants perceived poor scent in social patches in four interfaces. I also found that the participants seemed to appreciate Most Viewed Item and Multiple Items interfaces, meaning that document based interfaces (Most Viewed Item and Multiple Items interfaces) may contain enough scent rather than user based interfaces (Social User and Most Recent User interfaces). One possible reason is that participants liked to know what the documents people viewed rather than to know who viewed those documents. As a result, I selected both interfaces and improved them before conducting the next usability test.

### **5.5.3 Interface Redesign**

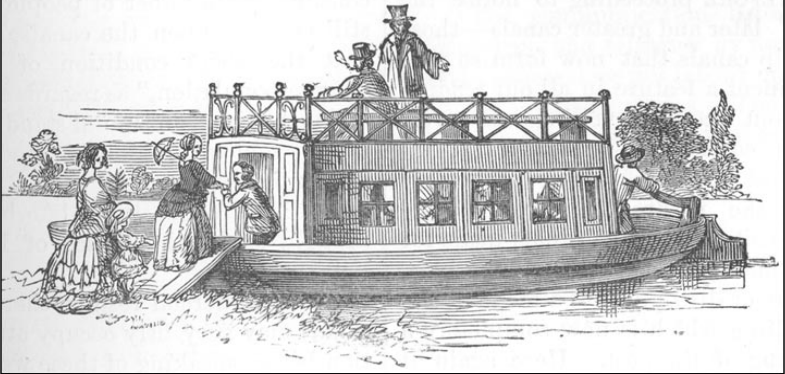
From an Information Foraging Theory as I described in Section 5.2.2, I made the following some changes in both interfaces in order to increase the high-scent:

- The cost of information is relative to the sizes of structure of information, meaning the more quantity of information, the more amount of cost of information (Card et al. 1996). In order to decrease the cost and time, the small cluster of popular categories were placed in the top of the screen and thus users

can locate it quickly. On the contrary, the official categories (a large amount of documents) were placed in the bottom of the page (see Figure 5.10 and Figure 5.11).

- The short description of each group in Official Victorian Times categories was removed due to avoid narrowing the user's imagination when reading brief descriptions of official groups (see Figure 5.10 and Figure 5.11).
- The pop-up will display textual information such as a document title, number of reviews and how often this item saved to item list by other people when the mouse moves over a document thumbnail. This would be a strong scent carrier to make a decision whether they continually follow this patch or leave a patch to explore a new one.
- Related items were added into the document page (see Figure 5.8). It provides a set of documents that have been viewed by people who have been looking the current items. These links might be useful for users and support decision, as well as carry the appropriate scent of related patches.





- Title: Passengers boarding a canal boat
- Author: [Croal, Thomas](#).
- Published: 1877
- total pages: 1
- Rights: Victorian Times Project
- Category: Transport » [Canal-boats](#)
- Views count: 92
- Doc. Code: BADI
- Description:

Reviews : 1 (items)

By : [kanako](#) , Email: [kanako@hotmail.com](mailto:kanako@hotmail.com) , When : 24/03/2010, 13:55  
That's good material

Collection : Review.

- Name: \*
- Email:
- Message: \*

• Enter characters as you see. It will help to protect for registration automatically.: \*

**Add to itemlist [Login required]**

[Print this page](#)

[Display slide show](#)

[PDF Files](#)

**Who Viewed this item**


[kanako](#) Viewed on:2010-02-09 10:04:39

[kanako](#) Viewed on:2010-02-09 10:05:00







[alice](#) Viewed on:2010-02-11 14:03:33

[jean](#) Viewed on:2010-02-11 14:08:47

(Total View:92 Annonymous:89)

 **Recommended by 2 people**

People who have interested in this object also looked at:

**Related documents**

Figure 5. 8 Related items on the document page

The Figure 5.8 shows “related documents (marked)”. This may carry scent if users think the current document is associated with their goals. The pop up shows a document title when mouse moves over a document thumbnail. This may carry scent for users decide whether to explore further in those related patches. This page also provides how often this item saved to item list by other people, by following hyperlink “Recommended by people”, for example, “Recommended by 2 people”, meaning the current document is

saved to item list by two people. The combination of a green symbol and “recommended by people” words may encourage users to decide to read the document. The perception of higher or lower scent may be manipulated by the number of people who saved the document.

- I created popular group page, another represented patch, offering to explore the popularity by groups (see Figure 5.9).

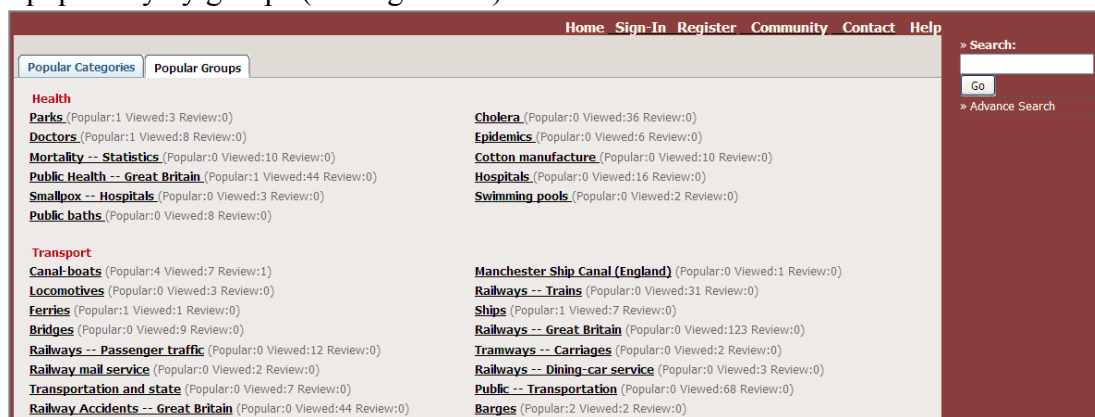


Figure 5. 9 Interface for popular group

Each popular category offers two scent carriers:

- Popular is indicated by the number of items saved to folders;
- View is indicated by the number of items had been viewed.
- I added social data to popular categories in Multiple Items interface (see Figure 5.11 (marked) in order to provide information scent cues, and thus users can follow the links to information source;
- Also, changing terminology used in social data in order to increase clearly strong scent, for example, changing “shared save articles” to “popular objects”; changing “Total users” to “recent visitors”; changing “Comment” to “Review”. I

also removed “user online”. “Viewed objects” was added in social data in order to keep track of the items in the popular category already viewed (see Figure 5.10 and Figure 5.11);

- The three thumbnail documents shown in each popular category are ordered by the number of views in order to rank document patches for browsing. This may help users decide whether to convey document content or leave to other patches.

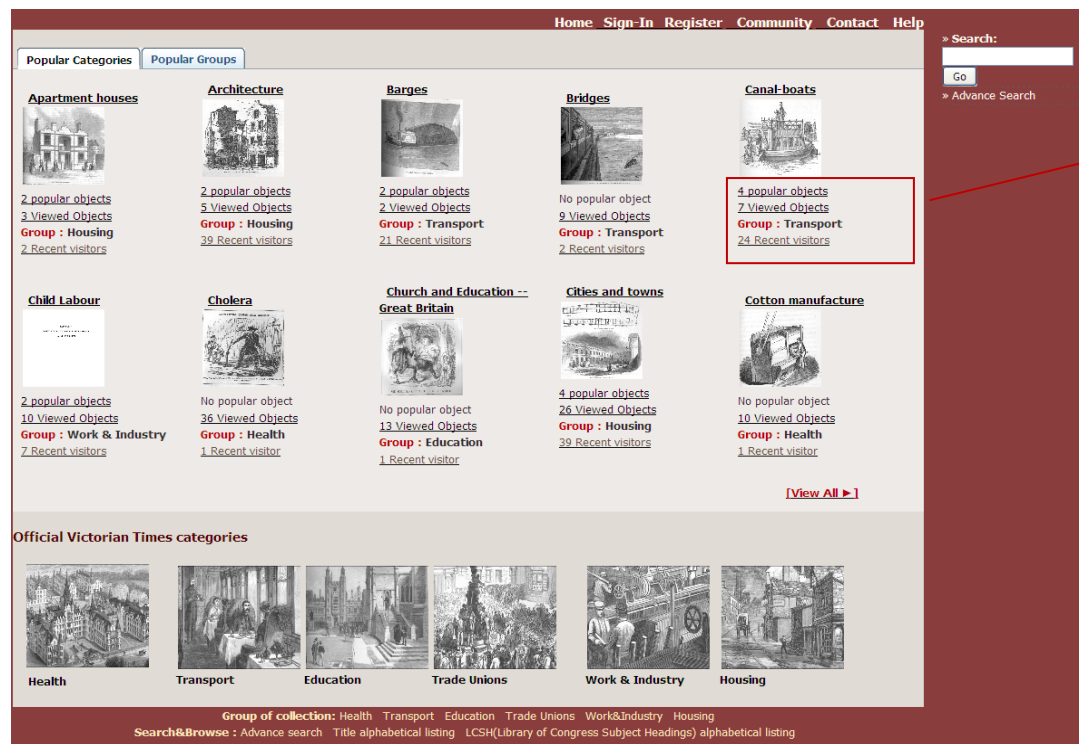


Figure 5. 10 The screen shot of Most Viewed Item Interface (redesigned interface)



Figure 5. 11 The screen shot of Multiple Items Interface (redesigned interface)

- I simulated more users to use the systems and make more transaction between users and items. I believe this might be increased scent for users to look at those items.
- When users clicked the popular category name, for example, “Child Labour”, the result page is displayed in Figure 5.12. The number of people who recommended this item (saved this item to their item lists) and the number of reviews of the document is provided on the page. These scent carriers may enhance perceive scent of the document and help users determine whether follow to explore the document or leave to other patches.

Child Labour		Item Lists : articles	
No.	Item	Item's details	Activites by
1		<b>Title :</b> <a href="#">The cry of the children</a> <b>Author :</b> St. John Conway, Katherine <b>Published :</b> 1894 <a href="#">More details</a> 4reviews <a href="#">add to my item list</a>	<a href="#">grace</a> Viewed on : 2010-02-27 14:01:17 <a href="#">pat</a> Viewed on : 2010-02-27 14:01:17 <a href="#">anita</a> Viewed on : 2010-02-27 14:01:17 <a href="#">Noah</a> Viewed on : 2010-02-27 14:01:17 See more 3 users ▶ ( Total View: 54 Annonymous:48)
2		<b>Title :</b> <a href="#">A bill to prohibit children</a> <b>Author :</b> - <b>Published :</b> 1900 <a href="#">More details</a> No review <a href="#">add to my item list</a>	<a href="#">meaw</a> Viewed on : 2010-02-09 10:21:45 ( Total View: 27 Annonymous:26)

Figure 5. 12 People’s activities with the popular category

If users detect scent in “Recommended by 2 people” in Figure 5.12 and click to follow the link, this scent leads to a new patch that related to people who recommended (or saved) this item to item list. The result page is displayed in Figure 5.13.

Item No :514 Title: The cry of the children			
No.	Who	User reviewed on this item	See other items in the same item list
1	 Noah Last login :2010-04-16 16:37:40	<b>This document explains what kind of jobs that very young children did it. and they had injured from accident during they worked.</b> (reviewed on 2010-04-22 20:12:43)	 Viewed: 39  Viewed: 25
2	 meaw Last login :2010-08-03 17:08:21	<b>This document explains what kind of jobs that very young children did it. and they had injured from accident during they worked.</b> (reviewed on 2010-04-22 20:12:43)	 Viewed: 39  Viewed: 25

Figure 5. 13 The lists of people who save the item to their item lists

Figure 5.13 shows a lot of scent carriers such as user image, last log-in date, user’s review, and other document thumbnails in the same item list. Other people’s reviews may influence the scent of document. Also, “See other items in the same item list” may carry scent. If one of these items in the same item list contains enough scent, users may want to move another patch. Every reviewer is a Victorian Times user. The link provides to the patch of this user, of which an example of user’ profile page is displayed in Figure 5.14.

**Noah's Profile**

  
**Noah**  
 Last accessed  
 161 days ago

**Bibliography:**  
 -

**Noah's activities**

**Noah's Item Lists** [Create your own list](#)

**Child labour** 2010-04-16 16:37:50 (3 items)  
 This list includes:

- [The cry of the children](#)
- [Observations on the state of the children in cotton mills / edited by Thomas Foster and David McWilliams](#)
- [Commercialism and child labour](#)

**Noah's review** [Create a new review](#)

- [Observations on the state of the children in cotton mills / edited by Thomas Foster and David McWilliams](#)  
 The children are compelled to rise before haft past five o'clock in the morning, both winter and summer, they didn't allow to leave from those factories till eight o'clock at night. Commented on : 22/04/2010, 20:201

Figure 5. 14 User's profile

As can be seen in Figure 5.14, the profile of users such as person's item list and person's reviews may carry enough scent that support users to follow the link.

In the next study, I conducted a larger scale usability study using Most Viewed Item and Multiple Item interfaces with native speakers in order to avoid participants' frustrated by poor English skills. Also, the participants were provided longer time to perform each task. A limited time per task was set within 20 minutes.

### 5.5.4 The usability test 3

Following usability test 2, this was an experimental study (within-subject), but with eight participants. Participants were asked to perform simulated search tasks using the two interfaces shown in Figure 5.10 and Figure 5.11. Each participant conducted two searches on two systems (one search per system), within 20 minutes a task.

The usability sessions were conducted on 11th-12th May 2010. The testing was carried out in an office research student room at the Department of Computer and Information Sciences, University of Strathclyde.

#### **5.5.4.1 Participants**

This study was carried out with 6 male and 2 female. Out of 8 participants, 7 participants were PhD students; one was a research staff member in the Department of Computer and Information Sciences. The participants were recruited through mailing lists of the department. None of the participants had experience on the interfaces. Five participants ranged from twenty one to thirty years old. Three of the participants were thirty one to forty years old. Five participants were native speakers and three participants were non-native speakers but fluent in English (international students).

All participants have used Springer link. Seven participants have used ACM and Science Direct. Some participants have used Emerald and others. Most participants dealt with digital library web site every day.

For internet usage, all participants used the internet for research every day. Five participants are social network web sites' members. Out of 8 participants, three have a little interested in History, Three have a medium interested in, and two have interested in History very much. Five participants have topics which interested in. Out of 8 participants, six have a little knowledge and two did not have knowledge about Victorian Times history. Seven participants usually use Mozilla Firefox. None use Netscape and Opera.

#### **5.5.4.2 Tasks**

The tasks were the same as those in the usability study 3. The participant conducted 2 searches on different topics on each version of the interface. In order to avoid learning effect from one system to another, the order of interfaces and tasks were rotated and demonstrated in Table 5.12.

Table 5. 12 A counterbalance design using related sample to examine two interfaces to perform two realistic tasks

Participant	The first interface	The second interface	The first task	The second task
1	Most Viewed Item	Multiple Items	1	2
2	Multiple Items	Most Viewed Item	2	1
3	Most Viewed Item	Multiple Items	1	2
4	Most Viewed Item	Multiple Items	2	1
5	Multiple Items	Most Viewed Item	1	2
6	Most Viewed Item	Multiple Items	2	1
7	Most Viewed Item	Multiple Items	1	2
8	Multiple Items	Most Viewed Item	2	1

### 5.5.4.3 Results and analysis

As in the usability test 2, to examine the effectiveness and user satisfaction of the interfaces, the participants carried out two search tasks with Most Viewed Item and Multiple Items interfaces.

#### (a) Participant perception of task completion in the interfaces

Following the usability test 2, this section presents the results based on questionnaires, my observation and qualitative data.

Table 5. 13 Participant perception of task performance and the features participants used during perform the task (n=8)

Interface	Task (n)	Average time	The number of participants				The level of Task Difficulty		
			Tools			Advanced		Social	
			Basic		Advanced				Social
			Search	Browse					
Most Viewed Item	1(5)	15.00	2	2	0	4	Easy(1) Med(3) Hard(1)		
	2(3)	9.00	2	2	0	3	Easy(3)		
Multiple	1(3)	15.07	0	2	0	3	Med(2)		

(Advanced = advanced features; social = social features and popular categories)



Interface	Task (n)	Average time	The number of participants				The level of Task Difficulty
			Tools			Social	
			Basic		Advanced		
			Search	Browse			
Items						Easy(1)	
	2(5)	11.20	1	5	0	3	Easy(3) Med(2)

The general picture as can be seen from Table 5.13 is that participants used popular categories and social features during task performance, meaning they felt that they might gain much valuable experience from these features.

Some interesting results of logging-data and my observations regarding to features used during performing the tasks were found that a majority of participants (6 out of 8) started to use popular categories, and then they used other features for completing the tasks. They spent much more time for reading, exploring documents and viewing other comments, while some (3 participants) preferred to use only popular categories. In addition, half of participants seemed to utilize popular categories, search, official categories, and other social features such as people’s reviews. This suggests that participants learn more about social features and might help them to complete the tasks.

Moreover, I noticed that one participant tended to start with search, but after the participant explored on the document page, (s)he appeared to appreciate with “Popular who interested in this object also looked at”. To accomplish information as users need, they might go through different resources. In the meantime, they come up with the new ideas from material found. This is relevant to “Berrypicking” techniques (Bates 1989) and also similar as Information Foraging Theory (Pirolli and Card 1999).

**(b) Comparison of interfaces**

As in the usability test 3, I compared the set of 8 scores on each differential for Most Viewed Item Interface with the corresponding set of 8 scores on each differential for Multiple Items interface. The results are demonstrated in Table 5.14.

Table 5. 14 Semantic differentials for two interfaces (score from 1 to 5, high=better)

Differential	Most Viewed Item (Median)	Multiple Items (Median)	P-Value
Relaxing	4.00	4.00	.655
Satisfying	<b>4.50</b>	4.00	.317
Useful	4.00	4.00	1.000
Easy	4.00	4.00	.414
Novel	3.00	3.00	1.00
Fast	4.00	4.00	1.00
Simple	<b>4.50</b>	4.00	.460
Effective	4.00	4.00	.564

Wilcoxon signed-rank test results show that both interfaces were relax, useful, easy, novel, fast and effective. Participants using the most viewed item interface felt more satisfying and simpler to use than the multiple items interface. However, there were no significant differences found with semantic differentials of two interfaces.

Finally, the participants were asked to rank two interfaces based on easier to find document, more attractiveness and more usefulness. The results from ranking interfaces are shown in Table 5.15.

Table 5. 15 Ranking four interfaces (low=better)

Statement	Most Viewed Item (Median)	Multiple Items (Median)	P-value
Easier to find information	1.50	<b>1.00</b>	.180
More attractive	2.00	<b>1.00</b>	.059
More useful	1.50	<b>1.00</b>	.046

As can be seen in Table 5.15, clearly, Multiple Items Interface was rated better than Most Viewed Item Interface in all of statements specified in the questionnaire, which suggests that it was preferred over the Most Viewed Item Interface. I found that most of the participants (6 out of 8) tended to favour Multiple Items Interface, while 2 felt that both interfaces are similar. Most comments regarding the Multiple Items Interface were generally positive. This may be because there have more document thumbnails displayed on the screen rather than those of Most Viewed Item Interface.

To confirm this, I conducted Wilcoxon Signed Ranks Test using SPSS version18. The results show that the ranking of Multiple Items Interface is significantly better than that of Most Viewed Item Interface, in terms of more useful ( $T=0$ ,  $n=8$ ,  $p=.05$ ). This suggests that facilitating more items displayed on popular categories would be helpful for users.

Most of the participants (5 out of 8) did not feel lost while 3 felt lost some times. One participant suggested that when user clicked at a small item's thumbnail, it should show a PDF file not display only the first page of a document. Two participants felt that they could not click a Web browser's back button some times.

### **(c) Qualitative data**

There were various comments regarding the best thing that worked well of the interfaces. They were quite impressive with good organization. The Multiple Items Interface was considered useful and easy. They liked necessary information available such as more details, the most viewed item, grouping of people, how many people use it, users' comments and the document thumbnails. In addition, some participants liked "People who have interested in this object also looked at" as commented that it's very useful.

Two participants expressed some design for searching texts in a PDF document. One participant gave opinions by saying, “I needed to be reminded to close an open document before I go to look for another. Maybe an ‘about’ page that explains the site layout such as site map”. In addition, two participants suggested that the interfaces should be included Citation links or Reference links for all articles cited in the pictures or text documents. It might be useful for users. One participant suggested that specially, icon to display one image and report should be different. For example, an icon image represents one image. A PDF icon represents a full report. On the item’s detail page, the additional tools like “people who have interested in this object also looked related items” should be displayed at above of the page not below.

#### **(d) Summary**

In this study, I conducted the usability test with five native speakers and three participants are non-native speakers but experienced in English. From the point of view of Information Foraging Theory, the finding indicates that most participants tended to use combined patches to accomplish simulated work task situations. They perceived strong scent in popular categories and social features patches, following by browsing official category patches, and create new search patches by issuing keyword queries respectively.

Based on my observation, when participants found a long list of documents in official categories, they had hesitation as to whether this document relevant as their goals. Although they looked at the title and metadata itself, perhaps there was hardly any scent to be perceived in this information. I also noticed that when participants looked at popular categories including social data and read other people’s reviews, they felt more confident and followed the link in the patches. This suggests that popular categories, social data and other users’ reviews possible contain strong scent. In addition, the finding found that a majority of participants appreciated more in multiple items interface, represented with the most viewed three document thumbnails and social data,

rather than a Most Viewed Item interface, represented with a document thumbnail and social data. This indicates that providing more number of document thumbnails may carry higher strong scent for participants rather than fewer number of document thumbnails.

In addition, the main finding of this study which I found different from those of the usability 2 is that most participants in this study tended to use popular categories and social features during performing the tasks. They could complete all tasks while the participants in the usability test 2 could not complete some of the tasks and did not use popular categories or any social features to complete the tasks.

## **5.6 Conclusions and Future work**

All usability studies aim to analyse how participants interact with the new interfaces in order to investigate the use of features for supporting them to find information. According to Information Foraging Theory point of view, it can be concluded that participants tended to select different patches in different tasks. Participants tended to adapt their behaviours in relative to the information they found based on limited time and cost.

For the specific and general tasks, I found that participants were more likely to use search rather than any features. This can be concluded that if people know exactly what they are looking for, they seem to use search strategy. In term of unknown specific goals, people seem to used more browse strategies rather than searching.

After improving the interfaces based on Information Foraging Theory and modifying the tasks (using simulated work task situation), I found that participants who were native speakers or non-native speakers but fluent in English seemed to utilize popular categories and social features on the interfaces to perform the tasks, according to Information Foraging Theory, suggesting that they perceived scent in the redesigned Victorian Times interfaces. However, the Victorian Times interface is needed to

improve for high scent, especially in popular categories and social features and retest with a larger sample size.

# Chapter 6

## Experiment

### 6.1 Introduction

The main objective of this thesis is to examine whether the functionalities in the social digital library help users to accomplish different task types with minimum effort. To achieve this objective, I performed an experimental study to investigate the use of features in digital libraries to perform various tasks. As discussed in Chapter 5, findings from the usability test 3 were promising. The final version of the social digital library was then evaluated against conventional interface in an effectiveness test on a larger sample of participants (24 participants). In this chapter, I present the experimental test to determine how participants interact with the Victorian Times interfaces, particularly focusing on how the features employed to accomplish different types of tasks and how the social features and social information can help participants to complete the tasks.

The remaining of this chapter is organized as follows. Study goals, research questions and hypothesis are presented in Section 6.2. Also, I describe methods that I conducted in this study in Section 6.3. I then present and discuss the results of the experimental study in Section 6.4. The conclusions are presented in Section 6.5.

## 6.2 Study goals, research questions and hypotheses

The study goals of the studies are as follows:

1. To evaluate the redesigned Victorian Times interfaces (Multiple Items Interface) and LCSH interface covering system interaction in terms of efficiency, effectiveness, helpfulness, ease of learning, ease of use and to examine participant satisfaction of overall the systems.
2. To analyse how participants interact with the redesigned interfaces in order to investigate the use of features for supporting them to find information in different work tasks and to provide valuable insight into how future features should be designed.
3. To compare the outcomes of different work tasks and subjective participant satisfaction when people use two interfaces.

In the current study, I will examine the use of features when users interact with the systems for different tasks. The research questions for this study are:

- 3) How the features employed by participants to accomplish on different types of tasks.
- 4) How the social features and social information can help participants to accomplish the tasks.

The interfaces used in the experiment provide traditional features but differ in the absence and presence of the social features and social information. More specially, the experiment was aimed to test these research hypotheses:

Hypothesis 1: social digital library interface supports participants to accomplish the tasks.



Hypothesis 2: social features and social information reduces user effort to find relevant information to the task.

Hypothesis 3: social features increase participant satisfaction with the social interface to the Victorian Times digital library.

Hypothesis 4: overall, participants prefer the experimental interface rather than the control one.

## **6.3 Method**

### **6.3.1 Experimental Design**

The underlying hypothesis for this study is that social features and social information reduces participant effort to find relevant information and increase participant satisfaction. This study was a 2\*3 study with a within-subjects design. There were 2 different interfaces and 3 different task types. Participants conducted three search tasks on different topics on each interface of the Victorian Times Digital Library. There were four sets of three task types: background information task; decision making task; and fact finding task, as in Section 6.3.7, which were always given to participants in the same order. A limited amount of time depends on task type: 20 minutes for background information task; 10 minutes for decision making task; and 5 minutes for fact finding task. Each participant searches with the two interfaces: the control interface and experimental interface described below. The order of the tasks was rotated by using Latin square in order to counterbalance tasks and the interfaces.

### **6.3.2 Interfaces**

To study the use of social features and effect of social information in the Victorian Times Digital Library, two Victorian Times Digital Library interfaces were used in this

study: a traditional Victorian Times interface without social features and social information for supporting users to find information (control interface), and the redesigned Victorian Times interface that augments control interface with social features and social information (experimental interface). In this section I described each of the interfaces.

### **Changes to the Victorian Times Digital Library interface**

Based upon suggestions of the previous iterative study in Chapter 5, I made the following significant changes in the Victorian Times interface prior conducting to this study:

- Providing the ability to click at a Web browser's back button (Mozilla Firefox) to the previous page.
- As participants' suggestions from the previous study, an icon to display one image and a report should be different. For example, an icon image represents one image. A PDF icon represents a full report. This might help users for making fast relevance decisions. The differentiated icons in document types would provide a fast way for making relevance decisions.
- "Print this page" and "display slideshow" features were removed from the item page (Figure 6.4 and 6.7) in order to avoid distraction.

#### **6.3.2.1 Interface 1: Control interface**

I developed a traditional Victorian Times interface without social features such as popular categories, popular groups and social information likes reviews and other people activities. The conventional Victorian Times interface serves as the control interface in this experiment since this interface represents typical information presentation including basic and advanced features on traditional digital libraries – such as searching, browsing

official Victorian Times categories (the basic features) and filtering information (the advanced features) as can be seen in Figure 6.1.



Figure 6. 1 The main page of LCSH interface (control interface)

According to Information Foraging Theory, in the official Victorian Times categories, users can explore the patch by selecting a group, then clicking category within the group. Once the category is chosen, a list of items and related metadata such as title, author, published year and more details are provided within this patch (see Figure 6.2). This can influence the scent of the item.



Figure 6. 2 The result in browsing LCSH subject Heading “Pubic Health-Great Britain”

Users can create their own patches by issuing queries in simple and advanced search.

The metadata about items are provided on the result patch (see Figure 6.3).




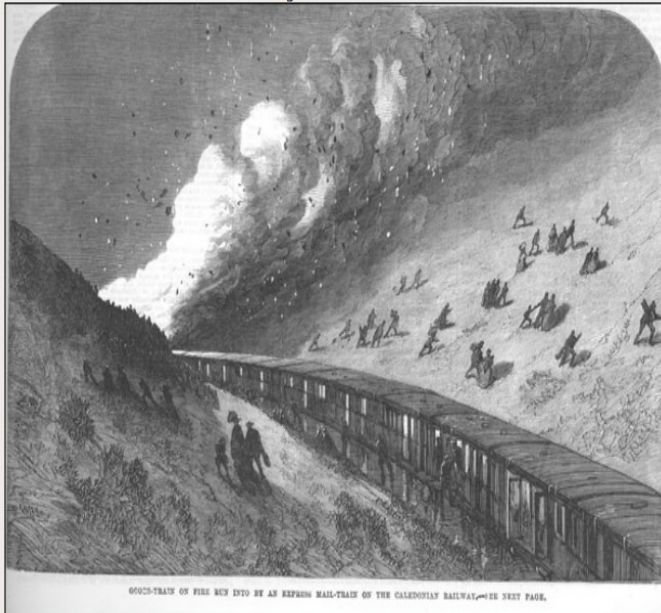
Search Term :snow(1)		
No.	Item	Item's details
1		<p><b>Title :</b> <a href="#">Portrait of John Snow (1813-1858), an eminent doctor. He recognised that cholera was transmitted by means of unclean water. Snow had a lively interest in anaesthetics such as ether and chloroform. The latter he administered to Queen Victoria during the bi</a></p> <p><b>Author:</b> <a href="#">Snow, John</a></p> <p><b>Published year:</b> 1857</p> <p><b>LCSH(Library of Congress Subject Headings) Term:</b> <a href="#">Cholera</a></p> <p><a href="#">More details</a> </p> <p> <a href="#">add to my item list</a></p>

Figure 6. 3 The result search page

Selecting an item from the result patch leads users to the item patch by clicking at either the items' titles or image thumbnails, of which an example is presented in Figure 6.4.

Click at the Image document to view a PDF file



GOODS-TRAIN ON FIRE BURNING BY AN EXPRESS MAIL-TRAIN OF THE CALEDONIAN RAILWAY.—SEE NEXT PAGE.

- **Title:** [Caledonia Railway- accident involving a goods train and an express mail train \(engraving\)](#)
- **Author:** [Illustrated London News](#)
- **Published:** 1867
- **total pages:** 1
- **Rights:** Victorian Times Project
- **Category:** Transport » [Railways - Passenger traffic](#)
- **Views count:** 9
- **Doc. Code:** LAFH
- **Description:**  
-

• [Add to itemlist](#) [Login required]

Figure 6. 4 The item's detail page of the specific item

### 6.3.2.2 Interface 2: Experimental interface

In addition to the basic and advanced features offered by the control interface, the experimental interface provides social features and social information. Based on the results from the previous studies in Chapter 5, I improved the overall interface, information presentation, some features, together with the implement different information presentation of the main page by applying idea from Information Foraging Theory (Pirolli & Card 1999) in order to increase more scent before conducting the experiment. I had improved the experimental interface described below.

- Modified the main page of the interface.



Figure 6. 5 The main page of the experimental interface

In terms of Information Foraging Theory, information foragers will follow the patch following on information scent. The experimental interface provides several ways for

users to browse within a patch or combine patches. On the main page in Figure 6.5, users can start interacting with the collection by (a) selecting a popular categories or popular groups - are presented in the top of main page. As can be seen below the “Popular categories” menu, patches are visually presented as a popular collection categorized by category name. The three most viewed thumbnail documents and information about the number of popular objects, the number of viewed objects, group name the popular category belongs to, the number of recent visitors in a popular category are displayed in the patch.

(b) Querying information in a simple search box after which results are presented as a patch – is displayed at the top-right part of the main page.

(c) At the below of the main pain, it is possible to browse information related to patched items within the particular group in official categories.


- Changing colour of the background-frame of the thumbnail documents and font colour of the popular category name.
- Providing both metadata about items such as title, author, published year, more details and other people’s activities such as reviews, the number of recommendations are presented on the search results. These cues might or may not provide scent to users. The same data also can be seen on the results in browsing official categories, the lists of items in popular categories. An example is shown in Figure 6.6, displaying the results of the keyword search for “The cry of the children”.

Search Term :The cry of the children(1)			
No.	Item	Item's details	Activites by
1		<p>Title : <a href="#">The cry of the children</a>            Author: <a href="#">St. John Conway, Katherine</a>            Published year: <a href="#">1894</a>            LCSH(Library of Congress Subject Headings) Term:<a href="#">Child Labour</a></p> <p><a href="#">More details</a> </p> <p> <a href="#">add to my item list</a></p>	<p> This document explains what kind of jobs that very young children did it. and they had injured from accident during they worked.            Lastest review from Meaw (2010-04-22 20:12:43)  <a href="#">See all (4reviews)</a></p> <p><b>Recommended by 2 people</b> </p>

Figure 6. 6 The results of the keyword query “The cry of the children”

- Users can click to see the details of a patch item (see Figure 6.7) by clicking at the thumbnail document rather than displaying only the first page of a document (from participants' suggestion).
- Changing the details of the item page.

Click at the Image document to view a PDF file



- Title: [Passengers boarding a canal boat](#)
- Author: [Croal, Thomas](#).
- Published: [1877](#)
- total pages: 1
- Rights: Victorian Times Project
- Category: Transport » [Canal-boats](#)
- Views count: 138
- Doc. Code: BADI
- Description:

• [Add to itemlist](#) [Login required]

**WRITE A REVIEW**






• Name: \*

• Email:

• Message: \*


• Enter characters as you see. It will help to protect for registration automatically.: \*

**People who have interested in this object also looked at:**

 Viewed: 99	 Viewed: 57	 Viewed: 38
 Viewed: 8	 Viewed: 6	

[All 1 Reviews](#) Hot

That's good material  
By : [kanako](#) (24/03/2010, 13:55)

[Recommended by 2 people](#) 

**Who Viewed this item**

[kanako](#) Viewed on: 2010-02-09 10:04:39  
[kanako](#) Viewed on: 2010-02-09 10:05:00  
[alice](#) Viewed on: 2010-02-11 14:03:33  
[jean](#) Viewed on: 2010-02-11 14:08:47

Figure 6. 7 The detail of item page of the experimental interface

- I moved “people who have interested in this object also looked at” section to the top-right of the item’s detail page in order to create stronger information scent (see Figure 6.7). “People who have interested in this object also looked at” section provides related documents to the currently selected item. These related items may carry scent for users to accomplish their goals.

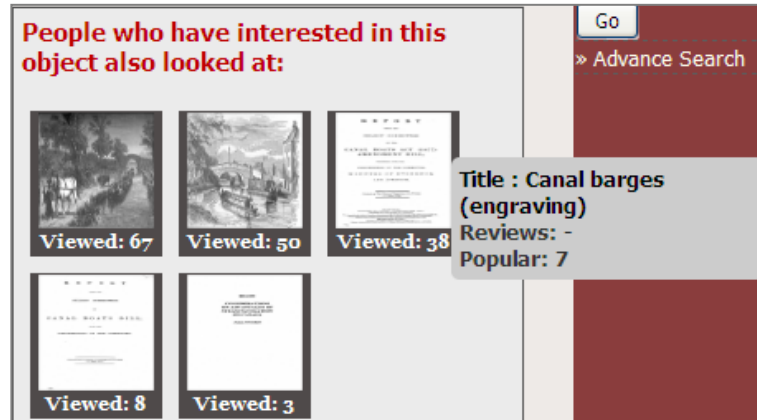


Figure 6. 8 The dialog box is shown item’s information when mouse over the thumbnail document

- In Figure 6.8, when users move mouse over the thumbnail document, it shows the document’s title, the number of reviews, the number of people who save this item to their item lists (or popular). The interface is designed to support fast identification of patches—also facilitated by providing descriptions when pointing the mouse at the patch name – and fast moving between patches
- Changed a symbol for displaying recommended items in order to increase the amount of scent (see Figure 6.9 and 6.10). I also increased the number of recommendations by other people, as well as the number of reviews. The higher number of recommendations and reviews may carry more scent so that the users will feel encourage to follow the link.

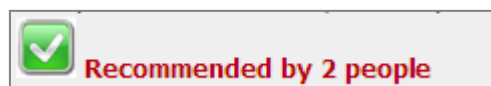


Figure 6. 9 Symbol of recommended in the pre-modified interface





Figure 6. 10 Symbol of recommended in the experimental interface

- Added navigation bar and changed a results screen in browsing popular category.

When users browse popular categories, a navigation bar was provided on the results screen. Also, the results of browse are displayed as a list of items, with social information such as reviews and the number of people who recommended these items (see Figure 6.11). These cue might assist users decide whether to click on the items. This could be considered as a way to assist users in making better decisions about potential relevance.

Current page : <a href="#">Home</a> >> Popular Category >> <a href="#">Canal-boats (4 popular objects)</a>			
Item Lists : 4 articles			
No.	Item	Item's details	Activites by
1	 Viewed: 116	<b>Title</b> :Passengers boarding a canal boat <b>Author</b> :Croal, Thomas. <b>Published</b> :1877 <a href="#">More details</a> 	 <b>That's good material</b> Lastest review from kanako (2010-03-24 13:55:20) <a href="#">See all (1reviews)</a> <b>Recommended by 2 people</b> 
2	 Viewed: 67	<b>Title</b> :Canal barges (engraving) <b>Author</b> :Illustrated London News <b>Published</b> :1874 <a href="#">More details</a> 	No review <b>Recommended by 7 people</b> 

Figure 6. 11 The result lists in “Canal-boats” popular category

- View all popular categories

Users can explore the entire popular categories patch by clicking View all” link in “Popular categories” section or clicking “Popular groups” menu on the main page. The popular categories were arranged and represented separated by group in order to

keep the interface uncluttered. There are group name links that allow users to quickly jump to the specific group (see Figure 6.12).

**Popular Categories** **Popular Groups**


Display by : [Lists](#) [Thumbnails](#)

[Health](#)
[Transport](#)
[Education](#)
[Trade Unions](#)
[Work & Industry](#)
[Housing](#)

---


**Health**

**[Cholera](#)**




No popular object  
[36 Viewed Objects](#)  
**Group : Health**  
[1 Recent visitor](#)

**[Doctors](#)**




[1 popular objects](#)  
[8 Viewed Objects](#)  
**Group : Health**  
[1 Recent visitor](#)

**[Hospitals](#)**




No popular object  
[16 Viewed Objects](#)  
**Group : Health**  
[1 Recent visitor](#)

**[Parks](#)**



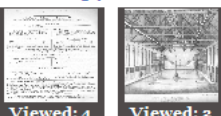
[1 popular objects](#)  
[3 Viewed Objects](#)  
**Group : Health**  
[1 Recent visitor](#)

**[Public Health - Great Britain](#)**




[1 popular objects](#)  
[44 Viewed Objects](#)  
**Group : Health**  
[2 Recent visitors](#)

**[Swimming pools](#)**




No popular object  
[2 Viewed Objects](#)  
**Group : Health**  
[1 Recent visitor](#)

**[Cotton manufacture](#)**



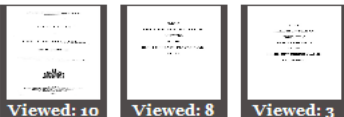
No popular object  
[10 Viewed Objects](#)  
**Group : Health**  
[1 Recent visitor](#)

**[Epidemics](#)**




No popular object  
[6 Viewed Objects](#)  
**Group : Health**  
[1 Recent visitor](#)

**[Mortality - Statistics](#)**




No popular object  
[10 Viewed Objects](#)  
**Group : Health**  
[1 Recent visitor](#)

**[Public baths](#)**



No popular object  
[8 Viewed Objects](#)  
**Group : Health**  
[1 Recent visitor](#)

**[Smallpox - Hospitals](#)**




No popular object  
[3 Viewed Objects](#)  
**Group : Health**  
[1 Recent visitor](#)

---


**Transport**

**[Barges](#)**



[2 popular objects](#)  
[2 Viewed Objects](#)  
**Group : Transport**  
[21 Recent visitors](#)

**[Bridges](#)**



No popular object  
[9 Viewed Objects](#)  
**Group : Transport**  
[2 Recent visitors](#)

Figure 6. 12 View all popular categories

- In popular groups

Users can click “Popular groups” menu on the main page, leading to the page displayed in Figure 6.13. This page presents entire popular groups along with a list of popular categories within a group. Also, there are group name links that allow users to jump to the specific group.

**Popular Categories Popular Groups**

**Health**

<a href="#">Parks</a> (Popular:1 Viewed:3 Review:0)	<a href="#">Cholera</a> (Popular:0 Viewed:36 Review:0)
<a href="#">Doctors</a> (Popular:1 Viewed:8 Review:0)	<a href="#">Epidemics</a> (Popular:0 Viewed:6 Review:0)
<a href="#">Mortality - Statistics</a> (Popular:0 Viewed:10 Review:0)	<a href="#">Cotton manufacture</a> (Popular:0 Viewed:10 Review:0)
<a href="#">Public Health - Great Britain</a> (Popular:1 Viewed:44 Review:0)	<a href="#">Hospitals</a> (Popular:0 Viewed:16 Review:0)
<a href="#">Smallpox - Hospitals</a> (Popular:0 Viewed:3 Review:0)	<a href="#">Swimming pools</a> (Popular:0 Viewed:2 Review:0)
<a href="#">Public baths</a> (Popular:0 Viewed:8 Review:0)	

**Transport**

<a href="#">Canal boats</a> (Popular:4 Viewed:7 Review:1)	<a href="#">Manchester Ship Canal (England)</a> (Popular:0 Viewed:1 Review:0)
<a href="#">Locomotives</a> (Popular:0 Viewed:3 Review:0)	<a href="#">Railways - Trains</a> (Popular:0 Viewed:31 Review:0)
<a href="#">Ferries</a> (Popular:1 Viewed:1 Review:0)	<a href="#">Ships</a> (Popular:1 Viewed:7 Review:0)
<a href="#">Bridges</a> (Popular:0 Viewed:9 Review:0)	<a href="#">Railways - Great Britain</a> (Popular:0 Viewed:123 Review:0)
<a href="#">Railways - Passenger traffic</a> (Popular:0 Viewed:12 Review:0)	<a href="#">Tramways - Carriages</a> (Popular:0 Viewed:2 Review:0)
<a href="#">Railway mail service</a> (Popular:0 Viewed:2 Review:0)	<a href="#">Railways - Dining-car service</a> (Popular:0 Viewed:3 Review:0)
<a href="#">Transportation and state</a> (Popular:0 Viewed:7 Review:0)	<a href="#">Public - Transportation</a> (Popular:0 Viewed:68 Review:0)
<a href="#">Railway Accidents - Great Britain</a> (Popular:0 Viewed:44 Review:0)	<a href="#">Barges</a> (Popular:2 Viewed:2 Review:0)

**Education**

<a href="#">Education - Curricula</a> (Popular:2 Viewed:30 Review:0)	<a href="#">Church and Education - Great Britain</a> (Popular:0 Viewed:13 Review:0)
<a href="#">Science - Study and teaching</a> (Popular:1 Viewed:2 Review:0)	<a href="#">Schools</a> (Popular:0 Viewed:60 Review:0)
<a href="#">School attendance</a> (Popular:1 Viewed:10 Review:0)	

**Trade Unions**

<a href="#">Trade Unions - Great Britain - Public Opinion</a> (Popular:0 Viewed:3 Review:0)	<a href="#">Sweatshops</a> (Popular:0 Viewed:2 Review:0)
<a href="#">Strikes and Lockouts - Great Britain</a> (Popular:0 Viewed:22 Review:0)	

**Work & Industry**

<a href="#">Mines and mineral resources</a> (Popular:0 Viewed:22 Review:0)	<a href="#">Child Labour</a> (Popular:2 Viewed:10 Review:6)
<a href="#">Industrial accidents</a> (Popular:0 Viewed:2 Review:0)	<a href="#">Factories</a> (Popular:1 Viewed:25 Review:0)
<a href="#">Workhouses - Great Britain(housing)</a> (Popular:0 Viewed:7 Review:0)	<a href="#">Women employees</a> (Popular:3 Viewed:8 Review:0)

**Housing**

<a href="#">Housing</a> (Popular:0 Viewed:12 Review:0)	<a href="#">Apartment houses</a> (Popular:2 Viewed:3 Review:0)
<a href="#">Architecture</a> (Popular:2 Viewed:5 Review:0)	<a href="#">Cities and towns</a> (Popular:4 Viewed:26 Review:0)
<a href="#">Royal houses</a> (Popular:0 Viewed:1 Review:0)	<a href="#">Dwellings - Great Britain</a> (Popular:9 Viewed:58 Review:0)

**Official Victorian Times categories**



Figure 6. 13 Popular groups

- Change font colour of popular categories

By using the control and experimental interfaces, I would be able to know whether social features and social information support users to fulfil work tasks, as well as examining the use of features to support users to accomplish different work tasks.

### **Pilot study**

The pilot test was set up in order to investigate of how well the work tasks were fitted within task type. This test was conducted with two participants who were recruited from within the Department of Computer and Information Sciences at Strathclyde University, each working on six search tasks classified into three types according to the level of task goal: finding background information, decision making and fact finding tasks.

I conducted the pilot study. The purposes of this step were to: 1) to avoid ambiguity in instructions, 2) to ensure that all three task types are different regarding the level of difficulty, and 3) to determine the appropriate maximum amount of time for participants to accomplish different task types.

A number of small modifications occurring for the pilot test on the work tasks are as follow:

The result found that one of the background information tasks required more effort to find information than in the three other background information tasks. If the task was too complicated, it is possible that participants would not complete the task within 20 minutes. The task was reduced to a sub-task from finding both information and images to finding only information. Thus the final topic was “Imagine you are studying for a master’s degree in History. Your advisor asked you to prepare a seminar about “the lives of poor children in Victorian times”. You already know that very young children were often forced to work very long hours. You would like to find documents about this topic.

Your task is to collect information on how the poor children work? For example, you might want to learn how many hours do they work a day, and where?”

Moreover, I found that in one of fact finding tasks, the query “Queen Victoria” results in one image returned due to limited resources. Displaying one item retrieved by a query “Queen Victoria” led one participant to believe that the system should have more images about “Queen Victoria” in a database and the participant seemed to attempt to find more images. I then explored another that could be changed to make the topic more challenge to explore information. By looking at information in the Victorian Times, I found that by changing the images of “Queen Victoria” to images of “Stagecoaches”, the task met this criterion.

### **6.3.3 Performance measures**

Since the purpose of this study was to evaluate the redesigned Victorian Times interface and the traditional one covering system interaction in terms of efficiency, effectiveness and participant satisfaction of overall the systems. I would like to know whether differences in the experimental results are due to the absence or presence of the social features and social information. To test the proposed hypotheses (as in Section 6.2), this study compared the following measures:

1. Task completion time: the time for the start until the completion of a retrieved task. The time taken to complete the task was determined through log files.
2. Participant satisfaction: In post-system questionnaires, eight 5-point semantic differentials indicating the level of participant satisfaction toward the interfaces after the participants completed a set of search tasks.
3. Pages viewed: the number of pages viewed by the participant. The pages viewed were determined through log files.

4. Relevant pages: the number of pages that participants found relevant information to accomplish the task. The relevant pages were identified by participants if they found relevant information on the page.

### **6.3.4 Participants**

This experiment was conducted from March to June 2011. Twenty four participants (8 females and 16 male) were primarily students from the University of Strathclyde at the Department of Computer and Information Sciences to participate in this study. It was assumed that master students in Information Sciences and Library Study, Information Management including the fourth and fifth year undergraduate students in computer background would be motivated to learn about finding information in digital libraries.

The participants who were recruited via email list. All were native English speakers. The academic background of the participants was divided among master students in Information Science and Library Studies (8/24), the fourth and fifth year undergraduate students in Engineering Computer and Electronic (7/24), master students in Information Management (2/24), PhD students in Computer and Information Sciences (5/24) and PhD in Sociology (2/24). The median age group category of the participants was (20-30). Half of participants (12/24) used Emerald (other digital libraries (10/24), Springer Link (9/24), Science Direct (9/24) and ACM (3/24)).

Although three of Engineering Computer and Information Science undergraduate students have never used digital libraries, the participants were experienced web users.

The participants were asked to rate how frequently have they visited a digital library web site; how often they can usually find what they are looking for on a 7-point scale (1=never, 7=daily) and how do they rate their level of expertise with finding information in digital libraries on a 7-point scale (1=novice, 7=expert). All participants rated

themselves for expertise with digital library, on Mean 4.96 (SD=2.03) average. When participants find information in digital libraries, they can usually find what they are looking for, on average 5.71 (SD=1.71). In the last six months approximately how frequently have you visited a digital library Web site, on average 5.42 (SD=2.08). Moreover, frequency of using internet was determined in an entry questionnaire, using a 7-point scale, with 1=never, and 7=daily. Those data are displayed in Table 6.1.

Table 6. 1 Internet experience of the subject (7-point low to high frequency)

<b>Type of Internet experience</b>	<b>Mean (SD)</b>
Research	6.67 (0.48)
Bulletin board posting/web board	4.33(2.24)
Chat room/Msn	3.42(1.93)
Web social network	5.58(2.30)

As illustrated in Table 6.1, most participants use internet daily for research. None of the participants had prior experience on the Victorian Times interfaces being investigated.

Using a seven-point rating scale to measure their interests in History and background knowledge about the Victorian period in the UK history, in which 1= “Not at all” and 7= “Extremely”, the average level of interested in history was 5.17; and with background knowledge about the Victorian Times was 4.29. Furthermore, I found that 5 of 24 participants reported had a Bachelor’s degree in History (1: the United States history, 1: Celtic History, 1: Scottish literature). 14 participants reported have topical interests in history. Only one volunteer reported having no prior knowledge about the Victorian Times involved in the study.

All participants can be seen as relatively experienced, regular searchers who participate in online searching as part of daily work and representative of participants in many of the evaluations of new interactive search systems.

As part of the demographic data collection process, participants were asked about which browser they usually used, and most of participants (21/24) used Mozilla (Internet explorer (5/24), other Web Browser (5/24)).

Participants were paid £20 for their participation in the study after completing tasks and questionnaires.

### **6.3.5 Setting and Apparatus**

The experiment was took place in a laboratory and performed a local computer with Mozilla Firefox. The computer was equipped with a video screen capture program, Camstudio that captured participants' interaction to both interfaces from screen and saved it in as an AVI (Audio-Video Interleaved) movie.

### **6.3.6 Procedure**

Participants were asked to interact with both interfaces in order to accomplish a set of work tasks. Questionnaires, think-aloud, observation and note-taking, log files, screen-recording were used to collect both quantitative and qualitative data for analysis. The participants were requested to response to questionnaires (see Appendix A.8). They were presented with the following steps: 1) Welcome and introduction, 2) Consent Form, 3) Pre-Test questionnaire: Demographics information 4) Tutorial on the first interface 5) Pre-Search Questionnaire, 6) Assigned Task, 7) Post-Search Questionnaire, 8) Steps 5 to 7 were repeated for the other two tasks, 9) Post-System Questionnaire, 10) Steps 4 to 9 were repeated for the second interface, 11) Exit Questionnaire and interview.

During performing the tasks, the participants were asked to write down relevant information to the tasks (see Appendix A.9). Participants stopped the tasks when they considered information found was sufficient to complete the tasks.



An experiment session took time between 1.5 to 2 hours in total.

### **6.3.7 Tasks**

I conducted a task-driven information search experiment. I chose search topics to allow for comparison of different interfaces on the same topics. An analysis of the 12 tasks in this set inspired by the following division (Toms et al. 2008).

**Task Type** This characteristic of task contained three levels of task goal:

- a) Fact finding task aims to find specific facts or pieces of information;
- b) Information gathering task or background information task aims to assemble information about a topic, usually from various sources;
- c) Decision making task requires participants to assess, decide and select the best pieces of information from available resources.

Each participant was asked to conduct six search tasks on the two Victorian Times Digital Library Interfaces: one background information; one decision making task; fact finding task per interface. All tasks were constructed using Simulated Work Task Situations (Borlund 2000). The search topics were constructed by tasks that might be interesting topics or widely known topics in the Victorian Times era and those topics should be supported by sufficient information in the current Victorian Times collection. Twelve topics were chosen from six areas of the Victorian Times collection: one health, three transport, three education, one trade and unions, three work and industry, and one housing, to represent a variety of topics for this study. Total 12 tasks for the experimental test are shown in Table 6.2.

Table 6. 2 Work tasks for the experimental test

Task Type	Task No.	Work task
Background information	B1	Imagine you are studying for a master’s degree in History. Your advisor asked you to prepare a seminar about “the lives of poor children in Victorian times”. You already know that very young children were often forced to work very long hours. You would like to find documents about this topic. Your task is to collect information on <b>how the poor children work?</b> For example, you might want to learn <b>how many hours do they work a day, and where?</b>
	B2	You are investigating your family tree and have learnt that your great-grandmother was a servant in Victorian Times. You are interested to learn more information about <b>what kinds of jobs women performed</b> in Victorian Times. <b>What jobs were popular</b> in Victorian Times for women, <b>what kind of jobs might you have done</b> if you were a woman in Victorian Times.
	B3	Imagine you are taking a class called “Victorian Times History”. For the class you need to prepare for a talk. You are interests in the development of railway and particularly interested in railway accidents. You would like to present the <b>number of railway accidents</b> occurring in the UK, <b>where, and the cause of railway accidents.</b>
	B4	My nephew is doing a school project on <b>how factories pollute the surrounding environment</b> and <b>how the work environment affected people’s health.</b> Moreover, it’s good if the report includes <b>the number of</b>

Task Type	Task No.	Work task
		<b>death-rates due to unhealthiness.</b> Can you help him?
Decision Making Task	D1	You are helping your friend's son write a school report on water transportation in Victorian Times. You would like to find <b>different types of transportation</b> and examples of what such transportation looked like. You are particularly interested in <b>good pictures of people using water transport</b> in Victorian Times.
	D2	As a graduate student, you are asked to write an essay about Strikes in the Victorian era. Now you want to learn more about <b>what people in Victorian Times held strikes about.</b> Moreover, you are interested to include <b>good pictures about strikes</b> in the essay.
	D3	You watched the recent BBC program titled “Primary History: Victorian Britain” and really liked the house style in Victorian Times. You are now interested in buying a Victorian style house. You think you should learn about House in Victorian Times and find <b>good pictures of houses</b> in Victorian era for presenting to an estate agent.
	D4	You are taking a class on the history of Victorian Times. For your next homework assignment, you have to present to the class historical images of schools in the Victorian era. What were the schools like? You need to <b>find good photographs</b> for your presentation.
Fact finding	F1	You love history, particular History in the Victorian era. You have heard that stagecoaches were widely used before the introduction of railway

Task Type	Task No.	Work task
		transport. You are curious to find images of stagecoaches.
	F2	<p>You are a master student at university. You are taking a British history class at your university.</p> <p>Your professor has suggested that your group begin project on Education in Victorian Times by looking for background information in a document titled “State and rate paid education”.</p>
	F3	<p>I studied the British History during High School and at that time a teacher gave a lecture on Education in Victorian Times and quoted one line on the blackboard discussing “Science in the education of the people”. Can you find the original source for the quote?</p>
	F4	<p>You have heard that in the Victorian Times, John Snow was an English physician and a leader in the adoption of anaesthesia and medical hygiene. He is considered to be one of the fathers of epidemiology, because of his work in tracing the source of a cholera outbreak in Soho. You would like to find more about where cholera took place in the Victorian Times.</p>

## 6.4 Experimental Results

In this section I present the main findings of the study based on the research hypothesizes stated in Section 6.2. Firstly, in section 6.4.1, I present the participants’ perception of the tasks and task completion time. In section 6.4.2, I present the study findings of participants’ interaction with the interfaces to complete the tasks. Then in section 6.4.3, I compare the responses to the interfaces based on their preferences.

Questionnaire, note-taking, think-aloud, transaction log files and video recording software, “Camstudio” are used to collect data for analysis. Camstudio was also used to capture when participants interacted with the system and recorded what the participants said performing the tasks and the exit interview. I had a total of 72 search sessions per interface in the analysis. As ordinal data variables from participants’ responses to questionnaires (pre-search, post-search and post-system questionnaire), the variables cannot be assumed to be normally distributed. Non parametric statistical testing is used in this analysis, such as Friedman and Wilcoxon signed rank tests. The level of significance is set to  $p < .05$ , unless otherwise stated. CO and EX denote the control and experimental interfaces respectively. SD is used to denote the standard deviation.

### **6.4.1 Search Tasks**

The first hypothesis H1 investigates whether the social digital interface supports participants to accomplish the search tasks. To examine this hypothesis, I first analysed participants’ self-reporting on task difficulty and task familiarity. The results are demonstrated in Section 6.4.1.1. Then, I analysed data gathered on participants’ perception of task completeness regarding on sufficient information and time. The results are shown in Section 6.4.1.2

#### **6.4.1.1 Participant Perceptions**

To test that background information, decision making and fact finding tasks were perceived differently, prior to conduct their searches, the participants were asked about their perception on difficulty and their familiarity of search task topic on a seven-point scale. They were asked to assess the work task from “Extremely easy (1)” to “Extremely difficult (7)”, and from “Totally disagree (1)” to “Totally agree (7)” respectively. The results are demonstrated in Table 6.3.

Table 6. 3 Participants’ perception of the search task according to topic familiarity and perceived difficulty. Highest values shown in bold indicate more agreement with the statement.

Task type	Median (SD)	
	Topic difficulty (1= extremely easy, 7= extremely difficult)	Topic familiarity (1= Totally disagree, 7= Totally agree)
Background information	<b>4.00(1.096)</b>	2.00(1.655)
Decision Making task	3.00(1.194)	<b>3.00(1.516)</b>
Fact finding	3.50(1.469)	2.00(1.353)

Table 6.3 presents the average and standard deviations regarding to topic difficulty and topic familiarity for each task type. Background information tasks were considered significantly more difficult than decision making and fact finding tasks. Fact finding tasks were considered slightly more difficult than decision making tasks. I ran the Friedman test to establish the statistical significance of the differences found among for three different task types. The difference between task type for difficulty is statistically different,  $F_{r(2)}=12.34$ ,  $p<.05$ . For perceived familiarity, all tasks are relatively low. There is no different mean of either measure,  $F_{r(2)}=5.15$ ,  $p>.05$ . Only one participant indicated topic familiarity of 7 for one topic. Four participants indicated topic familiarity of 7 for four topics.

#### 6.4.1.2 Perception of task success

After participants completed each task, they were asked to complete yes/no indicating their response to the attitude statements:

1. “Do you think you had enough time to do the work task?”
2. “Do you think you got enough information to support your work task?”

The participants were asked to response both statements on a dichotomous “yes/no” scale. The results are shown in Table 6.4.

Table 6. 4 The total number of “yes” responses to these statements for each interface and task type. Highest values shown in bold indicate more agreement with the statement.

Scale	Background information task		Decision making task		Fact finding task	
	CO	EX	CO	EX	CO	EX
Enough Time	<b>20</b>	19	21	<b>22</b>	<b>21</b>	19
Enough Information	19	<b>20</b>	<b>22</b>	20	19	<b>21</b>

Of the 48 background information tasks performed by the 24 participants, 9 were not completed (5 on the control interface and 4 on the experimental interface). Of the 48 decision making tasks performed by 24 participants, 6 were not completed (2 on the control interface and 4 for the experimental interface). Moreover, of the 48 fact finding tasks performed by 24 participants, 8 were not completed (5 on the control interface and 3 on the experimental interface). For the decision making tasks on the experimental interface, three participants reported that they had enough time but did not get enough information. The participants said they got everything in the tasks but they would like to go different sources as well (P6 and P5). Another participant commented that it might be because of limited resources in the database (P10). Moreover, for background information tasks on the control interface, two participants (P6 and P7) reported that they had enough time but did not get enough information because they would like to explore another resource or Web sites in order to collect more information.

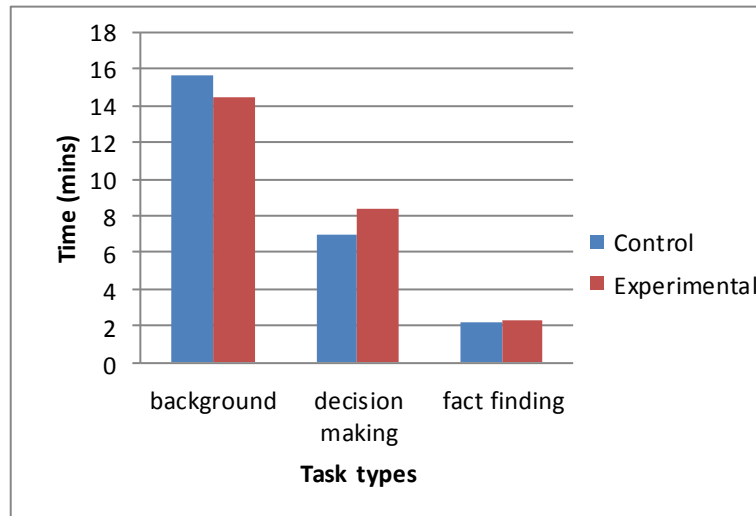


Figure 6. 14 Mean average task completion time

Figure 6.14 shows the task completion time for the background, decision making and fact finding tasks. Note that participants who had not finished the tasks were not taken into consideration. The findings found that the fact finding tasks were completed the quickest on the control interface (M=2.21mins) compared to the experimental interface (M=2.30), this was not found to be statistically significant ( $Z=-.885$   $p=0.376$ ). The decision making tasks were completed quicker on the control interface (M= 7.01 mins) compared to the experimental interface (M=8.39), but no significant difference was found ( $Z=-.896$   $p=0.370$ ). On the contrary, the background information tasks were completed quicker on the experimental interface (M=14.84) compared to the control interface (M=15.63), this was not found to be statistically significant ( $Z=-.454$   $p=0.650$ ). All of these differences were insignificant, suggesting that the efficiency of the two interfaces is similar. There was no difference in the efficiency of the two interfaces.

### 6.4.1.3 Summary

Analysis of subject perceptions of tasks and perception of task success indicates that the participants were able to accomplish the background information tasks in less time on



the experimental interface than did on the control one. In contrast, the participants were able to complete the decision making and fact finding tasks more efficiency than the experimental one. However, the finding indicates that for all three task types, there was not remarkable difference between the task completion times for the control and experimental interfaces. Overall, the results provide some evidence to support H1.6.4.2 Participant Interaction

## **6.4.2 Participant Interaction**

To investigate the research hypothesis H2 that social features and social information reduces participant effort to find relevant information to the tasks, I compare the control and experimental interfaces among three task types, analysing the findings obtained from transaction log files. The results are presented in this section 6.4.2.1. Then I analyse how participants interact with the experimental interface in order to investigate the use of features for supporting them to find information in different work tasks. The results are shown in Section 6.4.2.2

### **6.4.2.1 Page viewed and relevance pages**

Log transaction data were gathered during participants interacting with the systems in order to better understand how participants performed the tasks and investigate search effectiveness by using each interface. Table 6.5 shows the average number of pages viewed and relevant pages for each interface-task pair. The average value in each cell is computed for 24 participants on each task type and interface.

Table 6. 5 The number of page viewed and relevant pages to complete three task types

Scale	Background information task		Decision making task		Fact finding task	
	CO(SD)	EX(SD)	CO(SD)	EX(SD)	CO(SD)	EX(SD)
(1)Pages Viewed	19.04(17.41)	13.79(10.58)	22.63(9.86)	17.50(9.59)	6.88(5.64)	6.04(5.86)
(2)Relevant Pages	4.33(2.06)	3.54(2.08)	5.25(2.66)	6.04(3.55)	1.71(1.40)	2.00(1.719)
Ratio(1): (2)	4.55(2.91)	<b>3.59(1.80)</b>	5.67(4.44)	<b>3.77(2.57)</b>	4.17(2.51)	<b>2.59(1.50)</b>

As Table 6.5 shows, the participants browsed more individual pages to complete background information, decision making and fact finding tasks in the control interface than those using the experimental one, although not significantly so,  $Z=-1.491$   $p=0.136$  background information tasks,  $Z=-1.826$   $p=0.068$  decision making tasks,  $Z=-.423$   $p=0.672$  fact finding tasks. For relevant pages, the participant browsed more relevant pages to complete background information tasks in the control interface than those using the experimental one, although not significantly so,  $Z=-1.549$   $p=0.121$  while they browsed more relevant pages to complete decision making and fact finding tasks in the experimental interface than those using the control one, although not significantly so,  $Z=-.490$   $p=0.624$  decision making tasks,  $Z=-.772$   $p=0.440$  fact finding tasks. These suggest that there were no differences in the number of individual pages and the number of relevant pages of the two interfaces. Additionally, the mean number of pages viewed and relevant pages per task can be considered as a measure of effectiveness. The higher ratio of pages viewed to relevant pages to achieve the task would be a less effective search, indicating that participants put more effort to explore more non-relevant pages than relevant information. As can be seen in Table 6.5, the ratio of pages viewed to relevant pages for accomplish the background information, decision making and fact finding tasks in the experimental interface significantly lower or more effective than those in the control interface.

Wilcoxon signed-rank test results showed that participants using the experimental interface had a lower ratio of pages viewed to relevant pages to complete the background information tasks (M=3.59, SD=1.80) than those using the control one (M=4.55, SD=2.91), although not significantly so,  $Z=-.857$   $p=0.391$ . Also, the participants using the experimental interface had a lower ratio of pages viewed to relevant pages to complete the decision making tasks (M=3.77 SD=2.57) than those using the control one (M=5.67 SD=4.44). The significant result was found ( $Z=-2.086$   $p=0.037$ ). The participants using the experimental interface had a lower ratio of pages viewed to relevant pages to complete the fact finding tasks (M=2.59 SD=1.50) than those using the control one (M=4.17 SD=2.51). The significant result was found ( $Z=-2.659$   $p=0.008$ ). The finding indicated that the experimental interface could lead to an effective interaction for decision making and fact finding tasks.

To further understand how the features of the experimental and control interfaces are used across various types of tasks. These details are described in the following sections.

#### 6.4.2.2 Overall features used to perform different tasks

To analyse how participants interact with the redesigned interface in order to investigate the use of features for supporting them to find information in different types of task, the screen-recording of the participants' interactions with the both interfaces and log files were collected. The results are displayed in Table 6.6.

Table 6. 6 Overall use of features in three different tasks (the number of participants, N=24)

Features	Background information task		Decision making task		Fact finding task	
	CO	EX	CO	EX	CO	EX
1.Search	11	12	10	6	<b>18</b>	16
2.Browse official categories	<b>23</b>	14	<b>23</b>	19	14	8

Features	Background information task		Decision making task		Fact finding task	
	CO	EX	CO	EX	CO	EX
Advanced features(filtering)	9	4	<b>15</b>	10	5	-
3.Popular categories/groups	Social features unavailable	12	Social features unavailable	<b>14</b>	Social features unavailable	8
4.Review		<b>15</b>		14		2
5.The number of Recommendations		<b>8</b>		7		-
6.Related Items from other people		9		<b>11</b>		6

Results in Table 6.6 indicate that there is higher number of browsing official categories for the background information and decision making tasks on both interfaces. Furthermore, the number of participants using search features was greatest on the fact finding tasks. For the experimental interface, reviews from other people have been used by most participants during performing the background information tasks. Also, popular categories and related items from other people were used to complete the decision making tasks more than in the background information and fact finding tasks. The advanced features and the number of recommendation were rarely used to complete fact finding task. The results demonstrate that different tasks affect the use of features to complete the tasks. Overall, I found that there was a substantial usage in social features, especially popular categories in all three task types. It is some interesting to further investigate in depth how each task affects the sequence of features used in both interfaces. Also, the reasons why participants employed the features are provided. I will detail this point further in the following section.

#### 6.4.2.3 The sequences of features used to perform the tasks

The Victorian Times Digital Library Interface is redesigned by applying idea from Information Foraging Theory. An information environment can be considered as a patch structure. The experimental interface facilitates many ways or patches to support users

such as browsing patch, search patch, popular categories patch etc., while the control interface provides solely search and browse patches. Users will follow the patches based on information scent. They will follow the link that provides a strong information scent or switch to other patches if they found the current patch is low scent or to combined patches during the task. If a patch provides more scent, users spend more time for exploration on the patch.

In order to better understand how the features used to accomplish the tasks in more detail or to establish which patches are useful in which task with respect to Information Foraging Theory, I examine the sequences of features used in each interface to complete different kinds of task by using my observation, note-taking, transaction log, think-aloud protocol and interview questions. Only the advanced features and social information are excluded for analysis. In section 6.4.2.3.1 I present the sequences of features used to perform three different task types. Section 6.4.2.3.2 presents the sequences of features used to perform all tasks in each task type. These results are described from an Information Foraging Theory point of view.

Search denotes using only search features. Browse denotes only browsing official categories. (1) Search (2) browse denotes using search features first and then browse feature. (1) Browse (2) search denotes browsing official categories first and then using search features. (1) Browse (2) popular categories denotes browsing official categories first and then using popular categories. Popular categories denotes using only popular categories. (1) Popular categories (2) search denotes using popular categories first and then using search features. (1) Popular categories (2) browse denotes using popular categories first and then browsing official categories.

In the following section I will further investigate the sequences of features used to perform different task types.

### 6.4.2.3.1 The sequences of features used to perform different task types

This section reports on the sequences of features used to perform different task types on both interfaces.

#### The control interface

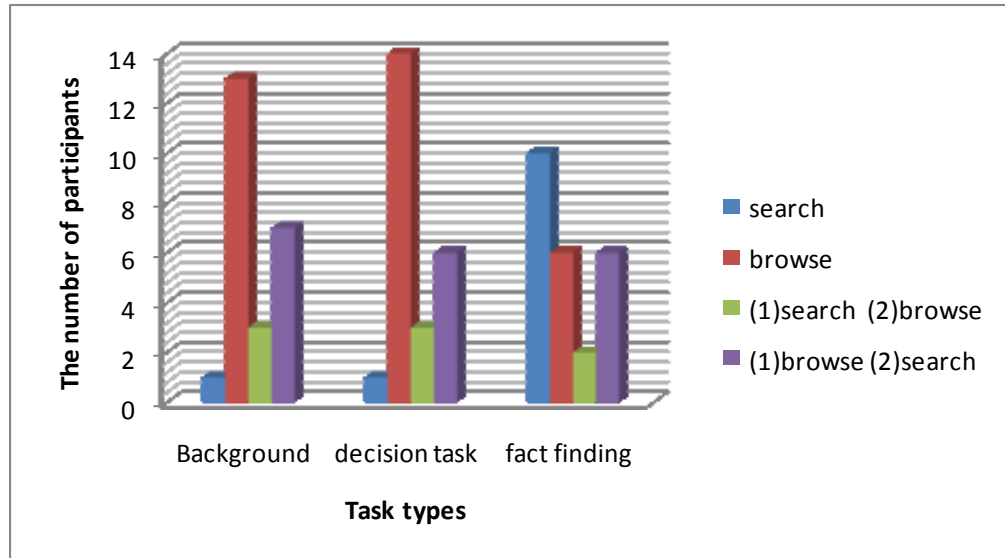


Figure 6. 15 The sequence of features used to perform different tasks on the control interface

As can be seen in Figure 6.15, for the background information tasks, most participants (13/24) only browsed official categories, followed by those browsed official categories and then used search features (7/24). For the decision making tasks, most participants (14/24) only browsed official categories, followed by those browsed official categories and then used search features (6/24). For the fact finding tasks, most participants (10/24) only used search features, followed by those only browsed official categories (6/24) or those browsed official categories and then used search features (6/24). The finding indicates that most participants were more likely to browse official categories in the background information and decision tasks compared to the fact finding tasks.

## The experimental interface

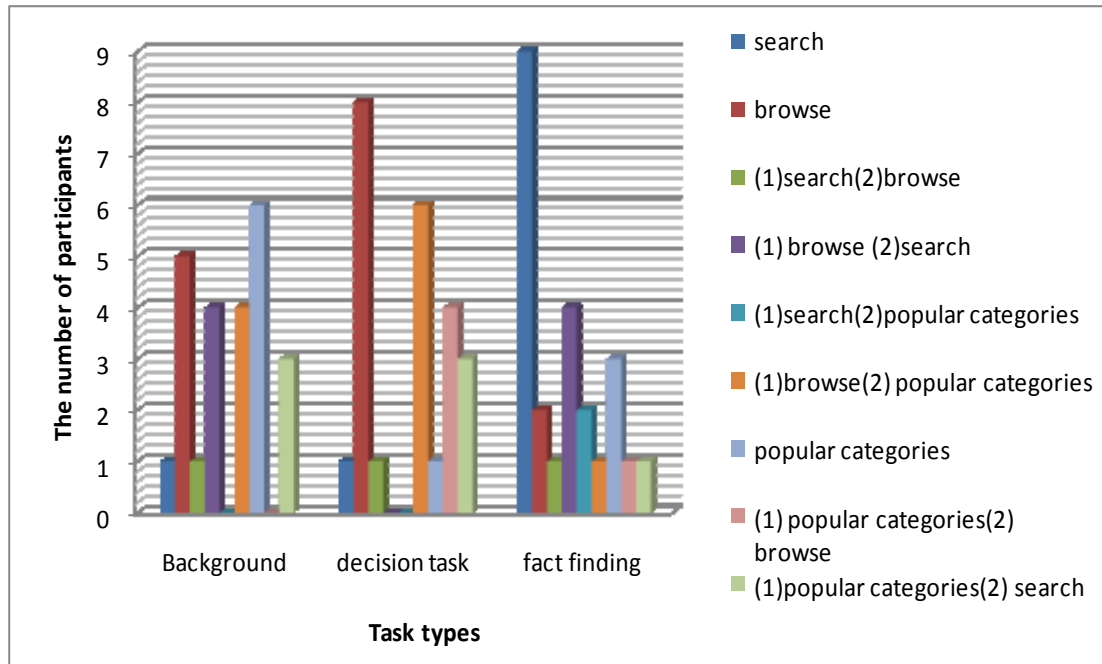


Figure 6. 16 Features used to perform different tasks on the experimental interface

As can be seen in Figure 6.16, for the background information tasks, most participants (6/24) only used popular categories, followed by those only browsed official categories (5/24). For the decision making tasks, most participants (8/24) only browsed official categories, followed by those browsed official categories and then used popular categories (6/24). For the fact finding tasks, most participants (9/24) only used search features, followed by those only browsed official categories and then used search features (4/24). It is interesting to point out that popular categories were used to perform all tasks, suggesting that this feature probably is a useful approach for participants during the work tasks.

### 6.4.2.3.2 The sequences of features used to perform all tasks in each task type

This section reports on the sequences of features used to perform all tasks in each task type on both interfaces, as well as provides reasons to use these features for a better understanding of the analysis of results.

## The experimental interface

### Background information tasks

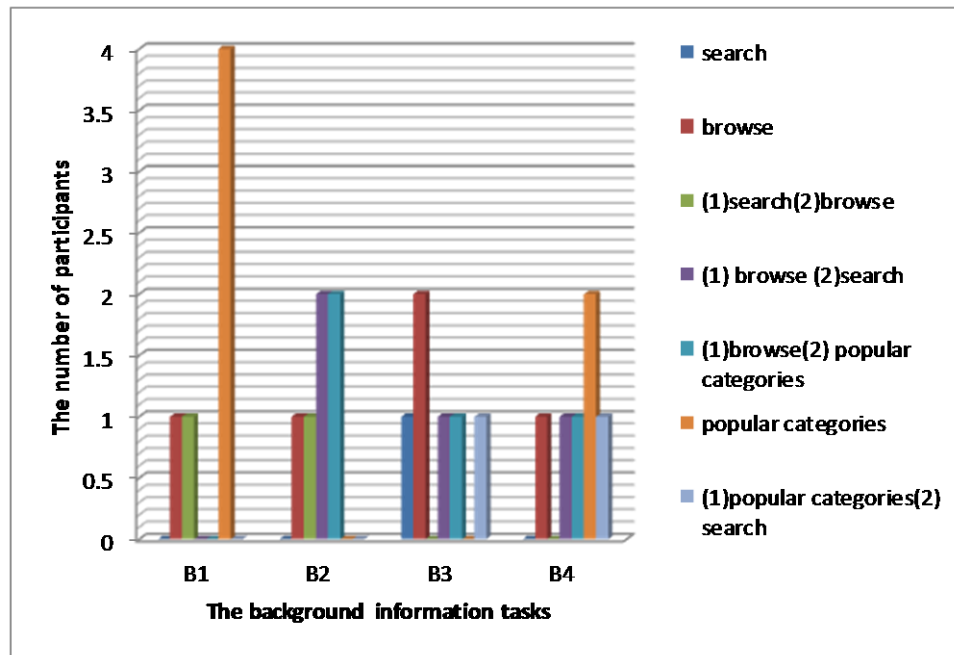


Figure 6. 17 Features used to perform the background information tasks on the experimental interface

As can be seen in Figure 6.17, popular categories was used by most participants to perform task B1 and B4, suggesting that probably the popular categories provides high scent for them to achieve these tasks. On the contrary, this feature rarely used in task B2 and B3. Also, browsing official categories was used by most participants in task B3,



suggesting that browsing official categories provides strong scent for participant to complete the task.

### **Task B1- Child labour**

*For task B1*, most participants only used popular categories because “Child labour” category appears on popular categories on the main page. This may be because the participants don’t want to take longer time to explore other approaches. The rest of participants used search and browse features to perform this task as normally the way they do when finding information.

- P4, only browsed official categories and was more likely to browse categories as many as possible and explored documents with confidence.
- P12, only used popular categories “Child labour” and did not search or browse official categories because “the first stepped I viewed on the main page”.

### **Task B2 - Women Jobs**

*For task B2*, most participants did not use popular categories because they were not sure whether the topic will be popular. The participants preferred to browse official categories because they know information will be there, suggesting that participants performed the task based on their prior experience.

### **Task B3 - the number of railway accidents**

*For task B3*, some participants did not use popular categories because the topic is quite boring and did not see topic about railway in popular categories on the main page. One participant stated that (s)he only browsed official categories because (s)he would like to look general information.

“I thought it’s better to go through the official categories where popular categories you might think more interesting results but not necessary the things that I am looking for. Also I think if you are looking for popular categories details of the number of railway accidents on likely to be popular? It’s quite a boring thing so I think the best way to go through browse official categories.” —P6.

### Task B4 - how factories pollute

For task B4, there have three sub-topics in the task. The results found that participants used various approaches to perform this task. Based on my observations and think-aloud, some participants had difficulty performing the task.

### Decision making tasks

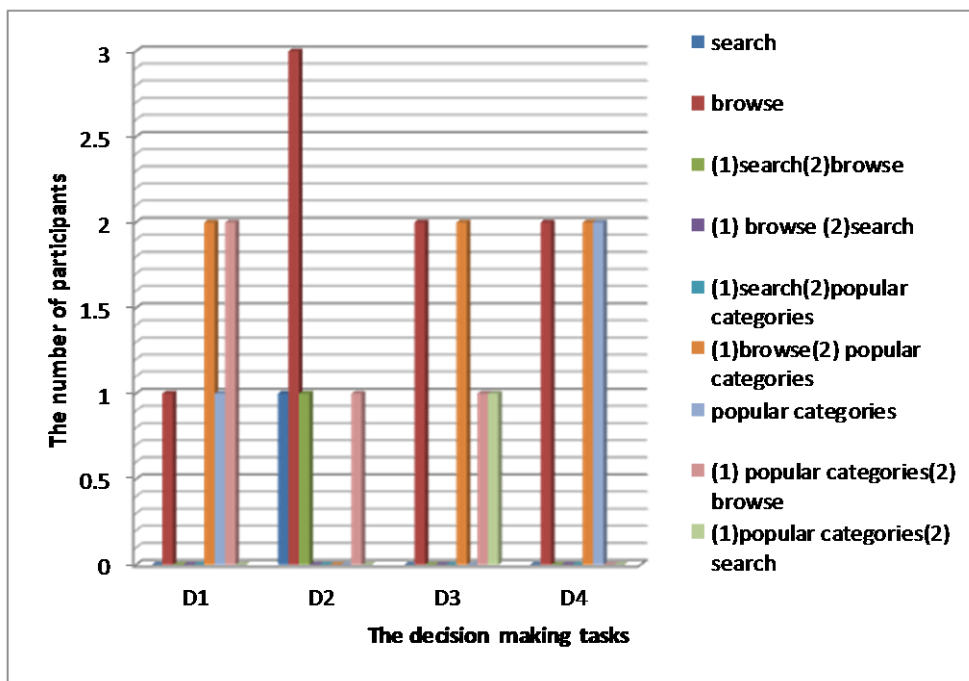


Figure 6. 18 Features used to perform the decision tasks on the experimental interface

As illustrated in Figure 6.18, browsing official categories was used by most participants in Task D2, suggesting browsing official categories may contain more scent compared to other features. Search features were used by one participant to perform task D2. Only popular categories were used to conduct task D1 and D4. Moreover, combined approaches are used to perform all tasks.

*For task D1 (Water transportation), D3 (Housing) and D4 (Schools),* these tasks are quite broad topics. The participants only browsed official categories to see all things in categories or combined with other approaches to get more specific information or quickly browse to see any things else. The participants seemed to attempt many ways to collect information. For example, some participants started looking popular categories first and then browsed official categories to get more information or conversely. This suggests that participants don't want to miss any information.

One participant only used popular categories because "I just look the popular one probably the best one see how people looked at it, save time and get the best results if you look at popular one rather than all of them." –P8 (task D1).

*For task D2 (strike),* this task is quite slightly specific. One participant was more likely to use search features if (s)he was not sure which group to browse or the participant appeared to browse official categories if (s)he know exactly which group the topic belongs to. Due to this task asking about the strikes and good pictures about strikes, some participants combined approaches to complete this task, for example, using search features for finding the causes of strikes and then browsing official categories to find good images.

## Fact finding tasks

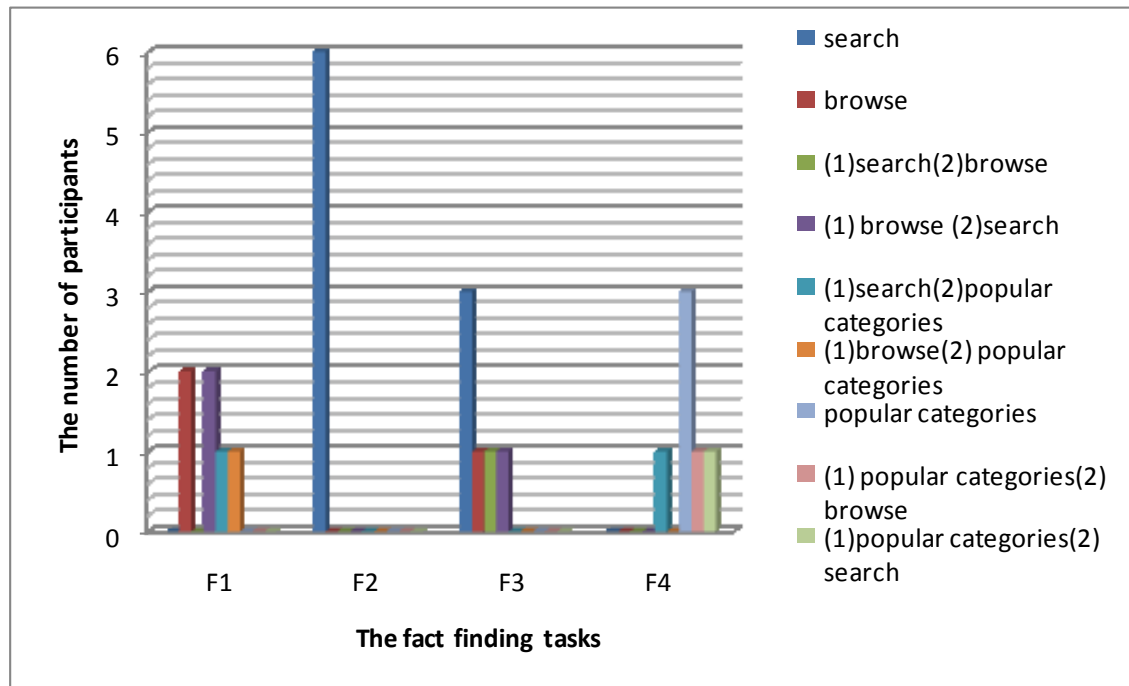


Figure 6. 19 Features used to perform the fact finding tasks on the experimental interface

As can be seen in Figure 6.19, search features were used by most participants to perform task F2 and F3. Interestingly, browsing official categories was used to perform task F1 and F2 and popular categories were used by most participants to perform task F4.

### Task F1 - images of stagecoaches

*For Task F1*, this task is specific for finding pictures. Some participants browsed official categories. This may be because they might know which category the topic belongs to. Some participants combined approaches in order to find anything else.

### Task F2 - a document titled “State and rate paid education”

*For Task F2*, this task is very specific piece of information. All participants used search features.

**Task F3 - quoted one line on the blackboard discussing “Science in the education of the people”**

*For Task F3*, most participants used search features to complete the task. Some participants combined approaches in order to check documents in case other documents quote this line. One participant mentioned that (s)he did not use search because “I found it’s too specific for search. I thought it gave me 0 result for it because it’s quite specific. It’s better you go through official categories”.—P 11

**Task F4 - where cholera took place in the Victorian Time**

*For Task F4*, most participants used popular categories because relevant information appeared on popular categories on the main page. For example, one participant stated that (s)he used only popular categories because “just in front of me”—P19. Some participants combined other approaches to get more information.

**Summary**

Analysis of transaction log, think-aloud protocol, my observations and interview questions gathered during the study indicated that for the background information tasks, the participants either (1) tried to find the information quickly as possible and go through popular categories because of its limited resources and relevance, this suggests that popular categories offer strong information contain items they need or (2) tried to look for general information and then found specific information by using combined approaches, suggesting that only one approach did not provide adequate information scent or did not contain enough information they want.

For the decision making tasks, participants attempted to browse information as much as possible for selecting the best ones. The participants either (1) tried just one approach to get all information, for example, only search features or only browsing official categories or popular categories, suggesting that single approach gives participant with sufficient strong scent or (2) combined approaches by both strategies: from general to specific or specific to general. The participants don't want to miss any information.

For fact finding tasks, if the task is finding specific images, the participants appeared to browse official categories. If the task is very specific piece, finding full text document, all participants only used search features to perform the task. This result indicates that there might be different approach for finding different types of specific information. Some participants only used popular categories to perform the task since relevant information appeared on the popular categories on the main page. In the other words, the popular categories provides a browsing cue matching the participants' goals. Also, combined approaches are employed either checking additional information or verifying information when they had already got some relevant information, or using other approaches when they did not get any relevant information.

#### *The reasons why participants did not use popular categories*

The findings from qualitative data shed some light on the causes of unused popular categories are as follows:

- (1) It's new thing. The participants had never used before.
  - "I never used these kinds of things. I have not seen this before" –P20 (task B4).
  - "It's new I think because it has popularity and elements. That's unusual digital library I think.–P16 (task B4).

- (2) Participants may know exactly categories for the topic to belong to or they would like to explore all items in the particular category. They don't want miss any information. Some information might not popular but relevant to their goals.
- (3) Participants thought topics may not be popular and not sure whether the popular categories have it.
- (4) Some participants did not rely on other people.

*Moreover, it is essential to underline that using popular categories depends on:*

- Participants' beliefs on popularity of the topics
- The location of desired information. Participants seemed to reduce clicking links for further exploration. The participants would like to use the approach that they think they can get information quickly.
- Participants have their own ways to find information and did not get use to new features. Some participants who get used the normal interface will search or browse official categories. They did not seem to use popular categories however, social information are still useful for them. They also mentioned that they probably will use this feature the next time.
- Participants have their own personal attitudes, for example, some participants did not trust or rely on other people' opinions.
- Display characteristic information, for example, too much information or cluttered information on the page. Some participants might ignore the popular categories on the main page.
- Lack of enough context information or the advance features on popular categories page. It does not have filter information between text and images on item lists when participants browsed popular categories. Also, no information about how many items contain in popular categories. This indicates that

providing the advanced features and adequate information may contain strong information scent.

- Some participants, who have very strong knowledge in the Victorian Times tended to go direct information, took time to explore and chose the relevant material by themselves, for example, P4 and P7, those participants could know and decided which one is good or relevant. Based on my observations, the participants felt confident during document selection.

## The control interface

### Background information tasks

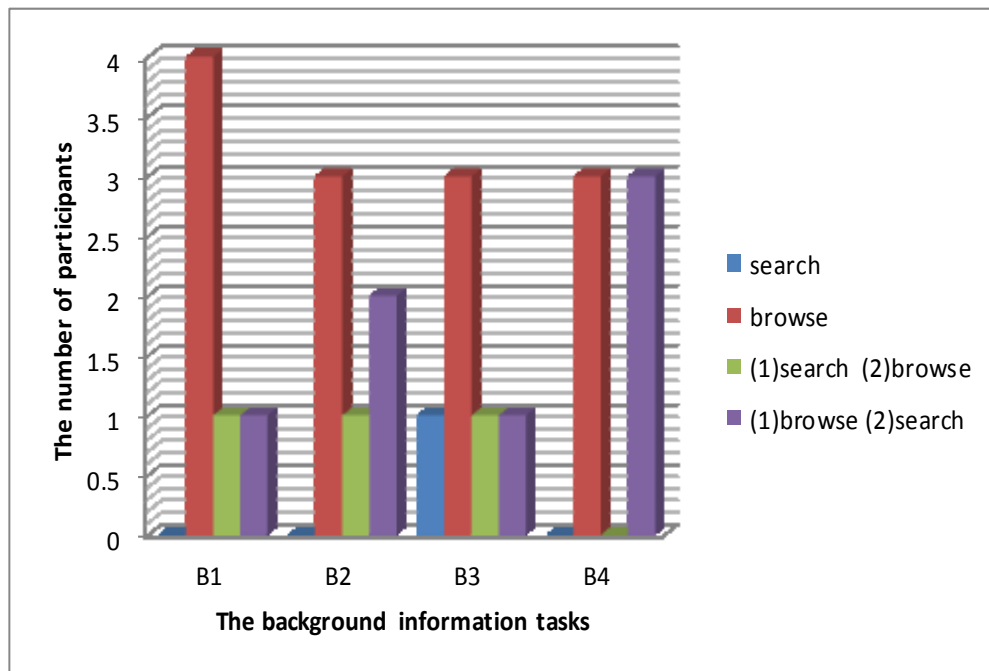


Figure 6. 20 Features used to perform the background information tasks on the control interface



As can be seen in Figure 6.20, browsing official categories are used by most participants to perform all tasks. Search features were used by one participant to perform task B3. The number of participant who combined approaches is highest in task B4 compared to other three background information tasks.

### Decision making tasks

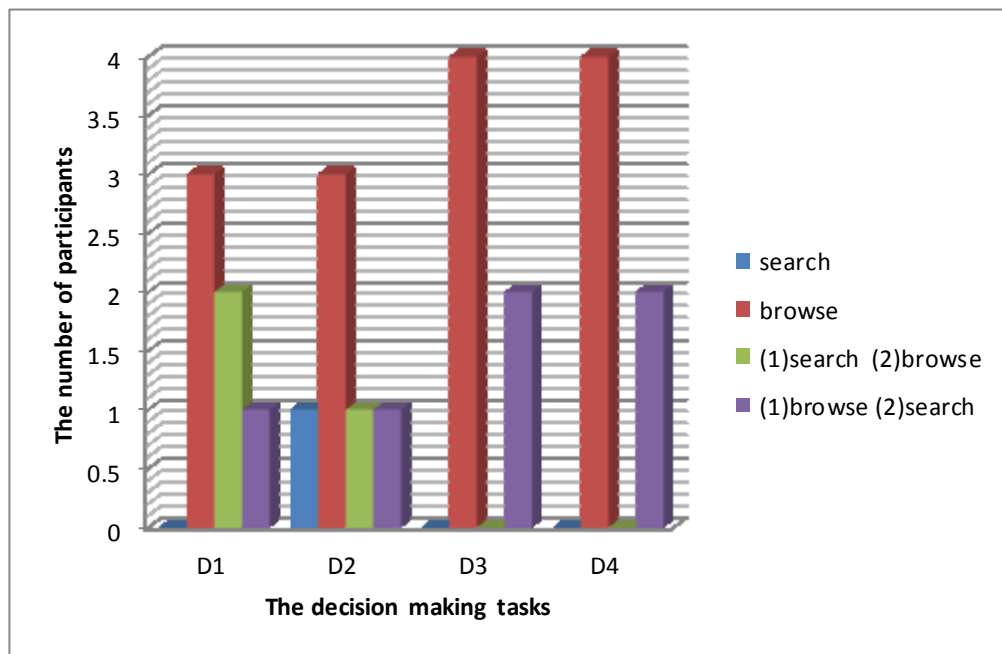


Figure 6. 21 Features used to perform the decision making tasks on the control interface

As illustrated in Figure 6.21, browsing official categories were used by most participants to perform all tasks. Search features were used by one participant to perform task D2. Moreover, combined approaches are used by the rest of participants to perform all tasks.

## Fact finding tasks

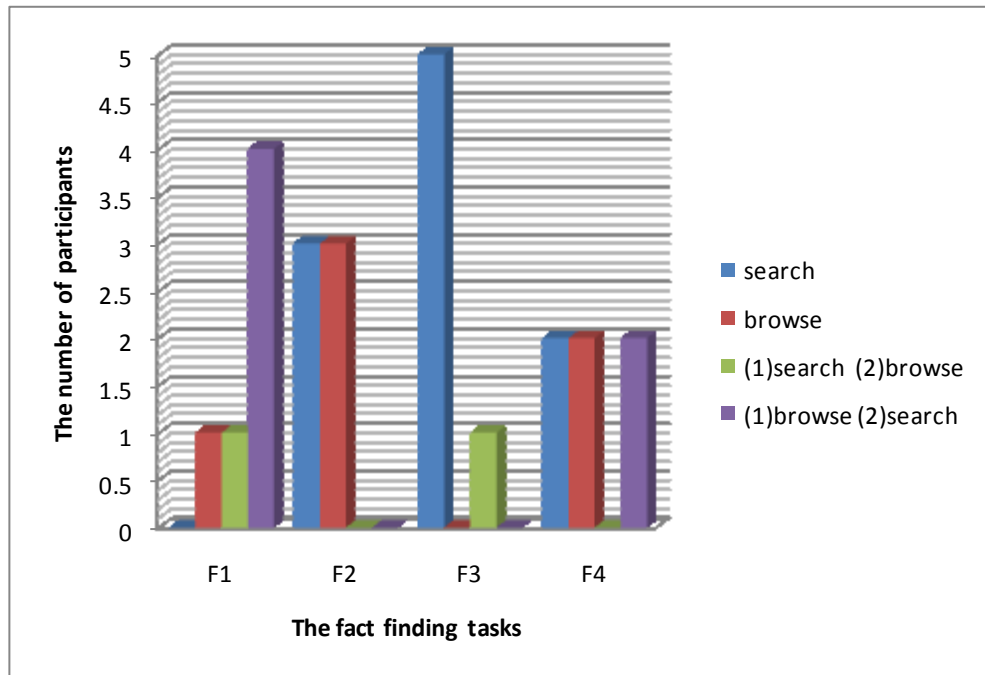


Figure 6. 22 Features used to perform the fact finding tasks on the control interface

As can be seen in Figure 6.22, search features were used to perform task F2, F3 and F4. Combined approaches were used by most participants to perform task F1. Moreover, search features are used by most participants to perform task F3. I also found that even though some participants got relevant information, they tended to use other approaches in order to find more information or verify information.

Surprisingly, for Task F2 (- a document titled “State and rate paid education”), even though this task is finding a very specific document, three participants used only browsed official categories to perform the task. It might be because they possibly know exactly the category the topic belongs to.

## Summary

Comparing to the experimental interface, for the background information tasks, browsing official categories was used by most participants in the control interface, while other features, for example, popular categories or combined approaches were used by most participants in the experimental one for completing the tasks except task B3. For task B3, I found that only search features were used to perform the task, as well as, browsing official categories was used by most participants in both interfaces. This can be explained by the fact that this task asking about the number of railway accidents that is quite specific comparing to other background information tasks. Based on interviews, some participants thought the topic may be specific and might not be popular. Therefore, the participants seemed to use only the basic features which provide in both interfaces.

For decision making tasks, popular categories and combined approaches (included popular categories and basic features) were used by most participants in the experimental interface to complete the tasks except task D2. On the contrary, browsing official categories were used by most participants to complete all decision making tasks in the control interface. This can be explained that the experimental interface provides more ways than the control one for finding information. For the experimental interface, the participants tended to explore more ways in order to collect information as much as possible in order to select the best ones, while the control interface provides less way, as well as the participants thought all information would be in the official categories. Moreover, I also found that for task D2, browsing official categories was used by most participants and search features were used to complete the task in both interfaces. This task was asking about causes and pictures of strikes that might be more specific than other decision making tasks.

For fact finding tasks, search features were used by most participants to complete task F3. I also found that for task F2, search features were used by all participants on the

experimental interface while search features or browse official categories was used on the control one. This can be explained that task F2 and F3 are very specific. The participants seemed to use basic features to complete the tasks.

It can be concluded that the different types of task influence the use of features, as well as the tasks themselves. Participants seemed to use different features to complete different tasks even though in the same task type, for example task B3, D2, F2 and F3. A possible explanation might be that these tasks compared to other tasks in the same task type seem specific so the participants tended to use the basic features rather than the social ones. This indicates that the basic features may contain enough strong information scent for the participants to complete the tasks.

#### **6.4.2.4 Social features and social information for performing the tasks**

In order to better understand how social features and social information assist participants to accomplish different tasks, transaction log, think-aloud protocol, note-taking and interview questions are gathered and analysed. In this part, only advanced features are excluded for analysis. Note that: participants who have not completed background tasks were not taking into consideration. (1) Basic denotes using basic features. (2) Social features + social information denotes using social features and social information. Combination (1)+(2) denotes combination between basic, social features and social information.

## Background information tasks

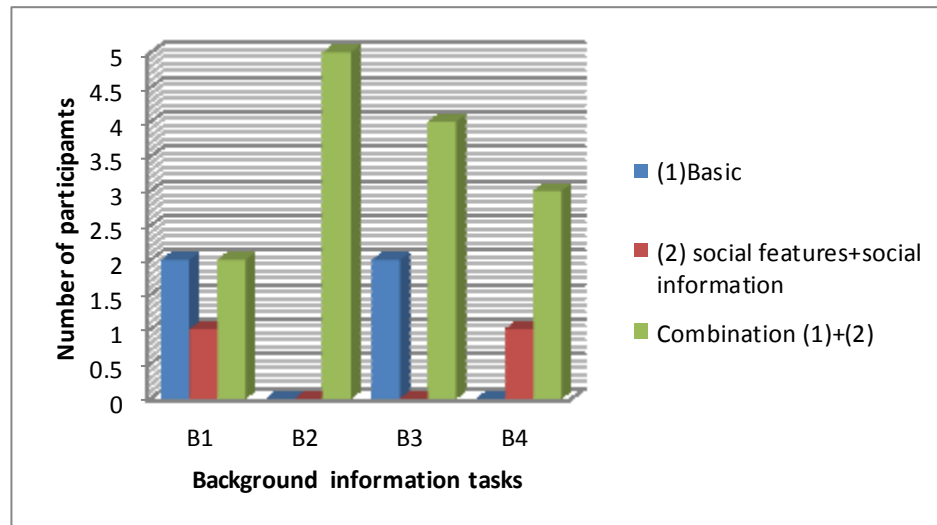


Figure 6. 23 Basic, social features and social information used to perform the background information tasks

Figure 6.23 found that the basic, social features and social information were used by most participants to perform task B2, B3 and B4. Search features were used by two participants to perform task B1 and B2.

*How social features and social information support participants to accomplish the background information tasks*

The qualitative data provide more specific insight into how social features and social information support participants to accomplish the background information tasks are as follows:

- If a lot of results were found, participants felt uncertainty about document to read first, the popular articles might help. The participant did not want to read entire things (P1).

- Participants started to select the document by looking at reviews. They were several comments regarding social information, for example, the reviews and the number of recommended by other people were more likely to be good (P1, P5, P8, P14, P17, P18, P10, P15, P16, and P20). For the number of people recommended, “I found recommended it’s good in terms of searching as well because a lot of people recommended it. Maybe it’s easy to access or easy to understand. It would useful. You maybe go through that before you go to something which is no one click —unknown quality at that point. It’s easy to go recommended like kind of cut in the middle step. It’s good for starting point people recommended let start with that one.” — P21. This indicates that reviews and the number of recommended by other people may carry enough scent so that participants will feel encouraged to explore the documents.
- Also, reviews may help people who have no knowledge in the Victorian Times, for example, “I think especially you don’t necessary know anything about the Victorian Times. You don’t necessary expect about the documents see other people recommended that in terms of give you away. This people obviously give particular I try that one first and I get on it. A lot of people said. This is good.” —P21.
- A participant felt uncertainty to go through the document without any review or recommendation. Also, the participant tended to select the recommended articles first and then will check later (if they have time) (P5).
- Participants clicked “People who have interested in this object also looked at” section because it related information that the participant were looking for (P9, P17, and P10).
- Participants used popular categories because people’ opinions may be great/ good to see and then may be quite a good group. “May be having something good so go through popular categories” —P15.

*The reasons participants used the basic and social features, as well as social information or combined approaches to accomplish the background information tasks*

Moreover, the qualitative data provide more details insight into the causes of used basic and social features, as well as social information or combined approaches to accomplish the background information tasks are as follows:

- For “People who have interested in this object also looked at” section, “I think it’s useful especially for images. I did some of that because I had begun with search object suggestive “People who have viewed this object also looked at” I found some of my own search material some more that could be useful. I like that” —P20.
- I found that one participant who combined approaches to complete all three task types, (s)he always ended the search process by using search features because “I just want to find information. If the last part fails, I will go to search. I will always go back to search just to find just in case you miss anything”—P22.
- For task B1, the participant started with using search, browsing official categories and exploring “people who have interested in this object also look at” section. (S)he expected can get more information. “Probably I saw it related information that I am looking for. You can get more information.” —P9.

## Decision making tasks

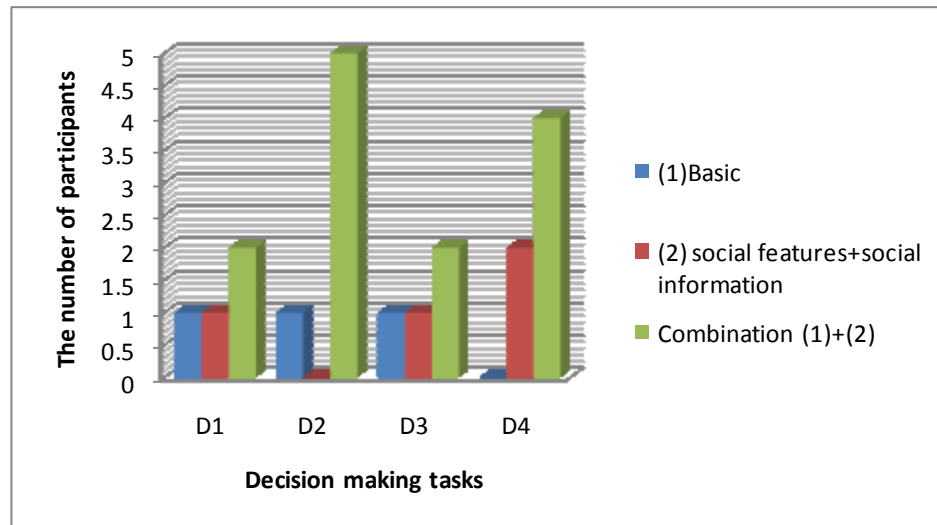


Figure 6. 24 Basic, social features and social information used to perform the decision making tasks

As can be seen in Figure 6.24, the basic, social features and social information were used by most participants to perform all tasks. Only basic features were used by one participant to complete task D1, D2 and D3.

*How the social features and social information support participants to accomplish the Decision making task*

The qualitative data shed some light on how the social features and social information support participants to accomplish the decision making task are as follows:

- “People who have interested in this object also looked at” section is useful for images (P14, P18, and P23), for example, finding Victorian house image because it has similar photographs or some related stuff. “It’s very useful when you used it for images. The second last exercise when looking for the picture, I found a lot of pictures about the strike that I mean I found another way searching” —P17.



Similarly, another participant stated, “It’s good. Something gonna be specific. I am gonna look as well. For example, Housing. It’s good you can see recommended of housing for images” —P14.

- Reviews are useful when document does not have description or participants looked at something that they are not sure about (P16, P4, P14, P20, and P22). For example, for strike task, one participant read reviews of other people about man pictures in strikes task. The participant made comments about reviews, “if there have two pictures: one has review, and another one does not have review, I will pick the one has a review because the one review talking about who he was and the other one did not have. I did not include that image because I don’t know who he is.” — P14. The findings found that without social information, the participant may have difficulty because of insufficient information (no description) in image documents. Another participant also made specific comment about this issue, for task D2, “There no description, It’s very difficult to figure out. It’s difficult to choose” —P1.
- Participants chose the pictures that been recommended by other people and reviews presumably it might be useful. Reviews of other people help them to choose pictures (P1, P8, P13, P14, P18, and P3), even though the document recommended by people is very long, the participants were willing to go through. For example, for task D2—about the cause of strike, one participant said, “Maybe something interesting. Something easier I will pick it” —P14. For task D3, one participant commented on an item, which is recommended by 16 people, “a lot of people, maybe it’s nice or interesting. I gonna have a look” —P3.
- Participants tended to use popular categories in order to save time and they seemed to get the best resources rather than viewing all of them since the popular one probably the best one. One participant stated more simply, “If I have more time, I will look transport official category. But just for quick browse I thought I just look for popular.” —P8.

- One participant made comment regarding “For people who have interested in this object also looked at” section. “Generally I like it I just browsing side. I definitely would use the popular a lot when I come to searching because I use to search automatic. I will do this..popular stuff more fun browsing. You see this person like other things likes I do see what else they looked at.” —P21

### Fact finding task

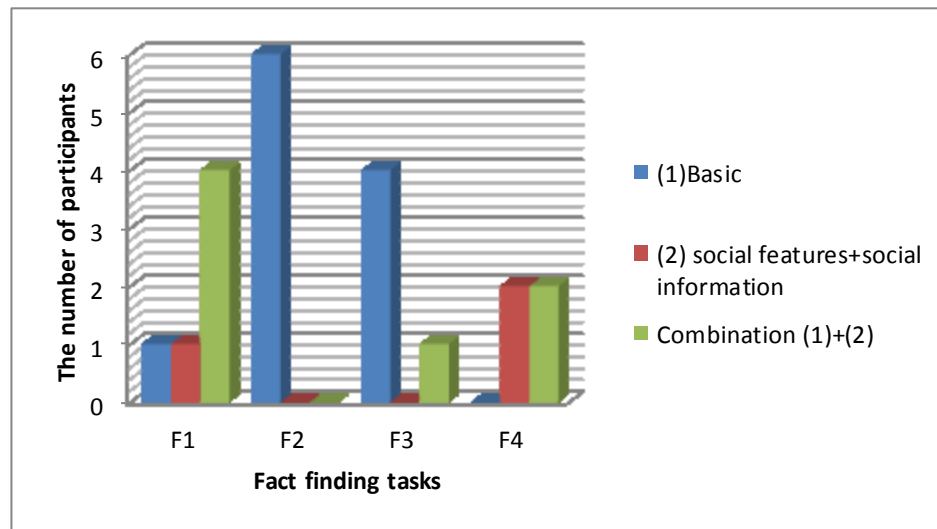


Figure 6. 25 Basic, social features and social information used to perform the fact finding tasks

As can be seen in Figure 6.25, the basic features were used by most participants to perform task F2 and F3. No participant used only the basic features to perform the task F4. One participant expressed satisfaction with helpfulness of social features and social information for supporting fact finding tasks. “For People who have been viewed this item also looked at, I found it really helpful with the cholera questions. I have trouble when I found documents that I am not really sure what I am looking for. May I should did when I do the task passenger transport question, because it’s 5 minutes for this question. I used it. It’s a shortcut for me” — P16.

*It also interesting to find out the reasons why participants used the basic features or social features but did not use social information (other people's reviews, the number of people recommended, "people who have interested in this object also looked at" section)*

The qualitative data shed some light on the causes of used the basic features or social features but unused social information are as follows:

- One participant used the popular categories but did not use social information, for example, other people's reviews. The participant said, "It might be useful. It's depended on why you are looking for, for example, if you are looking for specific search they just looking something entirely different (text) or looking something different pictures". — P5.
- Some participants seemed to pay attention for particular information rather than social information, for example, "for other's people reviews, I did not use. I used more detail stuffs but I think it probably useful in general. It's good thing like more details. I did not use it so much for the number of people recommended. I did not use it when I looking more specific just I know I am looking for particular things. I will interesting in details, links the things that I am looking for rather than the number of people recommended." — P24.
- Some participants did not use reviews because they probably can made decision by themself. One participant commented about reviews. "If pictures I can see myself the pictures of houses, I don't need reviews on that. It kind of common sense. If full text document maybe can use reviews" — P11. Another participant also mentioned that text documents are needed time to read and reviews can be useful while for image, participants can look and decide whether it's good or not (P15).
- One participant thought reviews maybe spam. The participant stated his feeling on "for people who have items in this object also looked at" section that different

people have different purposes to choose text or images or thought the person who commented are not real and unreliable, “possibly unreliable reviews. I don’t read reviews. Someone can spam maybe nonsense message when I goes by web site online. I will look for more details. It says relevant.” — P12.

*Moreover, it is interesting to find out what reasons for unused social features or social information at all*

I also found that two of 24 participants did not use the social features and social information during performing the tasks. The findings shed some light on the causes of unused the social features and social information are as follows:

- One participant frequently browsed official categories and did not use reviews from other people and the number of recommended by people. The participant echoed this feeling by saying, “For reviews, I just quick browse page not much pay attention to them because I did not know who they are unreliable”. For the number of people recommended, the participant also did not pay attention because “people some something different so may they look this and look something else. I just look by search. I don’t think other people looking for.” — P19. According to demographic data, the participant self-reported historical interest of 7 for Historical knowledge background.
- Another participant (P4) did not use any social features and social information to accomplish the task at all. The participant did not use popular categories because popular categories quite specific and the people in popular categories or who reviewed the document might have specific aims and different from the participant. According to demographic data, the participant graduated a bachelor degree in History. The participant seemed to have strong knowledge in history. From my observation, the participant felt confident to explore the documents and

to select group and categories. The participant probably can decide which document is relevant.

This suggests that the level of knowledge in History might affect the search behaviours of the participants conducting the tasks.

#### **6.4.2.5 Summary**

The results showed that search features were most frequently used in fact finding tasks, and browsing official categories was most frequently used in the background information and decision making tasks. It is possible that background information tasks required participants to explore overview of information. For decision making tasks, browsing official categories allow participants to browse related information within a particular category in order to find the best ones.

In terms of the usage of social features and social information, most participants may benefit from social information such as reviews, the number of recommended items and related items from other people during conducting the background information and decision tasks. As can be seen in Section 6.4.2.4, a majority of participants were more likely to use the social features and social information with the basic features to perform the background information and decision tasks while combining of these features were less likely to be used in the fact finding tasks.

The results demonstrate that three task types were better supported on the experimental interface than on the control interface as it enriches the participants' finding information by providing social features and social information. The participants were able to explore documents with less effort, particularly in the decision making and fact finding tasks (as described in Section 6.4.2.1). This suggests that popular categories and social information present in the experimental interface probably added to the perception of effort in different tasks.

To summarize, the results provided partial evidence to support H2.

### 6.4.3 Participant Perceptions

The third hypothesis examines whether social features increase participant satisfaction with the social interface to the Victorian Times Digital Library and the last hypothesis investigates whether overall participants preferred the experimental interface rather than the control one. To answer this hypothesis, I analyse interface support by using semantic differentials. The results are showed in Section 6.4.3.1. In the Section 6.4.3.2, I present participants' subjective assessments on the interfaces regarding on helpfulness, ease of use, ease of learning and overall the system. In the Section 6.4.3.3 provides participants' feedback on what they liked and disliked about the Victorian Times Digital Library interfaces and what features from other digital libraries they would like to see included on new user interface Victorian Times Digital Library.

#### 6.4.3.1 Interface Support

To evaluate the experimental and control interfaces covering system interaction in terms of participant satisfaction of overall interaction of the interface, participants were asked to response on eight 5-point semantic differentials of each interface in the post-system questionnaire. Table 6.7 displays this result.

Table 6. 7 The median response to statements for each interface (higher=better)

Differential	Control interface (SD)	Experimental interface (SD)	Wilcoxon Signed Rank Test
Relaxing	<b>4.00(0.83)</b>	3.00(0.93)	0.084
Satisfying	<b>4.00(1.13)</b>	3.00(1.05)	0.090
Useful	4.00(0.59)	4.00(0.65)	0.614
Easy	4.00(0.99)	4.00(0.69)	0.715
Novel	2.00(1.10)	<b>4.00(0.83)</b>	<b>0.002</b>
Fast	3.00(0.83)	3.00(0.93)	0.922
Simple	<b>4.00(1.02)</b>	3.00(1.12)	<b>0.002</b>
Effective	4.00(0.85)	4.00(0.74)	0.509

Table 6.7 displays semantic differentials of the control and experimental interfaces. Wilcoxon signed-rank test results show that both interfaces were useful, easy, fast and effective, although the difference was not significant ( $Z=-.504$ ,  $p=0.614$  for useful;  $Z=-.365$ ,  $p=0.715$  for easy;  $Z=-.099$ ,  $p=0.922$  for fast;  $Z=-.660$ ,  $p=0.509$  for effective). Participants using the control interface felt more relaxing and satisfying than those using the experimental interface, although no significant results were found ( $Z=-1.726$ ,  $p=0.084$  for relaxing and  $Z=-1.693$ ,  $p=0.090$  for satisfying). Moreover, the participants found the control interface to be significantly simpler to use ( $Z=-3.073$ ,  $p=0.002$ ) than the experimental one. The experimental interface to be significantly more novel ( $Z=-3.083$ ,  $p=0.002$ ) than the control one.

### **6.4.3.2 Interface Preference**

To investigate both interfaces covering system interaction in terms of helpfulness, ease of learning, ease of use and overall the system, First, the participants were asked how different did they find the interfaces from one another, using a 7-point scale, with 1= “Not at all”, and 7= “Extremely”. All participants rated the difference between the control and the experimental interfaces, on Mean 4.83 (SD=1.076) average.

Most participants (fourteen out of the 24 participants) thought that the experimental interface provides more information/categories/groups/ideas and quite complex such as reviews, viewed objects, recommendations and object related to each other. On the contrary, they thought that the control interface seemed to be simple. However both interfaces provide similar colour, official categories and thumbnail layout. For example, P18 said, “Similar, colours, categories and thumbnail layout However, more interactive interface on interface A (the experimental interface).” P22 said, “interface A (the control interface) is simpler and not as clustered as interface B (the experimental interface)”. P23 said, “the presentation of lists of results was fairly similar. The main difference

being that fewer categories were shown in interface B (the experimental interface) and the addition of related documents”.

To determine which interface is the best in terms of helpfulness, the ease of learning, the ease of use the system and overall reactions in the system, after participants complete of all tasks and all interfaces, they were asked to assess the two interfaces based on their preferences. These results are shown in Table 6.8.

Table 6. 8 Number of participants judge on interface preference

<b>Interface</b>	<b>Helpful</b>	<b>Easy to learn</b>	<b>Easy to use</b>	<b>overall</b>
Control	9	15	14	11
Experimental	12	2	5	11
Wilcoxon Signed-Rank Test	0.513	<b>0.002</b>	<b>0.039</b>	1.000

Table 6.8 shows the number of participants’ responses to the exit questionnaire that compared interface preference in these issues. For helpfulness, twelve participants felt more helpful on the experimental interface than those in the control interface, although the difference was not significant ( $Z=-.655$   $p=0.513$ ). For ease of learning, fifteen participants perceived easier on the control interface than those on the experimental one. For ease of use, fourteen participants perceived easier to use on the control interface than the experimental one. The difference was significant between the control and experimental interfaces in terms of ease of learning and ease of use ( $Z=-3.153$   $p=0.002$ ,  $Z=-2.065$   $p=0.039$ , respectively). For overall the system, the difference was not significant between the control and experimental interfaces in terms of overall the system ( $Z=0.000$   $p=1.0$ ).

- **Helpfulness**



According to the questionnaire, of the 24 participants, 12 (50%) preferred the experimental interface. Based on feedback from interviews and open-ended questions, the participants attributed their preferences of the experimental interface:

- P3 said, “less limit - more specific what you have to looking, good more things a looking, see something else that people looked at. I think this one is useful. For interface B (the control interface) you have to specific what you looking for which may be good. I think the interface is more information that more things you can look at or related what are you doing. It’s helpful you can look someone else looked something more. Maybe helpful for you.”
- P8 said, “the interface give me images related with otherwise what I found so does really help me complete the task. There are recommendations in there likes summary. In this case I don’t read full text document by myself. I just read summaries from reviews. So does helpful to complete the task quickly. I also can see what people review more, what people recommended. So I don’t waste my time reading documents. It’s very helpful to me. So definitely, I would say that interface A (the experimental interface) more helps.”
- P6 said, “more ways to search or browse to relevant items.” Also, six participants appreciated recommendation/ summary.

- **Ease of learning**

15 participants (62.5%) preferred the control interface for ease of learning. Based on feedback from interviews and open-ended questions, the participants attributed their preference of the control interface:

- P1 said, “It must more straight forward.”
- Twelve participants appreciated in less complexity, less clutter and simple basic layout. Moreover, P16 said, “Learning it more easier because it’s few things because when I am learning interface B (the experimental interface), I have to

learn about category and group to remember more which the control interface not much to remember. Logically work at from myself so have fewer things to memorize”.

- **Ease of use**

14 participants (58.33%) preferred the control interface for ease of use. Based on feedback from interviews and open-ended questions, the participants attributed their preferences of the control interface:

- Five participants said, “less clicking to get what you want, fewer choices”.
- Seven participants said, “The layout is simple, clear categories, less messy categories.”

- **Overall the system**

#### *The control interface*

11 participants (45.8%) preferred the control interface commented on simplicity, clearer and less cluster to look at e.g., “the categories are nice to browse and did not clustered.” (P9), “Simpler design It’s about easy to access and speed to access.” (P14), “less clustered to look at” (P19), “simplicity but still effective” (P20), “simple and gave you access information more easily.” (P5). It also straight forward e.g., “It allows experienced users to directly find what they want instead of all the images and irrelevant data you don’t need to view.” (P12), “faster for me to get useful articles.” (P24). Those who did not preferred this system disliked lack professional e.g. “the interface is less professional and not fancy” (P10) and taking time to locate relevant documents. “It’s not difficult to use but it’s difficult to find information when you click, for example, “education-curricular” and you see 32 things (items) here you have to go through them all. Maybe a lot of information in the category so it’s quite difficult to view all or to see.” (P15), “I spend a lot of time to go through each category one at a time. I can

actually find what I am looking for.” (P8), “It’s simple to use but bring back a whole range of materials. A lot of bring back when you start going through the documents.” (P21).

### *The experimental interface*

11 participants (45.8%) who preferred the experimental interface commented on the social features for usefulness e.g. “was helpful in (1) A lot of things to look at and you can go through them” (P3), “more ways to browse to useful and relevant items” (P6); (2) “you got recommendations and reviews to show you what other ones you should look at. The interface provides details what you actually want quickly. You don’t waste time” (P8), “Faster and finding what I wanted and more options just click popular category. It’s limited resources rather than go through search and got a lot of information (P11)”, “It was easy to use and made my searches much more productive so I used less time to find items of interest” (P17), “restricting to fewer, but more popular, categories and related articles” (P23) ;(3) “look nicer with more options” (P2), “look nicer, more professional. It looks fancy, looks like more professional web site as I expect to see.” (P10), “nicer to look, better features, not too crowd. I like recommendations.” (P13), “I like the interface as a virtual learner. I like a lot.” (P17) (4) Giving the feeling in terms of community web site e.g., “in terms of community perspective, in terms of broad person looking at I can totally web site. You gonna see what other people looking at.” (P21). Those who did not prefer this system disliked the distraction, complexity and confusing how to achieve information e.g. “the interface was too confusing because I could not remember the difference between “categories and groups”. I forgot where I was often in the interface.” (P16). “The interface more ways of accessing the interface can leave you worrying that you would get on better using a different approach.” (P24), “The interface is more clutter” (P5), “too much stuffs on the pages (a lot of options)” (P12), “Too many things here” (P22). (5) Unfamiliarity with the social web site and personal opinions e.g. “Sometimes popular is not what I am looking for, for specific

search task.” (P4), “I just browse page not much pay attention to them because I did not know who they are (other people’ reviews)” (P19).

#### *No preference/ both interfaces*

Two participants (8.33%) who did not prefer any interface commented that both interfaces have pro and con. e.g. “Interface B (the experimental interface)—was good to have popular categories but I did not like these being as prominent and would have preference to see their “Umbrella” category. Interface A (the control interface) — easier to navigate straight away but no user input (e.g. popular categories) which I liked slightly more “interface B (the experimental interface)” when I learned to use it. I preferred interface B (the experimental interface) more. Once I used it but interface A (the control interface) is easier to use, straight away so the first I preferred interface A (the control interface it). If I used regularly I preferred interface B (the experimental interface) because I know how to use it all the time.” (P18), “Overall, I really found interface A (the control interface) to be the simple interface but interface B (the experimental interface) was helpful when it comes up to evaluating documents through other searchers’ reviews. Like that you had the options of limiting image and text searches in each one and the search engine box was also useful.” (P21).

#### **6.4.3.3 Open-ended questions**

The final questionnaire also included open-ended questions that asked participants to describe what features from other digital libraries you would like to see included on new user interface Victorian Times Digital Library (note that the participant can indicate more than one feature). The results from open-end questions are as follows:

- Most people (fifteen out of the 24 participants) mentioned non-requirement of adding any features on new user interface Victorian Times Digital Library.
- Three participants would like to see full text search in PDF files.

- One participant suggested that it should provide interesting articles of the day.
- One participant suggested that the interface should provide auto complete in search. “For example, when users enter keywords here, it will show the lists.”
- One participant would like to see relevant feature (possible percentage wise). For example, if you would like to search for “Children”, it should show how much the relevant.
- Three participants mentioned that search functionality should be able to specific from search results, search again/ filter search.
- One participant would like to see a preview section where participants can scroll it there is more than one page.

## **6.5 Conclusions**

This study investigated the use of social digital library and the traditional one to accomplish different task types. The results indicate that for overall the system, half of participants (12/24) preferred the control interface and half of participants (12/24) preferred the experimental interface. A possible explanation might be that participants who preferred the control interface, they seemed to appreciate in simplicity and ease of learning, while participants who preferred the experimental interface, they seemed to appreciate in usefulness of social features and social information that assist them to complete the tasks. However, the difference was not significant between the control and experimental interfaces in terms of overall the system.

Overall, Hypothesis 3 and 4 were not significantly supported regarding participant satisfaction with the social interface to the Victorian Times Digital Library and participants’ acceptance on overall the system. Participants felt more usefulness and effectiveness on the experimental interface than those of the control one, but not significant also. There were no significant differences found on overall the systems. The number of participants preferred the experimental and control interfaces are equal, but not significantly so. For helpfulness, the number of participants preferred the

experimental more than those who preferred the control one, no significant differences were found.

In the next chapter, I will discuss the results in this study in order to gain more understanding of the use of the Victorian Times Digital Library interfaces to support participants in performing various search tasks.

# Chapter 7

## Discussion

### 7.1 Introduction

In the previous chapter, I presented and analysed the results of the experimental test to determine how participants interact with the Victorian Times interfaces, particularly focusing on what features employed to accomplish different types of tasks and how the social features and social information can help participants to complete the tasks. This chapter provides a discussion of the results of the test. Features support for different task types are discussed in Section 7.2. Section 7.3 discusses participant behaviours to accomplish the tasks based on Information Foraging Theory. The chapter is concluded in Section 7.4.

### 7.2 Features support for different task types

#### **Browse official categories**

- Official categories are useful when participants would like to explore all related documents within categories which provide non-popular and popular items. Moreover, participants can gain more understanding of the web sites.

- Browsing official categories is useful for support in finding information on different tasks for example, *in background information tasks* for looking something overall or general; *in decision making tasks* for looking all related documents within categories in order to select best ones; and *fact finding information tasks* in when participants don't know what appropriate keywords to search, for example, if participants entered very few keywords, it will bring a large amount of documents back or if users entered lots of keywords, no results might appear on the result page. This concept corroborated the one prescribed by Vakkari (2000). Participants will issue a query term when they have clear and specific information needs. Browsing can be beneficial for participants when they have difficulty to determine what information they want.
- Browse official categories to learn about topics. Some participants started by browsing official categories since they felt uncertainty about the topics and then the participants might use other methods to gain more information. This can be explained by Kuhlthau (2003). At the beginning stage of finding information, participants felt ambiguous or uncertainty about the topic. They require browsing information or asking some help from other people. When participants seem clearer on the desired information, they can find more particular information and further examine for additional resources.
- Participants did not use advanced search but browsed official categories instead because it does not have filtering by image type, for example, for task B4 (the control interface) — P12 “can't specific image type e.g. Stagecoach does not have option about search images.”, suggesting that lack of advanced features on the page affects for the participant to use.

### **Search features**

- Participants don't know what groups or categories the topic belongs to.



- *For background information and decision making tasks*, search can be used accompany with other approaches in order to find more information. For *fact finding information tasks*, participants would like to find very specific information in short time.

### **Popular categories**

- *For background information tasks*, participants used popular categories because its a short cut and they can collect limited and relevant resources. Popular categories can be considered as a form of information enrichment since the participants reduced their effort to explore the documents.
- *For decision making tasks*, participants used this feature more because they would like to explore all possible ways or possible approaches to get enough relevant information. They used this feature accompanied with other features, for example, the basic features because participants did not want to miss any information.
- *For fact finding tasks*, this feature helps participants if participants perceived high –scent in popular categories which match their goals or interests.

**Social information** e.g. reviews, the number of recommendation, and people who have interested in this object also looked at.

### **Reviews**

- Reviews were used a lot in the background information tasks because it helps participants to select information and this might increase effectiveness for finding information. Reviews are also useful for the decision making tasks because it provides more information and helps participants to select documents. This can involve additional information that can influence the scent of items.

However, reviews may be less useful for finding specific information like the fact finding tasks.

- When asked about trust in reviews, one participant said, “I will trust when I read it. I will probably go and search to make sure (check again).” — P14. For task B2, When one participant browsed official categories, (s)he read other people’s reviews and description. The participant tended to read reviews before and then looking for the text. However, he did not trust reviews and would like to check the document by himself. “I try to get something from reviews and read back to the document to double check but make a note.” — P21.
- One participant expressed idea about people’s reviews. “If you’re doing more in depth study. I think that useful. When you looking for a quick information, I don’t think you used this as much what people think about documents, it’s useful when you just looking for facts (very quick facts) but I don’t know it’s very useful. Straight forward so I want to find out was the job. I want to look for job titles no detail what is the point whether or the documents good or not go straight forward for quick facts (B2)” —P17.

### **Review is useful for**

- People who have no knowledge of the Victorian Times History.
- People who are overwhelmed by retrieved documents on the page.
- Not sufficient information for example, short or no description (metadata) in the documents.
- When participants have to decide whether it should look text or not, especially in very long documents. A lot of documents in Victorian Times are reports, and pictures that provide short descriptions or no description. It’s not possible to explore and read all documents from available resources in limited time.

- It's good and more reliable if the Web site is online and people who review documents are real people like in Amazon.com or their friends or lecturers in class.
- For reviews, one participant suggested that providing the ability to rate from users may increase reliable reviews.
- One participant read reviews when performing the decision making task (Strike). "I used reviews to get information that I am looking for. I did not use oh!! It's good document but I used for find facts. I used it just to get the facts. I am lazy I kind of bother of reading. I just know the fact quickly that why I used descriptions or used descriptions or used the reviews. If people said this document is good maybe you don't use it. If people say it's good and I search something more details and I think the review is worthwhile but I just want to find out fact then I did not worth that. It does not tell about the fact and I don't need to open up the document and read the way through that I am doing this in this case." —P17.

### **The number of recommendation**

- The number of recommendation is useful for participants to select information on the background information and decision information tasks. This can be a scent carrier for participants to explore information. However, this data might be not useful for participants who have specific goals for finding information.
- One participant made comments regarding the number of recommendation by people that may be useful for entertain or leisure purposes rather than journal articles. "If I am thinking about holiday then yes (adviser) it depends on what are you' re looking if holiday or entertainment then I want people's opinions. Is it a good place? Is the hotel clean because when it comes to journal articles, you're looking for information? I don't know it's good to read so I did not find the

recommend I did not really look at that. I just looking that tell information that I need. It might be different. If you're looking for more detail research. It might be different then it's about exercise which is quickness to get information quickly, easily as possible" —P17.

### **People who have interested in this item also looked at**

Useful for:

- Finding related images, especially during performing the decision making tasks.
- Some participants missed "people who have interested in this item also looked at." because they went direct to a PDF file rather clicked a document's title to see an item page.
- Collecting information: "it was handy when I browsed for collecting things. The reviews also handy." —P10

**Filtering information** (advanced features) were used often in the decision making tasks because these tasks are quite specific in the type of documents, for example, image documents, participants appeared to use this function to display only a particular type of documents before selecting the documents. Based on Information Foraging Theory, this provides "information enrichment" that assists participants for making fast exploration. These features were not used in fact finding task. It might be because participants have clear goals in mind for finding specific information.

## **7.3 Participant behaviour to accomplish the tasks**

The results of this study show that three different types of tasks affect participants in use of the features for accomplishing the tasks on the experimental interface. In general, for all three task types, if the relevant information appeared on the popular categories on the main page, the participants were more likely to use popular categories rather than browsing official categories. In terms of Information Foraging Theory, if the name of

popular categories carries enough scent for participants, they may feel encourage to explore popular items of the patches. Also, if participants did not find relevant information in popular categories on the main page, they were more likely to browse official categories rather than clicking “View all” popular categories. Once again, with regard to Information Foraging Theory, if the name of popular categories does not contain enough scent, the participant may feel encourage to explore official categories with high information scent. This can be explained by Information Diet in Information Foraging Theory (Pirolli and Card 1999). The participants make estimate the benefit from popular categories patch and browsing official categories patch. The participants will follow the patch that they anticipate to be the most relevant and match their goals. They seemed to go through the way that they maximize the gain of valuable information with minimum cost and effort. However, the participants tended to combine approaches if they found no scent in information patch, for example, no results display or a lot of information on the result page, they will switch to other patches in order to gain more information. I also found that in the fact finding tasks for finding specific images most participants tended to use other approaches to gain more information, even though they got relevant information. Also, in the fact finding tasks, especially if the task is a very specific piece of text document, I found that some participants did not use search features but browsed official categories to achieve information. It might be because of good categories and limited amount of resources so the participants probably know group the topic belongs to and they were willing to explore documents rather than using search features. These suggest that for the fact finding tasks, the different types of documents may have caused participants’ behaviours to accomplish the task differently. This finding differs from that of Hsieh-Yee (1993) study in that there is no difference in search behaviours between text and image documents during completing the specific task since task success depends on query formulation. For the decision making tasks, the participants seemed to open a lot of pages compared to the background information and fact finding tasks. The participants probably would like to see all relevant information

either using one approach or more than one approach. The participant required to explore plenty of information and select the best ones. For the background information tasks, I also found that the more complex the task, the more ways are used during searching, for example, task B4, there are three different sub-tasks in the topic, and the participants tended to use more than one approach to complete the task. This corroborated the one prescribed by Byström and Järvelin (1995), which confirmed that when tasks became more complex, participants are more likely to increase a variety of resources and ask for assistance from others.

Task type was also found to influence the use of features: basic, advanced and social features. Browsing official categories was more frequently used in the background information and decision making tasks than in the fact finding tasks. Search features were more frequently used in the fact finding tasks than background information and decision making tasks. This result is reasonable because in the background information tasks, participants browsed official categories in order to explore general information and specific information. Also, in the decision making tasks, participants browsed official categories in order to look into all relevant information for choosing the best documents. In fact finding tasks, participants were searching in order to find specific information. The results are confirmed by Qiu (1993). Qiu found that users often used search features to complete specific tasks rather than those did in general tasks. In contrast users more frequently used browsing feature on general tasks compared to specific tasks.

However, all three tasks the use of features sometimes is dependent upon results. When the participants were not satisfied with the outcome, they will switch to other methods for finding more information. This can be described by Hsieh-Yee (1998) that during the search process, if a large amount of information returned on the page, participants seemed to filter documents for finding targeted information. On the other hand, if no

desired information appeared, they tended to adapt search strategies or seek helps from others.

In addition, the findings found that the number of recommendations by other people and reviews might affect participants to select documents during performing the background information and decision tasks. They might think those documents which have the highest number of recommendations and reviews are useful and interesting. Both the number of recommendations and reviews provide information scent that leads them to navigate information items, for example, if two images, A and B, belong to the same category, both images did not have descriptions, but A has comments or has higher number of recommendation than, A possibly is selected by the participants. One participant expressed his/her opinion about the number of recommendation by other people or reviews that these data may be useful if they are looking for holiday or entertainment topics. Also, one participant mentioned that popular objects might be useful for young people especially when they are using social media. This indicates that people might perceive different scent carriers depending on information goals and task types.

I then considered the mean average of pages viewed and task completion time according to tasks in each of interfaces. The results found that the background and decision making tasks required participants more effort and time to explore documents rather than the fact finding tasks. These findings are similar from that of Belkin et al. (1993). The study has indicated that different type of tasks can affect users' search behaviours. Subject-search tasks require more effort from users compared to specific tasks.

I also found that in the experimental interface, participants can complete all three tasks by using less effort than those using the control interface. Also, I note that the more pages viewed there is in the task, the shorter is the average time participants spend on a page. At the point of Information Foraging Theory view, information foragers were more likely to spend their time on the patches that provide higher strong scent. If the

patch did not provide enough strong scent, the information foragers will switch to other patches which contain higher information scent. The ratio of pages viewed to relevant pages to accomplish the background, decision making and fact finding tasks in the experimental interface significantly lower than those in the control interface. This indicates that the experimental interface provide higher information scent for support participants to perform different tasks or more effective than the control interface, suggesting that popular categories and social information such as reviews, the number of people recommended items and related items from other people serves as information scent trail that lead participants to achieve their goals.

The participants using the experimental interface required less time in finding relevant information for the background information tasks when compared to using the control interface. Conversely, the participants using the control interface required less time in finding relevant information for the decision making and fact finding tasks when compared to using the experimental interface. However, this was not found to be statistically significant. Moreover, participants spent more time for finding relevant information in the background information tasks than did in the decision making and fact finding tasks. One reason might be explained is that by nature of the background information task, the structure of this task is not well-defined, users might have ambiguity in non-specific information needs in the early stage of information searching (Belkin 1980), if participants did not perceive strong scent, they would wander around in the information environment and spent more time to explore information or performed a random walk (Pirolli and Card 1999). In the background information tasks, the social features and social information may contain strong information scent to help participants in optimize their effort for finding relevant information. The social features and social information provide rich information scent that aids participants determine and choose documents with high potential value. For the decision making tasks, popular categories help participants to explore limited and relevant information. Reviews provide more information that may be useful for participants to select the documents especially when



the documents lack of sufficient details. Related items from other people can lead directly to the patch of related-items if participants think the current document is relevant. Also, if one of related-items contains enough scent, the participant may want to follow to that patch. Moreover, the advanced features support participants to filter type of documents for quick browsing. These features provide information enrichment which is limited relevant resources to support participants for exploration. For the fact finding tasks, some participants used popular categories during performing the tasks if it appeared relevant information in popular categories. This can be explained by Information Foraging Theory that the participants would follow the patch that provides high scent in their information goals rather than using other approaches or following other patches. However, the results found that some participants did not use popular categories to perform the tasks because of the clutter of information on the experimental interface. Some participants seemed to have more difficulty to learn and remember in the experimental interface than the control one. It might be because the experimental interface provides more options or ways for participants to find information. One possible explanation from the study of Khan and Locatis (1998) is about the effect of link density and information presentation. The finding indicated that providing less links on the page is more likely to decrease participants' cognitive load.

What is interesting to note from the finding is that only two participants did not use the social features and social information to complete any tasks. Based on demographic data, I found that both participants are very interested in History, indicating that they probably have knowledge in the UK history. According to my observation, during the participants performed the tasks, they seemed to explore and select relevant documents with confidence. This could be the explanation as to why those participants preferred to use only basic features to find information and did not involve with social facility.

## 7.4 Conclusions

This chapter presents two interfaces that provide different features for different tasks. The experimental interface was designed by including social features into existing basic interface (the control interface), which I hypothesized would best support for different tasks. I conducted the effectiveness test examine participant interaction with the Victorian Times interfaces based on task-based evaluation. This study helps me to understand search behaviours and how the features support finding information across task types. 24 within-subjects were conducted to compare the experimental interface with the control one to investigate whether (a) social digital library interface supports participants to accomplish the tasks. (b) social features and social information reduce participant effort to find relevant information to the task; (c) social features increase participant satisfaction with the social interface to the Victorian Times digital library; and (d) overall, participants prefer the experimental interface rather than the control one.

The results of the study show that the experimental interface provides better support for completing the background information tasks and fact finding tasks compared to the control interface. Conversely, the control interface provided better support for completing the decision making tasks compared to the experimental one.

As a qualitative study, the results found that participants who used the experimental interface seem to minimize costs to access relevant information to achieve three task types compared to participants who used the control interface. In term of Information Foraging Theory, the participants might gain benefit from social features and social information to make decisions about information if they perceive strong scent. It's possible that the combination of social features, social information and basic features assist users for information seeking in different tasks better than the basic interface which provides only search and browse functions. However, the social interface still

needs to be improved in order to gain the maximum benefit in social community perspective.

The next chapter summarizes all the studies and answers the research questions of this research that I introduced in Chapter 1. I also discuss the limitations, implications, contributions, as well as directions for future work concerning social digital libraries.

# Chapter 8

## Conclusions and future work

### 8.1 Introduction

The main objective of this research was to investigate how participants interact with a social digital library designed for supporting them to carry out different types of tasks and to evaluate the interfaces according to effectiveness and participant satisfaction. This study focuses on the evaluation of the social digital library interface based on user view rather than system perspective.

The social Digital Library is aimed at providing social features and social information to provide support for the user's task. This evaluation of the social interface involves a task-based evaluation. The social interface to the Victorian Times Digital Library is composed of basic, advanced and social features, such as popular categories and popular groups and social information, such as reviews, the number of recommendation and related-items by other people. I also evaluated the usability of the features incorporated in the Victorian Times Digital Library and investigated the redesigned Victorian Times interface in terms of efficiency, effectiveness, helpfulness, ease of use, ease of learning and participant satisfaction compared to the traditional one. This is important to examine

which features of the social interface support participants to accomplish different work tasks.

## **8.2 Addressing the research problem and questions**

To answer the research questions as described in Chapter 1, the research started with basic hypotheses : the social digital library interface supports participants to accomplish the tasks; the social features and social information reduces participant effort to find relevant information to the task; the social features increase participant satisfaction with the social interface to the Victorian Times Digital Library; and overall, participants prefer the social interface digital library rather than the traditional one. To achieve this, the Victorian Times Digital Library was redesigned and developed by integrating social features and social information. In total, I conducted three main studies.

First, two usability tests were conducted in order to evaluate the interfaces based on effectiveness, examine participant satisfaction, and evaluate the usefulness of different features to support participant seeking information in the system (Chapter 4). These usability studies enable me to construct more usable system and identify suggestions for usability improvements to the Victorian Times Digital Library. The results showed that font colour, font size and information presentation should be revised. The selected features were combined to the next version of interface.

Second, based upon results of the initial study in Chapter 4, I improved the Victorian Times Digital Library and conducted usability tests as an iterative design process (Chapter 5). The Information Foraging Theory was involved in improving the interfaces in order to increase information scent (Pirolli and Card 1999) and make sure that the interface truly supports users' information seeking. As Zhang et al.(2008, p. 441) stated, "The issue of 'how to get there' is closely related to how browsing interface is designed. Different designs may lead to different ways of reaching the desired information and may result in different user performance". Therefore, I implemented four interfaces of the Victorian Times Digital Library (Social User interface; Most Viewed Item interface; Multiple Items interface; and Most Recent Users interface) by focusing on four different scent carries in popular

categories, but the overall design and information presentation of those interfaces were identical. I believe that users may perceive information scents in four interfaces differently. Three usability tests were conducted in order to investigate the use of features for supporting them to find information, to determine which interface is the best, and to determine the interfaces based on effectiveness and participant satisfaction. The results found that a majority of participants appreciated more in the multiple items interface, represented with the most viewed three document thumbnails and social data. This indicates that the multiple items interface may carry higher scent for participants rather than other three interfaces. For the final study in the usability tests, the participants seemed to utilize social features and social information on the interfaces to perform the tasks. Thus, this study sheds light on how users employed social features and social information to achieve the tasks. However, the Victorian Times interface is needed to improve for high scent, especially in social features and social information and retest with a larger sample size.

Third, based on the results and suggestions of usability studies and an iterative design process in Chapter 5, I made significant changes in the Victorian Times Digital Library. Then I developed the traditional Victorian Times interface without social features and social information. This interface serves as the control interface, while the social digital library serves as the experimental one. The test was conducted with 24 participants in order to evaluate both interfaces covering system interaction in terms of effectiveness, helpfulness, ease of learning, ease of use, participant satisfaction of overall the systems. The study also aims to analyse how participants interact with the social digital library in order to investigate the use of features for supporting them to find information in three different kinds of tasks and to provide valuable insight into how future the social digital library should be designed.

From all findings as mentioned above, I will give answers the research questions, as outlined in Section 1.4.2 (Chapter 1), were:

### **How the features employed by participants to accomplish on different types of tasks?**

This research found that different work tasks significantly influenced the use of features to find information. On the traditional (LCSH interface) and the social digital library interface, similar behaviours were observed to both interfaces. During performing three task types, some participants used one approach, for example, popular categories, search, or browsing official categories to examine, explore and gather information, while some participants preferred to combine approaches to complete the tasks. Nevertheless, the use of features depends on displaying results on the page. If some participants felt satisfied with the results by using one approach meant that the feature they used probably provides strong enough scent. Conversely, some participants combined approaches to achieve the task, this indicates that the first feature they used probably lack of information scent so they will explore another way with higher scent.

On the social digital library, for background information tasks, most of participants felt uncertainty in the first stage of finding information. They seemed to make heavy use of browsing official categories in order to gain more understanding about the topic and then used other methods to find specific information. Some participants were more likely to use popular categories to fulfil the task because it may save time and find limited and relevant information. For decision making tasks, the participants seemed to explore more than one way in order to collect sufficient information for comparing and selecting the best ones. Participants were more likely to combine more than one approach, either started from basic features to get all information and then used popular categories in order to find anything else or started from popular categories to collect popular information and then used basic features to explore additional information. This is because they don't want to miss any information. For fact finding tasks, a majority of participants used the basic features to complete a very specific full text document. The participants did not perceive scent in popular categories for this kind of tasks. However, popular categories are still useful for them if they can detect scent on popular categories which match their goals or interests.

### **How the social features and social information can help participants to accomplish the tasks?**

The study also found that social features and social information can assist participants during different tasks. For background information tasks, reviews and the number of recommendation by other people help participants to identify potential documents. For popular categories, participants can save time and effort by providing limited and relevant documents. They did not spend longer time to explore all documents especially very long full text documents. For decision making tasks, the number of recommendation by other people and reviews helps participants to choose the documents, especially the documents without description. “For people who have interested in this objects also looked at” section was seemed to be useful for participants to find related documents if they found the current viewed item interesting. For fact finding tasks, there are different participants’ behaviours between finding images and full text documents. Most participants were more likely to use the search feature for finding very specific information, while some participants were more likely to use other features such as browsing official categories or popular categories. It depends on how much the participants perceived information scent on those patches. The finding also found that only two of 24 participants did not use social features and social information during performing the task at all. This is probably because they might have strong knowledge in the UK history or personal attitudes about social data, for example, one participant thought (s)he did not rely on other people’s comments, while another participant stated that different people have different goals for finding information that might be different from his/her goal. Also, I found that even though some participants did not use popular categories, they also used social information to perform the tasks. This suggests that they may benefit from social information to support their information seeking. Some participants indicated that they might use popular categories the next time to find information.

In terms of effectiveness of the system, it was found that the ratio of pages viewed to relevant pages for accomplishing the background, decision making and fact finding



tasks in the social digital library was significantly lower or more effective than those in the traditional one. The significant result was found that the participants using the social digital library had fewer ratio of pages viewed and relevant pages to complete the decision making and fact finding tasks than those using the traditional one. This can lead me to conclude that social features and social information are helpful and reduce user effort for users to complete different task types.

The most important finding of this thesis is that social features and social information could be effective and helpful for users to complete different type of tasks. This research started from developing the social interface and tested with usability tests based on an iterative design. Information Foraging Theory was used to apply in improving the interface and finally, the research conducted the effectiveness test in order to examine the use of features to support task types. This research focused on evaluation of users' behaviour with the system. This cannot be seen in previous studies that emphasised on the system's perspective rather than the user's perspective (e.g., Kruk et al. 2005, Candela and Straccia 2004 etc.). The findings from this thesis provide a richer understanding the nature of work tasks and information searching behaviour better.

In the next section, I will discuss implications of these findings and how these findings contribute to future design of the social digital libraries.

### **8.3 Implications**

This research emphasises on evaluation in user-oriented views by using task-based approach, which related to the study of the behaviour of users, depending on the tasks. In this study, Information Foraging Theory was used to design social interfaces to the Victorian Times Digital Library in order to help users to accomplish different task types as they need in least time and effort. Due to users' busy schedule, this theory is useful for designing web sites for supporting users to find desired information quickly. Two strategies were recommended are that designing a web site should look like "a nutritious meal" and provide "easy catch" for users, for example,

the web site should offer clear link design and explanations that assist them to get good information easily (Nielsen, J. 2003).

The study found that the basic features are common to all tasks but the social features and social information may influence document selection for participants to complete different task types, saving much time and effort. However, the findings found that two participants preferred to use only the basic features during task performance. They seemed to take time and effort to explore all information in official categories and were more willing to open a lot of pages in order to consider which documents are useful to their goals without using popular categories and social information. This suggests that the social digital library designed by applying Information Foraging Theory might not be useful for those participants. Based on demographic data, the participants are very interested in History. One possible explanation is that they may have prior-knowledge in the topic of their search and therefore no needs from other help to decide which of found item is relevant to the task. They were more likely to assess documents found based on their knowledge. This could be explained by the finding of Wildemuth (2004) that knowledge of domain may influence their information search process.

Also, the Victorian Times Digital Library Interface is quite novel. It seems to take time and effort to learn compared to the traditional one. Some participants noted that even though they did not use popular categories to accomplish the tasks at the first time, they possibly use it at the later time, indicating that the participants tend to use more the social features once they are familiar with the system.

It was hoped that considering other people's activities in the past such as the social features, reviews, the number of recommendations and related-items by other people will facilitate to support user tasks in future digital libraries design. The social digital library should help users complete different task types and increase user satisfaction with the system. Digital Libraries should provide social features and social information, as well as the basic features to support them.

In additionally, the findings from the study shed light on suggestions that might be considered for the future design of the social digital library:

(1) The system may need to provide filter information from the search results page, for example refining information by types of documents and LCSH or subject heading terms. Also, filtering features should be provided in all browsing item pages, such as popular categories, as well as query suggestions like Google might need to be included.

(2) The system may need to facilitate visualization of the collection, for example zooming feature, see all page and jump to the desire page users want or tools for navigating PDF documents.

(3) The system may need to provide components for checking reliable or unreliable data, for example, by log-in users or providing the ability to rate other people's reviews. This could be enhanced reliability of the social digital library.

(4) The system may need to obtain customization features for display features and styles, for example, providing a range of optional interfaces: simple and advanced interface for support users' personal styles.

## **8.4 Contributions**

The findings from this research make the following contributions to the field of User Interface and Digital Libraries:

1. I introduced a novel user interface to Digital Libraries by integrating the concept of social features and social information in order to support various types of users' tasks. Previous digital libraries have generally presented social functions. Some focusing on social and semantic services (e.g., Kruk et al. 2007). Some focusing on social bookmarking system or annotation features (Puspitasari et al. 2007, Hansen et al. 2007, Nichols et al. 2000). This study distinguishes from other systems since I focus on evaluating the

use of features in the social digital library for support task types based on user-based evaluation rather than system performance.

2. I demonstrated the value of social features and social information in support participants to find information. I evaluated the interfaces and gathered qualitative and qualitative evidence of how the social interface can assist participants to archive search goals (Chapter 4, 5, and 6). I studies participants' behaviour in how participants interact with the social digital library interface compared to the traditional one during the following different task types: the background information, the decision making and fact finding tasks. Participants were asked to complete three different task types by using both interfaces. The key contribution of this research is social features and social information in the social digital library would be able to assist users to complete their tasks. Also, the thesis provides suggestions for future design of the social digital library. I believe that augmenting digital libraries with social features and social information would help users to achieve their goals with minimum time and effort. This understanding has been utilised to provide implications for future support of the social digital libraries as well as to provide direction for future research in this area.

## **8.5 Limitations of the research**

Although the findings are supporting and useful, the present study has several limitations.

- First of all, I was constrained by a limited number of Victorian Time resources. This thesis was unable to detect the differences in participants' behaviour when they conduct task on a large amount of information in the collection. In order to study whether this is due to overwhelming information, the information resources should be larger than the current Victorian Times Digital Library.

However, the information in the Victorian Times collection is still sufficient to support participants to complete the defined tasks. Also, I combined log

files, think-aloud protocol, note-taking, questionnaires, a screen video capture software and interviews for analysing participants' behaviour. This will help to increase the accuracy of the analysis and interpretation of the results.

- Second, since the redesign Victorian Times Digital Library is restricted to use only on a local computer. Social data and people' activities to the system were created and simulated rather than data coming from real people. Based on this, I have to consider whether data from simulation can provide meaningful and useful for participants to complete the tasks. This could make up for the weak point.
- Third, this experiment is an experimental study in which participants will receive given topics rather than as participant-defined topics. Therefore, this study has limitations in terms of topics for finding information. However, I try to solve the problem by using Simulation Work Task situations by Borlund (2000).

## **8.6 Future Work**

- Future studies should be conducted at the online environment. The more users use the system, the more social data available. There is a greater increase in the number of social information if the Victorian Times Digital Library is available online. Then this would have enabled some recommendations, reviews, and related items from real people and make social information in the site more realistic and reliable.
- Future studies will still take social features integrated into the system or other domains such as multimedia video digital libraries, music digital libraries or public health digital libraries etc. in order to examine users' interaction in different task types since the study indicated that participants believed in the level of popularity of topics differently. It is important to investigate and compare the effects of social features and social information on users' interaction with systems in different contexts.
- Also, future social digital libraries may incorporate personalization and customization for serving different types of people. For example, Musto et

al.' (2010) study used Folksonomy-based Item Recommender System to provide recommendation for personalization in digital libraries.

- As discussed, various tools in the social digital library have been developed and tested to better support various types of tasks: background information, decision making task and fact finding tasks. Future research should consider providing tools that help users to select relevant information and enhance information seeking during different search tasks (e.g., Diriye et al. 2010, Liu et al. 2010). Moreover, providing learning facilitation and collaborative activities in efficient and effective way should be considered in a broader sense. This issue further to contribute greatly to the increase in research on collaborative features in digital libraries to support education for learning purposes (e.g., Wolfe 2008), with the hope that developing collaborative components will assist learning, as well as sharing knowledge and interests in digital library community.

## **8.7 Conclusions**

To conclude, this research has contributed to better understanding of the use of the social features and social information in the social digital library to assist users in information seeking tasks. The research findings have design implications for task-based evaluations. Future works will further develop the social digital library in different domain and continually contribute to this area.

# References

- Ackerman, M. S. (1994) 'Providing Social Interaction in the Digital Library', *First Annual Conference on the Theory and Practice of Digital Libraries*, 198-200.
- Ahmed, S. M. Z. (2008) 'A comparison of usability techniques for evaluating information retrieval system interfaces', *Performance Measurement and Metrics*, **9**(1), 48 - 58.
- Ahmed, S. M. Z., McKnight, C. and Oppenheim, C. (2006) 'A user-centred design and evaluation of IR interfaces', *Journal of Librarianship and Information Scienc*, **38**(3), 157-172.
- Arms, W. Y. (2000) *Digital Libraries*, Cambridge,MA: MIT Press.
- Avancini, H., Candela, L. and Straccia, U. (2007) 'Recommenders in a personalized, collaborative digital library environment', *Journal of Intelligent Information Systems*, **28**(3), 253-283.
- Badre, A. N. (2002) *Shaping Web Usability: Interaction Design in Context*, Addison Wesley.
- Bailey, G. S. (1993) 'Iterative methodology and designer training in human-computer interface design', in *CHI '93 Proceedings of the INTERACT '93 and CHI '93 conference on Human factors in computing systems*, Amsterdam, The Netherlands, ACM, New york, 198-205.
- Baim, S. A. (2006) 'Draw to Participate in Virtual Communities' in Dasgupta, S., ed. *Encyclopedia of Virtual Communities and Technologies*, Idea Group Publishing, 145-149.
- Balabanović, M. and Shoham, Y. (1997) 'Fab: content-based, collaborative recommendation', *Communications of the ACM archive*, **40**(3), 66-72.
- Bates, M. J. (1989) 'The design of browsing and berrypicking techniques for the online search interface', *Online Information Review*, **13**(5), 407 - 424.
- Bates, M. J. (1990) 'Where should the person stop and the information search interface start?', *Information Processing & Management*, **26**(5), 575-591.
- Bates, M. J. (2002a) 'The cascade of interactions in the digital library interface', *Information Processing & Management*, **38**(3), 381-400.

- Bates, M. J. (2002b) 'Towards an integrated model of information seeking and searching', *New Review of Information Behaviour Research*, **3**, 1-15.
- Belkin, N. J. (1980) '*Anomalous States of Knowledge as a Basis for information Retrieval*', *The Canadian Journal of Information Science*, **5**, 133-143.
- Belkin, N. J., Marchetti, P. G. and Cool, C. (1993) 'BRAQUE: Design of an interface to support user interaction in information retrieval', *Information Processing & Management*, **29**(3), 325-344.
- Belkin, N. J., Oddy, R. N. and Brooks, H. M. (1982) 'Ask For Information Retrieval: Part I. Background And Theory', *Journal of Documentation*, **38**(2), 61 - 71.
- Blandford, A., Keith, S., Connell, L. and Edwards, H. (2004) 'Analytical usability evaluation for digital libraries: a case study', *Digital Libraries, 2004. Proceedings of the 2004 Joint ACM/IEEE Conference*, 27-36.
- Boertjes, E. and Nijholt, A. (2007) 'Interaction' in *Multimedia Retrieval Data-Centric Systems and Applications*, Springer Berlin Heidelberg, 295-320.
- Booth, P. A. (1989) *An introduction to human-computer interaction*, London : Lawrence Erlbaum.
- Borgman, C. L. (1999) 'What are digital libraries? Competing visions', *Information Processing & Management*, **35**(3), 227-243.
- Borgman, C. L. (2002) 'Challenges in Building Digital Libraries for the 21st Century', *Proceedings of the 5th international conference on Asian Digital Libraries*, **2555**, 1-13.
- Borlund, P. (2000) 'Experimental components for the evaluation of interactive information retrieval systems', *Journal of Documentation*, **56**(1), 71-90.
- Borlund, P. (2003) 'The IIR evaluation model: a framework for evaluation of interactive information retrieval systems', *Information Research*, **8**(3), paper no. 152 [Available at: <http://informationr.net/ir/8-3/paper152.html>]
- Breakwell, G., Hammond, S. M., Fife-Schaw, C. and Smith, J. A. (2006) *Research methods in psychology*, 3rd ed., Sage Publications Ltd.
- Brinck, T., Gergle, D. and Wood, S. D. (2002) *usability for the Web Designing Web sites that work*, San Francisco : Morgan Kaufmann Publishers.
- Brusilovsky, P. (2008) 'Social Information Access: The Other Side of the Social Web' in Geffert, V., Karhumäki, J., Bertoni, A., Preneel, B., Návrát, P. and Bieliková, M., eds., *SOFSEM 2008: Theory and Practice of Computer*



*Science*, Springer Berlin / Heidelberg, 5-22.

- Brusilovsky, P., Cassel, L., Delcambre, L., Fox, E., Furuta, R., Garcia, D. D., Shipman, F. M., Bogen, P. and Yudelson, M. (2010) 'Enhancing Digital Libraries with Social Navigation: The Case of Ensemble', in Lalmas, M., Jose, J., Rauber, A., ebastiani, F. S. and Frommholz, I., eds., *Research and Advanced Technology for Digital Libraries 14th European Conference, ECDL 2010*, Glasgow, UK, Springer Berlin / Heidelberg, 116-123.
- Buchanan, G. and Hinze, A. (2008) 'Social Information Seeking in Digital Libraries' in *Social Information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively (Premier Reference Source)*, Information Science Reference, 209-229.
- Buchanan, S. (2009) 'Evaluating the usability and usefulness of a digital library', *Library Review*, **58**(9), 638 - 651.
- Byström, K. and Järvelin, K. (1995) 'Task complexity affects information seeking and use', *Inf. Process. Manage.*, **31**(2), 191-213.
- 'Cam Studio Open Source Free Streaming Video Software', [online], available: <http://camstudio.org/> [accessed 5 March 2010].
- Candela, L. and Straccia, U. (2004) 'The Personalized, Collaborative Digital Library Environment CYCLADES and Its Collections Management' in Callan, J., Crestani, F. and Sanderson, M., eds., *Distributed Multimedia Information Retrieval (Lecture Notes in Computer Science)*, Springer Berlin / Heidelberg, 156-172.
- Card, S. K., Robertson, G. G. and York, W. (1996) 'The WebBook and the Web Forager: an information workspace for the World-Wide Web', in *Proceedings of the SIGCHI conference on Human factors in computing systems: common ground*, Vancouver, British Columbia, Canada, 111-ff.
- Carmel, D., Zwerdling, N., Guy, I., Ofek-Koifman, S., Har'el, N., Ronen, I., Uziel, E., Yogev, S. and Chernov, S. (2009) 'Personalized social search based on the user's social network', in *In Proceeding of the 18th ACM conference on Information and knowledge management (CIKM '09)*, Hong Kong, China, November 2-6, 1227-1236.
- Case, Donald O. (2007). *Looking for Information: A Survey of Research on Information Seeking, Needs, and Behavior. Library and Information Science..* Emerald Group Publishing. Retrieved 6 January 2012, from <http://lib.myilibrary.com?ID=74689>>
- Chakraborty, A. K. (2010) 'Web 2.0 and Social Web Approaches to Digital Libraries'

- in Ashraf, T., Sharma, J. and Gulati, P. A., eds., *Developing Sustainable Digital Libraries: Socio-Technical Perspectives*, Information Science Publishing, 108-132.
- Chang, S.-J. and Rice, R. E. (1993) 'Browsing: A Multidimensional Framework', *Annual Review of Information Science and Technology (ARIST)*, **28**, 231-276.
- Chi, E. H. (2009) 'Information Seeking Can Be Social', *IEEE Computer*, **42**(3), 42-46.
- Choo, C. W., Detlor, B. and Turnbull, D. (1998) A Behavioral Model of Information Seeking on the Web --Preliminary Results of a Study of How Managers and IT Specialists Use the Web, Paper presented at the American Society of Information Science, Pittsburgh, PA.
- Choo, C. W., Detlor, B. and Turnbull, D. (1999) 'Information Seeking on the Web-- An Integrated Model of Browsing and Searching' in *Proceedings of the 62nd ASIS Annual Meeting, Information Today*, Washington, DC, **36**, 3-16.
- Clark, J. A. (2004) 'A usability study of the Belgian-American Research Collection: measuring the functionality of a digital library', *OCLC Systems & Services*, **20**(3), 115 - 127.
- Cohen, S., Ferreira, J., Horne, A., Kibbee, B., Mistlebauer, H. and Smith, A. (2000) 'MyLibrary Personalized Electronic Services in the Cornell University Library', *D-Lib Magazine* [online], available: [www.dlib.org/dlib/april00/mistlebauer/04mistlebauer.html](http://www.dlib.org/dlib/april00/mistlebauer/04mistlebauer.html) [accessed 8 February 2011].
- Cove, J. F. and Walsh, B. C. (1988) 'Online text retrieval via browsing', *Information Processing & Management*, **24**(1), 31-37.
- Crumlish, C. and Malone, E. (2009) *Designing Social Interfaces: Principles, Patterns, and Practices for Improving the User Experience*, O'Reilly Media.
- Dieberger, A., Dourish, P., Höök, K., Resnick, P. and Wexelblat, A. (2000) 'Social navigation: techniques for building more usable systems', *interactions*, **7**(6), 36-45.
- Diriye, A., Blandford, A. and Tombros, A. (2010) 'Exploring the Impact of Search Interface Features on Search Tasks' in Lalmas, M., Jose, J., Rauber, A., Sebastiani, F. and Frommholz, I., eds., *Research and Advanced Technology for Digital Libraries*, Springer Berlin / Heidelberg, 184-195.
- Dourish, P. and Chalmers, M. (1994) *Running out of space: Models of information*

*navigation*. Paper presented at Human Computer Interaction '94, Glasgow, Scotland.

- Eirinaki, M. and Vazirgiannis, M. (2003) 'Web mining for web personalization', *ACM Transactions on Internet Technology*, **3**(1), 1-27.
- Ellis, D. (1989) 'A behavioural model for information retrieval system design', *Journal of Documentation*, **45**(3), 171 - 212.
- Evans, B. M. and Chi, E. H. (2008) 'Towards a model of understanding social search', in *Proceedings of the 2008 ACM conference on Computer supported cooperative work*, San Diego, CA, USA, 485-494.
- Ferreira, S. M. and Pithan, D. N. (2005) 'Usability of digital libraries: A study based on the areas of information science and human-computer-interaction', *OCLC Systems & Services*, **21**(4), 311-323.
- Field, A. P. and Hole, G. (2003) *How to design and report experiments*, London : SAGE.
- Fleischmann, K. R. (2007) 'Digital libraries and human values: Human-computer interaction meets social informatics', *Proceedings of the American Society for Information Science and Technology*, **44**(1), 1-17.
- Franke, M., Geyer-Schulz, A. and Neumann, A. W. (2008) 'Recommender Services in Scientific Digital Libraries' in Tsihrintzis, G. and Editor: Jain, L., eds., *Multimedia Services in Intelligent Environments Studies in Computational Intelligence*, Springer Berlin / Heidelberg, 377-417.
- Freyne, J., Farzan, R., Brusilovsky, P., Smyth, B. and Coyle, M. (2007) 'Collecting community wisdom: integrating social search & social navigation', in *Proceedings of the 12th international conference on Intelligent user interfaces*, Honolulu, Hawaii, USA, 52 - 61.
- Freyne, J. and Smyth, B. (2004) 'An Experiment in Social Search', in Bra, P. D. and Nejd, W., eds., *Adaptive Hypermedia and Adaptive Web-Based Systems Third International Conference, AH 2004, Eindhoven*, Springer Berlin / Heidelberg, 95-103.
- Fuhr, N., Hansen, P., Mabe, M., Micsik, A. and Sølvsberg, I. (2001) 'Digital Libraries: A Generic Classification and Evaluation Scheme', *Research and Advanced Technology for Digital Libraries Lecture Notes in Computer Science*, **2163**, 187-199.
- Gazan, R. (2008) 'Social Annotations in Digital Library Collections', *D-Lib Magazine* [online], available:

<http://www.dlib.org/dlib/november08/gazan/11gazan.html> [accessed 27 October 2010].

- Geisler, G., McArthur, D. and Giersch, S. (2001) 'Developing recommendation services for a digital library with uncertain and changing data', in *Proceedings of the 1st ACM/IEEE-CS joint conference on Digital libraries*, 199-200.
- Greene, S., Marchionini, G., Plaisant, C. and Shneiderman, B. (2000) 'Previews and overviews in digital libraries: Designing surrogates to support visual information seeking', *Journal of the American Society for Information Science*, **51**(4), 380-393.
- Gross, T. (2005) 'CYCLADES: An Environment for the Cooperative Management of Digital Information', *Journal of Digital Information Management*, **3**(2), 146-152.
- Gundelsweiler, F., Memmel, T. and Reiterer, H. (2007) 'ZEUS – Zoomable Explorative User Interface for Searching and Object Presentation', in *In: HCI International*, Beijing.
- Hansen, P., Pejtersen, A. M. and Albrechtsen, H. (2007) 'Evaluation and Requirements Elicitation of a DL Annotation System for Collaborative Information Sharing', in *Proceedings of the 1st international conference on Digital libraries: research and development*, Pisa, Italy, Springer-Verlag Berlin, Heidelberg, 177-186.
- Hayes, N. (2000) *Doing Psychological Research: Gathering and Analysing Data*, Open University Press.
- Herget, J., Bauer, L., Hierl, S. and Weinhold, T. (2007) 'A LEAP AHEAD: ETOURISM TAKES THE WEB 2.0 CHALLENGE. REQUIREMENTS AND FUTURE DIRECTIVES.', in Krishnamurthy, S. and Isaías, P., eds., *Proceedings of the IADIS International Conference on e-Commerce*, Algarve, Portugal, 317-321.
- Hertzum, M. (2000) 'People as carriers of experience and sources of commitment: information seeking in a software design project', *The New Review of Information Behaviour Research*, **1**, 135 - 149.
- Hill, L. L., Carver, L., Larsgaard, M., Dolin, R., Smith, T. R., Frew, J. and Rae, M.-A. (2000) 'Alexandria digital library: user evaluation studies and system design', *Journal of the American Society for Information Science*, **51**(3), 246-259.
- Hill, W., Stead, L., Rosenstein, M. and Furnas, G. (1995) 'Recommending and

- evaluating choices in a virtual community of use', in *Proceedings of the SIGCHI conference on Human factors in computing systems*, Denver, Colorado, United States, ACM Press/Addison-Wesley Publishing Co. New York, NY, USA, 194-201.
- Hornbæk, K. (2006) 'Current practice in measuring usability: Challenges to usability studies and research', *International Journal of Human-Computer Studies*, **64**(2), 79-102.
- House, N. A. V., Butler, M. H., Ogle, V. and Schiff, L. (1996) 'User-Centered Iterative Design for Digital Libraries The Cypress Experience', *D-Lib Magazine* [online], available:<http://webdoc.sub.gwdg.de/edoc/aw/dlib/dlib/february96/02vanhouse.html> [accessed 5 March 2011].
- Hsieh-Yee, I. (1993) 'Effects of search experience and subject knowledge on the search tactics of novice and experienced searchers.', *Journal of the American Society for Information Science*, **44**(3), 161-174.
- Hsieh-Yee, I. (1998) 'Search tactics of Web users in searching for texts, graphics, known items and subjects: A search simulation study.', *Reference Librarian*, **60**, 61-85.
- Hwang, S.-Y., Hsiung, W.-C. and Yang, W.-S. (2003) 'A prototype WWW literature recommendation system for digital libraries', *Online Information Review*, **27**(3), 169-182.
- Jakob, J. (2000) 'Why you only need to test with 5 user', [online], available: <http://www.useit.com/alertbox/20000319.html> [accessed 5 March 2011].
- Jeng, J. (2005) 'What Is Usability in the Context of the Digital Library and How Can It Be Measured?', *Information Technology And Libraries*, **24**(2), 47-56.
- Kalbach, J. and Gustafson, A. (2007) *Designing Web Navigation: Optimizing the User Experience*, O'Reilly Media.
- Kani-Zabihi, E., Ghinea, G. and Chen, S. Y. (2006) 'Digital libraries: what do users want?', *Online Information Review*, **30**(4), 395-412.
- Kassim, A. R. C. and Kochtanek, T. R. (2003) 'Designing, implementing, and evaluating an educational digital library resource', *Online Information Review*, **27**(3), 160-168.
- Kengeri, R., Seals, C. D., Harley, H. D., Reddy, H. P. and Fox, E. A. (1999) 'Usability study of digital libraries: ACM, IEEE-CS NCSTRL, NDLTD', *International Journal on Digital Libraries*, **2**(2), 157-169.

- Khan, K. and Locatis, C. (1998) 'Searching through cyberspace: The effects of link cues and correspondence on information retrieval from hypertext on the World Wide Web.', *Journal of the American Society for Information Science*, **49**(14), 1248–1253.
- Kim, S., Lele, S., Ramalingam, S. and Fox, E. A. (2006) 'Visualizing user communities and usage trends of digital libraries based on user tracking information', in *In Digital Libraries : Achievements, Challenges and Opportunities, ser. Lecture Notes in Computer Science*, Berlin /Heidelberg : Springer, 111-120.
- Kimani, S., Panizzi, E., Catarci, T. and Antona, M. (2005) 'Digital Library Requirements: a Questionnaire-based Study', in Agosti, M. and Thanos, C., eds., *The 1<sup>st</sup> Italian Research Conference on DigitalLibraries*, Padova, Italy, 75-84.
- Klas, C.-P., Fuhr, N. and Schaefer, A. (2004) 'Evaluating Strategic Support for Information Access in the DAFFODIL System' in Heery, R. and Lyon, L., eds., *Research and Advanced Technology for Digital Libraries*, Springer Berlin / Heidelberg, 476-487.
- Komlodi, A., Marchionini, G. and Soergel, D. (2007) 'Search history support for finding and using information: User interface design recommendations from a user study', *Information Processing & Management*, **43**(1), 10-29.
- Kruk, S. R., Decker, S. and Zieborak, L. (2005) 'JeromeDL - Adding Semantic Web Technologies to Digital Libraries', in Kim Viborg Andersen, J. D., and R. Wagner, ed. *Database and Expert Systems Applications 16th International Conference, DEXA 2005*, Springer Berlin / Heidelberg: Copenhagen, Denmark, 716-725.
- Kruk, S. R., Kruk, E. and Stankiewicz, K. (2008) 'Evaluation of Semantic and Social Technologies for Digital Libraries' in Christensen-Dalsgaard, B., Castelli, D., Ammitzbøll Jurik, B. and Lippincott, J., eds., *Research and Advanced Technology for Digital Libraries*, Springer Berlin / Heidelberg, 74-77.
- Kruk, S. R., Woroniecki, T. and Gzella, A. (2007) 'JeromeDL – a Semantic Digital Library' in *Semantic Web Challenge*.
- Kuhlthau, C. C. (1991) 'Inside the Search Process: Information Seeking from the User's Perspective', *Journal of the American Society for Information Science*, **42**(5), 361-371.
- Kuhlthau, C. C. (2003) *seeking meaning*, Libraries Unlimited.

- Lassila, O. and Hendler, J. (2007) 'Embracing "Web 3.0"', *IEEE Computer Societ*, **11**(3), 90-93.
- Lauesen, S. (2005) *User Interface Design: A Software Engineering Perspective*, Addison Wesley.
- Lee, S.-S., Theng, Y.-L. and Goh, D. H.-L. (2003) 'Creativity in Digital Libraries and Information Retrieval Environments', in *ICADL 2003*, 398-410.
- Lekakos, G., Charami, M. and Caravelas, P. (2009) 'Personalized Movie Recommendation' in *Handbook of Multimedia for Digital Entertainment and Arts*, Springer US, 1-26.
- Lesk, M. (1997) *Practical digital libraries: Books, bytes, and bucks*, San Francisco, CA: Morgan Kaufman publishers.
- Levy, D. M. and Marshal, C. C. (1995) 'Going Digital: A Look at Assumptions Underlying Digital Libraries', *Communication Of The ACM*, **38**(4), 77-84.
- Lindgaard, G. (1994) *Usability testing and system evaluation : a guide for designing useful computer systems*, London ; New York : Chapman & Hall.
- Liu, J., Cole, M. J., Liu, C., Bierig, R., Gwizdka, J., Belkin, N. J., Zhang, J. and Zhang, X. (2010) 'Search behaviors in different task types', in *Proceedings of the 10th annual joint conference on Digital libraries*, Gold Coast, Queensland, Australia, 69-78.
- Loh, S., Saldaña, R., Lichnow, D., Borges, T., Rodrigues, R., Simões, G., Amaral, L. A. and Primo, T. (2004) 'Analyzing Web Chat Messages for Recommending Items from a Digital Library', in *n Proc. of the 6th International Conference on Enterprise Information Systems ICEIS*, 41-48.
- Lomas, C. P. (2005) '7 Things You Should Know About Social Bookmarking', [online], available: <http://www.educause.edu/ELI/7ThingsYouShouldKnowAboutSocia/156804> [accessed 8 October 2010].
- Maness, J. M. (2006) 'Library 2.0 theory: Web 2.0 and its implications for libraries', *Webology*, **3**(2) [online], available: <http://www.webology.org/2006/v3n2/a25.html> [accessed 21 July 2011].
- Marchionini, G., Plaisant, C. and Komlodi, A. (2001) 'The people in digital libraries: multifaceted approaches to assessing needs and impact' in *Digital library use: Social practice in design and evaluation*, MIT Press, Cambridge, Mass.

- Marinai, S., Marino, E. and Soda, G. (2007) 'Exploring Digital Libraries with Document Image Retrieval', in László Kovács, N. F., and C. Meghini, ed. *Research and Advanced Technology for Digital Libraries 11th European Conference, ECDL 2007*, Springer Berlin / Heidelberg: Budapest, Hungary., 368-379.
- Marshall, C. C. and Bly, S. (2004) 'Sharing encountered information: digital libraries get a social life', in *Digital Libraries, 2004. Proceedings of the 2004 Joint ACM/IEEE Conference.*, 218 - 227.
- Musto, C., Narducci, F., Lops, P., Gemmis, M. and Semeraro, G. (2010) 'Integrating a Content-Based Recommender System into Digital Libraries for Cultural Heritage' in Agosti, M., Esposito, F. and Thanos, C., eds., *Digital Libraries*, Springer Berlin Heidelberg, 27-38.
- Myaeng, S. H. and Korfhage, R. R. (1990) 'Integration of user profiles: models and experiments in information retrieval', *Information processing & management*, **26**(6), 719-738.
- Neuhold, E., Niederée, C. and Stewart, A. (2003) 'Personalization in Digital Libraries – An Extended View', in *In : Proceedings of ICADL 2003*, 1-16.
- Nichols, D. M., Pemberton, D., Dalhoumi, S., Larouk, O., Belisle, C. and Twidale, M. B. (2000) 'DEBORA: Developing an Interface to Support Collaboration in a Digital Library', in J.Borbinha and T.Baker, eds., *ECDL*, Springer Berlin / Heidelberg, 239-248.
- Nielsen, J. (1993) *Usability engineering*, Boston : AP Professional.
- Nielsen, J. (2000) 'Why you only need to test with 5 user', [online], available: <http://www.useit.com/alertbox/20000319.html> [accessed 5 March 2010].
- Nielsen, J. (2003, June 30). 'Information Foraging: Why Google Makes People Leave Your Site Faster', [online], available: <http://www.useit.com/alertbox/20030630.html> [ accessed 6 January 2012].
- Nielsen, J. and Loranger, H. (2006) *Prioritizing Web Usability*, Berkeley, CA: New Riders Press.
- Norberg, L. R., Vassiliadis, K., Ferguson, J. and Smith, N. (2005) 'Sustainable design for multiple audiences: The usability study and iterative redesign of the Documenting the American South digital library', *OCLC Systems & Services*, **21**(4), 285 - 299.



- O'Day, V. L. and Jeffries, R. (1993) 'Information artisans: patterns of result sharing by information searchers', in *Proceedings of the conference on Organizational computing systems*, Milpitas, California, United States, ACM New York, NY, USA, 98-107.
- Paepcke, A. (1996) 'Digital Libraries: Searching Is Not Enough : What we learned on-site', [online], available: <http://www.dlib.org/dlib/may96/stanford/05paepcke.html> [accessed 8 October 2010].
- Papatheodorou, C., Kapidakis, S., Sfakakis, M. and Vassiliou, A. (2003) 'Mining user communities in digital libraries', *Information Technology and Libraries*, **22**, 152-157.
- Pazzani, M. J. and Billsus, D. (2007) 'Content-Based Recommendation Systems' in *The Adaptive Web*, Springer Berlin / Heidelberg, 325-341.
- Pirolli, P. (2003) 'Exploring and Finding Information' in Carroll, J. M., ed. *HCI Models, Theories, and Frameworks: Toward a Multidisciplinary Science (Interactive Technologies)*, Morgan Kaufmann, 157-191.
- Pirolli, P. and Card, S. K. (1995) 'Information foraging in information access environments', in *Proceedings of the SIGCHI conference on Human factors in computing systems*, Denver, Colorado, United States, 51-58.
- Pirolli, P. and Card, S. K. (1999) 'Information foraging. Psychological Review', *Psychological Review*, **106**(4), 643-675.
- Pirolli, P., Card, S. K. and Wege, M. M. V. D. (2001) 'Visual information foraging in a focus + context visualization', in *Proceedings of the SIGCHI conference on Human factors in computing systems*, Seattle, Washington, United States, 506-513.
- Pomerantz, J. (2006) 'Collaboration as the Norm in Reference Work', *Reference & User Services Quarterly*, **46**(1), 45-55.
- Puspitasari, F., Lim, E.-P., Goh, D. H.-L., Chang, C.-H., Sun, J. Z., Aixin, Theng, Y.-L., Chatterjea, K. and Li, Y. (2007) 'Social Navigation in Digital Libraries by Bookmarking' in Goh, D., Cao, T., Sølvsberg, I. and Rasmussen, E., eds., *Asian Digital Libraries. Looking Back 10 Years and Forging New Frontiers*, Springer Berlin / Heidelberg: 297-306.
- Qiu, L. (1993) 'Markov models of search state patterns in a hypertext information retrieval system.', *Journal of the American Society for Information Science*, **44**(7), 413-427.

- Roda, C., Borel, A. M., Gentchev, E. and Thomas, J. (2005) 'Digital image library development in academic environment: designing and testing usability', *OCLC Systems & Services*, **21**(4), 264-284.
- Rosenfeld, P. M. L. and Rosenfeld, L. (2007) *Information architecture for the World Wide Web*, 3rd ed., Sebastopol, CA : O'Reilly.
- Rubin, J. (1994) *Handbook of usability testing : how to plan, design, and conduct effective tests*, New York : Wiley.
- Saracevic, T. (2000) 'Digital Library Evaluation: Toward an Evolution of Concepts', *Library Trends*, **49**(3), 350-369.
- Saracevic, T. (2004) 'Evaluation of digital libraries: An overview', [online], available: [http://comminfo.rutgers.edu/~tefko/DL\\_evaluation\\_Delos.pdf](http://comminfo.rutgers.edu/~tefko/DL_evaluation_Delos.pdf) [accessed 2 November 2010].
- Saracevic, T. and Covi, L. (2000) 'Challenges for digital library evaluation', *In Proceedings ASIS*, **37**, 341-350.
- Sastry, H. G. and Reddy, L. C. (2010) 'Significance of Web 2.0 in Digital Libraries', *International Journal on Computer Science and Engineering*, **2**(6), 2208-2211.
- Schafer, J., Konstan, J. and Riedl, J. (2006) 'Recommender Systems for the Web' in *Visualizing the Semantic Web*, 102-123.
- Schafer, J. B., Frankowski, D., Herlocker, J. and Sen, S. (2007) 'Collaborative filtering recommender systems' in Brusilovsky, P., Kobsa, A. and Nejdl, W., eds., *The adaptive web*, Springer-Verlag, 291-324.
- Schultze, S. J. (2002) 'A collaborative foraging approach to web browsing enrichment', in *Proceeding CHI '02 CHI '02 extended abstracts on Human factors in computing system*, Minneapolis, Minnesota, USA, 860-861.
- Shackel, B. (1991) 'Usability-context, framework, definition, design and evaluation' in Shackel, B. and Richardson, S. J., eds., *Human Factors for Informatics Usability*, Cambridge University Press, 21-37.
- Shah, C. (2008) 'Toward Collaborative Information Seeking (CIS)', in *JCDLWorkshop on Collaborative Information Retrieval*, Pittsburgh, Pennsylvania, USA.
- Sharp, H., Rogers, Y. and Preece, J. (2007) *Interaction design : beyond human-computer interaction*, 2nd ed. ed., Chichester ; Hoboken, NJ : Wiley.

- Shen, R., Vemuri, N. S., Fan, W., Torres, R. d. S. and Fox, E. A. (2006) 'Exploring digital libraries: integrating browsing, searching, and visualization', in *JCDL '06. Proceedings of the 6th ACM/IEEE-CS Joint Conference*, 1-10.
- Smeaton, A. F. and Callan, J. (2005) 'Personalisation and recommender systems in digital libraries', *International Journal on Digital Libraries*, **5**(4), 299–308.
- Smith, A. G. (2000) 'Search features of digital libraries', *Information Research* [online], available: <http://informationr.net/ir/5-3/paper73.html> [accessed 8 February 2011].
- Srivastava, J., Cooley, R., Deshpande, M. and Tan, P.-N. (2000) 'Web usage mining: discovery and applications of usage patterns from Web data', *ACM SIGKDD Explorations Newsletter* **1**(2), 12-23.
- Su, L. T. (1992) 'Evaluation measures for interactive information retrieval', *Information Processing & Management*, **28**(4), 503-516.
- Sullivan, M. and Ochoa, M. N. (2009) 'Digital library of the Caribbean: a user-centric model for technology development in collaborative digitization projects', *OCLC Systems & Services*, **25**(4), 249-262.
- Surowiecki, J. (2004) *The Wisdom of Crowds: Why the Many are Smarter Than the Few and How Collective Wisdom Shapes Business, Economies, Societies and Nations*, Little, Brown & Company.
- Terveen, L. and Hill, W. (2001) 'Beyond recommender systems: Helping people help each other', in J.Carroll, ed. *HCI in the New Millennium*, Addison Wesley.
- Theng, Y. L., Duncker, E., Mohd-Nasir, N., Buchanan, G. and Thimbleby, H. (1999) 'Design Guidelines and User-Centred Digital Libraries' in Abiteboul, S. and Vercoustre, A.-M., eds., *Research and Advanced Technology for Digital Libraries*, Springer Berlin / Heidelberg, 167-183.
- Theobald, M. and Klas, C.-P. (2004) 'BINGO! and Daffodil: Personalized exploration of digital libraries and web sources', in *In 7th International Conference on Computer-Assisted Information Retrieval (RIA0 2004)*.
- Thong, J. Y. L., Hong, W. and Tam, K.-Y. (2002) 'Understanding user acceptance of digital libraries: what are the roles of interface characteristics, organizational context, and individual differences?', *International Journal of Human-Computer Studies*, **57**(3), 215-242.
- Thong, J. Y. L., Hong, W. and Tam, K. Y. (2004) 'What leads to user acceptance of digital libraries?', *Communications of the ACM archive*, **47**(11), 78-83.

- Tidwell, J. (2005) *Designing Interfaces: Patterns for Effective Interaction Design*, O'Reilly Media.
- Toms, E. G., O'Brien, H., Mackenzie, T., Jordan, C., Freund, L., Toze, S., Dawe, E. and MacNutt, A. (2008) 'Task Effects on Interactive Search: The Query Factor' in Fuhr, N., Kamps, J., Lalmas, M. and Trotman, A., eds., *Focused Access to XML Documents*, Springer Berlin / Heidelberg, 359-372.
- Torres, R., McNee, S. M., Abel, M., Konstan, J. A. and Riedl, J. (2004) 'Enhancing digital libraries with TechLens', in *Digital Libraries, 2004. Proceedings of the 2004 Joint ACM/IEEE Conference*, 228-236.
- Tsakonas, G., Kapidakis, S. and Papatheodorou, C. (2004) 'Evaluation of user interaction in digital libraries', in *Notes of the DELOS WP7 Workshop on the Evaluation of Digital Libraries*, Padua, Italy.
- Twidale, M. B., Nichols, D. M. and Paice, C. D. (1997) 'Browsing is a collaborative process', *Information Processing & Management*, **33**(6), 761-783.
- Vakkari, P. (2000) 'Relevance and contributing information types of searched documents in task performance', in *Proceedings of the 23rd annual international ACM SIGIR conference on Research and development in information retrieval*, Athens, Greece, ACM, 2-9.
- 'Victorian Times', [online], available: <http://victoria.cdli.strath.ac.uk/about.php> [accessed 4 March 2011].
- Weibel, S. (1997) 'The Dublin Core: A Simple Content Description Model for Electronic Resources.', *Bulletin of the American Society for Information Science and Technology*, **24**(1), 9-11.
- Wexelblat, A. and Maes, P. (1999) 'Footprints: history-rich tools for information foraging', in *ACM Conference on Human-Computer Interaction (CHI'99)*, Pittsburgh, PA.
- Wildemuth, B. M. (2004) 'The effects of domain knowledge on search tactic formulation', *Journal of the American Society for Information Science and Technology*, **55**(3), 246-258.
- Witten, I. H. (2000) 'Browsing around a Digital Library: Today and Tomorrow', in Giancarlo, R. and Sankoff, D., eds., *Combinatorial Pattern Matching 11th Annual Symposium, CPM 2000*, Springer Berlin / Heidelberg, 12-26.
- Wodtke, C. and Govella, A. (2009) *Information Architecture: Blueprints for the Web (Voices That Matter)*, 2<sup>nd</sup> ed., New Riders.

- Wolfe, J. (2008) 'Annotations and the collaborative digital library: Effects of an aligned annotation interface on student argumentation and reading strategies', *International Journal of Computer-Supported Collaborative Learning*, **3**(2), 141-164.
- Woodruff, A., Rosenholtz, R., Morrison, J. B., Faulring, A. and Pirolli, P. (2002) 'A comparison of the use of text summaries, plain thumbnails, and enhanced thumbnails for Web search tasks', *Journal of the American Society for Information Science and Technology*, **53**(2), 172-185.
- Yang, Y. and Li, J. Z. (2005) 'Interest-based recommendation in digital library', *Journal of Computer Science*, **1**(1), 40-46.
- Zhang, X., Li, Y., Liu, J. and Zhang, Y. (2008) 'Effects of interaction design in digital libraries on user interactions', *Journal of Documentation*, **64**(3), 438 - 463.
- Zhang, X., Liu, J., Li, Y. and Zhang, Y. (2009) 'How usable are operational digital libraries: a usability evaluation of system interactions', in *Proceedings of the 1st ACM SIGCHI symposium on Engineering interactive computing systems*, Pittsburgh, PA, USA, 177-186.
- Zhu, W., Vu, K.-P. L. and Proctor, R. W. (2005) 'Evaluating web usability' in Vu, K.-P. L. and Proctor, R. W., eds., *The Handbook of Human Factors in Web Design (Human Factors and Ergonomics)*, Mahwah, NJ: Lawrence Erlbaum Associates, 321-337.

# Appendix A

## Materials for the usability and experimental tests

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A.1 Consent Form

A.2 Greeting the participant

A.3 Questionnaire for the usability test 1 described in Chapter 4

A.4 Questionnaire for the usability test 2 described in Chapter 4

A.5 Questionnaire for the usability test 1 described in Chapter 5

A.6 Questionnaire for the usability test 2 described in Chapter 5

A.7 Questionnaire for the usability test 3 described in Chapter 5

A.8 Questionnaire for the experimental test described in Chapter 6

A.9 Task Answer Sheet

A.10 Receipt

## **Appendix A.1 Consent form**

Dear Participants,

Thank you very much for agreeing to participate in our usability test process. Our aim is to study the usefulness and usability of a new user interface to the Victorian Times Digital library.

Please read the declaration of participation and sign this consent form that you are agreeing to allow us to use the information gathered from this interview to evaluate the usability of our prototype. The details of the declaration of participant as following.

I understand that:

1. No personal judgements will be made on data collected.
2. I can terminate my participation at any time without giving a reason and without any of my rights being affected.
3. I am under no obligation to respond to all aspects of the procedure: for example, I can refrain from answering any survey question(s) about which I feel uncomfortable.
4. All information I give will be treated with the utmost confidentiality and their anonymity will be respected at all times.
5. Data collected during the study will be statistically analysed and presented in various forms, including quotations.
6. The data may be published in a Thesis, research papers or presentation.
7. The data will be stored both on paper and electronically and I give permission for the investigator to maintain records of the study should a follow-up to the study be conducted in the future, or a further study be undertaken.
8. Ethical consent has been obtained.

All of your personal data that we collect will be entirely confidential and any information that you provide during this process will be used for research purposes, viewed only by the experimenter, and shared only as part of group results. You may withdraw your consent at any time.

Please feel free to ask any questions, or contact us anytime if you desire more information. Thank you once again for your time and efforts.

Name(print): \_\_\_\_\_

Signature: \_\_\_\_\_

Date : \_\_\_\_\_



## **Appendix A.2**

### **Greeting the participant**

## Greeting the participant

When the participant arrives, you the facilitator should:

- Bring the participant into the testing room using computer in the researching room.
- Introduce yourself

“Thanks again for coming today and agreeing to participate in our usability test today. My name is Suthanya Doung-in,. I am here to do research about designing user interface on a digital library. During the rest of the session, I’ll be working from a script to ensure that my instructions for everyone who participates in this study are the same.

- Explain the purpose of this testing:

“Our objective today is to observe you using two user interfaces of Victorian Times Digital library designed for support users to find information.”

- Describe the open-ended nature of the evaluation

“Please know that we’re not testing you, and there is no such thing as a wrong answer. You doing this helps us understand what works or doesn’t work about the site.”

During the session, we’ll have you do some specific tasks, to learn how these interface features work for people like you, please try to do whatever you would normally do, and there are no right or wrong ways to perform them. If you are unable to complete one of the tasks, it is fine to let me know.

- Encourage talking—thinking out loud:  
“What’s really helpful to us if you share your thoughts with me as you are completing the tasks, so please try to think out loud as much as you can. Let me know what you are thinking as you make decisions about how to conduct your search, why you make those decisions. For example, if you’re confuse, tell me what is confusing. The more you tell us, the more data we’ll have to help us improve user interface Victorian time’s digital library. Feel free to offer criticism, and don’t worry about hurting my feelings. ”
- Mention that the usability test will be recorded and have participant sign consent form.

“While you are working, I’ll be taking notes. Please sign this consent form, which indicated that you know this session will be recorded. The whole session will take total least than an hour. If you want to stop for a break any time, just say so.”

Here’s how the session will work:

- On the table in front of you, face down, Questionnaire and task lists. There have two tasks that I want you to do.
  - You do the task one at a time, first on one user interface and then the second. Please don't look ahead at the other tasks and don't skip any tasks.
  - I'll direct you from the same room about what to do and when to do it.
  - When directed, picked up the appropriate task sheet and read the task aloud. When you are ready to start, say "I'm ready to start."
  - Start working on the task only once I have said, "Please begin." I'll start recording time as soon as you touch the keyboard or the mouse—so don't touch either one until you're ready to start the task.
  - If you found the answer, please write down on task answer note, including the details of items you found such as title etc.
  - When you have completed the task, say aloud, "I'm done." Place your hands in your lap to signal that you're finished and waiting for the next task.
  - After each task, you'll answer a question about level of difficult for each task when you complete the task on that user interface.
  - At the end of the session, you'll answer one more questionnaire.
- Ask participant whether she/he has any questions or comment.  
"Do you have any questions before we begin? [Answer any questions.]"

## **Appendix A.3**

### **Questionnaire for the usability test 1 described in Chapter 4**

## Usability Test

### Part A: Pretest Questionnaire

Date: \_\_\_\_\_

Thank you very much for participating in this experiment. First, we would like to gather a bit of background information about you, the information you provide here will be held confidential and will be used strictly for research purposes.

Gender: <input type="checkbox"/> Male <input type="checkbox"/> Female
Age: <input type="checkbox"/> less than 20 <input type="checkbox"/> 20-30 <input type="checkbox"/> 31-40 <input type="checkbox"/> 41-50 <input type="checkbox"/> 51-60 or over
What is your current status: <input type="checkbox"/> Undergraduate <input type="checkbox"/> Master's Student <input type="checkbox"/> Doctoral Student <input type="checkbox"/> Staff <input type="checkbox"/> Other _____
Major/Department:
How many months/years have you been at Strathclyde University: _____ months/years
If you are from foreign country, how long have you been in the UK? _____ months/years
First Language:
Have you used Digital Library <input type="checkbox"/> yes <input type="checkbox"/> No If[yes] <ul style="list-style-type: none"><li>• How many Digital Library are you used? (Mark all that apply) <input type="checkbox"/> ACM <input type="checkbox"/> ScienceDirect <input type="checkbox"/> SpringerLink <input type="checkbox"/> Emerald <input type="checkbox"/> Other(specify) _____</li><li>• In the last six months, approximately how frequently have you visited a digital library Website site <input type="checkbox"/> Daily <input type="checkbox"/> Weekly <input type="checkbox"/> Monthly <input type="checkbox"/> Less than once a month <input type="checkbox"/> Never</li></ul>
What browser do you usually use? (Mark all that apply) <input type="checkbox"/> Internet Explorer <input type="checkbox"/> Netscape <input type="checkbox"/> Opera <input type="checkbox"/> Mozilla Firefox <input type="checkbox"/> Other _____

## Part B. Task1: Usability Testing Questions

Please complete the following tasks and circle the level of difficulty in completing the task. As you work, we encourage you to share your thoughts on the site and let us know if you have any questions or encounter any problems. There is no time constraint so proceed with the questions at your own pace.

1. From the main page of Interface Victorian Times digital library, click on simple search, then enter search key in the top right hand corner in order to

- a) Find images of John Snow.

Task difficulty: 

Easy	Med	Hard	Can't complete task
------	-----	------	---------------------

- b) Find the document entitled "The conditions required for a healthy house"

Task difficulty: 

Easy	Med	Hard	Can't complete task
------	-----	------	---------------------

- c) Find the more documents written by the same author of (b)

Task difficulty: 

Easy	Med	Hard	Can't complete task
------	-----	------	---------------------

- d) Find the document about "Education rate in Great Britain during Victorian times era."

Task difficulty: 

Easy	Med	Hard	Can't complete task
------	-----	------	---------------------

- e) Find documents about Health from 1838 to 1950.

Task difficulty: 

Easy	Med	Hard	Can't complete task
------	-----	------	---------------------

- f) Find documents about "gas company"

Task difficulty: 

Easy	Med	Hard	Can't complete task
------	-----	------	---------------------

### Part C. Post-Test Questionnaire

Thanks again for participating in this experiment. This questionnaire gives you an opportunity to tell us your reactions to the system you used. Please circle a number on the scale to indicate your reactions. Please write comments to elaborate on your answers. I will go over your answers with you to make sure that I understand all of your responses. Thank you.

#### Specific features:

2. Please rate usefulness of features provided in the Interface (Indicating 1 for the most useful and 5 for the least useful)

	Not useful		Very Useful		Did not use	
Browsing& displaying item format and details	1	2	3	4	5	<input type="checkbox"/>
search documents & displaying the result search format including detailed	1	2	3	4	5	<input type="checkbox"/>
Recently Viewed Items	1	2	3	4	5	<input type="checkbox"/>
Wish lists	1	2	3	4	5	<input type="checkbox"/>
Tag cloud	1	2	3	4	5	<input type="checkbox"/>
Title Alphabetical Listing	1	2	3	4	5	<input type="checkbox"/>
LCSH Terms Alphabetical Listing	1	2	3	4	5	<input type="checkbox"/>
Five Top View Items	1	2	3	4	5	<input type="checkbox"/>
Zooming &Preview features	1	2	3	4	5	<input type="checkbox"/>

	Not useful		Very useful	didn't use		
Displaying slideshow	1	2	3	4	5	<input type="checkbox"/>
Timeline	1	2	3	4	5	<input type="checkbox"/>
Display in PDF file	1	2	3	4	5	<input type="checkbox"/>
Display in each page of a document	1	2	3	4	5	<input type="checkbox"/>
All items in this collection menu	1	2	3	4	5	<input type="checkbox"/>

### Overall of system

3. Please rate the ease of use of the Interface Victorian Times digital library

Difficult					Easy
1	2	3	4	5	

4. What do you think about the organization of information on the site?

Unclear					Clear
1	2	3	4	5	

5. What do you think about the terminology used in the site? Are categories clearly labeled?

Very Disorganized					Well organized
1	2	3	4	5	

6. Is the site visually attractive?

Unattractive					Attractive
1	2	3	4	5	



7. Your overall reaction to the system:

Unsatisfied Satisfied

1	2	3	4	5
---	---	---	---	---

8. Do you feel lost while using the site?

Yes

No

9. Is the site easy to navigate?

Yes

No

#### **Part D. Interview script**

10. What is the best feature(s) of the site?

11. What is the worst feature(s) of the site?

12. What features from other digital libraries would you like to see included on New User Interface Victorian Times Digital Library?

## **Appendix A.4**

### **Questionnaire for the usability test 2 described in Chapter 4**

## Usability Test

### Part A: Pretest Questionnaire

Date: \_\_\_\_\_

Thank you very much for participating in this experiment. First, we would like to gather a bit of background information about you, the information you provide here will be held confidential and will be used strictly for research purposes.

Gender: <input type="checkbox"/> Male <input type="checkbox"/> Female
Age: <input type="checkbox"/> less than 20 <input type="checkbox"/> 20-30 <input type="checkbox"/> 31-40 <input type="checkbox"/> 41-50 <input type="checkbox"/> 51-60 or over
What is your current status: <input type="checkbox"/> Undergraduate <input type="checkbox"/> Master's Student <input type="checkbox"/> Doctoral Student <input type="checkbox"/> Staff <input type="checkbox"/> Other _____
Major/Department:
How many months/years have you been at Walailak University: _____ months/years
First Language:
Have you used Digital Library <input type="checkbox"/> yes <input type="checkbox"/> No If[yes] <ul style="list-style-type: none"><li>• How many Digital Library are you used? (Mark all that apply) <input type="checkbox"/> ACM <input type="checkbox"/> ScienceDirect <input type="checkbox"/> SpringerLink <input type="checkbox"/> Emerald <input type="checkbox"/> Other(specify) _____</li><li>• In the last six months, approximately how frequently have you visited a digital library Website site <input type="checkbox"/> Daily <input type="checkbox"/> Weekly <input type="checkbox"/> Monthly <input type="checkbox"/> Less than once a month <input type="checkbox"/> Never</li></ul>
What browser do you usually use? (Mark all that apply) <input type="checkbox"/> Internet Explorer <input type="checkbox"/> Netscape <input type="checkbox"/> Opera <input type="checkbox"/> Mozilla Firefox <input type="checkbox"/> Other _____

Internet usage survey :

For research	Daily	Weekly	Monthly	Never
Bulletin Board Posting/ Web board	Daily	Weekly	Monthly	Never
Chat room/Msn	Daily	Weekly	Monthly	Never
Web social Network (e.g. Hi5, face book)	Daily	Weekly	Monthly	Never
Other(specify)_____	Daily	Weekly	Monthly	Never

Do you have web social network?

No       Yes, please specify \_\_\_\_\_

Other information:

Email : \_\_\_\_\_

Mobile Phone : \_\_\_\_\_

## Part B. Task1 Usability Testing Questions (Usability task lists on Interface A)

Please complete the following tasks and circle the level of difficulty in completing the task. As you work, we encourage you to share your thoughts on the site and let us know if you have any questions or encounter any problems. There is no time constraint so proceed with the questions as your own pace.

### 1. Using search menu of Interface A

f) Find images of **Queen Victoria**.

Task difficulty:

Easy	Med	Hard	Can't complete task
------	-----	------	---------------------

g) Find the document entitled "**Lock hospitals and lock wards in general hospitals**"

Task difficulty:

Easy	Med	Hard	Can't complete task
------	-----	------	---------------------

- After you find the result, click at the title and look for more details, try to click at **Display slide show, Display each page, PDF files**, and tell me what are you thinking when you click at these functions.
- From this page, if you would like to find the more documents written by the **same author of (b)** show me how to this.

2. Using Title Alphabetical Listing menu, find the document entitled "**Lock hospitals and lock wards in general hospitals**"

Easy	Med	Hard	Can't complete task
------	-----	------	---------------------

Task difficulty:

3. Using browsing function,

a. Return to the main page, you would like to browse documents about **cotton textile industry**. Show me how to do this. Does Victorian Time Digital library have any documents about **cotton textile industry**? If so, how many of the documents?

Task difficulty:

Easy	Med	Hard	Can't complete task
------	-----	------	---------------------

- b. Using LCSH **Terms Alphabetical**, you would like to find documents about Gas industry. Show me how to do this. How many of documents?

Task difficulty:

Easy	Med	Hard	Can't complete task
------	-----	------	---------------------

4. **Using Search by Timeline menu**, Find documents about **Railway from 1839 to 1854**.

Task difficulty:

Easy	Med	Hard	Can't complete task
------	-----	------	---------------------

5. Please login by enter username and password given by me, and then choose one item from **Recently Viewed Items menu**. You would like to keep this item to use in the future by using **add to wish list** which is on the page. Show me how to do this?

Task difficulty:

Easy	Med	Hard	Can't complete task
------	-----	------	---------------------

## Part B. Task2: Usability Testing Questions (Usability task lists on interface B)

Please complete the following tasks and circle the level of difficulty in completing the task. As you work, we encourage you to share your thoughts on the site and let us know if you have any questions or encounter any problems. There is no time constraint so proceed with the questions as your own pace.

### 1. Using search menu of Interface B

- a) Find only images about Leicester **Town Hall**.

Task difficulty:

Easy	Med	Hard	Can't complete task
------	-----	------	---------------------

- b) Find the document entitled "**The Lace trade and the Factory Act**" (action)

Task difficulty:

Easy	Med	Hard	Can't complete task
------	-----	------	---------------------

- After you find the result, choose one of the result set, then click at title and look for more details on page, try to click at **Display slide show, Display each page, PDF files** and tell me what are you thinking when you click at these functions.
- From this page, you would like to find more documents which are categorized in the **same LCSH terms** of this document. show me how to this.

2. **Return to the main page**, please look at interesting topic section, you would like to find people who are interested in **factories**. Please show me how to do.

Task difficulty:

Easy	Med	Hard	Can't complete task
------	-----	------	---------------------

3. **Using searching people menu**, you would like to find people who are interested in **factories**. Please show me how to do.

Task difficulty:

Easy	Med	Hard	Can't complete task
------	-----	------	---------------------

- After you get the results, choose one person and try to click at **My Wish list, My history**, and tell me what are you thinking when you click at these functions.

4. Can you show me how you find the most popular search terms?

Easy	Med	Hard	Can't complete task
------	-----	------	---------------------

Task difficulty:

- After you found it, try to click at the search term, and then look at the details on page. Did you found people who are interested in this search term?

5. Assumption at that time candy is online now, and you would to find out what subjects is candy interested? Show me how to do this.

Task difficulty:

Easy	Med	Hard	Can't complete task
------	-----	------	---------------------

### Comparison between interface A and the interface B

6. Comparing the Interface A and Interface B, which did you find:

- a. Easier to find info: \_\_\_\_\_ Interface A \_\_\_\_\_ Interface B \_\_\_\_\_ Neither
- b. Easier to browse: \_\_\_\_\_ Interface A \_\_\_\_\_ Interface B \_\_\_\_\_ Neither
- c. More attractive features: \_\_\_\_\_ Interface A \_\_\_\_\_ Interface B \_\_\_\_\_ Neither
- d. More useful features: \_\_\_\_\_ Interface A \_\_\_\_\_ Interface B \_\_\_\_\_ Neither
- e. Better organized: \_\_\_\_\_ Interface A \_\_\_\_\_ Interface B \_\_\_\_\_ Neither
- f. Easier to access documents: \_\_\_\_\_ Interface A \_\_\_\_\_ Interface B \_\_\_\_\_ Neither



### Part C. Post-Test Questionnaire

Thanks again for participating in this experiment. This questionnaire gives you an opportunity to tell us your reactions to the system you used. Please circle a number on the scale to indicate your reactions. Please write comments to elaborate on your answers. I will go over your answers with you to make sure that I understand all of your responses. Thank you.

#### Specific features:

7. Please rate usefulness of features provided in **the Interface A** and rank the following features that would be the ten most useful to you in the new user interface. (Indicating 1 for the most useful and 10 for the least useful)

	Not useful					Very Useful
_____ Browsing& displaying item format and details	1	2	3	4	5	
_____ searching for documents (By using search menu)& displaying the result search format including detailed	1	2	3	4	5	
_____ Recently Viewed Items	1	2	3	4	5	
_____ Wish lists	1	2	3	4	5	
_____ Tag cloud	1	2	3	4	5	
_____ Title Alphabetical Listing menu	1	2	3	4	5	
_____ LCSH Terms Alphabetical Listing menu	1	2	3	4	5	
_____ Five Top View Items	1	2	3	4	5	

Not useful

Very useful

\_\_\_\_ Zooming image feature

1	2	3	4	5
---	---	---	---	---

\_\_\_\_ Displaying slideshow

1	2	3	4	5
---	---	---	---	---

\_\_\_\_ Timeline

1	2	3	4	5
---	---	---	---	---

\_\_\_\_ Display in PDF File

1	2	3	4	5
---	---	---	---	---

\_\_\_\_ Display in each page of a document

1	2	3	4	5
---	---	---	---	---

\_\_\_\_ All items in this collection menu

1	2	3	4	5
---	---	---	---	---

**Specific features:**

8. Please rate usefulness of features provided in **the Interface B** and rank the following features that would be the most useful to you in the new user interface.(Indicating 1 for the most useful and 8 for the least useful)

---

	Not useful				Very Useful
____Browsing& displaying item format and details	1	2	3	4	5
____searching for documents & displaying the result search format including details	1	2	3	4	5
____ Searching for people & displaying the result search including details	1	2	3	4	5
____ Shared wish lists	1	2	3	4	5
____ Commenting	1	2	3	4	5
____ Interesting topics(On the main page)	1	2	3	4	5
____ Shared history	1	2	3	4	5
____display interesting topics(On the main page)	1	2	3	4	5

---

## Overall of system

9. Please rate the ease of use of **the Interface B**

Difficult								Easy
1	2	3	4	5				

10. What do you think about the organization of information on the site?

Unclear								Clear
1	2	3	4	5				

11. What do you think about the terminology used in the site? Are categories clearly labeled?

Very Disorganized								Well organized
1	2	3	4	5				

12. Is the site visually attractive?

Unattractive								Attractive
1	2	3	4	5				

13. Your overall reaction to the system:

Unsatisfied								Satisfied
1	2	3	4	5				

14. Do you feel lost while using the site?

Yes                       No                       Some time

15. Is the site easy to navigate?

Yes                       No

## Part D. Interview script

16. What is the best feature(s) of the site?

17. What is the worst feature(s) of the site?

18. What features from other digital libraries would you like to see included on New User Interface Victorian Times Digital Library?

## **Appendix A.5**

### **Questionnaire for the usability test 1 described in Chapter 5**

## Usability Test

### Part A: Pretest Questionnaire

Date: \_\_\_\_\_

Thank you very much for participating in this experiment. First, we would like to gather a bit of background information about you, the information you provide here will be held confidential and will be used strictly for research purposes.

Gender: <input type="checkbox"/> Male <input type="checkbox"/> Female
Age: <input type="checkbox"/> less than 20 <input type="checkbox"/> 20-30 <input type="checkbox"/> 31-40 <input type="checkbox"/> 41-50 <input type="checkbox"/> 51-60 or over
What is your current status: <input type="checkbox"/> Undergraduate <input type="checkbox"/> Master's Student <input type="checkbox"/> Doctoral Student <input type="checkbox"/> Staff <input type="checkbox"/> Other _____
Major/Department:
How many months/years have you been at Strathclyde University: _____ months/years
First Language:
Have you used Digital Library <input type="checkbox"/> yes <input type="checkbox"/> No If[yes] <ul style="list-style-type: none"><li>• How many Digital Library are you used? (Mark all that apply) <input type="checkbox"/> ACM <input type="checkbox"/> ScienceDirect <input type="checkbox"/> SpringerLink <input type="checkbox"/> Emerald <input type="checkbox"/> Other(specify) _____</li><li>• In the last six months, approximately how frequently have you visited a digital library Website site <input type="checkbox"/> Daily <input type="checkbox"/> Weekly <input type="checkbox"/> Monthly <input type="checkbox"/> Less than once a month <input type="checkbox"/> Never</li></ul>
What browser do you usually use? (Mark all that apply) <input type="checkbox"/> Internet Explorer <input type="checkbox"/> Netscape <input type="checkbox"/> Opera <input type="checkbox"/> Mozilla Firefox <input type="checkbox"/> Other _____



**Part B: User tasks for Victorian Times digital library usability study**

Please complete the following tasks and circle the level of difficulty in completing the task. As you work, we encourage you to share your thoughts on the site and let us know if you have any questions or encounter any problems. There is limited time constraint in **10 minutes** to complete usability task list on each interface.

**Usability task lists on Interface 1**

1. Find an image of “**Queen Victoria**”

Task difficulty: 

Easy	Med	Hard	Can't complete task
------	-----	------	---------------------

2. I would like to know what does the house style look like in the Victorian time era?

Task difficulty: 

Easy	Med	Hard	Can't complete task
------	-----	------	---------------------

Please rate the following by circling a rating from 1 to 5 with 5 as the highest rating.

3. How it is easy to use this interface?	<b>Difficult</b>					<b>Easy</b>
	1	2	3	4	5	

**Please rate this interface**

	-3	-2	-1	0	1	2	3	
Ugly								Beautiful
Low quality								High Quality
Standard								Unique
Slow								fast
Unpleasant								Pleasant
dumb								smart
Casual								Formal
Unreliable								Reliable
Serious								Fun



**Usability task lists on interface 2**

1. **Find** out if the digital library has the document entitled “**The Metropolis Water Supply Bill**”

Task difficulty: 

Easy	Med	Hard	Can't complete task
------	-----	------	---------------------

2. I would like to know are there have any revolutions in Great Britain in Victorian period?

Task difficulty: 

Easy	Med	Hard	Can't complete task
------	-----	------	---------------------

Please rate the following by circling a rating from 1 to 5 with 5 as the highest rating.

3. How it is easy to use this interface?	<b>Difficult</b>					<b>Easy</b>
	1	2	3	4	5	

**Please rate this interface**

	-3	-2	-1	0	1	2	3	
Ugly								Beautiful
Low quality								High Quality
Standard								Unique
Slow								fast
Unpleasant								Pleasant
dumb								smart
Casual								Formal
Unreliable								Reliable
Serious								Fun

**Usability task lists on interface 3**

1. Find out if the digital library has the document entitled “**Lock hospitals and lock wards in general hospitals**”

Task difficulty: 

Easy	Med	Hard	Can't complete task
------	-----	------	---------------------

2. I would like to know about what water transportation people use in the Victorian time period? Moreover, you would like to see what the transportation looks like.

Task difficulty: 

Easy	Med	Hard	Can't complete task
------	-----	------	---------------------

Please rate the following by circling a rating from 1 to 5 with 5 as the highest rating.

3. How it is easy to use this interface?	<b>Difficult</b>					<b>Easy</b>
	1	2	3	4	5	

**Please rate this interface**

	-3	-2	-1	0	1	2	3	
Ugly								Beautiful
Low quality								High Quality
Standard								Unique
Unworthy								Integrity
Slow								fast
Unpleasant								Pleasant
dumb								smart
Casual								Formal
Unreliable								Reliable
Serious								Fun

**Usability task lists on interface 4**

1. Find only images about “**Leicester Town Hall**”.

Task difficulty: 

Easy	Med	Hard	Can't complete task
------	-----	------	---------------------

2. you would like to know about accidents and injures which have occurred on all the railway in Great Britain. Moreover, you like to find out the causes of accidents.

Task difficulty: 

Easy	Med	Hard	Can't complete task
------	-----	------	---------------------

Please rate the following by circling a rating from 1 to 5 with 5 as the highest rating.

3. How it is easy to this interface?		<b>Difficult</b>						<b>Easy</b>
		1	2	3	4	5		

**Please rate this interface**

	-3	-2	-1	0	1	2	3	
Ugly								Beautiful
Low quality								High Quality
Standard								Unique
Unworthy								Integrity
Slow								fast
Unpleasant								Pleasant
dumb								smart
Casual								Formal
Unreliable								Reliable
Serious								Fun

**Part C: Pest-test questionnaire**

**Comparison between interface 1, 2, 3, and 4**

1. Please fill in the following table regarding the 4 interfaces. For each characteristic, indicate 1 for the best and 4 for the worst.

	<b>Interface</b>			
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
Easier to find information				
More attractive				
More useful				
overall reaction to the system				

Explain why you ranked the features as indicated above.

2. Do you feel lost while using the interface 1, 2, 3, and 4?  
 Yes                       No                       Sometimes

If yes or sometimes, which one you feel lost

---

---

---

---

---

3. There are four interfaces. Which of these you prefer to use? Why do you prefer this one?

---

---

---

---

---

---

---

---

*Thanks again for participating in this study.*



## **Appendix A.6**

### **Questionnaire for the usability test 2 described in Chapter 5**

## Part B: User tasks for Victorian Times digital library usability study

Please complete the following tasks and circle the level of difficulty in completing the task. As you work, we encourage you to share your thoughts on the site and let us know if you have any questions or encounter any problems. There is limited time constraint in 10 minutes to complete usability task list on each interface.

### Usability task lists on Interface 1

#### Task A

1. You are investigating your family tree and have learnt that your great-grandmother was a servant in Victorian Times. You are interested to learn more information about what kinds of jobs women performed in Victorian Times. What jobs were popular in Victorian Times for women, what kind of jobs might you have done if you were a women in Victorian Times?

Task difficulty:

Easy	Med	Hard	Can't complete task
------	-----	------	---------------------

2. **Using this interface**, Please tick those that apply

	1	2	3	4	5	
Stressful	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	relaxing
Frustrating	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Satisfying
Useless	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Useful
Difficult	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Easy
Standard	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Novel
Slow	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Fast
Complex	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Simple
Ineffective	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Effective

## Usability task lists on interface 2

### **Task B**

1. Imagine you are an architect and work for the “Modern House Company”. John Brandy, your customer, who likes traditional British styles, asked you to design his home similar to the Victorian house. You have no knowledge about this and decide to explore information for the characteristics of houses in the Victorian era with Victorian Times digital library. You are also interested in good pictures of houses in Victorian Times.

Task difficulty:

Easy	Med	Hard	Can't complete task
------	-----	------	---------------------

### 2. **Using this interface**, Please tick those that apply

	1	2	3	4	5	
Stressful	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	relaxing
Frustrating	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Satisfying
Useless	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Useful
Difficult	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Easy
Standard	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Novel
Slow	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Fast
Complex	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Simple
Ineffective	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Effective



## Usability task lists on interface 3

### Task C

1. You are helping your friend's son write a school report on water transportation in Victorian Times. You would like to find different types of transportation and examples of what such transportation looked like.  
You are particularly interested in good pictures of people using water transport in Victorian Times.

Task difficulty:

Easy	Med	Hard	Can't complete task
------	-----	------	---------------------

2. **Using this interface**, Please tick those that apply

	1	2	3	4	5	
Stressful	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	relaxing
Frustrating	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Satisfying
Useless	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Useful
Difficult	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Easy
Standard	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Novel
Slow	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Fast
Complex	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Simple
Ineffective	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Effective

## Usability task lists on interface 4

### Task D

1. Imagine you are study a master's degree in History. Your advisor asks you to prepare a seminar about "the lives of poor children in Victorian times". Based your basic knowledge, you know that very young children were often forced to work very long hours. You decided to help her by finding document about this topic. Your task is to collect information on how the poor children work? How many hours do they work a day, and Where? You may also to put some pictures of them on your presentation.

Task difficulty:

Easy	Med	Hard	Can't complete task
------	-----	------	---------------------

2. **Using this interface**, Please tick those that apply

	1	2	3	4	5	
Stressful	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	relaxing
Frustrating	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Satisfying
Useless	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Useful
Difficult	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Easy
Standard	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Novel
Slow	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Fast
Complex	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Simple
Ineffective	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Effective

### Part C: Post-test questionnaire

#### Comparison between interface 1, 2, 3, and 4

3. Please fill in the following table regarding the 4 interfaces. For each characteristic, rank the interfaces in order of criteria: (1= best, 4 = worst):

	Interface			
	1	2	3	4
Easier to find information				
More attractive				
More useful				

Explain why you ranked the features as indicated above.

1. With four interfaces, how did you feel about each interface you used? Which of these you prefer and why

Interface1

Interface2

Interface3

Interface4

2. Do you feel lost while using the interface1, 2, 3, and 4?  
 Yes                       No                       Sometimes

If yes or sometimes, which one you feel lost

### **Part D: Interview script**

Based on your experience, please provide any additional comments regarding

1. What two things work well while searching the digital library interface?
2. What two things need improvement to help you more easily search the digital libraries web site?
3. What features from other digital libraries would you like to see included on New User Interface Victorian Times Digital Library?

## **Appendix A.7**

### **Questionnaire for the usability test 3 described in Chapter 5**

## Usability Test

### Part A: Pretest Questionnaire

Date: \_\_\_\_\_

Thank you very much for participating in this experiment. First, we would like to gather a bit of background information about you, the information you provide here will be held confidential and will be used strictly for research purposes.

Gender: <input type="checkbox"/> Male <input type="checkbox"/> Female
Age: <input type="checkbox"/> less than 20 <input type="checkbox"/> 20-30 <input type="checkbox"/> 31-40 <input type="checkbox"/> 41-50 <input type="checkbox"/> 51-60 or over
What is your current status: <input type="checkbox"/> Undergraduate <input type="checkbox"/> Master's Student <input type="checkbox"/> Doctoral Student <input type="checkbox"/> Staff <input type="checkbox"/> Other _____
Major/Department:
How many months/years have you been at Strathclyde University: _____ months/years
First Language:
Have you used Digital Library <input type="checkbox"/> yes <input type="checkbox"/> No If[yes] <ul style="list-style-type: none"><li>How many Digital Library are you used? (Mark all that apply) <input type="checkbox"/> ACM <input type="checkbox"/> ScienceDirect <input type="checkbox"/> SpringerLink <input type="checkbox"/> Emerald <input type="checkbox"/> Other(specify) _____</li><li>In the last six months, approximately how frequently have you visited a digital library Website site <input type="checkbox"/> Daily <input type="checkbox"/> Weekly <input type="checkbox"/> Monthly <input type="checkbox"/> Less than once a month <input type="checkbox"/> Never</li></ul>
What browser do you usually use? (Mark all that apply) <input type="checkbox"/> Internet Explorer <input type="checkbox"/> Netscape <input type="checkbox"/> Opera <input type="checkbox"/> Mozilla Firefox <input type="checkbox"/> Other _____

Internet usage survey :

For research	Daily	Weekly	Monthly	Never
Bulletin Board Posting/ Web board	Daily	Weekly	Monthly	Never
Chat room/Msn	Daily	Weekly	Monthly	Never
Web social Network (e.g. Hi5, face book)	Daily	Weekly	Monthly	Never
Other(specify)_____	Daily	Weekly	Monthly	Never

Do you have web social network?

No       Yes, please specify \_\_\_\_\_

How interested in history?

Not at all		Somewhat		Extremely
1	2	3	4	5

How much they know about Victorian period in The UK history?

Not at all    Slightly    Somewhat    Very    Extremely

Is it a topic they are interested in?

[yes]

[No]

## Part A: User tasks for Victorian Times digital library usability study

Please complete the following tasks and circle the level of difficulty in completing the task. As you work, we encourage you to share your thoughts on the site and let us know if you have any questions or encounter any problems. There is **limited time constraint in 20 minutes** to complete usability task list on each interface.

### Usability task lists on interface 1

#### Task A

1. Imagine you are studying a master's degree in History. Your advisor asked you to prepare a seminar about "the lives of poor children in Victorian times". Based your basic knowledge, you know that very young children were often forced to work very long hours. You would like to find documents about this topic.  
Your task is to collect information on how the poor children work? How many hours do they work a day, and Where? You may also to put some pictures of them on your presentation.

Task difficulty:

Easy	Med	Hard	Can't complete task
------	-----	------	---------------------

2. **Using this interface**, Please tick those that apply

	1	2	3	4	5	
Stressful	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	relaxing
Frustrating	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Satisfying
Useless	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Useful
Difficult	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Easy
Standard	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Novel
Slow	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Fast
Complex	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Simple
Ineffective	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Effective



## Usability task lists on interface 2

### Task B

1. You are helping your friend's son write a school report on water transportation in Victorian Times. You would like to find different types of transportation and examples of what such transportation looked like.  
You are particularly interested in good pictures of people using water transport in Victorian Times.

Task difficulty:

Easy	Med	Hard	Can't complete task
------	-----	------	---------------------

2. **Using this interface,** Please tick those that apply

	1	2	3	4	5	
Stressful	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	relaxing
Frustrating	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Satisfying
Useless	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Useful
Difficult	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Easy
Standard	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Novel
Slow	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Fast
Complex	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Simple
Ineffective	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Effective

**Part B: Post-test questionnaire**

**Comparison between interface 1 and 2**

1. Comparing the Interface 1 and Interface 2, which did you find

	<b>Interface</b>			
	<b>1</b>	<b>2</b>	<b>Both</b>	<b>Neither</b>
Easier to find information				
More attractive				
More useful				

Explain why you chose the interface as indicated above.

1. With four interfaces, how did you feel about each interface you used? Which of these you prefer and why

Interface1

Interface2

2. Do you feel lost while using the interface1 and 2?

Yes                       No                       Sometimes

If yes or sometimes, which one you feel lost



## **Appendix A.8**

### **Questionnaire for the experimental test described in Chapter 6**

## Test

### Part A : Pretest Questionnaire

Thank you very much for participating in this experiment. First, we would like to gather a bit of background information about you, the information you provide here will be held confidential and will be used strictly for research purposes.

#### Background information

1. Gender:  Male       Female

2. Age:     less than 20    20-30    31-40    41-50    51-60 or over

3. What is your current status:

Undergraduate       Master's Student       Doctoral Student

Staff       Other\_\_\_\_\_

4. Major/Department:

5. How many months/years have you been at Strathclyde University: \_\_\_\_\_months/years

6. First Language:

#### Digital library experience

7. Have you used digital libraries?

yes       No

If [yes],

ACM       ScienceDirect    Springerlink       Emerald

Other (Specific) \_\_\_\_\_

8. In the last six months, approximately how frequently have you visited a digital library Website site	Never			Monthly			Daily
	1	2	3	4	5	6	7
9. When you find for information in Digital Libraries, you can usually find what I am looking for	Rarely			Some-times			Often
	1	2	3	4	5	6	7
10. How do you rate you level of expertise with finding information in digital libraries	Novice						Expert
	1	2	3	4	5	6	7

**Internet experience**

11. How often do you use computer in .....	Never			Monthly			Daily
a. For research	1	2	3	4	5	6	7
b. Bulletin Board Posting/ Web board	1	2	3	4	5	6	7
c. Chat room/Msn	1	2	3	4	5	6	7
d. Web social Network(e.g. Facebook)	1	2	3	4	5	6	7
e. Other (Please specific)_____	1	2	3	4	5	6	7

12. What browser do you usually use? (Mark all that apply)

- Internet Explorer                       Netscape                       Opera  
 Mozilla Firefox                       Other\_\_\_\_\_

**Historical knowledge background**

13. How interested are you in history?

Not at all			Somewhat			Extremely
1	2	3	4	5	6	7

14. How much do you know about Victorian period in The UK history?

Not at all			Somewhat			Extremely
1	2	3	4	5	6	7

15. Is it a topic you are interested in?

[yes]    [No]

if yes, please specific \_\_\_\_\_

## Part B: User tasks for Victorian Times digital library effective study

Please complete the following tasks and circle the level of difficulty in completing the task. As you work, we encourage you to share your thoughts on the site and let us know if you have any questions or encounter any problems. There is **limited time constraint of 20 minutes for task (1), 10 minutes for task (2) and 5 minutes for task (3)** to complete the task on each interface.

### Task lists on interface A

#### **Task 1** (limited time constraint of **20 minutes** for this task)

Imagine you are studying for a master's degree in History. Your advisor asked you to prepare a seminar about "the lives of poor children in Victorian times". You already know that very young children were often forced to work very long hours. You would like to find documents about this topic.

Your task is to collect information on **how the poor children work?** For example, you might want to learn **how many hours do they work a day, and where?**

#### Pre-search questionnaire

Please indicate how difficult do you think this work task is:

Extremely easy	Easy	Somewhat Easy	Neutral	Somewhat difficult	Difficult	Extremely
1	2	3	4	5	6	7

I am familiar with the topic of this work task.

Totally disagree	Mostly disagree	Somewhat disagree	Neutral	Somewhat agree	Mostly agree	Totally agree
1	2	3	4	5	6	7

#### Post search questionnaire

1. Do you think you had enough time to do the work task?  
Yes \_\_\_\_\_ No \_\_\_\_\_
2. Do you think you got enough information to support your work task?  
Yes \_\_\_\_\_ No \_\_\_\_\_

## Task lists on interface A

**Task 2** (limited time constraint of **10 minutes** for this task)

You are helping your friend's son write a school report on water transportation in Victorian Times. You would like to find **different types of transportation** and examples of what such transportation looked like.

You are particularly interested in **good pictures of people using water transport** in Victorian Times.

### Pre-search questionnaire

Please indicate how difficult do you think this work task is:

Extremely easy	Easy	Somewhat Easy	Neutral	Somewhat difficult	Difficult	Extremely
1	2	3	4	5	6	7

I am familiar with the topic of this work task.

Totally disagree	Mostly disagree	Somewhat disagree	Neutral	Somewhat agree	Mostly agree	Totally agree
1	2	3	4	5	6	7

### Post search questionnaire

1. Do you think you had enough time to do the work task?  
Yes \_\_\_\_\_ No \_\_\_\_\_
2. Do you think you got enough information to support your work task?  
Yes \_\_\_\_\_ No \_\_\_\_\_



## Task lists on interface A

### **Task 3** (limited time constraint of **5 minutes** for this task)

You love history, particular History in the Victorian era. You have heard that stagecoaches were widely used before the introduction of railway transport. You are curious to find images of stagecoaches.

#### **Pre-search questionnaire**

Please indicate how difficult do you think this work task is:

Extremely easy	Easy	Somewhat Easy	Neutral	Somewhat	Difficult	Extremely
1	2	3	4	5	6	7

I am familiar with the topic of this work task.

Totally disagree	Mostly disagree	Somewhat disagree	Neutral	Somewhat agree	Mostly agree	Totally agree
1	2	3	4	5	6	7

#### **Post search questionnaire**

1. Do you think you had enough time to do the work task?  
Yes \_\_\_\_\_ No \_\_\_\_\_
2. Do you think you got enough information to support your work task?  
Yes \_\_\_\_\_ No \_\_\_\_\_

### Post system questionnaire

Using this interface A, Please tick those that apply

	1	2	3	4	5	
Stressful	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	relaxing
Frustrating	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Satisfying
Useless	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Useful
Difficult	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Easy
Standard	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Novel
Slow	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Fast
Complex	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Simple
Ineffective	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Effective

## Task lists on interface B

**Task 1**(limited time constraint of **20 minutes** for this task)

You are investigating your family tree and have learnt that your great-grandmother was a servant in Victorian Times. You are interested to learn more information about **what kinds of jobs women performed** in Victorian Times. **What jobs were popular** in Victorian Times for women, **what kind of jobs might you have done** if you were a woman in Victorian Times?

### Pre-search questionnaire

Please indicate how difficult do you think this work task is:

Extremely easy	Easy	Somewhat Easy	Neutral	Somewhat difficult	Difficult	Extremely
1	2	3	4	5	6	7

I am familiar with the topic of this work task.

Totally disagree	Mostly disagree	Somewhat disagree	Neutral	Somewhat agree	Mostly agree	Totally agree
1	2	3	4	5	6	7

### Post search questionnaire

1. Do you think you had enough time to do the work task?  
Yes \_\_\_\_\_ No \_\_\_\_\_
2. Do you think you got enough information to support your work task?  
Yes \_\_\_\_\_ No \_\_\_\_\_

## Task lists on interface B

**Task 2** (limited time constraint of **10 minutes** for this task)

As a graduate student, you are asked to write an essay about Strikes in the Victorian era. Now you want to learn more about **what people in Victorian Times held strikes about**. Moreover, you are interested to include **good pictures about strikes** in the essay.

### Pre-search questionnaire

Please indicate how difficult do you think this work task is:

Extremely easy	Easy	Somewhat Easy	Neutral	Somewhat difficult	Difficult	Extremely
1	2	3	4	5	6	7

I am familiar with the topic of this work task.

Totally disagree	Mostly disagree	Somewhat disagree	Neutral	Somewhat agree	Mostly agree	Totally agree
1	2	3	4	5	6	7

### Post search questionnaire

1. Do you think you had enough time to do the work task?  
Yes \_\_\_\_\_ No \_\_\_\_\_
2. Do you think you got enough information to support your work task?  
Yes \_\_\_\_\_ No \_\_\_\_\_

### **Task lists on interface B**

#### **Task 3**(limited time constraint of **5 minutes** for this task)

You are a master student at university. You are taking a British history class at your university.

Your professor has suggested that your group begin project on Education in Victorian Times by looking for background information in a document titled “State and rate paid education”.

#### **Pre-search questionnaire**

Please indicate how difficult do you think this work task is:

Extremely easy	Easy	Somewhat Easy	Neutral	Somewhat difficult	Difficult	Extremely
1	2	3	4	5	6	7

I am familiar with the topic of this work task.

Totally disagree	Mostly disagree	Somewhat disagree	Neutral	Somewhat agree	Mostly agree	Totally agree
1	2	3	4	5	6	7

#### **Post search questionnaire**

1. Do you think you had enough time to do the work task?  
Yes \_\_\_\_\_ No \_\_\_\_\_
2. Do you think you got enough information to support your work task?  
Yes \_\_\_\_\_ No \_\_\_\_\_

## Post system questionnaire

Using this interface B, Please tick those that apply

	1	2	3	4	5	
Stressful	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	relaxing
Frustrating	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Satisfying
Useless	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Useful
Difficult	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Easy
Standard	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Novel
Slow	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Fast
Complex	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Simple
Ineffective	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Effective

### Part C: Exit Questionnaire

To have a better understand of your overall experiences, I would like to ask you a few questions about your experiences today.

1. How different did you find the interfaces from one another?

Not at all			Somewhat			Extremely
1	2	3	4	5	6	7

Please specific reasons:

2. Which interface is more helpful in completing tasks?

Interface A       interface B       No difference

Please specific reasons:

3. Which interface did you find easier to learn to use?

Interface A       interface B       No difference

Please specific reasons:

4. Which interface did you find easier to use?

Interface A       interface B       No difference

Please specific reasons:

5. Which interface did you like best overall?

Interface A       interface B       No difference

Please specific reasons:

Based on your experience, please provide any additional comments regarding

1. What two things work welled while searching the digital library interface?
2. What two things need improvement to help you more easily search the digital libraries web site?
3. What features from other digital libraries would you like to see included on New User Interface Victorian Times Digital Library?

## **Appendix A.9 Task answer sheet**



## TASK ANSWERS / NOTES

**Interface** \_\_ : **Task** \_\_

Please write your answers or any noted in the space provided below. If you require more papers, please ask the experimenter. You have \_\_\_\_ **minutes** to attempt this task.

# **Appendix A.10 Receipt**

Receipt

Social interfaces to digital libraries

I confirm that I received the amount of twenty pounds (20£) from Suthanya Doung-In and Professor Ian Ruthven for my participation in their study.

Date:

Print name:

Signature:

Address (in the UK):

E-mail:

## **Appendix B**

### **Original user interface Victorian Times Digital Library**

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## Victorian Time Digital Library (Original User Interfaces)

The main page of the original Victorian Times Digital Library provides nine menus: Profile, Search, Browse, School, Research, Bibliographies, Timelines, Guided Tour, and About VT (See Figure 1).



Figure 1 The screenshot of the main page of the main page of the original Victorian Times Digital Library

### (1) Profile section

On the menu, on top of the main page, users can choose “Profile”, leading to the page displayed in Figure 2.

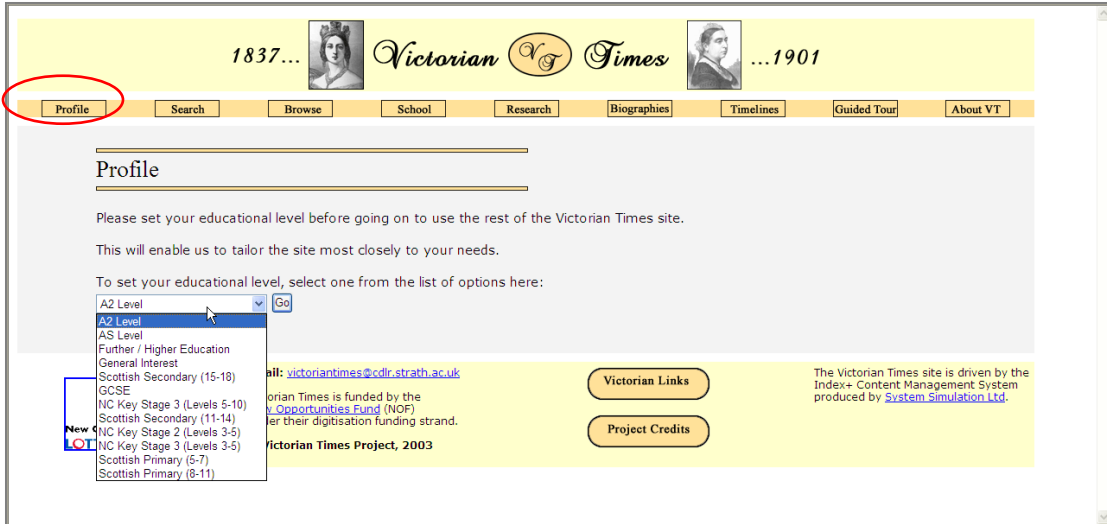


Figure 2 The profile page showing the list of options for user to set education level  
 Selecting “As level” in education level on the profile page leads to the page displayed in Figure 3.



Figure 3 A result page of choosing education level “As level”

## (2) Search

Searching document from the Victorian Times Database leads to search results page, of which an example is displayed in Figure 4.



Figure 4 the search results page

### (3) Browse section

On the menu, on top of the main page, users can choose “Browse”, leading to the page displayed in Figure 5.

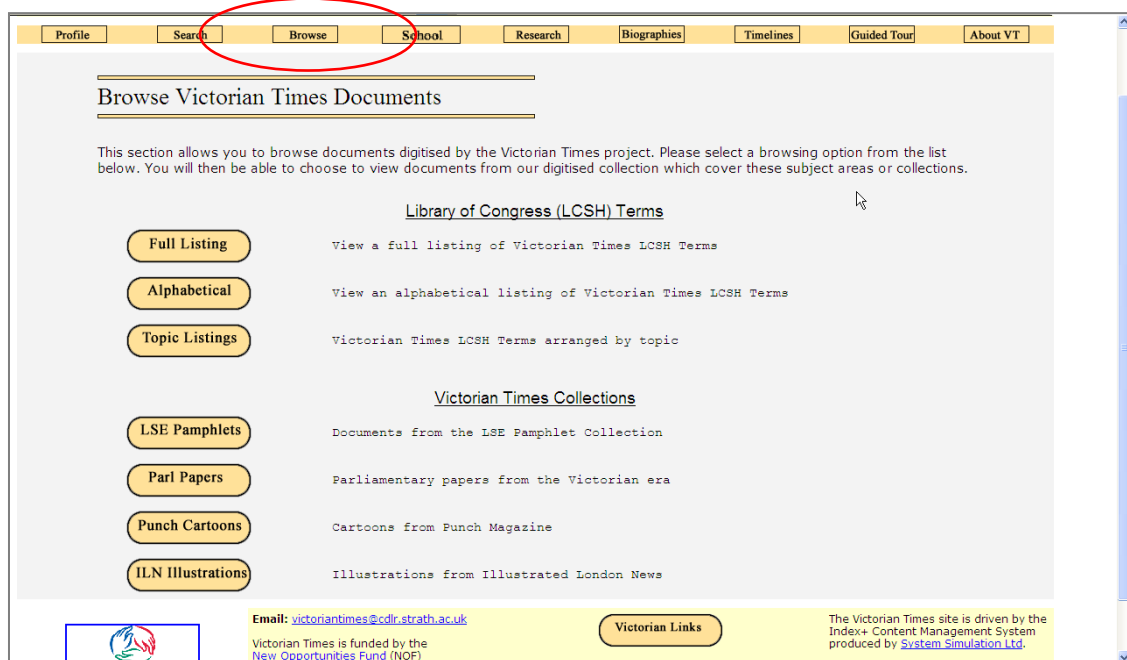


Figure 5 Seven ways of browsing Victorian Times Documents: Full Listing, Alphabetical, Topic Listings, LSE pamphlets, Parl Papers, Punch Cartoons, and ILN Illustrations

### 3.1 Browse Victorian Times—Full LCSH Listing

On the browse page (Figure 4), users can choose “Full Listing”, leading to the page displayed in Figure 6.

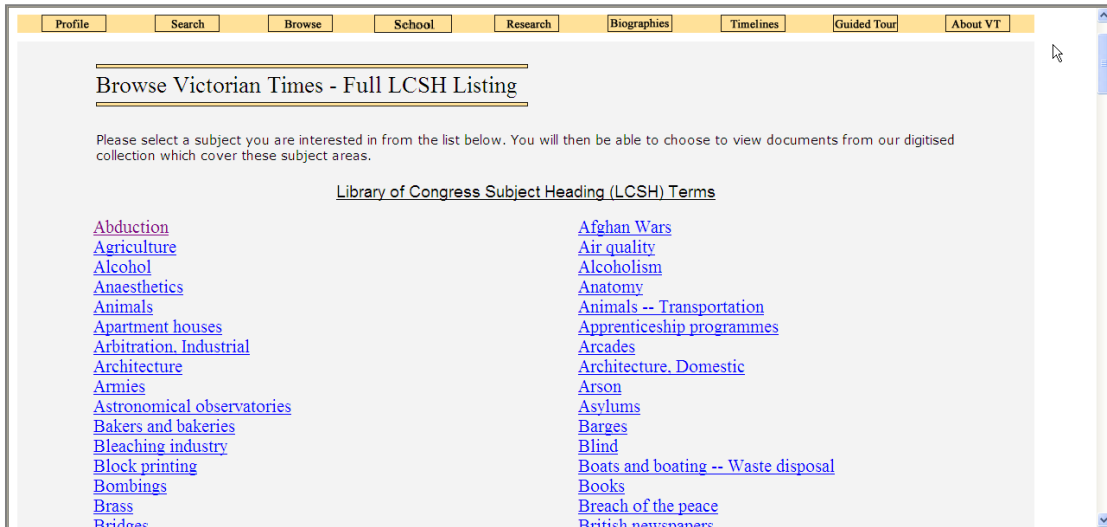


Figure 6 The “Full Listing” page of the original Victorian Times, showing Full LCSH Listing

### 3.2 Browse Victorian Times –Alphabetical Listing

On the browse page (Figure 4), users can choose “Alphabetical”, leading to the page displayed in Figure 7.



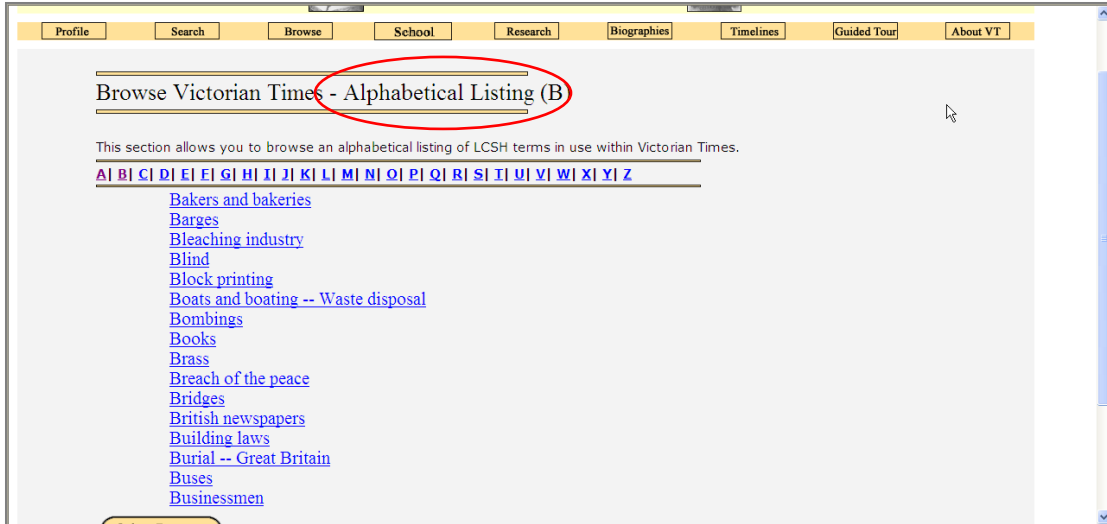


Figure 7 The “Alphabetical Listing” page of the original Victorian Times, showing an alphabetical listing of LCSH terms

### 3.3 Browse Victorian Times—Topic Listings

On the browse page (Figure 4), users can choose “Topic Listings”, leading to the page displayed in Figure 8.



Figure 8 The “Topic Listing” page of the Victorian Times, showing six topic listing in the Victorian Times Materials: Health, Education, Transport, Work & Industry, Trade Unions, and Housing

On the browse Victorian Times—Topic Listings (Figure 8), users can choose “Health”, leading to the page displayed in Figure 9.



Figure 9 The results of browsing “Health” Subject Terms

### 3.4 LSE Pamphlets Victorian Times

On the browse page (Figure 4), users can choose “LSE Pamphlets”, leading to the page displayed in Figure 10.

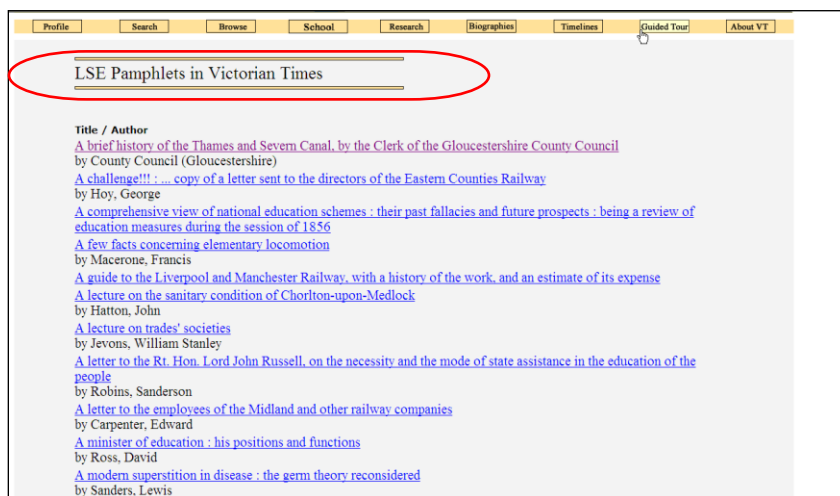


Figure 10 LSE Pamphlets Victorian Times

### 3.5 Parliamentary Papers in Victorian Times

On the browse page (Figure 4), users can choose “Parl Papers”, leading to the page displayed in Figure 11.



Figure 11 Parliament Papers in Victorian Times

### 3.6 Punch Cartoons in Victorian Times

On the browse page (Figure 4), users can choose “Punch Cartoons”, leading to the page displayed in Figure 12.

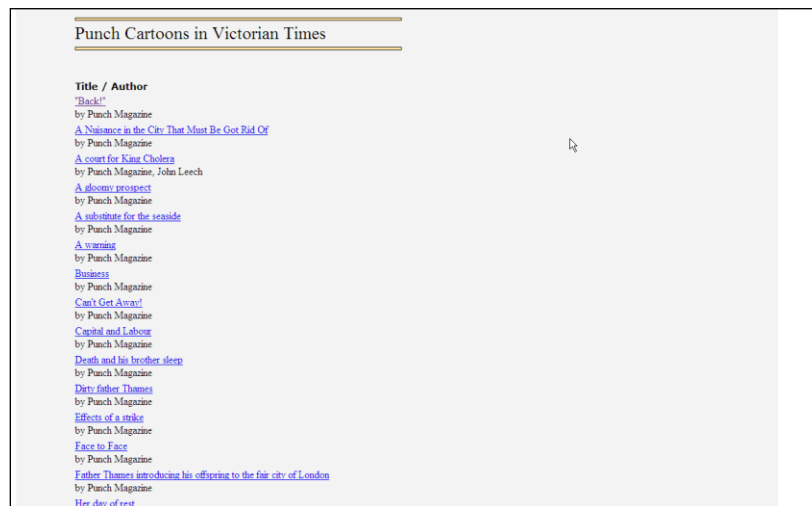


Figure 12 Punch Cartoons in Victorian Times

### 3.7 Illustrated London News Illustrations in Victorian Times

On the browse page (Figure 4), users can choose “ILN Illustrations”, leading to the page displayed in Figure 13.

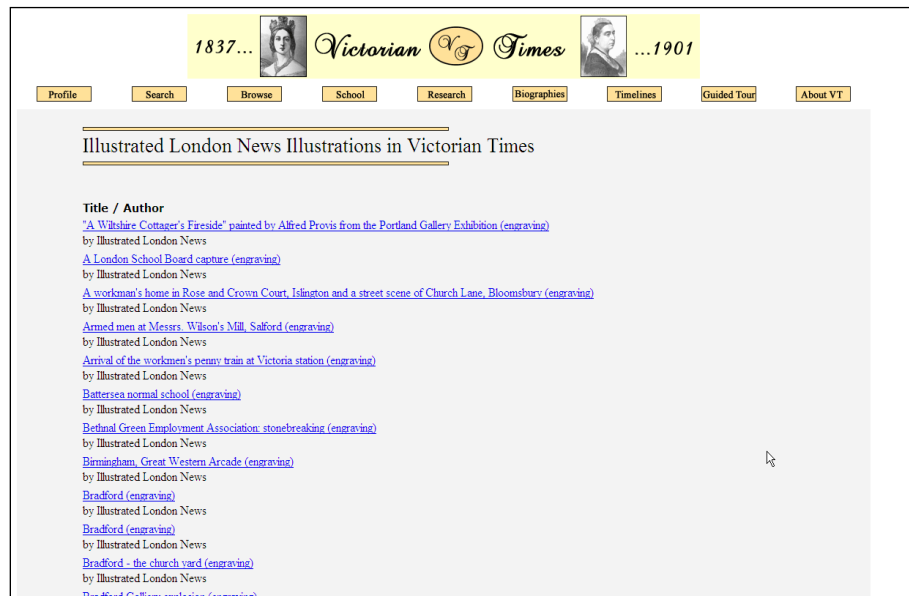


Figure 13 Illustrated London News Illustrations in Victorian Times

#### (4) School menu

On the menu, on top of the main page, users can choose “School”, leading to the page displayed in Figure 14.



Figure 14 School page

## (5) Research menu

On the menu, on top of the main page, users can choose “Research”, leading to the page displayed in Figure 15.

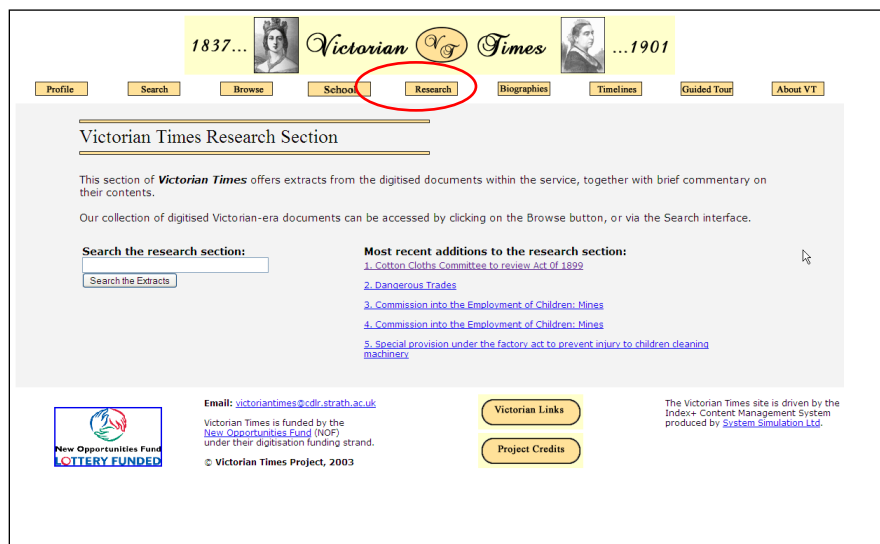


Figure 15 Research page

## (6) Bibliographies menu

On the menu, on top of the main page, users can choose “Bibliographies”, leading to the page displayed in Figure 16.



Figure 16 Bibliographic page

## (7) Timelines menu

On the menu, on top of the main page, users can choose “Timelines”, leading to the page displayed in Figure 17.

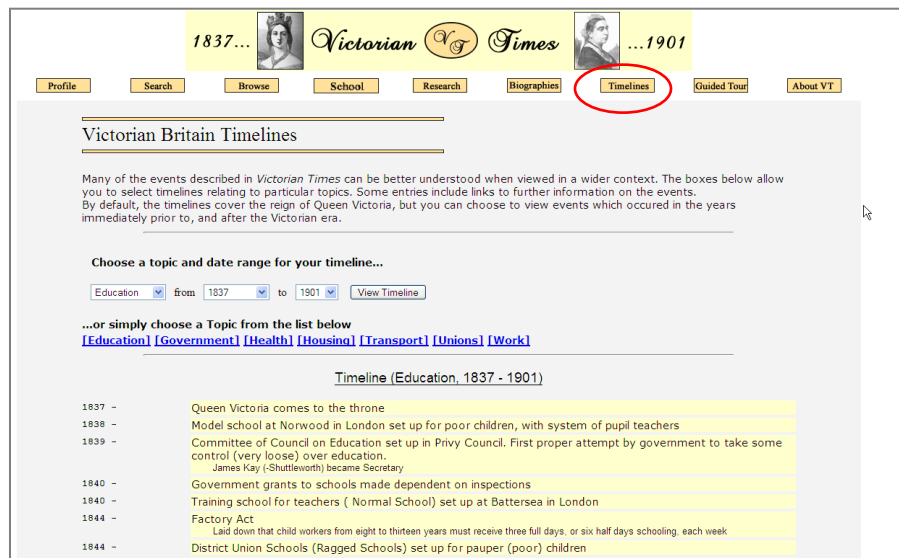


Figure 17 Timelines page

# **Appendix C**

## **Victorian Times Recovery Plan**

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# Victorian Times Recovery

Alan Dawson

30 June 2009

## Current status

The VT server is running ok, and the disk content has been recovered. The Index+ software on the VT server may be running, up to a point. The Adix client will run and attempt to connect to a database `e:\ssl\ixcms\dbs\db_1.1\db` with username SYSTEM, but we don't know the password and the anonymous login option does not work. However, we have two other sources of metadata:

- Various Access databases held in Andrew's folder on the U: drive.
- Harvested metadata stored in a mysql database called Hairst on cdlrdev. Parsed metadata is held in the 'dc' table in this database (where archive = 'Victorian Times'). Although the metadata has not been harvested for years, the metadata has not changed, so it should still be valid and up to date.

We should therefore be able to recover the metadata without access to the Index+ database. Most of the actual VT content consists of JPEG and PDF files, which are stored on the VT server in the `e:\ssl\ixcms\dbs\db\asset_arena` folder.

## Recovery plan

It does not appear feasible to get Index+ up and running again. We don't have the original software to reinstall it, we don't know the system password to try to access whatever is running, and we don't know how to configure it. Even if we could, it may not be desirable to continue using Index+. Therefore the proposed recovery plan is to create a new Victorian Times site to contain as much of the content as we can recover and organise:

1. Export harvested metadata from mysql database on cdlrdev to an Access database.
2. Retrieve a listing of all JPG and PDF files from the VT server, and add the filenames to the Access database.
3. Attempt to match up the harvested records with the JPG and PDF files, using filenames. There seems to be a consistent file naming scheme so this ought to be feasible.
4. Create a new file structure (one folder per metadata record) and copy all the JPG and PDF files into it (at present they are organised by page number, e.g. all the page 57s and page 157s of hundreds of different documents are stored in the same folder).



5. Try to create a new VT website using the same methods used for the Glasgow Digital Library, i.e generate web pages from the metadata held in Access, to link to the content, with basic page navigation and formatting. The new site could have two or more views, e.g. one based on the year and one based on the six principal VT topic areas: Health, Education, Housing, Transport, Industry, Trades Unions.
6. Add any additional educational material that can be retrieved, e.g. Word documents, Powerpoint presentations, exercises.

If this recovery plan works, the new site could be embellished with style sheets etc and copied to the VT server, or it could be hosted on Speirserver. The look and feel of the old Victorian Times site would be lost, along with some of its structure and options, but most of the content (maybe almost all of it) would be available again. If the new site is hosted on Speirserver, it may be worth considering migrating the metadata from Access to SQL Server, and creating the website dynamically (e.g. like BUBL or HILT) rather than statically (like the GDL). However, as the content is not being updated, this may be regarded as unnecessary extra work.

### **Size and scope**

There are 5325 harvested VT records in Hairst, and 98471 files in the asset\_arena folder of the main Index+ database (the 'image' folder has 97398 files, the 'text' folder has 1072 files). The collection of files is therefore much bigger than any other CDLR collection: BUBL, HILT, Scone, Strathprints and the GDL each have more records but relatively few documents or image files. There may be some duplication of VT records, and some images may exist at different sizes, or as thumbnails etc, so there may be fewer distinct items, but if so the work involved in organising the content will not be any less.

The feasibility of the recovery plan largely depends on how easy it is to automate matching the files with the records, and how long it takes to write the program to generate the new website. This is difficult to estimate at this stage, but it could easily take a few months.