Student Readers' Use of Library Documents: Implications for Library Technologies

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ABSTRACT

We report on a study of graduate students conducting research in libraries, focusing on how they extract and record information as they read. By examining their information recording activities within the context of their work as a whole, it is possible to highlight why students choose particular strategies and styles of recording for what these activities provide both at the time of reading and at subsequent points in time. The implications of these findings for digital library technologies are discussed.

KEYWORDS

Reading, annotation, note-making, paper, documents, digital documents, digital libraries, design, information recording

INTRODUCTION

As is shown by the emergence of specialist conferences, research projects, and journals, in recent years there has been a growing interest in the topic of "digital libraries". This growth is set to bring about significant changes in information services and library policies which, in turn, will impact on the work practices of library users. In order to better understand the impact of these changes, it is first necessary to have an understanding of the kind of work that library users carry out. Such an understanding can also guide the design of new digital technologies in support of library work. Hopefully, by doing so, these new technologies can be made more sensitive to the needs and current practices of library users.

The need to understand the requirements and work practices of library users is one that is very much recognised in the literature. Indeed there are many examples of user-centred approaches to the design of technology for the "digital library" [e.g. 4, 8, 17, 20]. However, much of this end-user research generally has a very narrow focus [1]. With the odd exception [e.g. 11, 13], user-centred approaches have concentrated primarily on how users search for and retrieve information. As such, much of the design effort in the field has been aimed at providing support for these activities.

As we will show in this paper, however, there is a great deal more document-related work that occurs once library users have retrieved their documents, and these activities have received far less attention in the literature. By underplaying these activities, the field ignores the need to gain a more comprehensive understanding of the work that library users engage in; more importantly, it ignores how all these document activities have a mutual influence on each other. We would argue that library users' activities need to be examined within the context of their work as a whole if we are to really understand how we can design technology to support them.

The purpose of this paper is to extend our notions of the work of library users by focusing on their reading activities, and more specifically by focusing on their "information recording" activities. By "information recording" we mean the way readers extract and record information from a source text, mainly through notes, annotations and photocopies. Because of this interest, we focus on library users (in this case graduate students) reading for research purposes as a representative sample of intensive library users. We examine their information recording activities within the broader context of their library work so as to highlight the contingencies and motivations that underlie them.

The Literature

The information recording activities of undergraduate students, such as note-making and annotation, have received considerable attention over the last 25 years. Much of this effort has been driven by the "encoding-review" framework of the learning benefits of note-making established by DiVesta and Gray [2] with the aim of identifying the circumstances under which information recording activities have positive, neutral and negative effects on learning behaviour. Particular attention has been devoted to understanding the effects of note-making on learning from lectures. Reviews of the literature [6, 9, 10] have revealed mixed findings, but on the whole, the evidence suggests that when positive effects are demonstrated, reviewing information in one's notes has a stronger influence on learning than the information gleaned during the course of actually making the notes. A smaller effort has extended some of the findings to information recording from text-based information sources. These again have demonstrated some of the

positive effects on learning of information recording activities such as underlining and note-making, with the stronger influence attributed to review aspects [e.g. 5, 7, 12].

This paradigm, while useful in some respects, may be directly responsible for the often conflicting nature of the findings in the field, by not respecting the range of functions that particular information recording strategies may have in different situations [12]. As Van Meter, Yokoi and Pressley [18] have noted, very little effort has been aimed at understanding note-making from the perspective of those who actually undertake the activity in terms of the various contingencies of their work as a whole that motivate their choices on different occasions (some exceptions include [3, 14, 19]). The study reported here is motivated along similar lines to Van Meter et al.'s [18] analysis of students' perspectives of note-making during lectures but focuses on information recording from text-based sources within libraries. Such a perspective can offer ways of generating new hypotheses about the document activities of library users, particularly in relation to annotation and note-making. In doing this, the aim is to help identify new opportunities for improving the design of digital library systems and technologies to support the document activities of library users.

METHOD
Participants
Participants in this study were 25 PhD students in the arts and humanities at Cambridge University at varying stages of their studies. All were volunteers who responded to an advertisement placed in some of the college libraries, and each was paid £25.00 for their participation.

The Libraries
The Cambridge University library system is made up of many libraries dispersed across the city. In addition to the main University Library, which houses the principal collection of materials, there are over 100 libraries linked in some way with the University, with the other major ones being the Scientific Periodicals Library, the University Medical Library, and the Squire Law Library.

Procedure
Participants were asked to complete a diary of their document-related activities during a working day at the library as well as any document-related research activities undertaken elsewhere. They were given pre-printed diary sheets on which to record details about their research activities including: the nature of a research activity, the time taken, the documents and sources used, any accompanying support activities such as note-making or photocopying, and the place where the activity was conducted. At the end of their working day (or the next morning if they worked late in the evening) they were interviewed for approximately 1 hour. The initial part of the interview was used to get a basic sense of the nature of the research being undertaken by participants, in order to help ground the later discussions about their document-related activities. The activities in the diary were then used as a basis from which to guide the remainder of the interview, during which participants were asked to elaborate upon their research activities and the motivations behind them were explored. The interview focused in particular on what, how and why information from the materials in the library was recorded and subsequently used.

A FRAMEWORK
From an initial analysis of the interviews and diary data we found it helpful to first sketch out a high-level model of the document related activities of library users at different stages of their research work (Figure 1). While such a view is clearly over-simplified, it nevertheless demonstrates how scholarly research may be characterised as a complex process of searching, information retrieval, reading, information extraction and recording by annotation and note-taking, information review, and writing new compositions (such as papers or thesis chapters). Many of these processes are iterative and there are potentially large time gaps between different stages, e.g. months or even years. Some of the activities take place in libraries, some at home, and some in other places.
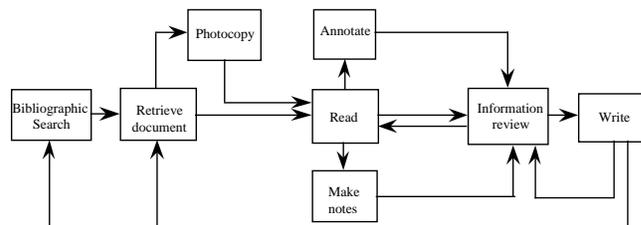

Figure 1. A model of document related activities of library users at different stages of their research work.

Outlining the context of the researchers' work in this way then provided a useful framework within which we could further analyse and understand in more detail the data from the interviews and diaries. It also helped us to understand the interdependencies that may arise within library users' activities, and consequently the choices and decisions that they make. For example, consider a researcher wanting to read a new article in a current periodical that is not available for loan. The researcher must either read it in the library or make a photocopy so as to be able to take it home. Because it is forbidden to mark up the original volume, if no photocopy is made, the researcher cannot annotate the document, but rather must take notes on a separate document so as to get the information home where it is used to help write a thesis chapter. These notes may be on paper or on a laptop. If the notes are on a laptop, this may allow notes and quotations recorded to be directly re-used in the thesis chapter. However, because of the limitations of screen space there will be problems laying out the notes for the purpose of cross referencing while writing. Conversely, if the notes are on paper this may facilitate review, but require information from notes to be re-entered into a computer if used when writing. From this it can be seen

how decisions taken during document activities early on in the process can affect document activities at later stages of the researcher's work.

FINDINGS
With this framework in mind, we proceeded to carry out a more in-depth analysis of readers' information recording activities. Here we focus on summarising participants' descriptions of their activities from their diary data, from the interviews we conducted, and from looking at and discussing their notes and annotations. We first present the findings in terms of the *nature* of the information they recorded and then in terms of the various *methods* by which they recorded it. Throughout, we comment on how these activities were shaped by readers' awareness and consideration of the larger context of their research-related document activities.

The nature of the information recorded
Before exploring the issues of just how this information was extracted and recorded, it is first of interest to describe the kinds of information readers were recording in more detail. These we were able to uncover both through the interviews themselves and by "walking through" our researchers' notes and annotations with them.

As is illustrated by the example in Figure 2, the nature of the information recorded by the researchers in their notes and annotations was varied. However, we were able to distinguish four basic kinds of information recorded: paraphrased content, verbatim information, readers' thoughts and ideas in response to a text, and bibliographic information.
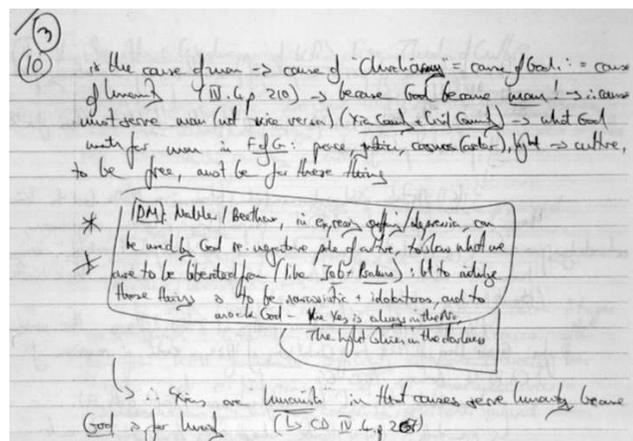

Figure 2. An extract from the notes of a researcher in the study.

Paraphrased Information. The recording of paraphrased material was essentially exclusively done by note-making. Traditional views in the literature have tended to associate the use of paraphrased material with greater cognitive demand than the recording of verbatim information (see [18] for a review). Comments from subjects did indicate that paraphrased information was indeed seen by them as demanding greater cognitive effort, but this in turn was something they claimed facilitated concentration and engagement with a text.

However, this was only one reason for choosing to make paraphrased notes. Other reasons had to do with supporting subsequent review of the notes. For example, a large proportion of readers' notes were made up of paraphrased material from the source text capturing key aspects of the content they thought that they were unlikely to remember later unaided.

The researchers also said that paraphrasing allowed them to convert the content of what they were reading into language that was clearer to them. This not only facilitated the encoding of the information, but also made subsequent review of the information much easier. Paraphrasing was especially flexible here in allowing information to be condensed by varying degrees (ranging from simple rewording to capturing the gist of an article in a single sentence according to the level of detail required). Furthermore, because meaning rather than form was the most important consideration, the paraphrased material was frequently recorded in personalised shorthand (see line 4 in Figure 2: "F of G".) and using graphics in order to reduce the time costs of the information recording.

The researchers also made use of structural organisation here. Most of the hand-written notes we examined were found to be very structured, helping to organise information both for encoding and for review purposes. Various formatting techniques were used, such as colour or underlining to emphasise subtitles and keywords, or to distinguish quotations from paraphrased notes. Indentations and bulleted lists were used to represent and organise ideas of different levels of structural status within the text.

Verbatim Information. Verbatim material was extracted and recorded in notes, as annotations, and through the use of photocopies. In contrast to paraphrased material, the literature has tended to associate verbatim information recording with less cognitive effort and familiarity with content area (see [18] for a review).

However, this view is undermined by the fact that, in the readers' notes we observed, verbatim material was very much interspersed with paraphrased material. It was clear that, for various reasons, participants consciously chose to record certain pieces of information in verbatim format. Further, with verbatim material, while participants did indicate that they thought the actual recording of the information was relatively "brainless", it was clear that the researchers' engagement with the text when choosing the information was a thoughtful and deliberate process.

One reason our researchers gave in choosing to record information verbatim was in anticipation of quoting it in their own written work. For this reason, participants were

often very specific about bibliographic details, and putting page numbers against quotations was common. Quotations within notes also acted as objects which they could then refer to, allowing the nature of the researchers' own comments and ideas to be more indexical in style. That is, the verbatim extract often formed the context that was then "pointed to" by a reader's comments.

Our sample of researchers was also aware that their views, ideas and interpretations would sometimes change over time. This was another factor that they stated in deciding to make verbatim recordings. Verbatim text allowed them to "revisit" a text or sections of a text within the context of new knowledge and to check or modify their initial interpretation of the text.

Finally, another reason participants gave for verbatim recording was to record texts where the texts themselves were the objects of analysis. Important information might be contained within the style of a text and an author's use of particular words and phrases, rather than just in the ideas represented by the text. In such cases, a high level of accuracy was required in the recording process, so as not to lose the subtleties or distort the meaning.

Readers' Remarks. Interspersed with the paraphrased and verbatim information made directly from the source text were the readers' own thoughts, ideas and critical views in response to the text. The recording of these thoughts, comments and ideas was often not necessarily specified in any complete or grammatical manner. Rather, they seemed inextricably bound to ideas in the text and knowledge in the readers' heads, their purpose being to cue this information rather than to record it in some final form that could be directly re-used. As such, both style and meaning of such remarks was extremely personalised.

With hand-written notes, many of the researchers were careful to make sure that their own thoughts and ideas were visually distinct from those of the author by using various mechanisms such as colour, asterisks, initials and square brackets to make (see Figure 2.). Reasons given for this included the need to avoid plagiarism when using notes for writing as well a way of making these remarks immediately discernable when reviewing them before writing.

Readers' thoughts and ideas were also recorded as annotations, which were generally placed in the margins of the (mainly photocopied) document. As with the hand-written notes, the nature of these annotations was not such that they recorded large amounts of information in any complete manner. Rather, single words or brief incomplete phrases were used, the meaning of which was dependent upon the textual context within which they were placed. The parts of the text to which they were tied was indicated by spatial coproximity, as well as underlined or circled portions of text, both in combination and isolation. Remarks or thoughts written in the margins

were therefore not separately interpretable, but rather derived their meaning from their combination.

Bibliographic Information. The recording of bibliographic information was of two kinds. The first related to the document being read at the time. Many participants were careful to invest time and effort at the reading stage to record the full bibliographic details associated with their source materials such as title and page numbers of the source text (see the circled "10" in Figure 2.). This was partly to construct the bibliography of subsequent writings such as research papers and partly to enable reference back to the original sources for contextual clarification if necessary. The second form of bibliographic information recorded related to potentially useful articles cited in the source text. This was to facilitate subsequent search and retrieval of new material at some later time, the researchers not generally wanting to interrupt their current tasks more than was necessary.

Methods of recording information

As we have already seen, recording information can be broadly categorised as involving note-making, annotating texts, and photocopying texts (often for subsequent annotation or note-making purposes). Although participants had their preferred methods, these tended not to be used in any mutually exclusive fashion. Rather, each researcher would use a mixture of these different methods in an attempt to optimise the level of functionality they would attain from their information recording activities, both at that time of reading and when subsequently reviewing or using the information.

Sometimes different methods were treated as alternatives with the relative trade-offs being consciously calculated for a particular situation. At other times, they were used in conjunction to provide their respective advantages and compensate for respective disadvantages. For example, some participants made notes but still kept backup photocopies of the source texts in case it became necessary to refer back to it later for clarification, elaboration, or re-interpretation of information. A further reason was that some notes were not written to allow interpretation in isolation from the photocopied text but rather would make indexical reference to information in the photocopy.

Researchers also monitored their information recording activities while reading and changed them mid-task if they were felt to be inefficient. For example, one researcher reported that because her notes became too detailed while reading a particular text she decided to stop taking notes and photocopy it. The following discussion aims to set out the major characteristics of the different methods which impact on readers' decision making about the optimal strategy for recording information.

Annotation. Annotating a text was seen as a time efficient way of focusing the reader's concentration on a text by engaging the reader in a dialogue with the text. The

recording of information could be done very quickly when compared with hand-written notes, making annotation a favourable choice in time critical situations and when large amounts of information needed to be read. Annotations were quick because comments could be made with reference to a pre-existing text using pointers and indexes to that text. For this reason, annotation was viewed by some of the researchers as more "continuous" with the reading itself, requiring fewer shifts in concentration than with note-taking. However, some researchers viewed it as less beneficial than note-making in terms of encoding the important information from the text.

> "I prefer to annotate and underline, basically, because it's less hassle, but I don't mind writing things as long as it's not too much. I just feel that taking hand-written notes is really slow and I think it's OK if you have to learn it - then it's good to write it out by hand. But if you don't have to actually learn it, and it's just for research and no one is examine you on it, then I prefer to zap across it with a highlighter."

Annotation was also sometimes chosen because of the way that it supported information review. Firstly, it reduced the amount of material that required review by allowing readers to select out important material at the time of reading. In addition, annotations could be easily distinguished from the source text when re-reading, thereby facilitating the retrieval of important points and comments. Furthermore, the co-proximity of the context and markings was seen by some researchers as useful, in that it made the source text and recorded information easy to integrate. The source text also provided additional context for clarification and elaboration of material when reviewing information. However, because annotations were necessarily tied to the text, they could not be collated and offered little in the way of re-organising material in the text. Additionally, limited space would sometimes restrict the detail with which thoughts and comments could be made. While this facilitated the quick recording of ideas, it sometimes made comments difficult to understand during later review, which also impacted on its choice as a recording technique.

Owing to the restrictions on writing on library texts (though these were not strictly adhered to), the use of annotations to record information from library texts often required the researcher to first obtain a photocopy of the source text on which they could then write. As such, this method of recording information would often incur financial and temporal costs that restricted its use in some circumstances.

Note-making. Like annotations, notes were used because of the way that they encouraged dialogue with the text and thereby the processing of the information in the text.

> "If I have a pencil in my hand or something and can jot in the book...I find it helps me concentrate... I think a lot of writing it down is just to fix it in my head really."

Notes offered the researchers greater flexibility over the nature of information recorded (e.g. a choice of paraphrased over verbatim material), the detail in which it was recorded, and over the organisation of the information. The organisation was considered important for the researchers in terms of encoding and review functions of information recording. Notes could be used to bring information from disparate sources together in a unified format and to condense information, making re-reading and cross-referencing during writing more efficient. Notes were also chosen because they did not cause any permanent damage the source text.

While generally more time consuming than making annotations, the financial costs of note-making were dramatically less than photocopying and annotation. In some circumstances, however, making hand-written notes was also seen as less time consuming. For example, recording small amounts of information from a text such as a short quote or a few key points would often not justify the costs of a trip to the photocopier to allow annotation.

> "So I think "Do I get up, go down 3 flights of stairs, go off and get a photocopy card, stand in a queue for the photocopier, just to photocopy this one page. And so often I will just write it out because its actually quicker just to write it out rather than go though all that."

Nevertheless, there was evidence that researchers would choose to incur the time costs of note-making because they believed that taking notes forced them to think about exactly what was relevant and to encouraged deeper processing of the information. This, in turn, would make the information easier to review at the point when it came to be used. As the comment below illustrates, there was a belief that quicker, easier ways of recording information counteracted these benefits:

> "In a way having the technology to be able to photocopy, write, scan - in a way it makes you do too much. If you can do things fast you tend to do things more. You tend not to think about it and have hard criteria about what you actually choose to write."

For the majority of participants, notes tended to be hand-written on paper of various formats (only 2 subjects used a laptop for note-making). One reason for this was related to how they would subsequently use their notes. For example, notes were often used during the writing process for planning and cross-referencing. Previous studies have shown how paper is generally the preferred medium for supporting these kinds of activities [15] and this was consistent with the preferences of the researchers studied here.

> "I have the file open, I take a lot of these sheets out and spread them all around… using some paper [for reference], writing on others and occasionally looking for references."

A further reason for using paper notes was that, as an information recording medium, paper notes were easily transferable across work locations (although, of course, this was not always true of the sources). For example, one participant continued working on a particular research

activity that was started earlier in one library, while staffing the issue desk later in a different library. Another researcher used reference cards to record the details of articles or references that she came across while reading, whether at home or in the library.

Photocopying. Photocopying a text provided researchers with a personal resource that removed various constraints, such as borrowing restrictions, availability, and the ability to mark up texts. It also provided researchers with greater flexibility over when, where and how they interacted with a text. Photocopying was seen as a time efficient way of recording large amounts of information but not very suitable for recording small text extracts. This was due to the relatively large costs of going to the photocopier and queuing. Additionally, photocopying small amounts of information was sometimes seen as a problem from the point of view of organisation within a larger set of notes. In some circumstances, the photocopied text would stand alone as a resource but, in general, photocopies formed the basis for further information recording such as annotation and note-making

A number of participants stated that they would only photocopy those texts that they felt were particularly important and that they would be likely to refer back to or which were particularly dense with information. Other decision criteria were based on the text type. For example, one participant stated that she would only photocopy information from primary sources and not from secondary sources, while another participant would only photocopy those articles which reviewed a particular subject area. The physical characteristics of a text also affected participants' photocopying decisions; articles from large, heavy bound journal volumes were sometimes photocopied to avoid have to carry the complete volume home.

Summary: Functions of Information Recording
In summary, careful examination of *what* information readers record in libraries, and *how* they record that information reveals a range of different purposes they are serving in the course of their research work as a whole. Some of these are tied to the immediate context of the reading task itself, while others are more temporally removed from the reading and recording context to some subsequent point in time for use of that information. The important point here is not just that there were multiple purposes that motivated information recording, but rather that researchers were aware of the complex inter-relationship between these goals and the nature, format and medium used for their information recording.

Information recording to focus attention and facilitate encoding. One way in which information recording supported participants' learning was that it encouraged them to focus attention on the text and to maintain a level of concentration necessary for understanding. The task of information recording demanded more active involvement with the information in the text, creating a deeper level of

cognitive processing that facilitated encoding. This was not just due to the task of selecting the important ideas but also the critical assessment of these ideas. In addition, by recording their own thoughts and ideas in response to the text, participants linked this information to their existing framework of knowledge.

Information recording for clarification and interpretation. Certain information recording activities were used for the purposes of clarification and interpretation. Translations of foreign words or paraphrasing of obtuse language was one level at which clarification might be provided. A second level was the use of information organisation (e.g. bulleted lists) to clarify information in the text, such as making it clearer for the reader to understand and encode.

Information recording for mapping out directions for literature review. New references and directions to pursue were often found when reading, which needed to be followed up at a later date. By recording these bibliographic details through highlighting, note-making, or making reference cards, the researchers mapped out a means by which they could span the related literature in the future. Such information could also act as a reminding device, prompting a researcher to go and look up certain articles. The bibliographic information recorded itself became the subject of annotation at these later points in time, for example, the shelf location information was written against it.

Information review and re-use. Reviewing information at some later point in time was one of the reasons for making notes. These notes were used to re-acquaint researchers with a corpus of material, which, in some cases, might have been brought together from disparate sources to form a single source. The review of information was considered by researchers as important for learning and in preparation for writing a new document. Recorded information might also be used during the writing process for the purpose of cross-referencing, as well as the direct use of recorded information such as quotations and bibliographic references.

A portable resource. Another reason for information recording was to researchers to transcend the constraints of the various locations in which they either wanted or needed to work. Recording information provided participants with a personal resource, the use of which was not restricted by opening hours, borrowing rights or availability. It allowed information to be transported to different locations, thereby allowing participants the freedom and flexibility to work with the information whenever, wherever and in whichever ways that they wanted. For example, a number of researchers had word processors at home on which they wrote new documents. By recording information of texts stored in the library, the researchers could the move the information from its source location (library) to where it was to be used to support writing (e.g. home).

DISCUSSION AND IMPLICATIONS FOR DIGITAL LIBRARY TECHNOLOGIES

This study has shown how we can offer a more comprehensive understanding of library users by examining their various document activities within the broader framework of their work as a whole. In particular, it has helped demonstrate the sometimes complex inter-relationships between information recording behaviour and other aspects of research work such as reading, information review, writing, and information search. It has shown how researchers' awareness of these interrelationships can have an impact on their information recording behaviour. Further, it has begun to help us map out the space of decision making criteria (e.g. time costs, financial costs, accuracy, level of retention resulting from recording information etc.) that govern such things as what information is recorded, in how much detail, the type of recording method, and the medium used.

From a design perspective, this type of understanding provides a useful resource with which to think about and critically assess the role of technologies in libraries at several different levels. At a relatively simple level, by allowing us to specify a range of document related activities that take place within a library during the course of academic research, the analysis has highlighted new areas where we might consider introducing technological support for the researcher in the library.

At another level, where the analysis has addressed the relationships and mutual dependencies between different activities, it becomes possible for us to consider how technologies designed to support one particular activity (e.g. note-making) may have knock-on consequences for the performance of other activities at different stages of the research process (e.g. information review). This allows us to consider the impact of technologies on the outcome of the research process as a whole which, after all, is the ultimate concern of the user.

Finally, by highlighting the parameters within which researchers make their decisions about their research behaviour at different stages of the research process we can delimit the design space with a richer set of criteria to be considered when developing new technologies. Additionally, while some of these decision making parameters remain difficult to measure in any meaningful and controlled manner, they can nevertheless provide the means by which to think about the evaluating of the introduction of new technologies into libraries.

To illustrate, let us consider the following example where a researcher is making notes from a paper text. For any verbatim piece of text to be recorded, the transcription process is tedious and time consuming. At the first level this suggests that a potentially useful technology might be a hand held scanner, for example, because it could save time spent transcribing.

If we go on to consider the second level where the relationships and mutual dependencies are considered, the use of a handheld scanner affects other aspects of the note-making and research process:

- By shifting the researcher to on-line note-making, it becomes more difficult to create the more free-form and idiosyncratic style of paraphrased information and reader comments that might normally be interleaved with verbatim information.
- Difficulties may be caused during the search and retrieval stages when the reader needs to takes notes to a catalogue and annotate them with shelf location information which can subsequently be taken to the shelf as a memory aid.
- At the information review stage, certain benefits may result from having notes on-line such as the ability to search notes electronically but difficulties may arise when trying to read the notes in any intensive way which is likely at this stage [15].
- At the writing stage, having verbatim information on-line will be of benefit when incorporating a quotation within the researcher's written work by obviating the need to retype. However costs may come about from the need to check for OCR accuracy. Also at this stage having information on-line may lead to problems for information organsiation and cross-referencing where notes need to be laid out in space [15]. This may require the information to be printed out on paper.

Moving on to the level of the decision parameters such as time costs, financial costs, accuracy of recording and extent to which information is retained due to information recording, we can think about the situation in the following terms:

- The hand held scanner can reduce time that would be spent transcribing but is likely to increase time spent creating free-form paraphrased notes and comments by making it more cumbersome.
- It could be argued that by reducing the time cost to record verbatim information (and potentially the financial cost of photocopying) the researcher may become less selective in terms of the amount of information recorded. This can have a negative impact on the processing of information in the text and therfore the extent to which it is retained beyond the recording stage.
- Consequently, time spent reviewing may increase by making review more necessary and by reducing familiarity with the information space such that the researcher spends more time trying to locate information in the notes.
- By having the notes on-line, time costs may be reduced through electronic search but this needs to be traded off against the ease of manipulating and arranging paper notes. This could be overcome by printing out the notes but this merely transfers financial cost to another stage of the research process.
- At the writing stage, time costs may be saved having information in electronic form for easy re-use in new

compositions. However, this needs to be weighed up against time spent checking for and correcting errors from imperfect OCR accuracy.

This illustrative example clearly involves a certain amount of speculation, but nonetheless we would argue that this framework provides a more systematic way of analysing the potential impact of new library technologies.

CONCLUSIONS

The study has shown how it is useful to take a broader view of library use which goes beyond information access; in this case considering the whole range of activities that involve information recording and extraction which happen once library users have found the books and documents they want. Further, we have shown that by examining information recording within the context of researchers' work as a whole, we can gain new insights into the motivations and decision parameters that influence the nature of research activities as well as the mutual dependencies and interrelationships between different stages of the research process. While the study focussed on a small subset of library users, namely postgraduate students in the arts and humanities, the activities uncovered would appear to be common to more general forms of document intensive work. As such the implications should have more wider applicability. We hope that the study has provided a useful way to help designers to think about design and evaluation of new technologies for supporting library work in a digital future.

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