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Information Seeking, Retrieving, Reading and Storing Behaviour of Library Users

by Kristine Turner

Information Seeking, Retrieving, Reading, and Storing Behaviour of Library-Users.

Kristine Turner
email: kristine@clear.net.nz

Abstract

In the interest of digital libraries, it is advisable that designers be aware of the potential behaviour of the users of such a system. There are two distinct parts under investigation, the interaction between traditional libraries involving the seeking and retrieval of relevant material, and the reading and storage behaviours ensuing. Through this analysis, the findings could be incorporated into digital library facilities. There has been copious amounts of research on information seeking leading to the development of behavioural models to describe the process. Often research on the information seeking practices of individuals is based on the task and field of study. The information seeking model, presented by Ellis *et al.* (1993), characterises the format of this study where it is used to compare various research on the information seeking practices of groups of people (from academics to professionals). It is found that, although researchers do make use of library facilities, they tend to rely heavily on their own collections and primarily use the library as a source for previously identified information, browsing and interloan. It was found that there are significant differences in user behaviour between the groups analysed. When looking at the reading and storage of material it was hard to draw conclusions, due to the lack of substantial research and information on the topic. However, through the use of reading strategies, a general idea on how readers behave can be developed. Designers of digital libraries can benefit from the guidelines presented here to better understand their audience.

Introduction

"The migration of information from paper to electronic media promises to change the whole nature of research" (Witten *et al.* 1995). Through the advent of office computers and the transformation of media, the popularity and usage of digital libraries has increased. Researchers can benefit from the search, retrieval, reading and storage facilities available to them from the comfort and convenience of their own chair. An important issue in this day of human-computer interaction is that not only the information needs of these researchers are meet, but user requirements also.

To cater for researchers, it is in the interest of digital library designers to investigate and understand user behaviour. Ignorance in understanding how human behaviours influence digital libraries can lead to a potential risk of design inadequacies. A consequence is that digital libraries may not satisfy the requirements of users. To rectify this problem, an investigation and summary of the main research surrounding user behaviour of traditional libraries is presented here. By studying the user behaviour in traditional libraries and how they seek, retrieve, read and store selected materials, one can begin to understand how these attributes can be used to enhance the search and delivery facilities of a digital library.

There are specifically two components that are addressed which are distinct in nature and shed light on the behaviour of library users: library-user interaction, and information use and storage. Library-user behaviour covers the information seeking process — from acknowledging a need of specific information to the delivery of the relevant material required to resolve the need. This paper looks at this process and the activities involved in relation to traditional libraries. When looking into the usage and storage of information, the reading behaviours involved in extracting information from retrieved material was investigated. This focussed primarily on conventional reading environments and methods, and document presentation and storage. The goal is to begin to understand how researchers find and use information based on the findings of previous studies.

Library-User Interaction

Information Seeking and Retrieval
Different search techniques are undertaken by library users to search and locate relevant information. To understand how users of libraries search and locate relevant documents we need to understand the search techniques and what resources and sources of information they generally use.

There are many ways of looking at the information seeking process. Of the research viewed, each one had its own ideals and factors that shed new light on the activities conducted. Ford (1973) offers a conceptual model for researching information needs and uses on the basis of information communication. The model has six components — sources or originators, methods or activities, messages, channels or media, recipients, and information. It is presented as:

  (SOURCE)   (METHOD)   (MESSAGES)
"The source / writes or speaks / ideas, research results, etc. / which are trans-

          (CHANNEL)   (RECIPIENT)   (METHOD)
mitted by / journal, meeting, etc, etc. / to the recipient, who reads or hears /
the message and is thus informed. At this point the message is converted
into INFORMATION" (Ford 1973, p. 85).

This view of information flow can aid in researching information seeking and retrieval practices by providing a basis to analyse interactions.

In contrast, Kuhlthau (1993) offers an uncertainty principle as a framework for understanding how individuals conduct information seeking. The article looks at the feelings, thoughts and actions associated with information seeking as a person "move[s] from ambiguity to specificity, or ... uncertainty to understanding" (Kuhlthau 1993, p. 340), and argues that information seeking cannot be based on certainty and order as these are variables which fluctuate and need to be considered. The information seeking tasks identified by Kuhlthau (1993) are: initiation, an awareness of an information need; selection, the identification or selection of an approach or subject to explore; exploration, the investigation of information to gain understanding; formulation, where the person gains a perspective or point of view on the problem; collection, the gathering of the relevant information; and presentation, to fulfil the information need and conclude the search. Through these stages of information seeking, the individual is subject to feelings of uncertainty, optimism, confusion, frustration, doubt, clarity, sense of direction, confidence, and satisfaction or disappointment. Actions move from

exploration to the documentation stage; thoughts move from being vague in the earlier stages to being focussed as interest increases (Kuhlthau 1993, p. 343, figure 1).

Often research on information seeking practices is characterised by an individual's task or problem (Mick *et al.* 1980; Belkin *et al.* 1982; Ingwersen 1992 found in Bystrom and Jarvelin 1995). These studies investigate the relationship between a person's task (for example, in sciences, social sciences, humanities) and their information seeking behaviour. Bystrom and Jarvelin (1995) acknowledges that people's information seeking depends on their task and it looks at how task complexity can be used to model information needs, seeking, channels and sources. However, other research shows that task alone may not be specific enough to analyse the behaviour of information seekers and users. They argue that other factors other then tasks may contribute to information seeking behaviours (Kuhlthau 1993).

Those papers that characterise information seeking practices based on tasks, surveyed scholars and professionals in particular fields to determine similarities and generalisations within and between these groups of people. These determine an overall way in which certain groups of people search for information and their needs and uses of it. Studies reviewed looked at the scientific community (Ellis *et al.* 1993; Hallmark 1994; Seggern 1995), computer sciences (Cunningham and Connaway), social sciences (Folster 1995), humanities (Broadbent 1986; Wiberley and Jones 1989), and professionals (Leckie *et al.* 1996). There are other more specific studies, such as anthropology (Hartmann 1995), philosophy (Sievert and Sievert 1989), and engineering (Pinelli 1991; Holland and Powell 1995). This classification of people means that in general it is easy to determine the type of behaviour expected from an individual based on their task or field of interest.

This paper makes utilises these communities of people to describe information seeking and retrieval activities. However, it has to be noted that, although categorising provides good generalisations of information seeking behaviour there are often conflicts. This is demonstrated in the study by Pinelli (1991), where the information seeking practices of scientists and engineers are compared. In the past these two groups of people have been studied synonymously. It has now been determined that the differences in their behaviour is quite distinct. For instance, engineers make more use of unpublished technical material than their academic counterparts. This shows that even with similar or related communities, there may be considerable differences in information seeking behaviour (Pinelli 1991).

Research generally agrees on how people go about searching for information. Ellis *et al.* (1993) discusses interviews conducted on information and diffusion activities, focussing specifically on the information seeking habits of physicists and chemists. It offers characteristics of the information gathering activities for these scientists, in comparison to social scientists, and presents a behaviour model. While these activities are associated with a particular group of people, they can be generalised to encompass scholars, researchers and professionals. Ellis *et al.* (1993) realises that information seeking behaviour is comparable and is very similar in different fields, the difference generally comes in the emphasis. There are six main activities identified by Ellis *et al.* (1993) — starting, chaining, browsing, differentiating, monitoring and extracting.

Starting
In the starting stage of the information seeking process the researcher is beginning a new or unfamiliar project. This initial familiarisation involves "... activities characteristic of the initial search for information" (Ellis *et al.* 1993, p. 359) and includes obtaining starting references and

information. The idea is to identify the topic and begin a search for relevant information. In starting a research project there are many informal and formal resources one could use. Informal resources can include personal contacts or colleagues, browsing through catalogue systems or the Internet. Formal resources are such things as printed indexes, formal bibliographies, research guides, and abstracts.

In the field of Science, the most common way of gaining the initial information needed to begin a project is through personal contacts (Ellis *et al.* 1993; Hallmark 1994; Seggern 1995). Ellis *et al.* (1993) explains that is because there are usually contactable fellow scientists who are familiar with information regarding this new topic, or for those scientists who are doing PhD research, the initial references are usually provided by their supervisors. Another source of starting information for scientists comes from keeping up to date with reviews, prominent authors and articles in fields of interest and knowing where to locate these introductory references (Ellis *et al.* 1993; Hallmark 1994). Computer scientists also rely heavily on the above informal sources and less on the formal sources. However, computer scientists also include the use of the Internet to view authors' sites and the World Wide Web (in conjunction with search engines) to locate initial information (Cunningham and Connaway). In the same flavour, social scientists also rely on personal contacts (Ellis *et al.* 1993). However, social scientists also use such formal sources as abstracts and indexes, bibliographies, catalogues and book reviews (Folster 1995; Hartmann 1995). In contrast to scientists, people in the field of humanities tend to use formal resources more. They mainly use printed primary sources, abstracting and indexing sources, catalogues, research guides, and formal bibliographies (Broadbent 1986; Sievert and Sievert 1989; Wiberley and Jones 1989). Non-academic professionals, on the other hand, have a different outlook on the initial resources used. They generally use informal sources, including colleagues, trade publications and unpublished reports (Pinelli 1991; Holland and Powell 1995; Leckie *et al.* 1996). Leckie *et al.* (1996) notes that professionals rely more heavily on their personal files, knowledge and experience. "Shuchman (1981) reports that engineers first consult their personal store of technical information, followed in order by informal discussions with colleagues, discussions with supervisors, use of internal technical reports, and contact with a "key" person in the organization who usually knows where the needed information may be located" (Pinelli 1991, p. 19).

Nearly all researchers use personal contacts or colleagues for initial information sources, but there is a noticeable difference in the use of formal resources between fields of study. There are two principle factors which determine the use of particular sources for information: accessibility and quality (Ford 1973). Accessibility is based on the perceived cost of attaining the source of information. For example, it could be based on the distance to travel or the time delay waiting to retrieve the resource. Accessibility is seen as one of the strongest predictors of use. Quality "governs the acceptability of the information retrieved" (Ford 1973, p. 88). Studies note that researchers generally do not rely on libraries for providing the information required in the starting phase of the information gathering process (Folster 1995). Libraries or librarians are seen as sources for acquiring material previously identified as relevant, rather than as a primary source for identifying relevant information. They do not play an important part in the initial search process for sources (Folster 1995). However, academics in humanities read, on average, more than people in other fields of study. A consequence of this is that they tend to know where to find information required to start a new project, and generally make more use of the library and its facilities (Wiberley and Jones 1989).

Chaining
The chaining or chasing stage is "...following chains of citations or other forms of referential connection between material" (Ellis *et al.* 1993, p. 359). Chaining involves locating references to further work by using relevant material already retrieved. Ellis *et al.* (1993) categorises chaining as being either forward or backward chaining. Backward chaining looks at the references within an article to locate other relevant printed articles written in the past. Forward chaining makes use of citation indexes to find out which articles have cited the relevant article you possess (Ellis *et al.* 1993). Another method of chaining is using catalogue systems to locate work with the same author, subject, topic or classification.

Most studies regarding information seeking did not state the way in which information is located once the initial relevant references were found. However, Hallmark (1994) remarks that most scientists use references from their literature to chain both backwards and forwards. It is also seen that they make use of the online databases and library facilities. Ellis *et al.* (1993) finds that for scientists and social scientists "Backward chaining [is] ... identified as the principle means employed to chase references" and that forward chaining is less widely used and understood. Most scientists know about and utilise citation indexes (generally the *Science Citation Index*). This is unlike the social scientists Ellis *et al.* (1993) studied who had very little or no knowledge of citation indexes and did not know of the existence of the *Social Science Citation Index*. Social scientists are more likely to use reference lists in books and journals to locate information sources. They also use CD-ROM and online databases (Hartmann 1995). Computer scientists use reference lists to initiate trials (Cunningham and Connaway). They also make use of on-line keyword search techniques. Individuals in the humanities use bibliographical tracings and subject and publisher's catalogues (Broadbent 1986; Sievert and Sievert 1989; Wiberley and Jones 1989). In the research on information seeking behaviour of professionals, Pinelli (1991), Holland and Powell (1995) and Leckie *et al.* (1996), did not indicate how people in professional situations locate further information after gaining initial references.

The library services used in the chaining stage of information seeking is limited mainly to online bibliographic and catalogue services. Even then, most of those that acknowledge the use of these facilities prefer, when possible, to use these facilities from the comfort of their own personal computers (Cunningham and Connaway).

Browsing
Browsing is a "... planned or unplanned examination of sources, journals, books, or other media in the hope of discovering unspecified new, but useful information" (Apted and Choo 1971, p. 228). It is concerned with searching from where to what rather than from what to where (Chang and Rice 1993). However, is must be noted that there are two main types of browsing, across-document browsing and within-document browsing (Marchionini 1995). Across-document browsing is often identified with card catalogue systems or bookshelves and it is when records or books are surveyed to find items to examine more closely. These items could be on a specific topic or to keep up to date. Within-document browsing is mainly used during the differentiation stage of the search process to determine if the material retrieved is relevant or to gain an overview (this is explored further below). Browsing can be seen as either a specific stage in the information seeking process or an activity carried out during phases of the process; for example, during the starting stage one may browse library bookshelves for initial sources of information.

Research into different types, the meaning, and evaluation of browsing is discussed by Apted and Choo (1971). This research also finds that there seems to be a contrast between browsing methods used by people in different disciplines. Scientists, for example, tend to browse current material and make a deliberate attempt to include this activity in their information seeking behaviour. It is usually conducted haphazardly and is mainly for maintaining awareness in the current literature. This point is emphasised by Hallmark (1994) who states that "[m]ost scientists argue that browsing in library and personal journal issues is of critical importance in keeping up with the literature" (Hallmark 1994, p. 203-204). The methods of browsing for scientists include browsing in journals, *Current Contents*, abstracts, along shelves in the library or in bookshops, and displays at conferences (Ellis *et al.* 1993). Most computer scientists know the primary journals in their field and browsing them is an activity that is performed regularly. It is also recognised that computer scientists browse their personal bookshelves and use the Internet when looking for information sources (Cunningham and Connaway). In contrast, social scientists rank browsing low down in their information seeking tasks, after reference lists, bibliographies, and reviews for use in locating sources of information (Hartmann 1995). This may be due to the structure of the library for providing a useful browsing environment for social scientists. "[Browsing] ... is an approach to information seeking that is informal and opportunistic and depends heavily on the information environment" (Marchionini 1995, p. 100). Because of the many topic areas studied by social scientists the books and journals used are vast and wide spread through out the library, making it difficult to browse all the relevant publications. Thus, since the environment is not ideal for a social scientist, browsing can often be unrewarding. For humanities scholars, as in social sciences, browsing is not ranked highly as an information seeking activity. Sievert and Sievert (1989) remarks that browsing for humanists is not a regular habit and that "only a few, a very few had any pattern of browsing anywhere" (Sievert and Sievert 1989, p. 92). When they do browse, however, it is usually a wider base, using both old and new material and material on almost any topic. It also is seen as a less deliberate act, than that of the sciences. In the studies perused, there is little mention on the browsing behaviour of non-academic professionals. Leckie *et al.* (1996) say that engineers monitor or browse journals. This is perhaps a characteristic of all non-academic professionals.

Browsing can be a rewarding task because "Browsing is a natural and effective approach to many types of information-seeking problems. It is natural because it coordinates human physical, emotive, and cognitive resources in the same way that humans monitor the physical world and search for physical objects. It can be effective because the environment and particularly human-created environments are generally organised and highly redundant" (Marchionini 1995, p. 100). The library is an organised environment classified to invite browsing by topic area, yet there are some disciplines in which their subject can include many topics scattered through out the classification scheme. This may be a reason why most individuals prefer to browse their own collections rather than browse library bookshelves for relevant information. Apted and Choo (1971) lists a few ideas that could improve library browsing, one being the use of small sections of material, continually refreshed with information of high interest and potential. However, there are arguments for and against such structuring (Apted and Choo 1971; Ellis *et al.* 1993).

Differentiating
Ellis *et al.* (1993) define differentiating as "... an activity which uses differences between sources as a filter on the nature and quality of the material examined" (Ellis *et al.* 1993, p. 362). Differentiating is based on human judgement to determine the relevance of the information retrieved. Schamber (1994) addresses relevance and the problems surrounding an

accurate definition. The term 'relevance', when discussed here, pertains to the situational view where it "refers to a relationship between information and the user's information problem situation" (Schamber 1994, p. 8). The selection of material based on some predefined criteria defines the usefulness or satisfaction of the information retrieved. This criteria can be based on the actual information contained in the publication, or guidelines such as cost saving, precision, completeness, credibility, and convenience of location (Gluck 1996), or it could be based on the perceived relevance of specific authors, journals, institutions, etc.

To determine relevance on the basis of subject, individuals often read the material specifically to gain an overview to form an opinion on its content. Browsing can be used to ascertain this. "For example, by scanning the title page, table of contents, section headings, index, and reference list of a book, we gain a sense of the content's scope, depth of coverage, and the author's organizational perspective and thereby can decide quickly whether to invest time reading it. It is important to note that in the case of books, those attributes that we browse first are well-established standards to aid browsing" (Marchionini 1995, p. 102). Marchionini (1995) calls this within-document browsing.

It was found that research did not specifically comment on selection behaviours of specific disciplines. But the research did reveal that most scholars differentiate between sources of information on the basis of the material's subject. Ellis *et al.* (1993) state that scientists and social scientists tend to use factors such as topic, author, and journal source. The source of information was also analysed for the quality, level and type to decide relevance. From these factors, a list of core journals is often determined which can also be used to identify material. Researchers in humanities also have a high regard for authors and also works (Sievert and Sievert 1989). As with the other disciplines, studies on professionals did not cover how they determine information relevance.

Determining the relevance of a document or source is solely an individual's perspective, so the library or librarian is not a determining factor in differentiating sources. It would, however, be advantageous for a library to know and have the relevant material available for use. Traditionally, librarians have sort to provide relevant material. However, due to the rising cost of documents, they have had to be more selective in their acquisitions. In response, positions such as special librarians were created. A special librarian is usually engaged to determine and purchase relevant material for an associated subject area (Folster 1995). This service is advantageous to both novices and experts in a particular subject area. These librarians can direct novices to their area of interest, knowing where relevant material might be located. Experts benefit from this system because their subject area has been investigated so that relevant and frequently used information is easily accessed.

Monitoring
Monitoring "is the activity of maintaining awareness of developments in an area through regularly following particular sources" (Ellis *et al.* 1993, p. 362). As previously noted, a large part of monitoring is conducted using browsing techniques. However, browsing is also a major information gathering technique in its own right. In monitoring the individual must determine a select range of sources to look at so as not to get overwhelmed. These sources are usually the predominant sources used in the particular field. There may be different sources of information used in each discipline for monitoring, but the overall nature and form of the activity is the same (Ellis *et al.* 1993).

For scientists, monitoring often means constantly surveying their small number of core sources, mainly personal contacts and journals. Other sources can include conferences, conference proceedings, magazines, abstracts, books, newspapers, television and computer search updates (Ellis *et al.* 1993). Scientists also maintain an often concise personal collection of information which is used for monitoring their fields of interest. Seggern (1995) notes that this behaviour is due to the convenience of having the journals on-hand. In comparison, where scientists place a lot of emphasis on journals for maintaining awareness, social scientists use core books and journals equally. They also use newspapers and published catalogues (Ellis *et al.* 1993; Hartmann 1995). Studies on humanists and professionals had no direct references to their monitoring behaviours. Sievert and Sievert (1989) did say that in the humanities they do a lot of reading but they are not concerned with keeping up to date with the most recent publications. Also, Leckie *et al.* (1996) does say that engineers monitor journals for opportunities and threats and to see "what's out there". This may be generalisable to all professionals, but more formal study is required. In an ever changing environment (especially areas like health care and law) professional individuals must keep up with what is happening.

From the information gathered on the topic of information seeking patterns of academic disciplines, Folster (1995) concludes that high on the list of priorities for services implemented by libraries should be current awareness services. One such service is *Current Contents*. *Current Contents* provides an alternative to scanning journals, but it is not frequently used by academics. Other facilities include printed and electronic abstracts and indexes such as OCLC FirstSearch, UNCOVER, reviews, guides, and citation indexes.

Extracting

Extracting is defined by Ellis *et al.* (1993) as the behaviour involved in systematically going through a specific source and identifying material to locate or follow up on. Formal sources are more frequently used for systematic analysis, although informal sources may also be used in extracting. This is a task which is primarily carried out during the starting or initial familiarisation phase of the information seeking process to produce a concise list of references to begin searching with. Folster (1995) also includes the reading of material to decide what information will be a part of a final report as an extracting activity. This will be discussed further in a following section on the reading behaviours of people and how they go about extracting information from publications.

Research into extracting generally only reveals the sources used. Ellis *et al.* (1993) is the only study found that discloses the actual use of sources. However, Ellis *et al.* (1993) only discusses the significance of the activity and reveals the stages of the information seeking process in which extraction of source material is most likely to happen. For most scientists, extracting for further information is a minimal activity that generally only happens in the starting and monitoring stages. In the case of physicists, after initially familiarising oneself with a project, they tend not to seek further. Physicists also tend to use extraction during current awareness activities. Likewise, chemists are inclined to use this activity in writing reviews, forcing them to maintain awareness. The sources used in extracting for scientists are usually journals, monographs, indexes, abstracts, bibliographies and computer databases (Ellis *et al.* 1993). Sources of information that are mainly used by computer scientists are journals and computer databases, specifically the Internet. Online catalogues and CD-ROMs are used infrequently. Computer scientists locate information via the World Wide Web and investigate the home pages of researchers and research institutions. This sort of activity is not an extensive one for computer scientists and they tend to base their own contributions on only one or a few documents. One computer scientist who was surveyed said that "I know people

who know the literature too well and never get any research done ... [t]he referees will tell me if I have missed some important reference (Cunningham and Connaway). In a comparison between scientists and social scientists, Ellis *et al.* (1993) remarks that social scientists use extracting mainly during monitoring. For this group of people, books, journals, book reviews, and bibliographies are the main sources used (Hartmann 1995). Humanities use these sources and also include subject catalogues, printed indexes and research guides (Broadbent 1986; Sievert and Sievert 1989). In studies discussing the information seeking activities of professionals, sources are generally not mentioned. Leckie *et al.* (1996) notes that professionals make use of trade journals, books, printed catalogues and internal sources.

For most users, the library is seen as a reservoir of information, so it is expected to provide easy access to formal sources used to extract information. When extracting is used to maintain current awareness, access is particularly important for browsing and reading the most recent core journals in the respective fields. The material must also be current and relevant. An ideal is again the use of special librarians who know the particular sources which are reliable and applicable for specific fields of study.

Verification and Ending
Verification and ending are information gathering activities used during the verifying and ending phases of researching. In verifying, the information and sources used to produce their own material are checked for information accuracy and errors. The sorts of problems that come to light include typographical, numerical, equation, and citation errors. Verification for most only involves knowing and using reliable sources. To take it further, "one chemist did a spot check on everything, as well as checking obvious errors and material from sources he regarded as unreliable; another did a spot check on new textbooks" (Ellis *et al.* 1993, p. 365). This sort of activity is seen as minor and is usually subsumed under other activities; for example, social scientists tend to include it under chaining (Ellis *et al.* 1993).

Ending is the assembly and dissemination of information or the actual drawing together of material for publication. It covers the information seeking activities concerned with finishing a topic or project (Ellis *et al.* 1993; Folster 1995). Most scholars do their major information gathering activities at the start of a project for initial familiarisation, and some also perform literature and information searches during the lifetime of the project. However, Ellis *et al.* (1993) notes that some chemists returned to the literature at the writing up stage of the project to discuss their contribution in light of the reviewed literature. Two of these chemists minimally collated information in the starting stage of the project and performed a thorough information search at the end. "Both were aware of dangers with this type of approach in finding material at the end which would have led them to modify the work they carried out or in finding that the work had already been undertaken" (Ellis *et al.* 1993, p. 365).

Location and Delivery of Material
In regard to researching behaviour, there are other aspects that need to be considered that are not discussed by Ellis *et al.* (1993). These are the location and delivery of material and the implications of the decisions made in these areas. Locating a known document or publication reference is often by using an individual's own collection, the library, or the interlibrary loan system (interloan).

The majority of the people surveyed in the articles examined stated that they maintained and extensively used personal collections of journals, documents and/or books. It is not surprising that a personal collection is kept, as the core material related to their field of interest is often

known by researchers. Sievert and Sievert (1989) had respondents who "commented that once they [humanists] knew an item was likely to be of importance to them, they tended to purchase it" (Sievert and Sievert 1989, p. 85). A preference for their own collections is mainly due to convenience. For scientists, this reason was mentioned most often by the researchers surveyed (Seggern 1995). This is because they preferred their own classification systems and their own environments. They did not like the barrier experienced in libraries such as temporary unavailability due to binding or use by others. Other reasons for having a personal collection are: researchers can annotate the text for their own purposes (Sievert and Sievert 1989); local libraries no longer carried the essential journals for the researcher's discipline; the problems with obtaining journals that are now stored in storage due of lack of shelf space; loss, theft, negligence of material; missing and mutilated journals; and general accessibility (Hallmark 1994). It has been found that researchers rely more on the items they have on hand rather than relying on library services (Folster 1995).

If researchers do not have the required reference or information in their own collection, they will often resort to using their local library collections. The library is seen as a repository for information and a mechanism for document delivery for those items not owned. Librarians are rarely consulted by researchers when looking for information. Some researchers surveyed commented that the library is a supplementary source rather than a primary source of information. It is seen as a place to get information from once a reference has been found, or a place that provides document delivery services (Ford 1973; Sievert and Sievert 1989; Folster 1995). Some find that the library system is pleasing and easy to obtain the necessary material from the shelves, but others lack an appreciation for the library classification system, believing it to be difficult to navigate (Hallmark 1994).

Researchers can generally agree on two things, that their local library services are usually adequate for locating material and that they make extensive use of interloan facilities. The material that is not readily available elsewhere can be retrieved via interloan, which is usually done through the local library. The unavailability of material at the local library most often results in an interloan request (Hallmark 1994; Hartmann 1995). However, for computer scientists, interloan was found to be only used when the material could not be located at the library or on the World Wide Web (Cunningham and Connaway). The only problem with interloan is the time delay from the request for information to actually receiving it. Hallmark (1994) concludes that "They [researchers] do expect and need fast, efficient, and inexpensive document delivery for material not owned and not available electronically" (Hallmark 1994, p. 208) and says that at present there is an unacceptable wait. It points out that requests that have taken too long are no longer of interest. For professionals, at least, it seems that accessibility is a major issue when requiring information. Pinelli (1991) and Leckie *et al.* (1996) state that accessibility appears to be a criteria used most often when selecting an information source even if that source proved to be the least useful or not of high quality. Another issue that is stipulated is timeliness. Information that can be obtained immediately or in a reasonable amount of time is more likely to be used. The usefulness and impact of the retrieved information will decrease as time proceeds (Leckie *et al.* 1996). So, the relevance of a document is often based on accessibility and timeliness, two of the down sides to using interloan. "[The biggest problem] is being able to obtain the article easily and rapidly...in such cases interlibrary loan can be too slow and require too much time and effort to be worthwhile" (Hallmark 1994, p. 206).

Summary
From looking at how researchers in the academic and professional roles conduct information seeking and retrieval, it is interesting to note that the library is mostly used as a source for previously identified material, to browse bookshelves (mainly for current awareness), and for the interloan facilities. This definition of library usage is very different from what libraries provide and researchers are recommended to use. To further strengthen the argument, Folster (1995) suggests that improvements to services mean that libraries must focus on document delivery services, current awareness services, and customised search services, as these are the most utilised facilities. The article also advises training in new technologies.

In most cases, the way in which researchers of different disciplines conduct information seeking and retrieval is very similar. Often the difference between disciplines is in the sources used and the importance attached to the activity. The actual act is the same across the fields. When looking at the differences in the use of libraries by researchers, they are significant. Humanists and social scientists boast that they use the library a lot more frequently than scientists and computer scientists. Professionals, on the other hand, use the library rarely. Most people overall may use the library to retrieve information at some time, but a lot do not know about or use other facilities offered by the library. Holland and Powell (1995) describes a survey performed on a sample of engineers who took a specific course at university. This course involved formal training on conducting information research. The responses to that survey and to a survey conducted on another sample engineers, who did not take this course, were compared. A result of the comparison was that both groups of people showed similar information gathering preferences, but those that took the above course showed more awareness of library services. Increasing the exposure of the library leads to an increase in the use of materials and services (Ford 1973). These trends discussed here are replicated in Broadbent (1986), where it is noted that inexperience is the cause of the limited knowledge of library services. This lack of formal training among researchers is not uncommon; for example, all the computer scientists in Cunningham and Connaway had received no instruction in conducting a literature search or in using the common indices. The result of this is that users of the library do not make the most of services available to them, and the library is not seen as anything more than an information repository.

Information Use and Storage

Once relevant material has been located and retrieved, information is then extracted for use. How individuals read can be analysed for insight into their behaviour during this activity. Most research into reading concentrates on either identifying letters, words, and sentences when learning to read, or on the cognitive processes involved, or on strategies for reading better or more efficiently. There is very little documented research found on how readers actually behave when confronted with material — where and when reading occurs, what is read, and how information is extracted from relevant material. Research on the utilisation of materials — the what-where-when-how-and-why of material use — in the library yields similar results due to the difficulty to record such activities (Ford 1973).

Reading Environment
An integral part of reading behaviour is the effect of the environment on the reader. The environment can influence concentration and reading ability. Preferences for reading environments are subject to the self-defined factors of users. Factors for choosing a particular reading area can include noise or distractions (or the lack there of), the presence of other people, privacy, seating arrangements, and the availability of other materials (Sommer 1966;

Gifford and Sommer 1968; Sommer 1968; Fishman and Walitt 1972). An assumption cannot be made that there is one optimal reading environment that will meet the needs of all individuals (Gifford and Sommer 1968; Sommer 1968) so it is recommended that in designing reading areas, there needs to be a variety of reading spaces for everyone. In this way individuals can choose the most suitable place according to their reading preferences.

Reading, primarily for research, can be done in such places as the library, in study rooms, offices, etc. Most research is inclined to look at the library when discussing reading environments. Contradicting this, most studies reviewed indicated that researcher do not spend much time in the library. Thus, there is a requirement to know what researchers do and need in the place that they actually read. However, Ford (1973) looks at the study environment in the library. The requirements of library patrons include personal needs such as "[c]onditions of work — heating, lighting, draughts, sound-proofing, ease of entry/exit — turnstiles, porters etc. ... [a]menities — location of lavatories, smoking rooms, food, drink" (Ford 1973, p. 88). It is also noted that these and other needs of people are variable and that it is important for the library to cater for all.

The reading environment also includes how material is presented. This affects not only the readability but can also influence the processing of information. Duchastel (1982) investigates text processing and finds that the presentation of material is particular to its purpose. For example, "[d]ictionaries ... are used for looking up the meaning of words, reference books for finding out specific information about a subject, novels for entertainment [and] ... [t]extbooks are used primarily for learning" (Duchastel 1982, p. 170). The use of these materials are considerably different and so the display techniques to aid information processing is therefore specific to the material's purpose. Such techniques include labelling, highlighting and illustrating.

The presentation medium of reading material is generally either printed or electronic. There is a lot of research into the effects of reading from a screen and comparing this to reading from a paper copy (Askwall 1985; Mills and Weldon 1987; Oborne and Holton 1988; Muter and Maurutto 1991; De Bruijn *et al.* 1992). It has been found that today, due to computers being more advanced, comparatively faster, and more reliable, and owing to increased exposure to the computing environment, there is little evidence that there is a difference in reading speed or comprehension when material is presented on a screen or hard copy (Askwall 1985; Oborne and Holton 1988; Muter and Maurutto 1991). Therefore, if these are the only two factors considered of significance when determining readability, then the reading medium is dependent on the readers preference. However, reading and comprehension are only two of many factors which dictate the use of paper versus computers when reading (Oborne and Holton 1988).

Paper copies are widely used because paper is permanent; it can be recalled without recourse to high technology; it is convenient; and easily transportable (Showstack 1982; Oborne and Holton 1988). "Paper ... is still the most popular method of communications and is likely to remain so" (Plume 1988 quoted in Muter 1991, p. 257). In comparison to computer screens, paper appears to be easier and faster to read, but the size of the effect depends on the quality of both the paper and the screen presentation (Mills and Weldon 1987). Use of computer screens for reading electronic copies is often dependent on the textual display. Advances in technology have increased the legibility of computer screens through better resolution, clearer and more varied fonts, negative contrast capability (dark characters on a light background) and a higher refresh rate, to name a few. This provides flexibility in textual presentation of information (Muter and Maurutto 1991). Merrill (1982), Mills and Weldon (1987), and

Muter and Maurutto (1991) list several factors concerning how to display information on computer screens to get optimum readability. Readers may prefer computer screens, even though users' performance may not be as good with computer screens as with paper (Mills and Weldon 1987). Both paper and electronic copies have their advantages and disadvantages. Perhaps readability is dependent on reader preference where the reader determines which of the mediums disadvantages them the least.

When looking at researchers who were surveyed, there are mixed responses to their preference for reading medium. Computer scientists preferred to use paper copies. Documents that were retrieved in electronic format were printed and in most cases only the printed documents were retained. The electronic copy might be kept while it was of immediate use (Cunningham and Connaway). In contrast, Holland and Powell (1995) found that engineers preferred to receive information in electronic form and would prefer to receive less paper in the future. Scientists also expressed the usefulness of the retrieval of full text online documents, then "files could then be viewed on the scientist's screen and printed on the local laser printed if desired (Hallmark 1994, p. 206). These preferences for electronic documents were mainly due to the convenience of retrieval. Research was not found to confirm that these electronic documents were then read online.

Reading for Information Use
"In simple terms, information has only one use — ie. the assistance of problem solving" (Ford 1973, p. 88). One main technique for extracting information is by reading. Alternative techniques are listening and viewing an oral discussion, presentation, demonstration, etc. When looking at reading as an activity for extracting information to use, there are positives and negatives associated with reading as an activity for extracting (Norman 1993). Positive aspects of reading are that the individual has control over which portion of text is read, which is skipped, which is repeated, and at any moment they can stop reading. Moreover, it gives them the chance to reflect on what has been read, so that they can contemplate, question, ponder and agree or disagree. On the other side, reading can be comparatively slow and difficult in comparison to other mediums of information. It takes training and practice and "[r]eading ... requires relatively greater effort and thought" (Showstack 1982, p371). Reading takes mental effort, mental demands, concentration, and requires a focus of attention on the material. "Written material tends to be information-rich, so that considerable mental activity is needed to decode the author's message" (Norman 1993, p. 244).

There are many research and study guides that instruct readers on the benefits of using reading methods to increase reading speed and comprehension. One such strategy for scanning documents to determine the material of relevance is recorded in Booth *et al.* (1995) where speedier reading is achieved through five steps. Booth *et al.* (1995) acknowledges that this is only used to identify and understand the work and states that the important sources require careful reading. More thorough strategies for critical reading was developed by Hardcastle (1996) from a variety of sources. This proposes that these strategies can make reading more satisfying and productive. The seven strategies include: previewing, learning about a text before actually reading it; contextualising, placing a text in its historical, biographical, and cultural context; questioning to understand and remember, asking questions about the content; reflecting on challenges to your beliefs and values, examining you personal responses; outlining and summarising, identifying the main ideas and restating them in your own words; evaluating an argument; testing the logic of a text as well as its credibility and emotional impact; and comparing and contrasting related readings, exploring likenesses and differences between texts to understand them better (Hardcastle 1996). Another reading method is

examined in Sweet *et al.* (1993) for use within a teaching and learning environment. These reading strategies can be used to extract information, but in doing so ideas, arguments and conclusions are also formed.

Strategic reading usually insists on the use of annotations and notes to guide information extraction. Hardcastle's (1996) critical reading strategies, reviewed above, state that annotating directly on the page is fundamental to these techniques. Annotations can include, "underlining key words, phrases, or sentences; writing comments or questions in the margins; bracketing important sections of the text; constructing ideas with lines or arrows; numbering related points in sequence; and making note of anything that strikes you as interesting, important, or questionable" (Hardcastle 1996). Annotations are usually written directly on a paper copy to refer directly to specific parts of the text for reading clarity, proof-reading, or refereeing. "[U]sers often show a strong preference for the "hard-copy" medium of document presentation when it comes to reading activities such as those that involve proof-reading or refereeing the document" (Tucker and Jones 1993), even though the use of computers for displaying documents is increasing. When using electronic copies of documents, some editors provide annotating facilities. These can be awkward to use, often requiring specific file formats and dictating how the user must annotate. This is discussed further by Tucker and Jones (1993) with respect to the use of written, typed or spoken annotations. Annotating is an individual task that enhances and establishes the author's message as the reader interprets it. Differences in annotation marks when comparing the same document that has been annotated by two people are linked to personal understanding and preferences (Showstack 1982) and it has been found that "[m]ost readers annotate in layers, adding further annotations on second and third readings. Annotations can be light or heavy, depending on the reader's purpose and the difficulty of the material" (Hardcastle 1996).

It is recommended that in addition to annotating that the reader should take notes to reflect the "quality of thinking" at the time (Booth *et al.* 1995).   Specific information that should be recorded include, bibliographical data, key words, summaries and thoughts, and a call number (if applicable). Making notes can enhance reading by focussing the reader's concentration, increasing the reader's understanding of the text, and enforcing an evaluation of the quality of the source document. It is used to gather information and create links between what you know and what you have read from different sources. This gives you a broader perspective and the ability to draw conclusions. It also records information that can be stored for later use (LDC 1996).

Although the strategies above dictate how one *should* read, it is not known how individuals *actually* read. In particular, frequency and quality are characteristics of reading which are often unknown and hard to measure. Reading for information can be a specific, casual or a subliminal activity. With the amount of information propelled upon individuals, how much does a person read and process? One way of measuring reading frequency for researchers is by determining the utilisation of library materials. It has been found that even though the materials that are on loan are often retained until the due date, the use made of the materials is small relative to the length of time they are on loan (Ford 1973). The quality of use during this period is not known. By looking at the time allocation of researchers to the activity of reading, one may be able to determine not only how often reading occurs, but the quality and quantity of information read.

Information Storage

During the research period and afterwards it would be of interest to know what happens to the material, information, and notes collected? Also, what sort of format are they kept in? These questions may be answered by looking at the preferences for reading environments. Examples include, a partiality for paper or electronic copy, the original or a photocopy, borrowed or own copy of material. In general, from the research seen, most scholars prefer to have their own hard copy (be it the original or a photocopy). Most, if not all, information is retained and filed for possible use the future. It has already been noted that researchers prefer their own collections; one reason given by scientists is that they then can apply their own classification systems when filing materials (Seggern 1995). Such schemes are personalised and can be quite elaborate. Sievert and Sievert (1989) describes the organisation of research materials by the humanists surveyed. Most scholars have some sort of informal classification scheme for filing which may include index cards, notebooks or some combination of books, photocopied articles or a log of some sort. Documents can be arranged by the traditional Dewy Decimal, alphanumeric, or Library of Congress classification numbers, or more likely grouped by author or subject. Cunningham and Connaway captures the essence of scholarly filing: "piles, generally not by project ... boxes of reprints, folders of notes, folders in the filing cabinet, pigeonholes with papers and drafts for recent papers ... basically it's chaos. Usually I manage to find the most important stuff" (Cunningham and Connaway).

Summary
Ford (1973) gives a good summation of reading behaviour in libraries in that there is a large gap in our knowledge when it comes to the utilisation of materials. One can only assume that the accuracy of the reading strategies available has been investigated as to their worth and practicality and that they are characteristic of reading behaviour. These strategies and directions for reading give an overall impression on how readers should read. Most readers obviously apply some or all of the guidelines. Consequently, all of these strategies can be included as reader behaviour, although some are more characteristic than others.

Conclusion

By gaining a fuller understanding of how users of traditional libraries behave and the reading styles of individuals, the knowledge can be applied to enhance a digital library environment. It can be used to create an inviting and familiar surrounding that caters for the majority of users. Research into library-user interaction is quite thorough in contrast to the research on the behaviour involved in information use and storage. Ford (1973) discovered a gap in knowledge on the what-where-when-how-and-why of material use in libraries. There is also a lack of information on the actual reading methods used, the frequency and quality of material use, and the storage of documents. Further research is required to extend our knowledge on these behaviours. In light of the research found on traditional library interactions, it would be interesting to know if the patrons of this library environment have the same requirements as the digital library patrons. It would be beneficial for designers of digital libraries to understand the behaviours of the people they are intended for.

References

Apted, E., and Choo, C. W. (1971). General purposive browsing. *Library Association Record*, **73**, 228-230.

Askwall, S. (1985). Computer supported reading vs reading text on paper: a comparison of two reading situations. *International Journal of Man-Machine Studies*, **22**, 425-439.

Booth, W. C., Colomb, G. G., and Williams, J. M., (1995). *The craft of research*. University of Chicago.

Broadbent, E. (1986). A study of humanities faculty library information seeking behaviour. *Cataloging & Classification Quarterly*, **6**, 23-37.

Bystrom, K., and Jarvelin, K. (1995). Task complexity affects information seeking and use. *Information Processing & Management*, **13**, 191-213.

Chang, S. J., and Rice R. E. (1993). Browsing: a multi-dimensional framework. *Annual Review of Information Science and Technology*, **28**, 231-276.

Cunningham, S. J., and Connaway, L. S. (). Information searching preferences and practices of computer science researchers. Working paper.

De Bruijn, D., De Mul, S., and Van Oostendorp, H. (1992). The influence of screen size and text layout on the study of text. *Behaviour & Information Technology*, **11**, 71-78.

Duchastel, P. C. (1982). Textual display techniques. In *The technology of text*, (ed. D. H. Jonassen), pp. 167-192. Educational Technology Publications, New Jersey.

Ellis, D., Cox, D., and Hall, K. (1993). A comparison of the information seeking patterns of researchers in the physical and social sciences. *Journal of Documentation*, **49**, 356-369.

Fishman, D., and Walitt, R. (1972). Seating and area preferences in a college reserve room. *College & Research Libraries*, **33**, 284-297.

Folster, M. B. (1995). Information seeking patterns: social sciences. In *Library users and reference services*, (ed. J. B. Whitlatch), pp. 83-93.

Ford, G. (1973). Progress in documentation: research in user behaviour in university libraries. *Journal of Documentation*, **29**, 85-106.

Gifford, R., and Sommer, R. (1968). The desk or the bed? *Personnel & Guidance Journal*, **46**, 876-878.

Gluck, M. (1996). Exploring the relationship between user satisfaction and relevance in information systems. *Information Processing & Management*, **32**, 89-104.

Hallmark, J. (1994). Scientists' access and retrieval of references cited in their recent journal articles. *College & Research Libraries*, **55**, 199-209.

Hardcastle, V. (1996). *Critical reading strategies*. Found at http://mind.phil.vt.edu/www/1204.html, on 6 December 1996.

Hartmann, J. (1995). Information needs of anthropologists. *Behavioural & Social Sciences Librarian*, **13**, 13-24.

Holland, M. P., and Powell, C. K. (1995). A longitudinal survey of the information seeking and use habits of some engineers. *College and Research Libraries*, **56**, 7-15.

Kuhlthau, C. C. (1993). A principle of uncertainty for information seeking. *Journal of Documentation*, **49**, 339-355.

LDC (Learning and Development Centre). (1996). *Reading and Notemaking.* Found at http://www.macarther.uws.edu.au/ssd/ldc/Readnote.html, on 21 January 1997.

Leckie, G. L., Pettigrew, K. E., and Sylvain, C. (1996). Modeling the information seeking of professionals: a general model derived from research on engineers, health professionals, and lawyers. *The Library Quarterly*, **66**, 161-193.

Marchionini, G. (1995). *Information seeking in electronic environments*. Cambridge University Press, New York.

Merrill, P. F. (1982). Displaying text on microcomputers. In *The technology of text*, (ed. D. H. Jonassen), pp. 401-414. Educational Technology Publications, New Jersey.

Mills, C. B., and Weldon L. J. (1987). Reading text from computer screens. *ACM Computing Surveys*, **19**, 329-358.

Muter, P., and Maurutto, P. (1991). Reading and skimming from computer screens and books: the paperless office revisited? *Behaviour & Information Technology*, **10**, 257-266.

Norman, D. A. (1993). *Things that make us smart: defending human attributes in the age of the machine*. Addison-Wesley, Massachusetts.

Oborne, D. J., and Holton, D. (1988). Reading from screen versus paper: there is no difference. *International Journal of Man-Machine Studies*, **28**, 1-9.

Pinelli, T. E. (1991). The information-seeking habits and practices of engineers. *Science and Technology Libraries*, **12**, 5-16.

Schamber, L. (1994). Relevance and information behavior. *Annual Review of Information Science and Technology*, **29**, 3-48.

Seggern, M. V. (1995). Scientists, information seeking and reference services. In *Library users and reference services*, (ed. J. B. Whitlatch), pp. 95-104.

Showstack, R. (1982). Printing: the next stage: discourse punctuation. In *The technology of text*, (ed. D. H. Jonassen), pp. 369-376. Educational Technology Publications, New Jersey.

Sievert, D., and Sievert, M. E. (1989). Philosophical research: report from the field. *Proceedings of the Humanists at Work symposium* (April, Chicago), pp. 79-94. University of Illinois at Chicago.

Sommer, R. (1966). The ecology of privacy. *Library Quarterly*, **36**, 234-248.

Sommer, R. (1968). Reading ares in college libraries. *Library Quarterly*, **38**, 249-260.

Sweet, A. P., Riley, R. W., Robinson, S. P., and Conaty, J. C. (1993). *State of the art: transforming ideas for teaching and learning to read*. Found at http://www.ed.gov/pubs/StateArt/covpg.html, on 21 January 1997.

Tucker, P., and Jones, D. M. (1993). Document annotation: to write, type or speak? *International Journal of Man-Machine Studies*, **39**, 885-900.

Wiberley, S., and Jones, W. G. (1989). Patterns of information seeking in the humanities. *College & Research Libraries*, **50**, 638-645.

Witten, I. H., Cunningham, S. J., Vallabh, M., and Bell, T. C. (1995). A New Zealand digital library for computer science research. *Proc Digital Libraries '95* (April, Texas), pp. 25-30.

Bibliography

Apted, E., and Choo, C. W. (1971). General purposive browsing. *Library Association Record*, **73**, 228-230.
   A good overall article on across-document browsing. It researches different types, the meaning of, and evaluating browsing. It also looks at general browsing in the library environment. Light and easy reading.

Arnold, K. (1994). *The electronic librarian is a verb / the electronic library is not a sentence*. Found at http://www.press.umich.edu/jep/works/arnold.eleclib.html, on 9 December 1996.
   A presentation to a conference on the place of libraries and librarians in today's information society. The author also discusses the challenges of the library in an electronic, user-pays system. Light conversational reading.

Askwall, S. (1985). Computer supported reading vs reading text on paper: a comparison of two reading situations. *International Journal of Man-Machine Studies*, **22**, 425-439.
   Compares the use of computers and paper for reading, skimming and comprehension. Contains a good set of references.

Booth, W. C., Colomb, G. G., and Williams, J. M., (1995). *The craft of research*. University of Chicago.
   Contains strategies that can be used when reading for information. The methods of research discussed are practical and realistic. A very good book to use for researching and writing papers.

Broadbent, E. (1986). A study of humanities faculty library information seeking behaviour. *Cataloging & Classification Quarterly*, **6**, 23-37.
   An insight into what library sources humanities faculty use. It has views on the kind of information catalogue facilities they would prefer. It also looks at how faculty prefer to search, indicating electronic services required to cater for this.

Bystrom, K., and Jarvelin, K. (1995). Task complexity affects information seeking and use. *Information Processing & Management*, **13**, 191-213.
   The article argues that task alone is not specific enough to analyse information seeking and use behaviour. It provides an information seeking model and a method to look at how the level of task complexity affects the information needs, seeking, channels, and sources.

Chang, S. J., and Rice R. E. (1993). Browsing: a multi-dimensional framework. *Annual Review of Information Science and Technology*, **28**, 231-276.
   A good review of the literature published on browsing. This article has a specific section on browsing in a library. Easy to understand.

Cunningham, S. J., and Connaway, L. S. (). Information searching preferences and practices of computer science researchers. Working paper.
   Looks at how and where, under research situations, computer scientists locate information. It covers the information seeking process from seeking to the storage of relevant documents.

De Bruijn, D., De Mul, S., and Van Oostendorp, H. (1992). The influence of screen size and text layout on the study of text. *Behaviour & Information Technology*, **11**, 71-78.
This article looks at how changes to the presentation of text on a screen can influence the readability. Two factors discussed is the screen size and text layout. It does not directly look at the reading behaviours of the computer users.

Duchastel, P. C. (1982). Textual display techniques. In *The technology of text*, (ed. D. H. Jonassen), pp. 167-192. Educational Technology Publications, New Jersey.
Looks at the display of text in books and how this affects or enhances readability. It offers techniques that can be used to create a more attractive product. This chapter of the book includes a section on how humans process text.

Ellis, D., Cox, D., and Hall, K. (1993). A comparison of the information seeking patterns of researchers in the physical and social sciences. *Journal of Documentation*, **49**, 356-369.
Presents a comparison between physical, chemical and social scientists in the way they go about searching for information. The article develops a very good general model for the information seeking process (it does not specifically relate the activities to the library environment). Thorough and worth while reading.

England, M., Shaffer, M. (1995). *Librarians in the digital library*. Found at http://www.csdl.tamu.edu/DL94/poistion/england.html, on 9 December 1996.
This article discusses the roles that a librarian has an opportunity to fulfil in an electronic library environment. It discusses the librarians role as a researcher, organiser and publisher, member of the digital library design team, and as a teacher and consultant.

Fishman, D., and Walitt, R. (1972). Seating and area preferences in a college reserve room. *College & Research Libraries*, **33**, 284-297.
A study into a specific reading area of one library. It discusses factors of seating preferences (front versus back, the seating position, etc.) and their relevance to users of a college reserve room. The research does not extend to the reading behaviours during the users stay.

Folster, M. B. (1995). Information seeking patterns: social sciences. In *Library users and reference services*, (ed. J. B. Whitlatch), pp. 83-93.
A look at the information seeking behaviour of social scientists over the last three decades determining trends that library services can be based on. Not very thorough; it covered everything briefly and did not draw many conclusions from the findings.

Ford, G. (1973). Progress in documentation: research in user behaviour in university libraries. *Journal of Documentation*, **29**, 85-106.
A practical look into understanding the interaction between the library and its users and how these findings can be applied to increase library usage. Very relevant and worth while reading.

Furuta, K. (1995). *Librarianship in the digital library*. Found at http://www.csdl.tamu.edu/DL94/position/kfuruta.html, on 9 December 1996.
Looks at the role of the librarian in the traditional library and what they can offer a digital library. Also what experience the librarian has that can be used in designing digital libraries.

Gessesse, K. (1994). Science communication, electronic access and documentation delivery: the new challenge to the science/engineering reference librarian. *International Information &Library Review*, **26**, 341-349.
Describes the relevance of technology in the information seeking and retrieval process and is a call to reference librarians to embrace it. It looks briefly at the information needs and seeking behaviour of scientists then describes how the reference librarian can assist the scientist in obtaining the material.

Gifford, R., and Sommer, R. (1968). The desk or the bed? *Personnel & Guidance Journal*, **46**, 876-878.
Looks at the preferences of study environments for students and whether there is any substantial evidence confirming students study better at a desk. Does not discuss reading behaviour, but does look at environment preferences.

Gluck, M. (1996). Exploring the relationship between user satisfaction and relevance in information systems. *Information Processing & Management*, **32**, 89-104.
Discusses the relevance and user-satisfaction in regard to determining and comparing qualities for information systems. Good definitions and reference to other material regarding relevance and information behaviour.

Grogan, D. (1992). *Practical reference work*. Library Association Publishing, London.
Looks at the role of reference librarians in answering library-user enquires sufficiently and accurately. It gives examples of the sort of queries that might be asked by library users.

Hallmark, J. (1994). Scientists' access and retrieval of references cited in their recent journal articles. *College & Research Libraries*, **55**, 199-209.
A good concise article which discusses how scientists from different fields of interest become aware of relevant information and how they eventually retrieve it. It is opinionated as it draws on the views of the scientists studied indicating their positive and negative perspectives on literature seeking and retrieval. The article discusses the pitfalls of library interaction.

Hardcastle, V. (1996). *Critical reading strategies*. Found at http://mind.phil.vt.edu/www/1204.html, on 6 December 1996.
Introduces reading strategies to better understand the material being read. It is a concoction of ideas "culled over the years from various and sundry sources". Worthwhile looking at when considering reading behaviours.

Hartmann, J. (1995). Information needs of anthropologists. *Behavioural & Social Sciences Librarian*, **13**, 13-24.
Covers the information sources and resources of anthropologists in comparison with other social scientists. It looks at the library use and attitudes of anthropologists.

Holland, M. P., and Powell, C. K. (1995). A longitudinal survey of the information seeking and use habits of some engineers. *College and Research Libraries*, **56**, 7-15.
A comparison of graduated engineers who had and had not taken a paper which included formal training on conducting information research. This study shows that those who had done the paper were more aware of library resources.

Kuhlthau, C. C. (1991). Inside the search process: information seeking from the user's perspective. *Journal of the American Society for Information Science*, **42**, 361-371.
A theoretical approach to information seeking practices. It discusses the behaviour involved in information seeking and builds a model based on past research and a survey conducted.

Kuhlthau, C. C. (1993). A principle of uncertainty for information seeking. *Journal of Documentation*, **49**, 339-355.
Develops a high level model of feelings, thoughts, and actions associated with information seeking. Does not look at the physical activities involved or the library.

LDC (Learning and Development Centre). (1996). *Reading and Notemaking.* Found at http://www.macarther.uws.edu.au/ssd/ldc/Readnote.html, on 21 January 1997.
Strategies on how to read to gain a better understanding of the material and how making notes can assist this process. A good practical article that is aimed at students.

Leckie, G. L., Pettigrew, K. E., and Sylvain, C. (1996). Modeling the information seeking of professionals: a general model derived from research on engineers, health professionals, and lawyers. *The Library Quarterly*, **66**, 161-193.
A literature review of the needs, uses, location and relevance of information for professions in the fields of engineering, health services and law. An overall model for all professionals, based on this review, is developed and justified. Not a lot of information on the actual search process undertaken by professionals is conveyed. Quite vague.

Marchionini, G. (1992). Interfaces for end-user information seeking. *Journal of the American Society for Information Science*, **43**, 156-163.
The process for information seeking is explained and then the best way to solve it via electronic medium is discussed. It covers from defining a problem through to the extraction of information.

Marchionini, G. (1995). *Information seeking in electronic environments*. Cambridge University Press, New York.
Looks at the information seeking process in conventional and electronic environments. It includes a very good section on browsing and has a complete set of references.

Marchionini, G. (1996). *ASIS presentation on browsing.* Found at http://www.glue.umd.edu/~march/tea1.html, on 7 January 1996.
Slides used by the author to present information on browsing to a conference. The information presented is also found in Marchionini (1995).

Marchionini, G., Dwiggins, S. S., and Katz, A. (1993). Information seeking in full-text end-user-oriented search systems: the roles of domain and search expertise. *Library and Information Science Research*, **15**, 35-69.
A look at electronic settings for information searching and compares experts in the domain (for example, scholars) and experts in searching (for example, librarians). Does not discuss the library interaction.

Merrill, P. F. (1982). Displaying text on microcomputers. In *The technology of text*, (ed. D. H. Jonassen), pp. 401-414. Educational Technology Publications, New Jersey.
This chapter of the book looks at how text can be displayed on a computer screen that

will benefit the reader. It includes a good summary section on the principle of displaying text on a computer.

Mills, C. B., and Weldon L. J. (1987). Reading text from computer screens. *ACM Computing Surveys*, **19**, 329-358.
    Looks at the characteristics of reading from a screen and how, by altering them, readability can increase or decrease. It has a good section that compares reading from a paper copy versus reading from a screen.

Morse, P. M. (1970). Search theory and browsing. *The Library Quarterly*, **40**, 391-408.
    Discusses and evaluates an optimal procedure for browsing using previously developed search theories. It then looks at how this can be implemented in a library situation so as to produce high interest browsing. The article includes a lot of numerical analysis and use of theoretical equations to evaluate browsing.

Muter, P., and Maurutto, P. (1991). Reading and skimming from computer screens and books: the paperless office revisited? *Behaviour & Information Technology*, **10**, 257-266.
    An article that is not directly related to reading behaviour although it does give an insight into the implications on online reading and skimming of documents.

Norman, D. A. (1993). *Things that make us smart: defending human attributes in the age of the machine*. Addison-Wesley, Massachusetts.
    This book reassures readers that the computer is not as intelligent as them. A fun and easy book to read but only mildly relevant to the topic. It does include a small bit on the positives and negatives of reading medium.

Oborne, D. J., and Holton, D. (1988). Reading from screen versus paper: there is no difference. *International Journal of Man-Machine Studies*, **28**, 1-9.
    Uses reading and comprehension to compare reading from a computer screen to reading off a paper copy. It indicates that these two factors are not the only factors that need to be considered. Includes a good set of references on this topic.

PITCR (Panel on Information Technology and the Conduct of Research). (1989). *Information technology and the conduct of research: the users view*. National Academy Press, Washington D.C.
    Discusses the conduct of research under electronic media. It gives an insight into the opportunities and problems that are associated with each area of research when it is conducted electronically. An enlightening book which includes small anecdotes throughout.

Pinelli, T. E. (1991). The information-seeking habits and practices of engineers. *Science and Technology Libraries*, **12**, 5-16.
    Distinguishes scientists and engineers by their information needs and then proceeds to describe the information needs of engineers in more depth. It is a concise literature review that includes more information about the practices of engineers than their behaviour.

Reneker, M. H. (1993). A qualitative study of information seeking among members of an academic community: methodology issues and problems. *The Library Quarterly*, **63**, 487-507.
    Outlines the advantages of doing a qualitative study into information seeking behaviours.

It compares the benefits of qualitative and quantitative studies. Unfortunately, no results were concluded that relate to the topic under consideration.

Sandstrom, P. E. (1994). An optimal foraging approach to information seeking and use. *The Library Quarterly*, **64**, 414-449.
   An argument putting forward the theory of the optimal forging approach to model information seeking behaviour. Difficult reading with a lot of deductions.

Savolainen, R. (1995). Everyday life information seeking: approaching information seeking in the context of "way of life". *Library & Information Science Research*, **17**, 259-294.
   Indicates that it discusses the information seeking practices of individuals, however, it includes a lot of definitions and theories that needs to be waded through. It delves into a whole lot of theory on "the way of life" (order of things) and "mastery of life" (keeping things in order).

Schamber, L. (1994). Relevance and information behaviour. *Annual Review of Information Science and Technology*, **29**, 3-48.
   A long article on how individuals determine relevance of retrieved material. It defines relevance and the problems with its use in research. Has a good background section on past research into human information behaviour.

Seggern, M. V. (1995). Scientists, information seeking and reference services. In *Library users and reference services*, (ed. J. B. Whitlatch), pp. 95-104.
   Discusses the information needs and sources for scientists and the implications it has towards library reference services. It includes a summary of works on scientists' information seeking habits and conclusions and recommendations drawn from them in relation to the library.

Showstack, R. (1982). Printing: the next stage: discourse punctuation. In *The technology of text*, (ed. D. H. Jonassen), pp. 369-376. Educational Technology Publications, New Jersey.
   It compares the two-dimensional structure of text compared to ideas which are multi-dimensional. The article calls to publishers to use discourse punctuation to improve reader understandability, speed, and efficiency. Also it can be used to convey the author's message more clearly.

Sievert, D., and Sievert, M. E. (1989). Philosophical research: report from the field. *Proceedings of the Humanists at Work symposium* (April, Chicago), pp. 79-94. University of Illinois at Chicago.
   A commentary about the work "currently" undertaken to determine now philosophers go about researching - the seeking, retrieval and use of relevant information. Easy, light reading, filled with small anecdotes.

Snavley, L, and Clark, K. (1996). What users really think: how they see and find serials in the arts and sciences. *Library Resources & Technical Services*, **40**, 49-58.
   The experience of the two authors is presented on how people find and locate serials. It discusses some solutions to problems identified through working as reference librarians. The article calls to librarians to be aware of these problems.

Sommer, R. (1966). The ecology of privacy. *Library Quarterly*, **36**, 234-248.
Discusses the connection between privacy of readers in the library and the physical
environment. It covers now people choose their seating position in a library with regard
to the current seating arrangement. Interesting reading about reader behaviour in the
library, not the behaviour when reading.

Sommer, R. (1968). Reading ares in college libraries. *Library Quarterly*, **38**, 249-260.
Examines the adequacy of reading areas in college libraries as study places. The article
looks at the environmental needs and preferences of studiers in libraries and the
implications.

Sweet, A. P., Riley, R. W., Robinson, S. P., and Conaty, J. C. (1993). *State of the art:
transforming ideas for teaching and learning to read*. Found at
http://www.ed.gov/pubs/StateArt/covpg.html, on 21 January 1997.
A series of ten ideas on how to teach and learn to read. Based in an educational
environment, this article offers strategies for reading. Idea eight looks at how expert
readers have strategies that they use to construct meaning and is helpful when looking at
reading behaviour.

Tucker, P., and Jones, D. M. (1993). Document annotation: to write, type or speak?
International Journal of Man-Machine Studies, **39**, 885-900.
It tries to decide on an acceptable medium for annotating documents online. The article
compares written, typed and spoken annotations when proof-reading and refereeing.

Wiberley, S., and Jones, W. G. (1989). Patterns of information seeking in the humanities.
College & Research Libraries, **50**, 638-645.
An in depth discussion into how humanities scholars go about locating information. It
mainly looks at the resources that the scholars use and the implications it has for
librarians and libraries. The article does not discuss library behaviour but does have how
humanities see libraries.

Wilson, T. (1995). *Information-seeking behaviour: designing information systems to meet out
clients' needs*. Found at
http://www2.shef.ac.uk/info_studies/public_html/public_html/lecturer/acuril.html, on 6
December 1996.
Defines information needs with respect to information seeking behaviour and how this
can be implemented in services. A good article that is easy to read.

Witten, I. H., Cunningham, S. J., Vallabh, M., and Bell, T. C. (1995). A New Zealand digital
library for computer science research. *Proc Digital Libraries '95* (April, Texas), pp. 25-
30.
Gives an overview to the New Zealand Digital Library. Relevant to look at when
discussing research behaviour with respect to implications for digital libraries.

References to material not sighted

Barzun, J., and Graff, H. F. (1977). *The modern researcher*, (3rd edn). Harcourt Brace
Jovanocich, New York.

Bates, M. (1989). The design of browsing and berrypicking techniques for the online search interface. *Online Review*, **13**, 220-228.

Bell, W. J. (1991). *Searching behaviour: the behavioural ecology of finding resources*. Chapman and Hall, London.

Cooper, W. (1971). A definition of relevance for information retrieval. *Information storage and retrieval*, **7**, 19-37.

De Mul, S., and Oostendorp, H. (1990). Het bestuderen van teksten en het maken van aantekeningen op do computer (studying texts and making notes on the computer). *Onderwijsresearchaagen*. Technologie en Methodologie, ITS, Nijmegen.

Dillon, A. (1994). *Designing usable electronic text; ergonomic aspects of human information usage*. Taylor and Francis, Bristol, PA.

Gorman, G. E. (1989). Patterns of information seeking and library use by theologians in seven Adelaide theological colleges. *Australian Academic & Research Libraries*, **50**, 638-645.

Gould, C. C., Pearce, K. (1991). *Information needs in the sciences: an assessment*. Research Libraries Group, Mountain View California.

Hurd, J. M., Weller A. C., and Karen, L. (1992). Information seeking behaviour of faculty: use of indexes and abstracts by scientists and engineers. *American Society of Information Science 55th Annual Meeting*, (Pittsburgh).

Hyman, R. J. (1972). *Access to library collections: an inquiry into the validity of the direct shelf approach, with special reference to browsing*. Scarecrow Press, New Jersey.

Lancester, F. W., and Warner, A. (1985). Electronic publication and its impact on the presentation of information. In *The technology of text: principles for structuring, designing, and displaying text*, Vol. 2, (ed. D. H. Jonasssen), pp. 292-309. Educational Technology Publications, Englewood Cliffs, New Jersey.

Markey, K. (1984). *Subject searching in library catalogues before and after the introduction of online catalogues*. OCLC, Online Computer Library Centre, Dublin, Ohio.

McGregor, J. H. (1994). Information seeking and use: students' thinking and their mental models. *Journal of Youth Services in Libraries*, **8**, 69-76.

Mosenthal, P. B. (1996). Understanding the strategies of document literacy and their conditions of use. *Journal of Educational psychology*, **88**, 314-332.

Paris, S. G., Wasik, B. A., and Turner, J. C. (1991). The development of reading strategies. In *Handbook of research in the english language arts*, (ed. J. Flood, J. M. Jensen, D. Lapp, and J Squire), pp. 609-635, Macmillan, New York.

Odini, C. (1993). Trends in information needs and use research. *Library Review*, **42**, 29-37.

Radecki, T. (1988). Trends in research on information retrieval - the potential for improvements in conventional boolean retrieval systems. *Information Processing & Management*, **24**, 219-227.

Saracevic, T. (1975). Relevance: a review of a framework for thinking on the notion of information science. *Journal of the American Society for Information Science*, **26**, 178-194.

Saracevic, T., Kantor, P., Chamis, A. Y., and Trivison, D. (1988). A study of information seeking and retrieving. *Journal of the American Society for Information Science*, **39**, 161-216.

Steinke, C. A. (ed.) (1991). *Information seeking and communicating behaviour of scientists and engineers.* Haworth Press, United States.

Van Leunen, M. (1986). *A Handbook for scholars*. Alfred A Knopf, New York.

Wettler, M. (1996). Information processing in information retrieval from the viewpoint of associanist and cognitive psychology. *Review of Information Science*, **1**.

References by subject

Reference	mo	Info and	and	retr	Bro	Rel	Lib	Lib	Re Tex	Re	Re	An Re	Re	Inf
Apted and Choo (1971)					X									
Arnold (1994)				X			X							
Askwall (1985)									X					
Booth *et al.* (1995)											X		X	
Broadbent (1986)		X	X			X								
Bystrom and Jarvelin (1995)	X													
Chang and Rice (1993)					X									
Cunningham and Connaway ()		X	X											X
De Bruijn *et al.* (1992)									X					
Duchastel (1982)									X	X				
Ellis *et al.* (1993)	X	X	X											
England and Shaffer (1995)				X			X							
Fishman and Walitt (1972)						X		X						
Folster (1995)		X	X	X										
Ford (1973)			X			X								
Furuta (1995)				X			X							
Gessesse (1994)		X	X				X							
Gifford and Sommer (1968)								X						
Gluck (1996)					X									
Grogan (1992)						X	X							
Hallmark (1994)		X	X											
Hardcastle (1996)											X	X		
Hartmann (1995)		X	X											
Holland and Powell (1995)		X	X											
Kuhlthau (1991)	X													
Kuhlthau (1993)	X		X											
LDC (1996)											X	X		
Leckie *et al.* (1996)	X	X	X											
Marchionini (1992)			X	X										
Marchionini (1995)	X		X	X	X									
Marchionini (1996)				X										
Marchionini *et al*. (1993)	X		X	X										
Merrill (1982)									X					
Mills and Weldon (1987)									X					
Morse (1970)	X				X									
Muter and Maurutto (1991)									X					
Norman (1993)										X				
Oborne and Holton (1988)									X					
PITCR (1989)				X									X	
Pinelli (1991)		X	X											
Reneker (1993)			X											
Sandstrom (1994)	X		X											
Savolainen (1995)	X	X												
Schamber (1994)			X			X								
Seggern (1995)		X	X											
Showstack (1982)										X		X		
Sievert and Sievert (1989)		X				X							X	X
Snavley and Clark (1996)		X	X											
Sommer (1966)						X		X						
Sommer (1968)						X		X						
Sweet *et al*. (1993)										X	X			
Tucker and Jones (1993)												X		
Wiberley and Jones (1989)		X	X			X								
Wilson (1995)		X	X	X				X						
Witten *et al*. (1995)				X										