THE FEASIBILITY OF ELECTRONIC JOURNALS:

SOME STUDIES IN HUMAN COMPUTER INTERACTION

by

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ABSTRACT

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Human-Computer Interaction

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Computer-based tools for communication are a recent technological
development.   They promise to provide new routes by which to communicate
with others and to transform some communications that have hitherto been
dependent on media such as paper.   One example is the possibility of
supporting scholarly communication by the use of electronic systems, which
also promises a method by which the information explosion might be handled.
The research is an examination of whether or not the support of scholarly
communication in this way is feasible.   To investigate communication
systems requires a large scale study over a long period.   Accordingly the
research rests on a study programme on 'electronic journals', BLEND, which
ran from 1980 to 1984, funded by the British Library Research and
Development Department.   The feasibility of electronic journals is
investigated by exploring the usability, utility, likeability and
cost-effectiveness of the communications system.

An analysis of the frequency and distribution of the use of the
computer-based communications system showed that many things seemed to get
in the way of accessing it.   Several techniques were used to examine this:
transaction recording, interviews, telephone surveys, questionnaires and
analysis of requests for help.   Once the system was accessed, a comparison
of users' aims with actual use shows that different forms of the journal
should be explored in the future. Two reasons for the access rate and type
of use made of the system was the degree to which researchers were able to
accommodate the use of a new communications system into existing patterns
of work and the level of usability of the system.   One area in usability
that is explored in detail is the way that text can be read easily on a
screen.   The cost-effectiveness of the system is examined by projecting
from actual costs and patterns of use.   The final chapters bring together
the studies in a 'Barrier' framework for understanding the use of a
communications system and look forward to the future of electronic
journals.

AUTHOR'S RESPONSIBILITY FOR THE WORK SUBMITTED

The investigations described in this thesis were undertaken with the author as principal investigator but in association with other researchers. The exact responsibility of the author is described below.

The research is associated with a larger study, the BLEND 'electronic journal' programme funded by the British Library Research and Development Department (BLR&DD) and awarded to Professor Brian Shackel of Loughborough University of Technology. Many of the investigations described fall within the framework established by that research contract, which was jointly implemented with Professor Brian Shackel, Dr Peter Dodd, Mr Tim Maude and representatives of the BLR&DD. The design of the transactional recording of use of the computer system, the design of the questionnaires for pre- and post-use of the system, the design of the telephone surveys and responsibility for their analyses were the author's. Research colleagues in the University of Birmingham and Loughborough University of Technology assisted in the implementation of the software and analysis of data. Responsibility for the results and ensuing discussion is solely the author's.

The identification of problem areas and their detailed analyses was the author's initiation. In particular, the work described in Chapter 7 on reading full text on-screen was completed under a grant from the British National Bibliographic Research Fund to the author. Dawn Wellavize and Martin Bontoft helped plan and run the experiment, respectively. The research implementation and results were the responsibility of the author.

All discussion of the results and suggestions for development of the use of computer-based communication systems for scholarly communications are the responsibility of the author.

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1. INTRODUCTION

1.1 Computers as tools for communication.

The computer is a tool for people to use, probably the most versatile tool ever invented. It can be used as a tool in many different ways and the relatively recent integration of telecommunications and computer technology has enabled computers to be used as communications tools.

Frequently these tools have been developed to handle larger quantities of information and to facilitate a greater amount of routing than were hitherto possible. Electronic mail and viewdata are two of the more familiar examples. In both, the computer acts as a repository of text, in the former case being the text of messages and in the latter a store of information provided by companies and services. The routing is provided by the 'enveloping' of the message in the former, so that the correct person receives the message, and by selection procedures in the latter which guide the user to the information required.

Offices generate large quantities of textual information and here too the integration of telecommunications and computers has initiated the development of computer-based systems for the storage and transfer of documents of many different types. These types vary from short electronic mail messages to large reports, and from small to large databases such as financial records and other similar administrative data. The need to access and transfer these between sections of a company or between companies has encouraged research into standards for the processes.

The developments promise to change the way that people accomplish their tasks by altering the tools they have available and by changing their priorities in using them. They promise to change the way that people relate to each other, by giving them new and different channels through which to communicate and by changing the pattern of those with whom they are in regular contact. They also promise to change the tasks that they accomplish, by providing them with new opportunities for different tasks.

These changes therefore relate to the individual, to groups and to the design of the computer-based system which subserves the functions required to do the job. This is the area that is under investigation in this thesis. It is studied by means of evaluation and experimentation on a computer-based system subserving many different types of communication in scientific research with the co-operation of groups of users engaged in the study programme.

Why concentrate in this way on scholarly communication? In exploring the use of computer-based systems and examining their feasibility, scholarly communication offers several advantages as an area for study. First, much research depends on accessing and assimilating previous work, i.e. that communication is an essential ingredient in the development of ideas and concepts in research. Secondly, as communication it has a wide range of types. Thirdly, the actual content varies widely, including diagrams as well as alphanumeric text. Fourthly, the use of a computer-based communication system seems to offer additional benefits for which many researchers are asking, such as more rapid access to others in the field. Fifthly, researchers are well used to communicating in text. These reasons suggest that scholarly communication could be a fruitful area of exploration.

The other main reason lies in the fact that the research community has discretionary use of such a system, that they do not have to use this type of system as part of their work, there being alternative ways of finding the information they require and of communicating. One of the major indications of the feasibility of a system is whether it gets used. Consequently it is preferable to evaluate the use made of the system in a situation in which the users can decide to do so or not.

1.2   Background to thesis

The work described herein was accomplished over a six year period of research, from 1980-1986, and arose out of a real situation. The research is generated in a large part by that situation, rather than in any form of rigid preset pattern, and consequently the content of the thesis changed over time as new ideas were developed and new experiments undertaken in response to the situation.

The situation from which the research springs is one where the
British Library Research and Development Department awarded a grant
to Professor Brian Shackel, Loughborough University of Technology to
run a study programme on electronic journals. The plans accepted
and approved by the research granting body are described fully in
Shackel, 1982a. The history is told by a series of reports published
annually (Shackel, 1982a; Shackel, 1982b; Shackel et al, 1983;
Pullinger & Shackel, 1984).

1.3   Outline of thesis

The use of computer-based communications tools has not proved to
have had a smooth introduction. Difficulties have been experienced
in what the tools can do and in how to use them. From the new
facilities on digital telephone services to major services such as
electronic mail and Prestel, the take-up of the use of the tools by
the consumer was lower than initially expected. The problems
associated with this kind of system are usually transmitted as
anecdote, rather than discovered by any kind of major study to
investigate any difficulties that appear.

From within the work of the situation of the study programme on
electronic journals, this thesis systematically explores the
difficulties experienced by the users and seeks to investigate the
feasibility of electronic journals based on this research.

As areas that need development became apparent during the study
programme, surveys have been undertaken to understand the response
of the users and if necessary remedies implemented to alleviate any
difficulties, followed by an assessment of the effect on the users.
This is often described as 'action research'. Other areas have
required development for which experimental programmes were devised
and the results of which were not necessarily able to be
implemented. Still other areas were analysed, but the development
of other areas with greater priority overtook the wish to proceed
further with detailed experimentation.

In investigating the feasibility of electronic journals, we take the
meaning of 'feasibility' to be that the system is used and that it
is acceptable to the users. Shackel, 1983a, distinguishes four
areas which lead to this kind of acceptability:

- utility, the system does what is needed functionally;
- usability, the system does what is needed and the
  users are also to make it do it;
- likeability, the system is useful (i.e. has utility) and usable,
  and is also felt as suitable; and
- it does not cost too much in effort or price.

The examination of these areas in the implementation of one
computer-based communication system to support scholarly
communication forms the basic structure for the thesis.

After an initial review of the promise of 'electronic journals' and
how that promise is supported by the new computer-based
developments, we explore how the medium itself may change the
concept of a journal and the types of scholarly communication that
now exist. There seem to be good reasons for developments in a
world where no single researcher can hope to keep up with the
current publication rate.

The question of how to approach the examination of large-scale
systems which do not yet exist calls for a study of the
methodologies available and those appropriate to be used in this
situation. The second chapter continues with a look at two
experiments in electronic journals, of which the second is the
situation from which this research emerged, before ending with the
identification of the research directions and an overview of the
structure of the thesis.

The following three chapters follow a sequence in which we first
examine how often the system was accessed and discover some
particular problems in the situation local to the prospective user.
These local difficulties are not the only ones and the next chapter
explores some of the issues emerging from a study of the usefulness
of the system to support communication. The third chapter continues
the exploration with a study of the work habits of the researchers
under investigation and their attitudes to the system and its
support for communication, particularly noting any change from
before to after experience with using the system.

Low usability may also affect potential utility so an examination is
made of the host computer system which stores and handles the

scholarly communications and we ask whether it was found usable.
Some problem areas are identified and researched. One particular
area became a focus of attention; whether or not reading articles on
a visual display unit (VDU) was feasible. Finally, the system may
support communications satisfactorily but be too expensive to do so
feasibly. This aspect is studied in a hypothesised context for its
future viability.

The four threads are brought together in the concluding chapter.
There some ideas are brought forth from the research as frameworks
for considering the use made of the system and future possibilities
in scholarly communication.

1.4   Acknowledgements

In particular, Dr. Ken Eason has informally acted as a mentor at two stages in the development of the thesis and to him I am greatly indebted. Without his advice and encouragement the thesis would never have been written.

Mrs. Wendy Buckland as typist and word-processing operator to the study programme has seen this work at a variety of stages during its gestation and has been a major strength and support in the years of the study. Her work is most gratefully acknowledged. The typing and editing of the thesis on the word-processor has been facilitated by Mrs. Mandy Marshall and Mr. Jon Walker and accomplished with great forbearance by Liz Bourne, Alison Mott, Jayshree Lakha, Sue Sutton and Jeanette Taylor.

Finally, I would like to add a note of appreciation for the support of my parents, who always believed that it would be completed, and Rachel, who has encouraged me through the final stages during 1987.

Despite the large amount of gratitude I owe for all this help, the conceptual approach and any responsibility for error remain mine.

2. ELECTRONIC JOURNALS: THE PROMISE AND METHODOLOGICAL APPROACH TO INVESTIGATION.

The focus of the research is on the analysis of the feasibility of a computer-based communication system (CBCS) to support scholarly communication. This chapter reviews the reasons why it is claimed to be advantageous to support scholarly communication in this way and some of the background to what are considered essential ingredients of that communication. The analysis of the literature serves as a basis for the considerations in our research and confines itself to the literature published prior to the start of the research. More recent publications are brought in and discussed in relevant chapters, particularly in the light of analysis and experimental results. Other research areas introduced as a result of evaluation also lead to discussion of published work in the context in which they arose. Interspersed in the considerations of scholarly communication is an explanation of why CBCS are now perceived to be a potential medium for supporting the research community and the methodology whereby investigations may proceed with exploring the feasibility or otherwise of the use of a CBCS for this purpose. Finally, the situation from which the research work emerged is described.

2.1 The promise of electronic journals

Today the journal is the major form for dissemination of scientific research and has achieved its pre-eminence in a constant trend over the last three centuries (Meadows, 1974 p.90). It became feasible following the general improvement of postal services throughout Western Europe in the seventeenth century and Meadows (p.67) describes its aims as being to:

- encourage research
- aid the flow of information
- establish priority claims as quickly as possible
- carry separate parts of a programme of research.

The first two were also the aims of the scientific societies, which gradually diminished in usefulness as the journal developed. The last two developed as a response to the long delays inherent in the publishing of books which established priority claims and reported

the result of a series of researches. The move from societies and books seems, therefore, to have been caused by the need for speed of dissemination of information, both for status and for facilitating within the scientific community the development of research programmes.

At first, because of the difficulty of access to information, journals largely consisted of re-printing old research. This gradually lessened with the development of a distributed system of libraries, backed up by the National Lending Library (now part of the British Library) after the Second World War, and with the emergence of a further system in the form of abstracts journals and listing of the contents of current journals. However, demand was only partially met by the new primary and secondary communication system, and the system itself brought about difficulties connected with the time taken for journal publication and the overwhelming amount of information available.

Publication of journals is slow because of the difficulty of getting articles reviewed quickly by peers and because of the number of articles waiting to be printed and made available to the readers. The quantity of information has been doubling every 10 to 15 years in the United States, resulting in more and more journals, of increasing bulk, being published (Meadows 1974, p.22). It is doubtful whether the publisher-library system itself can be maintained, because of its cost, and the reader may not always be able to gain access to information at the time it is required. Licklider, 1966 (p.1044) illustrates this point when he says:

> "Sixty years ago, the 3,000 character per minute reader required only 25 minutes a day to keep up with everything in his field. Eleven years hence he will have to read continuously, every hour of the day."

Licklider sees the solution in the use of computing power to select pertinent documents, but above all in improvements to the arrangements for processing the information contained therein.

The advent of a new transmission channel in electronic form promises to provide some of the facilities required and to bring about as

radical change as the new improved postal system did three centuries earlier:

"....the closing years of this century may witness the virtual annihilation of time and effort as barriers to the productive use of information."

(Bamford, 1976, quoted in Rhodes & Bamford, 1976, p.159)

"....the present form of the journal will disappear sometime and be replaced by completely electronic storage and retrieval of the alpha-numeric-graphic content of scientific articles."

(Senders, 1976, p.161)

What is this new electronic channel that promises such radical change? Using computers for communicating text is a result of the convergence of many developments, technological, analytical and sociological (Hiltz & Turoff, 1978). There is no need here to document again the rate of progress in the development of power, speed and memory in computers, which has meant that microcomputers, with attributes that only a few large systems possessed a decade ago, are available to most people who wish to own them. This development has led to the possibility of computer-to-computer communication. Initially ordinary telephone lines were used but increasingly special lines to carry digital information at high speed have been designed. Some are public services such as PSS (the packet switching service), while others are private and funded by commercial enterprises. Increasingly, public utilities are becoming available. The developments all promise to provide the facilities to produce a radical change in scholarly communication.

2.2   Computer-based communication systems (CBCS)

There are two general components underpinning the arguments for the computerisation of scientific communication; the storing of information, including papers, and use of electronic communication for more informal message passing. It is the development of the integration of storage and electronic communication that supports the beliefs of the proponents for the electronic journal. The storage of information and electronic communication have a largely separate genesis. The former designed for long-term archiving of

generally short textual elements, which are selectable, and the latter for quick communication between individuals and groups of people, originating often from military command and control systems (Shackel, 1982c). As those functionalities are integrated, the systems have certain attributes which distinguish them from other communication systems. In order to make a distinction with the many systems now included in the generic term 'electronic communication' we would prefer to use 'computer-based communication system' (CBCS) following and broadening slightly the term Computer-Based Message System (CBMS) introduced by the International Federation for Information Processing Technical Committee 6 (Uhlig, 1981). First, we can distinguish that the communication can be asynchronous, i.e. that the sender and receiver of the information are not required to be engaged in the communication process at the same time. In order to support this feature, a CBCS must be able to store information, whether this is held in a centralised store or in distributed stores. Secondly, the information must be processed in some way, by positioning it into a data structure for later retrieval by others, or by routing it to the correct place for it to be collected by another person. Thirdly, there are channels for data telecommunication to enable individual users to access or receive the information over a wide geographical area. The first three main attributes of a CBCS are therefore the following:

1. storage of communication,
2. processing of the communication and systems,
3. access to the communication.

Examples of CBCS include electronic mail systems, bulletin boards and computer conferencing. Electronic mail stores short messages which are routed into stores which enable the recipient to pick up those addressed to him or her, or alternatively routes the message to the individual's own store, whether a mainframe computer or microcomputer. The main processing is therefore in the routing procedures. Bulletin boards store messages, generally of a short nature, in a centralised store, allowing individuals to access that store and browse through the messages. The processing is in placing the message in the store. Computer conferencing stores short messages in a centralised store which are accessed by individuals. There is additional processing in that the software keeps a record

of what each user has read and has not read and informs the user when others are present on the system and preparing messages to send.

The difference between the systems is in the number of people potentially engaged in each communication. They are respectively individual to individual (or addressed group), individual to non-addressed group and group to group.

Other systems such as viewdata and information retrieval are not included in this concept of CBCS for the reason of another attribute:

4. both originators and receivers should have equal access to the system (both technical and procedural).

Although viewdata services such as the British Telecom Prestel system can store and process information which is available to people over a wide area and so act as a publishing system (Hooper, 1980; Dukes, 1980) it does not allow equal access to those wishing to originate and those wishing to receive. When Price et al, 1980, reject the debate on whether or not electronic mail and teleconferencing is 'information' or 'communication', they are implicitly claiming that the storage attribute and the equal access attribute are both attributes of a CBCS.

As well as the asynchronous textual nature of a CBCS and the processing which includes selectivity of material, one of the main advantages is perceived to be the speed of transfer of information. If the processing and storage are accomplished on a mainframe computer then this may be almost instantaneous, but possibly somewhat slower if use is made of distributed networks for its distribution. Nevertheless, it is an important perceived attribute even if having, for the latter reason, to be vaguely expressed as a comparative:

5. communication accessible to receiver within a short time (relative to other media for textual communication).

These five attributes enable a CBCS to fill a communication gap for the speed of communication in the range of hours to months to groups

of people ranging in number from a few to a few thousand (see Figure 2.1).

```
10,000    | Radio        Newspaper                    Books
          | TV
Order of  |                              Magazines
     1,000|                                        Academic
number    |        _____     Journals
          |       |                           |
of     100|       |                           |
          |       |   CBCS                    |    Conference
people    |       |   potential               |
       10 |       |                           |
reached   |       |_____|
          |               Mail          Meetings
       1  | Telephone
          |_____
            Hour      Day       Week     Month      Year
```
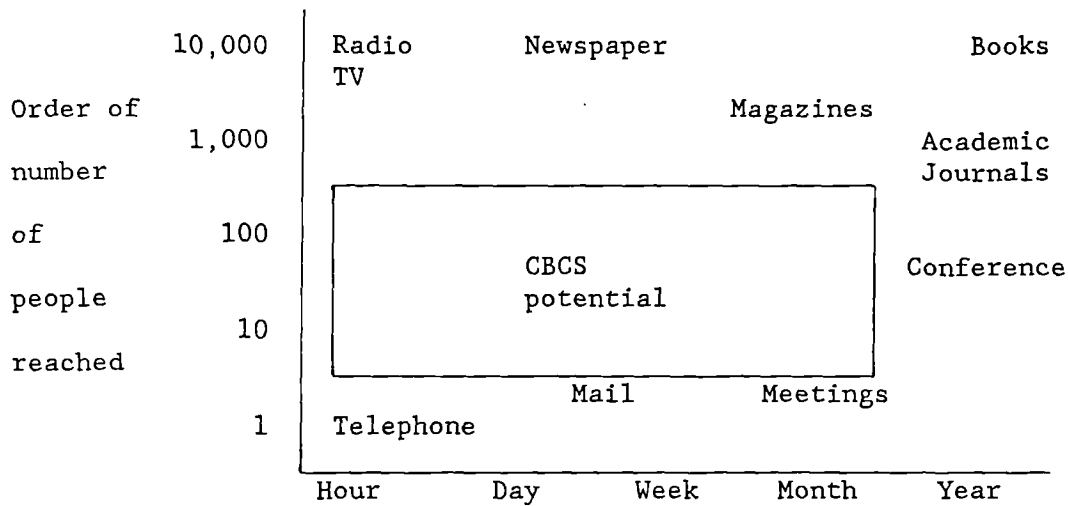
Figure 2.1:   Diagram to illustrate the number of people reached in an average timescale by various media.

It is because computer conferencing is designed to support groups that makes it promising to support scientific communication (Vallee and Wilson, 1976). It is, as Johansen et al, 1979, have demonstrated, useful for types of communication not supported by other media, so not necessarily replacing but rather supplementing them. This results in a new tool for which protagonists Hiltz and Turoff, 1978, clearly express an optimistic future:

"The experience to date is of such a nature as to warrant the following general views on the parts of the authors:

- Computerised Conferencing will be a prominent form of communication in most organisations by the mid-1980s.
- By the mid-1990s, it will be a widely used in society as the telephone today....." (p.xxiv)

Because it is especially geared to groups, it is seen as a suitable communication channel for scientific communities:

"Other forms of scientific communication, such as the journal, the grant review process, and the scientific meetings, are likely to change if CC systems become widespread within scientific specialities." (p.215)

2.3   New possibilities in scientific communication

Communication is quintessential to research. Without it, the work might never have been accomplished, because there would be no entry into that corpus of information called scientific knowledge (Ziman, 1968). But there are many channels through which that essential transfer of research results can take place. Some channels are formal, for example, journal articles and books, while others are informal, for example, talks to colleagues and to colloquia. These include those listed in Figure 2.2. Garvey & Griffith, 1971, argue that the informal dissemination forms a prevenient evaluation process in which a preliminary report is transformed into a finished scientific product, i.e. a journal article or book (p.360). The latter is the goal, for the research must be assimilated into the scientific literature of the field and by long-term evaluation counted as credible and significant. Although this process takes 10-15 years, they argue that the distinctions between formal and informal domains are essential for science (p.362). Thus the journal with its peer review system is an essential part of scientific research.

Reports of preliminary findings
Reports of completed work to small, informal audiences
Reports of completed work to sizeable, restricted audiences
Reports of completed work to societies
Technical reports
Journal article pre-publication drafts
Journal articles
Specialised texts

(Adapted from Figure 3, Garvey & Griffith, 1971)

Figure 2.2: The informal and formal channels for dissemination of research results.

Informal chit-chat among colleagues.
Job-related communication between institutions (e.g. external examination).
Work-related communication between institutions (e.g. general research discussion)
Requests to 'expert' for assistance.
Requests to assist in peer review system of articles and research proposals.
Professional society committees.
Advisory committees for future and current research.

Figure 2.3: Some channels in which informal communication takes place.

In face of other options, they therefore argue for the maintenance of the following.

1. A process of informal dissemination of research results at the discretion of the originator.

2. A publishing procedure giving sufficient time in the informal dissemination in order to refine and modify the result.

3. A clear distinction between informal and formal dissemination, the latter being journals.

4. An editorial and peer review system to support the distinction between informal and formal dissemination.

5. A long judicial period of secondary publication and access to establish the research findings as credible.

Of course, scientists do not only do research which is initiated and accomplished in isolation. Their ideas and hypotheses usually come from a consensus about what is important in the field and so result from both a formal and informal communication process. These channels for so doing are various, for example, those listed in Figure 2.3, but the predominant participants are seen to be the more senior researchers. In rapidly expanding areas of research, Crane, 1965, summarises the process as occurring among two distinct groups of participants. The first is among groups of collaborators in research, frequently of non-intersecting groups of authors, and the second among an 'invisible college' or network which links sub-groups or collaborative groups through the leaders (p.34). In Figure 2.3 the first case would be an example of the former and the rest, of the latter. These ways must be considered general, for the degree to which they (co-)exist varies between disciplines:

"We found no clear-cut network or group of networks which transfer scientific information among groups of active scientists [in applied psychology]: nor are there media that present in a comprehensive and coherent way the materials being developed within even one speciality"

(Garvey & Griffith, 1971, p.354).

Nevertheless, they found an informal communication extant and necessary to the health of the field. We draw from this the necessity for informal communication in the following two ways:

6. A process of informal communication within collaborating groups.

7. A process for communication between collaborating groups or between individuals in the discipline.

This process may also be considered as necessary because of the postulation by Licklider, 1966, that, owing to the quantity of information being produced and it being impossible for one individual to keep up with the field, a group-consciousness emerges and it is the group that replaces the individual in this task, however the group is defined. It is still in the mind of an individual that the ideas relevant to a particular development or problem must be brought together. Therefore, the processes prior to this integration, which have largely been implicit when an individual was master of a field, must be externalised; and to be made to work effectively, must be understood. This is probably why different disciplines vary in the degree to which clear channels of communication exist. In some they have been established (externalised) because of necessity.

Even with the move from individual up-to-dateness to group awareness, the fact that an individual must integrate the ideas relevant to a particular problem (however small this is) implies that something must be done about the rate of publication. Licklider considers three courses of action:

- reduce the rate of publication
- improve the arrangements for selecting documents
- improve the arrangements for processing the information the documents contain (p.1046).

He considered the first as unlikely, that in the second course computers would augment the traditional apparatus of bibliographic control extensively, but that the third was the key in the long-term, using a combination of the algorithmic capabilities of the computer with the heuristic capabilities of people.

We turn now to consider the use of computers and new media in the areas of primary communication. They will be considered in two parts, those which use new media to accomplish some of the seven points above and those which use them to change, modify or combine one or more of the points. The former include synopsis journals and Editorial Processing Centres (EPCs).

Various forms of synopsis journals have been tried. One original idea was to reduce the quantity of material in journals so that an author would submit both a 1000-word synopsis and a full paper and the editorial process would decide which to publish (Maxwell, 1973). This, however, did not prove popular in experimentation (Dugger et al, 1973) and the manner in which it survived is that the conventional printed version contains a one to two page summary of the paper, possibly including one or two diagrams, tables or references, while the full paper uses the new media of either microfiche or mini-print, or it is archived and photocopies are made available on request. One such journal is the <u>Journal of Chemical Research</u>, although in general the idea has not yet caught on.

The Editorial Processing Centre (EPC) was conceived as a mechanism for combining small publishing operations to achieve a scale great enough to make computerisation worthwhile in the areas of journal editing and management, while leaving each editor in full command of his, or her, own publication (Bamford, 1972, p.306). EPCs were designed to handle the automatic logging of articles received by a journal editor, assistance with selection of referees by keeping a database of information on them, automatic mailing to the referees, recording of their comments and so on, until the article was prepared on a magnetic tape ready for computer-controlled photocomposition. At this early conceptual stage all the communication between editor, referees, author and printer were still planned to be accomplished by printout and mail. The concept was further developed to suggest that the editor might have a direct terminal link to the EPC, and by incremental addition the author having the same facility (Aspen Systems, 1974). This was extended in concept to a general communication network (Rhodes & Bamford, 1976) and considered for feasibility in the UK by Woodward, 1976b. From here it was a small step to consider passing electronic copies of the article around or allowing readers to take a printout of the

machine-readable form of an article resulting from the editorial processing at the EPC (Senders et al, 1975).

All of this was to increase the efficiency and/or economics of Point 4: an editorial and peer review system to support a clear distinction between informal and formal dissemination of research results.

Senders et al, 1975, had already hinted at a change in the peer review process, which was amplified by Woodward, 1976a. The latter argued that the size and complexity of science has outgrown conventional technology and that the new technology follows recognition of that problem (p.14). Therefore, he argued, we should beware of the adaptations to printing technology which have become sacrosanct traditions of necessity and he included in these the peer review process. The peer review process had already proved unreliable (Gustafson, 1975; and later, Harnard, 1982). Each and every article could be accepted because there was no limit on the cost of producing printed pages. Roistacher, 1978, summarised the state in his description of the 'virtual journal':

- have peer review system,
- but since there is infinite page space [sic], all articles are published,
- together with a reviewer's score so that effectively a series of journals is produced with different prestige,
- and made available immediately on the system by adding to the journal's lists,
- and these may be further annotated by anonymous or named ratings by the reader.

This effectively removes Point 3 in that the process for informal dissemination of research results at the discretion of the originator could form part of such a system and thereby remove any clear distinction between informal and formal dissemination.

Indeed, this was precisely the objective of several of these protagonists, that reports, pre-publication drafts and all the literature lost to the secondary services might be captured, archived in some form and made accessible to a wider public. Woodward, 1976b, in his review suggests that with a general reader

evaluation scheme, the printed journals might be used for those articles which have proved of sufficient status to warrant that particular expense, thereby re-affirming some of Points 1, 2 and 3 (p.16). However, this is not necessarily the general view of many who postulate the promise of electronic journals. Subsequently one question to consider in any research on the use of computers to support primary communications is whether or not the hypothesis and results of research by Garvey & Griffith, 1971, are substantiated.

The direction of those suggestions by the protagonists of modifying the peer review system tends towards using computers to facilitate access to material which includes much of what was previously considered 'informal'. There is also a general proposal to use CBCS for informal communication as we have already reviewed above. The latter comes from another direction, using electronic communication to subserve some of the functions of transfer of information informally within and between groups (Points 6 and 7). Mick et al, 1980, argues for the importance of the integration of these two developments:

> "Information-producing and -seeking behaviours are closely linked and that one reason most information systems are not better accepted is that they fail to provide linkage between the two activities.... The potential for this linkage has been at least partially demonstrated by the recent success of computer conferencing services such as those offered by Infomedia Corporation and the New Jersey Institute of Technology"

At the New Jersey Institute of Technology, Turoff and Hiltz, 1978, indicated four journal types that could be produced using the EIES computer conferencing suite:

1. an informal newsletter;
2. an unrefereed poster paper journal;
3. a traditional refereed journal;
4. a structured inquiry-response system.

The variety included the type of mix envisaged by Mick et al.

To summarise, three major communication areas are thought to be affected by the use of a CBCS in a research community:

- the refereed papers system with its relatively long origination to publication period;

- the 'grey literature', informal papers and reports that are not destined for refereed papers journals; and

- informal communication within and between groups in the research community.

One major area also identified has been in the way that computer-based systems might aid thinking, in that the information published in journals could possibly be handled by individuals doing research, i.e. that there are

- methods of handling the information explosion.

Finally, Mick et al, 1980, argue that a CBCS allows an underlying integration of the production and use of information,

- integration of information-producing and -seeking behaviours.

To explore such questions require a special consideration of appropriate methodologies and they are considered in the following section.

2.4   <u>Methodology for investigating the feasibility of an electronic journal.</u>

How does one investigate the potential support provided by a CBCS and its impact on the communications in a research community when such systems do not yet exist? This is one problem that human and social scientists meet when there is need for research into large scale systems based on developments in a rapidly moving technology. The usual route to understanding is by the collection of empirical data, but this is not possible for systems remaining only possibilities, as is the case with the electronic journal. This section briefly reviews some of the approaches and the methodological framework used for this type of research.

2.4.1 The case for action research.

Eason, 1983, lists four approaches frequently adopted in research in those areas:

1. The scenario approach. An outline of the future situation can be given to people and then they can be questioned about their likely responses to it.
2. Generalizations from existing research (or 'expert view'). Extrapolations can be made from the results of the nearest similar research findings, taking into account the difference between the old and the new.
3. The pilot experiment (or 'simulation trial'). A small-scale version of the future technological system can be built in order to test people's reaction under controlled conditions.
4. Action research. Use the development of the first examples of new technology that emerge in order to assess people's reactions, influence the design of the system and research the effect of the change.

Each of these approaches has been used in investigations of CBCS and the developmental concepts for an electronic journal. The scenario approach was used in the Commission of the European Communities conference of 1979 and raised many issues (CEC, 1980). The arguments for and against different possibilities were based on speculation and it is difficult to judge behavioural response to hypothetical situations. Consequently they remained hypotheses with no general direction emerging from the differing views presented. Existing research falls into the three areas from which CBCS have developed, so one looks for work generalised from those areas. It is found in generalisation from work on stored text, in the positive appraisal of Editorial Processing Centres (Woodward, 1976a; Woodward et al, 1976) and in the work on communications by Vallee and Johansen (Vallee et al, 1974-1978; Johansen et al, 1979) and Hiltz and Turoff (1978). The methodological approach of the work of Vallee and Johansen on CBCS may be described as a series of pilot studies. Any statements in relation to electronic journal must be considered as 'expert views' generalized from that existing work. The pilot study can examine the use made of a system within some

constraints but can lead, as other approaches, to artificiality and simplification.

Action research is proposed by Sackman as well as government sponsoring of work in a developing thesis on how best to explore and evaluate computer-based systems. By the end of the Sixties, experimental testing was a pervasive process regulating system development and introduced at many levels throughout the evaluation of man-machine digital systems (Sackman, 1967, p.213).

He saw the approach to be followed as the applied science principle of 'evolutionary experimentation' with a group of participant researchers, i.e. the changes are suggested and introduced by users faced with problems (p.531). The problem was that the users needed to be sufficiently acquainted with experimental method to participate in the process. By the early seventies, he was recommending in more detail the concept of full working prototypes (Eason's 'pilot trial') with

> "appropriate recording, reduction and analysis tools superimposed on normal operations to tap user behaviour along lines most relevant to computer utility problems" (1971, p.156)

He was also moving towards a philosophy whereby the systems experimentation shifts from the laboratory to a real world redesign and reconstruction based on evolving experimental results (1971, p.264) i.e. the action research methodology.

But for the type of system media investigation considered here, he saw one final crucial step as being;

> "large scale social experimentation using prototype utilities for one or more specific communities of users" (1970, p.247).

The role of government bodies was seen as essential in both educational and motivational roles, and also in allowing public discussion of the system being tested.

Johansen, 1976, stresses one other aspect of the use of social evaluation of CBCS, that the first users may not be typical. For this reason Eason, 1983, emphasises the need for a experimental programme of long enough period so as to overcome initial learning

difficulties and other initial responses and to allow the use of the system to settle into some kind of pattern of use. He summarises the ideal as follows:

> "In three sentences the most desirable kind of project would be as follows. It would consist of a <u>field investigation</u> of a teleinformatic system designed by <u>multidisciplinary teams</u> from a <u>sociotechnical perspective</u> for <u>real use</u> by <u>ordinary users in their normal circumstances.</u> The investigative period would be <u>longitudinal</u> covering the period before implementation and a considerable period of actual use and the process should be <u>evolutionary</u> so that feedback from investigations can be used to successively modify and refine the system. Ideally a number of such projects should run concurrently in different countries so that knowledge can be pooled and used to <u>formulate and test proposed methods and standards</u>".
>
> (Eason, 1983)

This is the kind of methodology used by Turoff and Hiltz in their government funded work on the computer conferencing system EIES. By building a software suite which was iteratively developed and studied by a sociologist, this came very close to the ideal as portrayed by Sackman and Eason.

2.4.2 The feasibility of a system.

In the preceeding subsection on methodological approaches, it can be seen that there are slightly different emphases on the end product. For Eason, the emphasis is on building up a body of knowledge about user response to developments of interest, which Hiltz calls 'summative evaluation' (Sheridan et al, 1981), whereas for Sackman the primary goal was the development of systems, which Hiltz calls 'formulative'. Both recognise that the feasibility of a system depends on its utility, its development to support the task for which it is designed, and the response from users, particularly if they are discretionary in choosing to use it again or not. The work of the partnership of Turoff and Hiltz emphasise the necessity for the integration of these two aspects, both the formulative and the summative for the overall development of a human-machine system, Turoff being interested in computer-based product development and Hiltz in psycho-sociological studies of system use.

These different emphases are reflected in the suggestions of
Shackel, 1983a. The four main areas of study which lead to the kind
of system that is used and acceptable to users, utility, usability,
likeability and cost effectiveness, raise questions for the use of a
CBCS to support scholarly communication within a research community:

- Can the CBCS be designed to support scholarly communication?
- Can the research community use the CBCS for scholarly
  communication?
- Will the research community like the CBCS for scholarly
  communication?
- Can the use of the CBCS for scholarly communication be cost
  effective?

The questions call not only for an examination of the users and the
communication but also of the CBCS itself and the cost factors
associated with its use. Thus three main components interact in any
study: the type of communication, the group of users and the use of
the electronic medium, the CBCS (see Figure 2.4). Eason, 1981b,
adds a fourth component in stressing the importance of the context
in which these interactions take place. The context in any study of
the feasibility of an electronic journal will contain a range of
considerations which includes, in particular, the need for the
communication task between members of the group in their research
area, i.e. the context of all communication.
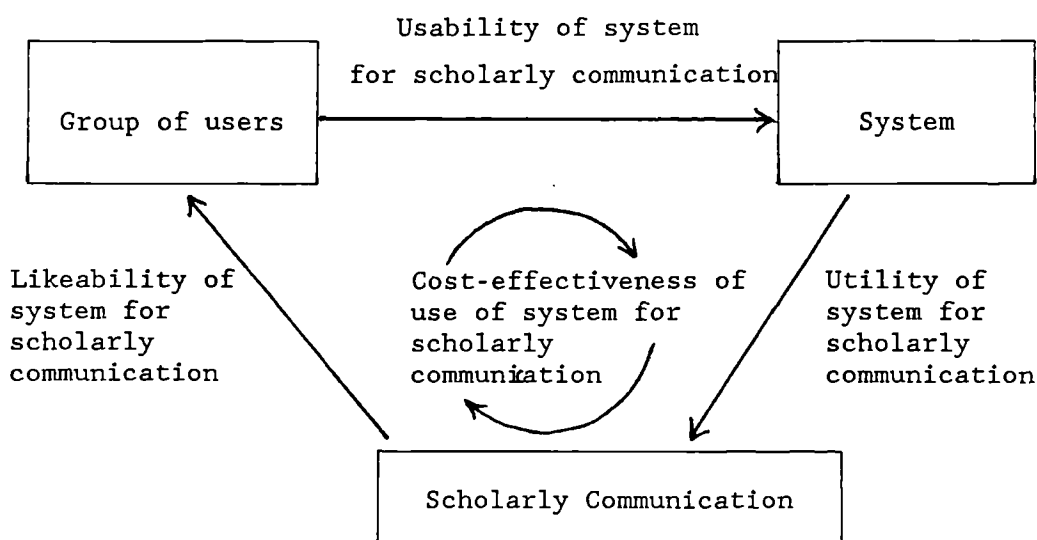
Figure 2.4: The main components in the study of the feasibility of a
system to support scholarly communication.

2.4.3 Individualising the theory.

Mick et al, 1980, argue that investigating theoretical benefits from large scale systems must also be 'individualised'. They showed that in some work on information seeking the single most important factor in the success of the system to support the task was whether or not the general hypothesised situation was related to an individualsed need. We might, for example, have a general situation in which communication would be improved by use of the electronic medium, but first it should be established if this is particularised as a need at the individual level. This suggests that the methodology should also study individual use in addition to collective group use and behavioural responses. The four questions raised by the utility, usability, likeability and cost-effectiveness can thus be re-framed to the following:

- can the CBCS be designed to support the individual communication task?
- can the individual researcher use the system satisfactorily?
- will the researcher like the CBCS for communication?
- will the use of the CBCS be cost-effective for the researcher?

The context is also individualised and will include the factors external to the use of the system for communication which nevertheless impinge directly on the individual, for example, the attitude of the organisation, of which the individual is a member, to the use of the CBCS for communication (see Figure 2.5).
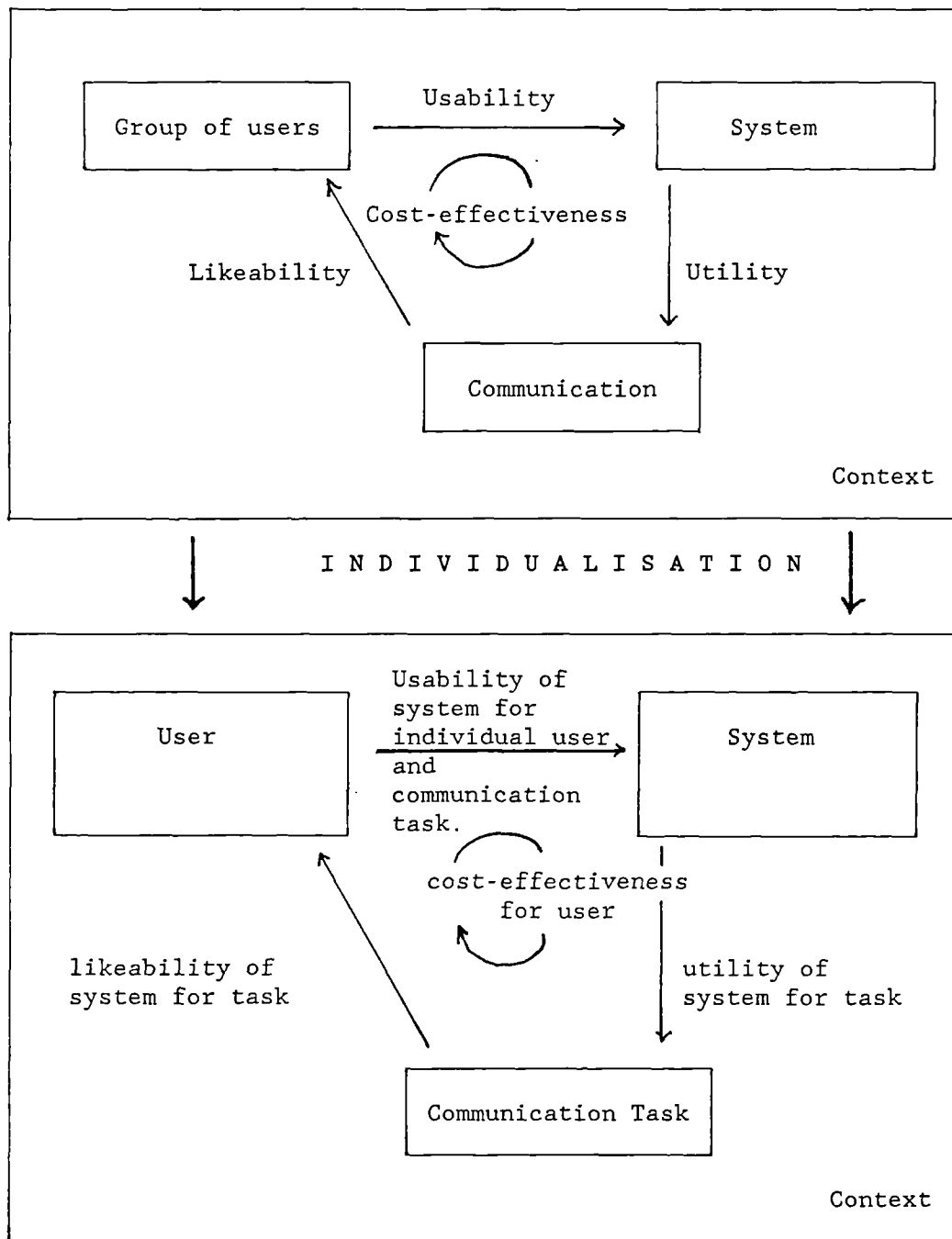
Figure 2.5: Individualising the main components of researching the feasibility of a communications system.

Indeed, much of the argument for use of CBCS lies at the individual level and can be summarised in the word 'convenience'; convenience in not having to be synchronously present in telephone or face-to-face conversations, in being able to choose when to send and receive communication, convenience in sending and receiving a variety of kinds of communication through one communication channel, convenience in speed of access to information and communication,

convenience in not having to travel to participate in research community committees, convenience in having not to go to the library, colleagues for information etc (see, for example, Hiltz and Turoff, 1978). This would suggest that there is an individualised need.

The work of Mick et al suggests that investigations of feasibility need to be examined at both group and individual level. The examination at both levels seems important, for without individual need the system will not be used and without group communication there will not be individual communication tasks to do.

In summary, an action research model is considered best, consisting of a field investigation of a CBCS by a multi-disciplinary team used for real day ordinary researchers in their normal circumstances. The feasibility of the system can be studied by considering four components, usability, utility, like-ability and cost-effectiveness at both group and individual level. The investigative period should be longitudinal in covering pre-use and use periods and cover a sufficiently long time to allow patterns of regular use. In the development and evaluation of the feasibility of such large scale experimentation the government has an important role.

2.5   The cost of electronic journal publishing.

Cost is an important factor in the publication of journals. Indeed Meadows, 1979, writes in the preface to the first section in his collection of articles on the scientific journal:

"I place the question of finance near the beginning, because it is obviously a fundamental factor - often the fundamental factor - in the publication of journals" (p.21).

Indeed one of the main impetuses for consideration of the scientific publishing system is precisely because of its cost. The rise in cost of the primary communication system was calculated to be faster than a uniform exponential rate (Senders, 1977 p.6) and the cost of the secondary services dependent largely on government aid which cannot maintain indefinitely the expansion of the number of scientists and the number of articles and journals. In the UK, a Royal Society review of the situation concluded that the scientific

information system, so long taken for granted by scientists, can no longer be regarded as stable (Royal Society, 1981).

Many of the developments in computer communication have been justified by cost; the development of computers themselves, the use of them in communications, for example, the packet switching services, their introduction into offices, process control and in keeping information. As the cost balance between computer systems and employees' salaries has tipped in favour of the former, long-term saving of expenses has proved the justification for an initial large-scale investment of resources (Turoff, 1976). This is usually calculable to a greater extent in the semi-controlled environment of business. However, where people have choice, where they are discretionary users, the predicted scenarios do not necessarily prove reliable. The telephone is one case:

> "Bell's proposal to place his instrument in every home and business is, of course, fantastic in view of the capital costs involved in installing endless numbers of wires".

> "Bell expects that the subscribers to his service will actually pay for each call made, and that they will agree to pay a monthly minimum if no calls are made. We feel it is unlikely that any substantial number of people will ever buy such a concept..."
> (Western Union Committee quoted in Parker 1976 p.1).

That was one case where the public bought the concept and instrument. Other products, such as the videophone and national viewdata services have not received the same attention.

Nevertheless, it was the promise of a communication channel cheaper than the future held for the printed publication, a channel of the magnitude of the telephone, that lured thoughts of radical change (Senders et al, 1975):

> "Increases in the costs of raw materials and energy, and delays in printing and posting, together with the difficulty in identifying and retrieving scientific information will lead to the demise of the printed scientific journal and its replacement by a wholly electronically operated system. Even without marked improvements in or radical alterations to the presently available communications systems for handling digitial information, the

cross-over time when electronic alternatives become cheaper than the conventional printed journal will be within the next 10-15 years".

(Senders, 1977, Abstract)

The transformation of scientific and technical scholarly publishing from print on paper to electronic storage and dissemination was the subject of an extensive research project by King, Roderer and colleagues (1978), following the assessment of the economic validity of Editorial Processing Centres (Berul et al, 1974). Both studies extrapolate from existing patterns of behaviour using the present publication system and compare current costs with large scale hypothetical systems. The costs for the Editorial Processing Centres are favourable in some circumstances, but the conclusions on the electronic alternative to the whole of scientific and technical paper on print scholarly publishing show an increase in cost to the subscriber, for reprints, for all users except for inter-library loan when costs were projected to 1985 (p.109).

The difficulty of accurately projecting the costs and including a correct apportionment of all the variables included in the total communications system means that cost-effectiveness predictions are likely to vary considerably. Unfortunately the adoption of the methodology discussed above could not allow a full investigation of cost because of the government aid involved and the size of the communication system itself. The action research model could, however, allow empirical data on real behaviour in normal working situations to be collected and this would give an improved database upon which to base projections.

2.6   An electronic journal experiment.

In 1977, the National Science Foundation (NSF) of the US announced an 18-month action research programme in a scientific community which was to include a refereed papers electronic journal and other scientific communication. It was to be developed on the EIES system and in April 1979 the software was declared ready for use for the journal. In the event no papers were immediately forth-coming and so the co-editors, Sheridan and Moray, submitted papers. There was one other paper submitted in March 1980, shortly before the end of the research programme. The results were a disappointment to the

organisers (Senders, 1980, Moray, 1980) and learning was summarised
by a number of authors.

First, Sheridan claims that one of the unique and planned features
of the programme was its cross-atlantic international aspect which
for reasons associated with the telecommunications organisations
could not proceed. Secondly, it was considered that the usability
of the system was very low (Guillaume, 1980, Senders, 1980).
Thirdly, there was a recognition of the importance of local
arrangements in having access to a terminal (Tracz, 1980).
Fourthly, Turoff and Hiltz, 1980, thought there were a number of
reasons for lack of communication based on the nature of the
particular group of users and their need for communication.
Sheridan et al, 1981, in their later analysis in the final report to
the NSF listed seven requirements for a successful electronic
journal:

1. satisfactory design of the human-computer interface in both
   hardware and software;

2. well considered and executed group processes in interpersonal
   communications;

3. benefits to the participants to fulfil motivational need to
   achieve status from publishing activity;

4. clear understanding of commercial and regulatory realities if
   one wishes to 'go public' or international;

5. realistic assessment of the quality and quantity of substantive
   material waiting to be published; (one and a half years too
   short to allow material to develop in the experimental
   programme).

6. clear outline of the phases of research and development.

7. balance between clearly stated goals and careful assessment of
   resources.

The learning from the experiment may be expressed in our feasibility
methodological framework as follows:

At the group level: the group did not want to communicate
    or were not facilitated to do so (Turoff & Hiltz, 1980).

At the individual level: because there was no need for
    communication, there were no communication tasks. Even if there
    had been, one and a half years was too short a time to prepare a
    refereed paper as a communication task for the group and the loss
    of the copyright to the journal meant a lack of motivation to do
    so (Sheridan 1981).

At the system level: the system was not usable because of
    the lack of equipment to use it (Tracz, 1980) and the difficulty
    of using the EIES system (Guillaume, 1980; Senders, 1980),
    particularly with regard to the journal (Moray, 1980).

For research methodology: a longer period than the one for
    preparing the communication task is needed. The investment of
    limited resources need to be tied to achievable goals within an
    action research experiment. Greater cognisance of external
    regulations and other factors that may bear on the research
    programme (Sheridan et al, 1981).

For the above reasons, particularly in the lack of, and opportunity
for, communication, the experiment was not able to test the utility
of the system for the support of scholarly communication. In
particular the 'individualisation' of the group was not fully
appreciated in the development of the research programme.

2.7   The BLEND experimental programme.

In 1979, shortly after the operational start of the NSF-funded
experiment in the US, the British Library Research and Development
Department (BLR&DD) approached Professor Brian Shackel of the
University of Technology, Loughborough, with the intention of
setting up some action research and developing a system that could
be used as a testbase for evaluating and experimenting the
usability, utility and cost of electronic journals

To follow as closely as possible the best available methodological
approach and to take into account the learning from the NSF-funded
electronic journal experiment, the programme investigated and took
the piece of software most suitable for supporting the CBCS and then

it was modified by an interdisciplinary team of computer scientists
and human factor experts according to available knowledge. This was
then accessed by a research community from their normal working
environment. Research was planned to continue over a three and a
half year period of actual use and an evolutionary approach to
system development adopted as a result of the evaluation of use.
This accords well with the methodological 'ideal' discussed in
Section 2.4.

This thesis is based on research carried out in conjunction with
this 'electronic journal' experimental programme. The latter and
the author's relation to it are described in this section.

2.7.1   The plans for the BLEND experimental programme.

The programme was established in July 1980 with the initial
principal emphasis from BLEND on a refereed papers journal as a
means of scholarly communication (Shackel, 1982a). While that
remained the starting point, the proposal for the project was
extended to include the exploration of other possible uses of
electronic communication networks. These covered both the range of
communications found in research communities and in the exploration
of new possibilities not previously able to be implemented.

Consequently the aims were described as follows:

    "The aims of the BLEND system programme are to explore and
    evaluate the usage of an electronic communication network as an
    aid to writing, submitting and refereeing papers, and also as a
    medium for other types of scientific and technical communication"
    (Shackel, 1982a).

In order to accomplish these aims, the following main steps were
planned and taken.

1. Setting up a host computer system.

    Because it was not clear what kind of software and system
    configuration would be necessary to support scholarly
    communication, it was decided to purchase the nearest possible
    software and to modify it according to expert opinion and
    experience. Following two surveys of possible software suites,

including Shackel, 1980, the NOTEPAD computer conferencing suite from Infomedia Corporation, Palo Alto, was chosen.

This computer conferencing suite runs on a DEC20 computer, and after a survey of such host computers in the UK, the University of Birmingham made their university machine available for the experimental programme.

Thus was born the acronym BLEND, the Birmingham and Loughborough Electronic Network Development, as describing the system.

2. Setting up a group of users.

There was in 1979 a strong move within the research community, of which the project director was a member, for increased contact and a focus for the widely dispersed community. Thus funding was provided to about 40 people within the Computer Human Factors research community in order to allow them to join in the programme. They were called the Loughborough Information Network Community (LINC). In return for funding, the participants agreed to submit one longer and one shorter paper to the system each year in order to study scholarly communication.

3. Setting up electronic journals

It was planned to start with a range of journal-type communications, initially implementing the refereed papers. The full list envisaged is given in Figure 2.6.

1. Refereed Papers - full refereeing (with anonymity), etc.
2. Comments & Discussions - e.g. for linking with papers.
3. Annotated Abstracts - bibliographic literature review.
4. LINC News - network and related information.
5. Bulletin - general news about current work.
6. Co-operative writing of papers.
7. Poster Papers - i.e. "paper fair" or "free for all".
8. Enquiry - Answer system between experts.
9. Publication of complete issues or journal parts to "Readers Only".

Figure 2.6: The types of journal and communication to be explored in the BLEND programme.

4. Developing the system.

The software suite would need modification to support scholarly communication from the support for the short messages for which

it had been designed. Surveys and experience led to
recommendations for change which were planned for implementation
at approximately yearly intervals with new user manuals.

5. Introducing other groups of users to the system.

There was provision made to bring four or five other
communities, which were to be unfunded, onto the system after
the first year.

6. Analysing and evaluating the system and groups of users.

Stages 1 to 5 were preparatory for the research which was to be
carried out by evaluating use and for which methodology was
outlined in the project proposals. The methodology used and my
role in this is discussed in the following section.

The organisation of the experimental programme was across two
sites and run by an interdisciplinary team consisting of a
senior lecturer and research officer at the University of
Birmingham Centre for Computing and Computer Science and the
project director and a research fellow at the HUSAT Research
Centre, Loughborough University of Technology. Birmingham were
responsible for maintaining the computer system, for advice on
computer and telecommunications matters, for negotiating changes
to the software, and for writing programs to develop the system
further. Loughborough were responsible for the documentation,
user support, training of the groups of users, for the research
necessary for the development of the software and for evaluation
of the whole programme. The author was the Research Fellow in
Loughborough who also acted as Project Co-ordinator for a total
time of nearly two years in the absence of the Director.

2.7.2 The author's research.

Shackel, 1980, lists four main headings under which it was planned that assessment of the programme would be considered:
- cost, in financial terms to the user and for the running of the system;
- performance, both of the users and of the computer system together, questions of complexity, ease of learning and usage would be included;
- objective characteristics of behaviour, to establish the change in behaviour for research communications from pre-use to post-use of the system;
- subjective experience of participants, a measure of whether the participants would like using the system and what they might be prepared to give up for it.

Finally, it was anticipated that these assessments would be carried out between several user communities and with control groups not using the system nor one similar to it.

In following the plans for he assessment of the experimental programme, the ideas for some of the research described in this thesis were pre-planned, particularly those appertaining to the focus of the programme, the electronic journal. However the implementation of those ideas led to a considerable development from that which was planned for a number of reasons. First, the data collection was modified by what was established as possible in the automatic recording of data by the computer. One of the reasons for the choice of the NOTEPAD teleconferencing software suite was that the data collection package was integrated into the normal use of the suite (Shackel, 1980). However the software did not record the data properly. For each group activity on the system, it was discovered by extensive trial and experimentation that the persons' data was collected in a set of 36 and only 36 files. This meant that any group consisting of more than 36 participants were treated modulo 36 (i.e. that the $36N + n$'th person's data for $N = 0,1,2...$ and $n = 1$ to 36 were mapped onto the n'th person's data). For this reason other means of data collection were devised and the actual data collected slightly modified from that originally envisaged. Secondly, areas of the work were expanded as a result of public interest, for example, the analysis of whether or not it would be

financially possible to run such a system commercially. Thirdly, the research planned was modified by the re-prioritization of different analyses as the programme unfolded. The lack of several fully participating communities, for example, meant that comparative data on system use was not able to be collected.

As the programme developed, research needs emerged out of the experiences with use of the system and the users reaction to the system. Some of the research described, therefore, results from joint awareness of the need for it, as, for example, in the data collected in the telephone surveys. In the 'action research' methodology, this kind of development is to be expected. Although the original intention was to study electronic journals, the development showed that there were many more issues to be considered. As with the pre-planned areas, the data collected, its analysis and interpretation were the author's responsibility.

There is also research here that was neither preplanned nor which emerged from joint thinking. These areas emerged from individual reflection on the results of surveys and experiences on the system. Thus the analysis of the log-in emerged from the difficulties of explaining the log-in procedures to both first time users and the computer scientists who were familiar with them. The frustrations of reading full-text on the screen led to a research programme on possible reading aids that could be provided.

In summary, the research in the thesis emerges from engagement with the issues in the experimental programme, from the attempt to understand results in evaluative work and in the generation of new ideas and experiments from experience with the system.

2.8   Research directions.

Will the use of the electronic medium for scholarly communication transform the way in which it is presently accomplished, even as the journal was developed in the seventeenth century as a result of the availability of the postal service? There was the new availability of a communications system and also the need for the development of research. It is argued that these two are present today. Let us consider some of the component questions associated with the question asked above.

First, can the electronic media, in the form of a CBCS, be developed to support the researchers in their scholarly communication? The methodological approach that seems appropriate to assess the feasibility of a potential system is a framework in which the usability, utility, likeability and cost effectiveness of the system are systematically examined, both at group and individual levels. One specific area of usability is whether or not systems are used more if information-seeking and -producing behaviours are both supported by facilities on one system, such as is possible in a CBCS.

Secondly we can ask what the effect of the CBCS will be on scholarly communications. Three main areas to study were analysed from the debates about the different possibilities: the refereed papers journal, the 'gray literature' and the informal networks of communication within and between groups of researchers.

Thirdly, will the use of a CBCS in scholarly communication help in any way the problem of handling an explosion of information so great that the individual researcher cannot keep up with the research published?

These three questions guide the research presented here. The structure of the thesis closely follows the framework for systematically examining the feasibility of a system. The following chapter starts retrospectively in looking at the overall use made of the system and then seeking an explanation for it in individual use of the system. The explanation is continued in a study of the utility of the system at group and individual level and the impact that the utility has on the work habits of the researchers. Two chapters then examine the usability of the system before the cost-effectiveness is studied. The final chapters bring the strands together to question the feasibility of an electronic journal.

The other two main questions are interwoven into this structure as appropriate evidence is discovered and used to further the development of understanding in those areas.

The section's title is carefully chosen as 'Research directions'. More detailed aspects for research within the three questions have already been spelled out in this chapter. However, the

participation in an 'action research' methodology implies, as we
have said, that the directions the research takes are not always of
one's choosing, but lead to the need for understanding and
responding, if possible, to the developing situation. Consequently
it will be found that substantially more effort was required in the
study of usability than had been anticipated and hence the study of
utility and the development of research on the impact of scholarly
communication, were commensurately diminished. For this reason the
background review is broader than some of research areas covered,
and some new directions of research are revealed in response to the
situation. However, the three questions form the guiding purpose
for the research undertaken.

3. ACCESSING THE BLEND SYSTEM

The feasibility of a CBCS to support scholarly communication starts by an examination of whether users accessed it. The low rate of access would suggest a range of studies necessary to determine if this was a user response to the lack of utility, the lack of desire to communicate with others, the lack of an individual need to use the system, or the lack of usability of the system, to suggest a few areas identified in the review. We start at the end, in order to give an orientation to the exploration of accessing the system, with a retrospective analysis of the number of accesses to the system and the frequency and pattern of those accesses. This will guide us in the investigation, for whether the system was used more often or less frequently than expected, the reasons for behaviour of the group will inform us about the feasibility of a CBCS to support the communication of a research community.

It was observed early on in the experimental programme that the number of members of the LINC group who accessed the system was lower than expected and dropping slightly, was this a temporary set-back? In terms of the number of people who later used the system frequently the answer was positive, but in terms of the reasons that underlaid it, the answer negative. To see that this is not a short term problem to be glossed over but one to investigate we turn first to the long-term access patterns of the users, analysed after two years from the start of the programme. This requires a detour into some statistics, but provides useful information. The chapter then follows a historical account of the developing research on one factor in the reasons for the access rates.

3.1 Methodology for analysing access rates

To analyse the access patterns of the group of users in the Computer Human Factors research community, LINC, a program (LOGBOOK) was written to record the date and time of access of each participant. The total number of accesses to the DEC20 computer at Birmingham, made by LINC members shows a general increase in the use of BLEND over the years of the experimental programme (see Figure 3.1), after an initial drop.
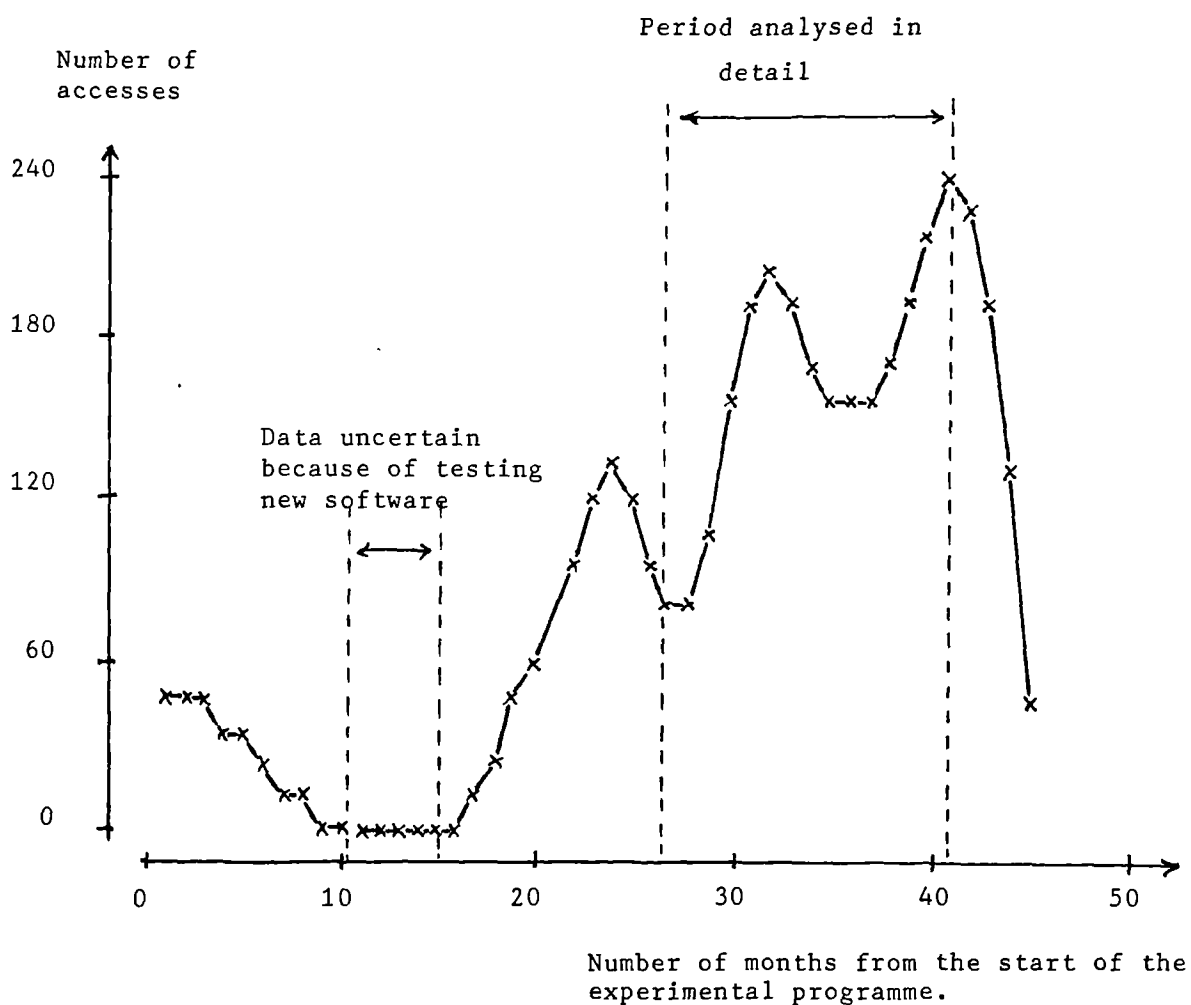
Figure 3.1: Total number of accesses by month by LINC member

However, the LINC users of the system were not a stable group for a number of reasons: they were requested not to consider themselves participants if not adhering to the requirements agreed (Shackel, 1982a); a new influx was recorded in 1983, as a result of

invitations sent out in that year; users leaving an organisation
frequently passed on their terminal and manuals to another person;
and non-LINC researchers requested access to the system to enable
them to communicate and collaborate with existing members.

In order to study relatively stable patterns of use, the analysis of
the data was restricted to a period from 1st May 1983, the
introduction of the main enhanced BLEND software, to June 30th 1984,
the formal close of the investigative period and the data collection
on the BLEND system. Of the 73 LINC members registered excluding
the research team, 24 were removed. Six were removed for having an
average of less than 1 access per year and 18 because their first
accesses had only been made in the last 12 months of use. The
analysis of the data was done for the remaining 49 LINC members.

3.2   How frequently did users access the system?

The peaks and troughs in the number of accesses over the whole
period were also apparent week by week and observed across and
within individual users' accesses. How did these come about, were
they a consequence of an accumulation of a distinctive behavioural
pattern carried out at different rates? The section explores this
question.

First, it may be reasonably hypothesised that the distribution of
accesses be random from a Poisson population as is found in the
arrival of telephone calls to telephone exchange . Alternatively
some cumulative effect of individual behaviour may account for the
access distribution. Three hypotheses might be the following: users
have a relative, but different, sense of the interval between
accesses; that users maintain the same average number of accesses
over time, but they are grouped so as to be able to 'catch-up' with
communication; and that each user maintains an access frequency when
they are free to enter and this is constant even after a long
interval of non-access.

Taking a week as a period for analysis, the hypotheses suggested the
examination of two measures. The average number of accesses per
week was calculated by dividing the total number of accesses made by
an individual by the total number of weeks from the time of first
accessing the system to the end of the data collection, June 30th

1984. The proportion of weeks in which there was at least one
access was calculated by dividing the number of weeks in which there
was at least one access by the total number of weeks from the time
the researcher first accessed the system to the end of the
investigative period. Plotting the two measures gives us the graph
in Figure 3.2.

Average number
of accesses per week
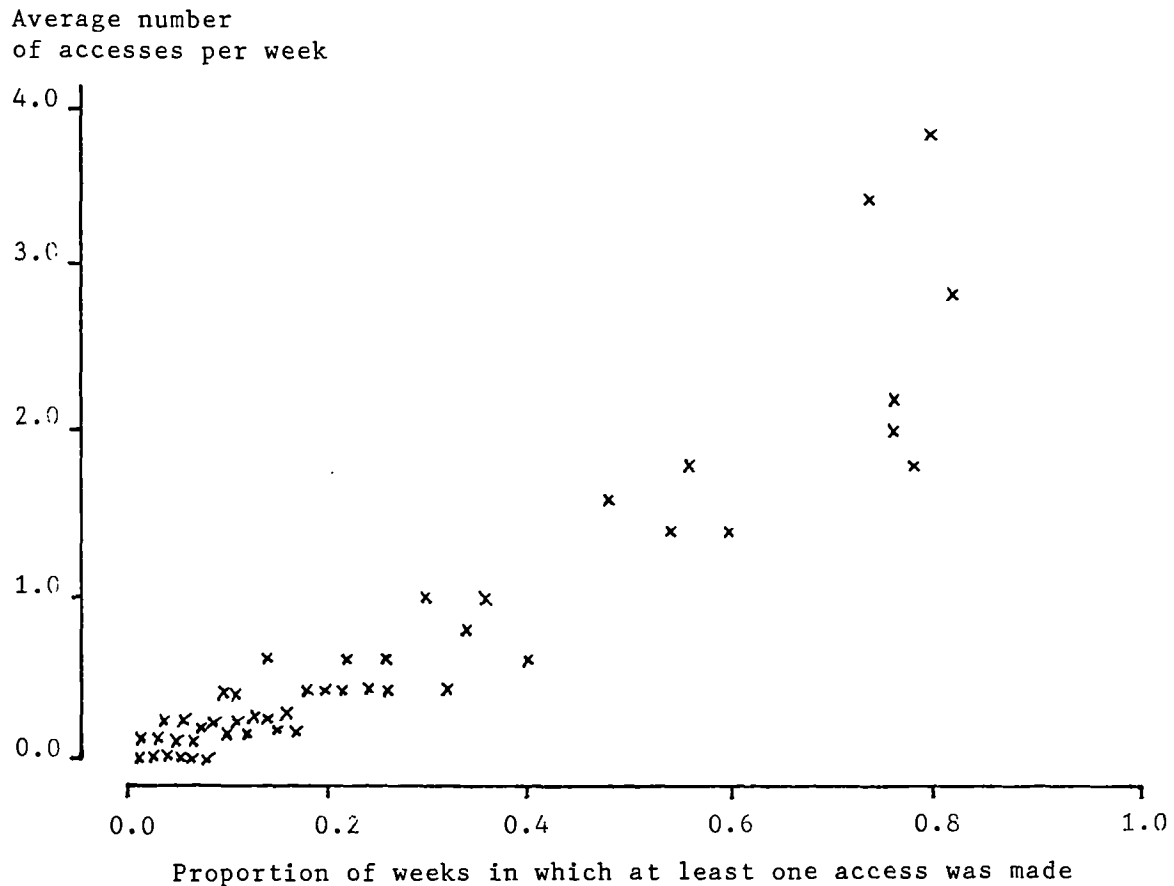
Figure 3.2: Plot of the two measures to study user access

The correlation with a Poisson distribution is fairly good on this
cumulative graph, but there are a greater number of weeks with a
lower number of accesses than might be expected. Moreover the
assumptions for a Poisson distribution do not seen to be valid for
individual behaviour. An inspection of individual's histograms of
the number of accesses per week ratifies the high number of weeks
with a relatively low number of accesses relative to the mean and a
dispersion index test rejects the Null Hypothesis that the
distributions came from a Poisson population. (Full details of this
and the other tests used in this section are given in Appendix A).

Expressing the three other hypotheses in terms of the two measures, gives hypothetical graphs that do not bear a good fit to the one discovered. What then is happening? The high number of weeks with a relatively low number of accesses and the low number with relatively high number of accesses, i.e. a large variance to mean ratio, suggested the Negative Binomial Distribution as a description for the data (Johnson and Kotz, 1969). This has a good fit, with correlation coefficient of 0.995 and a regression on the expected values giving observed values equal to 0.96 of the expected values.

The good fit of the Negative Binomial Distribution suggests seeking a description of the individual patterns of behaviour that might result in that distribution. Let us consider each individual and imagine each week which is observed as a sample from a population of weeks which we might have observed. If this process is a Poisson one, i.e. that the week observed is a random one according to the Poisson distribution and the weeks observed are homogenous, then the average rate of access for each week would be the same across the observed weeks, although the actual values will be different due to random Poisson-type fluctuations. That model was rejected, but if the average rate of access for each particular week varies by some Gamma distribution then a Negative Binomial Distribution is the result. This suggests such a description might be that all the influences of life in toto cause a fluctuation week by week of the probability of access to the system for each person. If the experimental programme was able to run, say, 100 times (which of course it could not!) then we would expect to see a Poisson-type random access pattern. However, because we only see the sequence of events once, we are observing general influences modifying the probability of entry.

In answer to our question "What is the pattern of accessing the BLEND system?", we may conclude that it is dependent on that which is going on around individuals and that their patterns of behaviour are modified by their circumstances altering week by week.

What are the 'things of life' that modify individual access to the CBCS? To explore this we begin with an investigation of the user's circumstances.

3.3   A Six-month telephone survey of participants.

3.3.1   Background and methodology.

The conditions under which the participants had agreed to join in
the experimental programme included funding themselves with a
terminal, preferably of speed higher than a 10cps teletype and if
possible a modem to be connected via a separate telephone line
(Shackel, 1982a). Furthermore, access to the centralised host was
restricted in that participants were requested not to try and gain
access in the periods 10-12 am and 2-4pm during termtime.

The LINC community started full trials on the BLEND system on
January 15 1981. Naturally, not all LINC members had obtained the
necessary equipment for full participation by this date, but most
members were gradually receiving the necessary terminals and modems.

Over the five month period from January to May 1981, computer use
statistics showed that approximately one third of the LINC community
had logged in regularly (though with different frequencies), a
second third had logged in regularly until Easter and hardly at all
subsequently, and, finally, the remaining third had never entered
the BLEND system.

Various facts were known that might be contributory to an emerging
pattern of decreasing usage in the second third of users, for
example, that the DEC computer at the University of Birmingham was
down 15% of the time from April to May 1981 and that many LINC
members had experienced long delays in obtaining modem equipment
partly owing to the University Grants Committee cuts which demanded
both financial and discussion time sacrifices.

In order to investigate this pattern of use, a survey was planned
whose aims were the following:

1.   To establish the perceived reactions of the LINC community to
     the BLEND system, in particular to note what gave the community
     the most concern about their participation.

2.   To discover any problems with which the Project Management Team
     might help, in particular to linking hardware and software to
     facilitate communication.

3. To find out the progress in each members commitment of participation in submission of one larger and one shorter paper per year to the BLEND system.

Various survey techniques were considered, including written questionnaires sent through the postal system, questionnaires sent via the computer based message system in BLEND, telephone interviews and face-to-face interviews. Factors that influenced these considerations included the relative cost, the number of LINC members that would probably be contacted successfully by each technique, the availability of members' and the researcher's time.

In order to cover the whole range, including those who had never and those who regularly logged into the BLEND system, it was decided to hold a telephone survey. This survey presented structured questions while allowing free responses which were analysed subsequently.

The questions which were included in the interview covered file areas:

1.	Use of the system	-	How much have you used the BLEND system?
	.	-	Do you envisage this level increasing?
2.	Hardware	-	Have you got all the equipment that you hoped for by now?
		-	Access to equipment.
3.	Design of system	-	What changes to the technical, software or procedural aspects of the BLEND system would you like to make?
4.	User support	-	Have you found the user documentation satisfactory?
		-	What other forms of user support would you like?
5.	Scientific Communication	-	Have you had scientific communication through participation in this project with those of you who did not previously communicate with?
		-	Have you started a paper or dispatch for the project yet?

The pro-forma used for the survey is given in Appendix B.

Attempts were made throughout the month of June 1981 to contact each and every member of the LINC community.

130 calls were made, 14 of which reached the person required on the first attempt and 36 of which were successful in the end. At the time of the survey there were 59 scientific LINC members so that the proportion of successful first time calls was 23.7% and the average number of calls made to each person 2.4. It is to be noted that a few were not tried for one of two reasons, either because they were contacted on the same phone call in the same location as another or the researcher was informed that a member was away on holiday or at a conference. From an introductory questionnaire and interviews conducted in the first three months of the experimental programme, November 1980 - January 1981, the situation of most of the LINC members were known to the researcher. In this context it was decided not to make a set number of attempts to contact each person, but more attempts were made to those who had a differing situation to other members, in order to maximize number of reasons for low access rates.

Although this was partially successful it is clear that the sample was largely determined by the availability of LINC members. Views were biased more towards the users of the system, rather than the non-users, perhaps arising to their greater time availability in general.

The general response to being called by phone in this way was very positive. The aspect about which interviewees spent most time talking was noted on the occasion of the interview. 17 interviewees spent most time on reasons why the BLEND system had not been used as much as they would have hoped. 9 spent most time on how they would change the system and 4 on the need to establish a focal point of interest to users.

3.3.2   Survey Results

The survey confirmed the impression given by the observed use pattern that many of the community had logged in a few times and along with some of the regular users, had then not done so so frequently in the period from Easter to May 1981.

Access to equipment and from thence to the DEC at Birmingham was
reported to be one of the major problem areas for the following
reasons:

1. Delay in installation of lines and equipment by British Telecom.
2. 'Political' bureaucratic non-cooperation and non-availability
    for installation of direct lines.
3. Existing equipment and procedures not able to be extended to
    access Birmingham.
4. 'Political' bureaucratic non-cooperation for terminals being in
    own rooms.
5. Dislike for the conflict situation arising in finding others
    using terminals.
6. Time constraints on when DEC may be accessed.
7. DEC not always running when accessed.

Six members reported lengthy delays in having telephone lines
installed and awaiting modems to be delivered by British Telecom
(then the Post Office). Other problems were caused by noisy lines
by those using internal lines passing through switchboards or poor
acoustic couplers. Although there was funding in the project with
which to help participant members to come on-line by paying for
installation of outside direct telephone lines to avoid switchboard
line noise, the aid has been thwarted in several instances. The
reasons are;

a. political - 'why should so-and-so have an outside line not under
    supervisory control?',
b. problems of establishing a procedure for payment of bills,
c. knowledge of 5 to 6 month waits for British Telecom to install a
    telephone line or being told that there are 'no new numbers
    available in your area'.

The 5 to 6 month wait also applied for alteration to existing lines
in the London area and hence terminals were not moved to more
accessible rooms or to the office where a member worked.

Only 8 members had terminals in their office, 21 had access to
terminals in another room in the same building whereas 7 members had
to walk to another building (where the terminal phone may well be
under lock and key). Some of these members, moreover, had to walk

to another building even though they might have a terminal sitting on their desks which they regularly use. Those members in computer departments had terminals connecting to their mainframe. If that mainframe could connect by some procedure to the telecommunications system or to a computer network linking with Birmingham, then the member may have used his familiar procedures to access BLEND e.g. through MIDNET. However it was more frequent that this was not the case, and it seemed that members were inclined to walk and then use unfamiliar terminals and procedures that duplicate services in which they might already have some experience e.g. of ARPANET or of SERCNET.

Offers of financial help in these latter cases to install lines and make access easier were refused in two cases on the ground that the members wanted to use the systems with which they were familiar and preferred to seek ways of so doing rather than getting more equipment which was incompatible with their existing practices and which would not make their working life more convenient for the preparation of research papers, given the cost constraints in the availability of this help. Specifically, for this type of member, computer or satellite networks need to be developed so that, when wanting a system on one particular computer it is able to be accessed by a variety of channels according to the working procedures already in practice, which might include a filing system, knowledge of editor and other text processing familiarity.

A number of reasons were given why it was not permissible for LINC members to move terminals to their own rooms: a terminal was seen as an extra piece of equipment which might not be consistent with an equalization of status in the organisation; a terminal, despite being bought for the experimental project, was seen as a University departmental asset; all terminals were considered to have to be centrally located in one room to facilitate electric cable and table requirements.

When people go to a room in which a terminal is positioned and find another person engaged in work on the terminal, or external telephone line, there arises a conflict situation. If the member wishes to go ahead and use the system then they have to interact, possibly unfavourably, with the then present user. Some reported

avoidance of this situation completely rather than create possible unpleasant atmospheres.

Time-sharing is a constraint that may interact both with a working life and also with the time availability of the University of Birmingham DEC computer. At the time of the survey, this had been available for 24 hours a day during vacations but not available 10-12am and 2-4pm during term time. Some users had experienced several attempts to log-in while the computer was down. During the period Easter-June 1981 the DEC was down 15% of the time. This figure would appear much higher to a user restricted to hours outside 10-12am and 2-4pm, when the engineers who work normal working hours would not be available to get the DEC operating again.

Members expressed that their participation in the BLEND project was of lower priority than their other working matters. This was both a conscious decision, for example participation might not be what they are paid to do, and an unconscious one. In the latter case there are two contributory factors. Firstly a highly reactive, rather than proactive, response to the demands of the moment. This seems to be true particularly for university members who are traditionally relatively lacking in secretarial and other forms of clerical support. This is further exacerbated by a lack of visibility of participation, for example a member might well answer the letter that has been hanging around the in-tray for 3 weeks, whereas not log into a terminal in another room (due to the visible cue for the need for action).

Seven direct suggestions were made that would improve access to the host computer for them. Four were for getting a 1200 baud modem and three to make sure that the host computer was always operative. It may be seen from our previous discussion that the three were not alone as a small group in this wish, others expressed it in different ways, for example, in descriptions of frustration.

3.3.3 Summary of Six-month Survey.

It was apparent from the survey that there were major problems in accessing the system. These can be grouped into four main areas:
- getting equipment installed;
- visibility of equipment;

- easy access to terminal equipment;
- easy access through terminal equipment to the host computer.

The factors associated with those areas are listed in Figure 3.3. These form an inter-related set of responsibilities for working through problems in order to access the system. Four groups are responsible: the telecommunications equipment supplier, the individual user or prospective user, the organisation of which the user is a member and the system provider, the BLEND project management team.

The survey revealed for the first time in the experimental programme the difficulties associated with the organisation of which the user or prospective user was a member, particularly when considered in relation to that organisations relationship with British Telecom.

Main Areas identified by by Six-month survey	Aspects given by interviewees	Responsibility for changing situation
Receipt of tele-communications equipment.	- installation of telephone lines.	Tele-communications Infrastructure.
Visibility	- being reminded to use the system. - using the system as part of work.	Individual user
Easy access to a terminal.	- terminal in same office. - terminal able to be used at any time. - terminal not shared.	User in relation to organisation
Easy access to DEC.	- DEC up and running. - access any time. - access by routes other than PSTN. - access by familiar procedures and routes.	BLEND system management.

Figure 3.3: Areas in which to facilitate access to system as reported in the six-month survey.

3.4   Changes as a result of the Six-month survey.

As a result of the six-month survey the following immediate actions were taken by the Project Management Team, with regard to improving access to the system.

1. A poster reminding users of the existence of the system was sent to every participant.

2. Additional discretionary financial help was offered to those with difficult terminal access to help in the provision of external telephone lines to their offices and negotiation with the organisation offered.

3. The DEC was rescheduled to make the system available to LINC users in a limited way throughout the afternoon.

4. A trial use was made of the new services being offered by British Telecom for communication over the Public Switch Telephone Network at 1200 baud. The increase in rate leads to an increase of speed of word display on the screen from 5 to 20 words per second.

5. The host computer was made available through PSS, the Packet Switch Stream run by British Telecom, and investigation was made of links to ARPAnet and a Science and Engineering Research Council (SERC) funded university computer network.

6. Communicating microcomputers made available to some participants. A little later the first microcomputer designed for telcommunication, the TORCH, appeared on the market and the survey was used as a rationale for purchasing 13 units.

3.5 A Thirty-five month telephone survey of participants.

3.5.1 Background and methodology.

In the two and a half years following the Six-month survey, two major versions of the software were introduced and the experimental programme extended to September 1984. As part of this extended programme, ten LINC members were provided with TORCH microcomputers with auto-log-in facilities to aid access to BLEND and upon which to undertake related experimental work to be reported on the BLEND system.

With this background, a repeat phone survey of the LINC community was instigated with similar aims and questions to the Six-month survey in June-July 1981.

The aims of the survey were:

1. To establish the perceived reactions of the LINC community to the BLEND system, in particular to note what gave the community most concern.

2. To discover any further problem with which the Project Management Team might help, in particular with the provision of hardware and telecommunications to facilitate communication.

3. To discover the views of the LINC community on the material (messages, newsletters, papers and references) held on the BLEND system.

4. To discover ways in which the LINC members may get more involved in the BLEND system so as to maximise the use of the resources remaining in the experimental programme.

The methodology adopted was to be the same as the Six-month phone survey, to allow coverage of both those who used and did not use the BLEND system, and also to permit a comparison of the results.

The questions included in the interview covered six areas:

1. Use of the System - How much do you use the BLEND system?
                       - Do you envisage this level increasing or do you consider it to be static?

2. Hardware   - Have you got all the equipment that you
                        need?
                        Is your access to the equipment
                        satisfactory?

3. Design of System - What changes would you like to make to the
                        software or the procedural functioning of
                        the BLEND system?

4. Content on BLEND - Do you find the content of the material on
                        the BLEND system appropriate in quality and
                        quantity?

5. User support   - Is the BLEND documentation sufficient?
                      - What other forms of user support would you
                        like?

6. Scientific   - Have you had communication
    communication   through participation in the BLEND project
                        with those who you did not previously
                        communicate?
                      - How many papers have you written for the
                        BLEND system?
                      - Have you other papers in preparation?

Attempts were made during the week of November 14-18th 1983 to
contact each member of the LINC community. Excepted were all the
new members who had responded to recent invitations to join the LINC
Community and the few senior members who had been invited to join
for initial observation only.

101 calls were made, 6 of which reached the person required at the
first attempt and 32 of which were successful in the end. At the
time of the survey there were 92 scientific members (including the
research team), of whom 26 had recently joined. Of the remaining
66, 30 had been interviewed in the Six-month survey and 22 of these
were successfully reached for the survey reported here. Many of the
others had not logged on other than for demonstration or trial
purposes.

The general response to being called by phone was very positive and
all members seemed prepared to give up time to answer questions and

to express their views freely. In particular there was a general
prevailing opinion that the research undertaken on and with BLEND
was worthwhile and needed increasing. Thus this survey, like the
Six-month survey, should be taken as a 'snapshot' of the attitudes
of the LINC members interviewed, because many had already expressed
views on the matters covered in the survey.

An analysis of the area in which members spent most time talking (as
noted during or immediately after the interview) revealed that two
aspects, access (13 people) and the BLEND software (10 people),
still caused the most most difficulty or initiated some other
subjective response. A small group (4) were concerned about making
the on-line members more communicative and creating an active
community. Only the first aspect is discussed here.

3.5.2 <u>Survey results.</u>

LINC members were asked how much they used the BLEND system. Of
those interviewed, over two-thirds were up-to-date with proceedings,
having regularly logged in once a month or more frequently (see
Figure 3.4).

Average	0 (recently)	4	Number of LINC
Frequency	A few times	10	members in each
of Use of	Once per month	3	frequency
BLEND by	Once per week	2	category.
LINC Members	2/3 times per week	7	
Interviewed.	3/4 times per week	<u>6</u>	
		32	

<u>Figure 3.4:</u> <u>Frequency of use by LINC members interviewed.</u>

This accords well with the use of the system as observed in the
system. Of those that logged in, over three-quarters were
up-to-date in the Messages activity. However, only 4 in 10 of all
LINC members had logged into this area and only half had logged in
since the second major change of software in May 1983, the others
dipping into different journals.

Those in the frequency category "2/3 times a week" were split into
regular and irregular users, the former accessing BLEND daily when
opportunity was given and the latter having spells of high activity
followed by weeks of being away completely, owing to other
engagements and external pressures. Those who had not logged on at

all were in the position of having moved jobs or types of job (2) or
not having had time to organise things (2).

A total of 23 people thought that they had all the equipment that
they needed. The remaining 9 had varied requirements ranging from a
printer to go with a TORCH or microcomputer to equipment situated
where they could use it. Only 3 surveyed could not log in
satisfactorily. The members exhibiting an above average usage
tended to have more equipment and more ways in which to access the
BLEND system. Figure 4.5 illustrates the variety of ways in which
users could choose alternatives.

Access for 13 members was "dramatically" altered by the availability
of the TORCH microcomputers (the effect which contributes to the
increase in access rate in Figure 3.1). Moreover, 23 of the 32 were
entirely satisfied with their access, whether their terminal
equipment was in their own office, at home, conveniently situated in
a nearby office or distant to the office. It is to be noted that
when the terminal equipment was sited at hand in an office or at
home, general remarks were made to the effect that use patterns
altered from occasional sessions consisting of several hours to
short sessions 2 or 3 times a week. However, some users preferred
the longer session away from the office where one is uninterrupted
by phone calls and visits.

Tele-printer and Modem (4)

```
              1        2     1

(2) Direct terminal
    into DEC20      1                                    1
                    1                                    2  VDU & Modem (7)
                                                         1
                                                         2
                                                         1

                    3                                    5
(7) Micro or VDU    1                                    1  Micro & modem
    via Mainframe   2                                    2  (8)
                    1

                    1    1    1    5    2    2    1

                         TORCH (13)
```
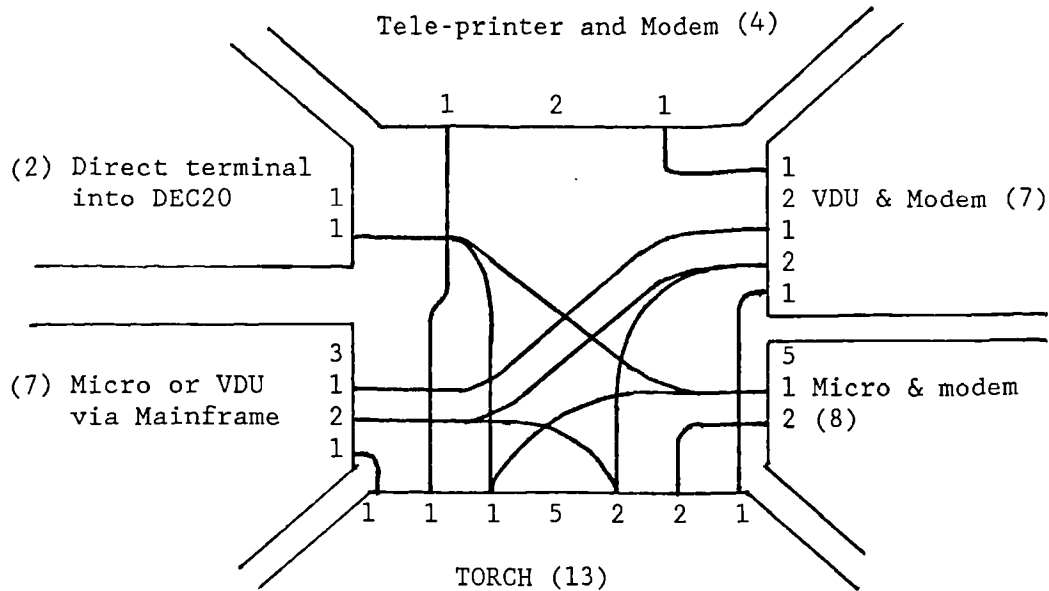
The lines indicate choice of equipment. For example, starting in any box, if that particular piece of equipment is not operational, then following the lines will indicate the other possibilities. The number below it gives the number of members with that combination. The members with larger choice tend to use the system more.

Figure 3.5: Variety of equipment for 29 members

Nine users had terminals distant to them or in a room close by which was found inconvenient for some reason. This was most often reported as being owing to the terminal equipment being in another office and there being a disinclination to move away from their own office however strong the invitation to do so. Many of these expressed the benefits of a terminal in the office as

(a) creating a visible reminder to use the system,

(b) removing the effort barrier of access and,

(c) enabling one to fill in two or three minutes before coffee (or similar) period by logging in.

In particular there are differences in behavioural patterns resulting from an unsuccessful attempt to use the system. When a terminal is in your room, then failure to connect, owing to busy telephone lines or the BLEND system being unavailable, may be a temporary setback after which another attempt was made. Such a repeat attempt is reported as highly unlikely in the case of a terminal being situated out of the office.

Specific difficulties and requirements were:

1. Deciding on the best telecommunications equipment to serve more than one purpose. (2)

2. Ordering and obtaining the correct telecommunications sockets from British Telecom. (2)

3. Integrating equipment into the rest of the computer system so that a consistent system is produced (to make use easier). This is applicable to both equipment, terminal software and telecommunication routes such as PSTN, PSS and SERCnet. (2)

4. Flexibility of equipment in both what is used (e.g. printer or VDU) and where it is positioned. (1)

5. Having access to BLEND system between 9am and 5pm (considered "absolutely essential"). (4)

6. Communication between NOTEPAD and other message systems such as ARPAnet and COM.

3.5.3 Summary

Although some LINC members were still experiencing the problems identified in the Six-month survey, particularly with installation of telecommunications equipment, the general areas of concern had moved from the pre-requisites to access the system to how access could be integrated into work. They were seeking improvements in two main areas: working arrangements and equipment to allow them flexibility of use of CBCS and computer facilities, and flexibility of use of the BLEND system in relation to the use they made of the equipment (see Figure 3.6). Thus it seemed that when the users got a restricted amount of use from the CBCS and other computer-based resources, they demanded more use of both the local equipment and the host computer systems.

```
┌─────────────────────────┐        -  flexible telecommunications equipment
│                         │           not dedicated to
│  Flexibility of local   │           one purpose.
│  equipment.             │        -  integrated equipment.
│                         │        -  choice of equipment for BLEND use
└─────────────────────────┘           (VDU or printer, location).


┌─────────────────────────┐
│                         │
│  Flexibility for        │        -  host computer accessible at
│  BLEND use.             │           any time.
│                         │        -  messages passed from CBCS to CBCS.
└─────────────────────────┘
```
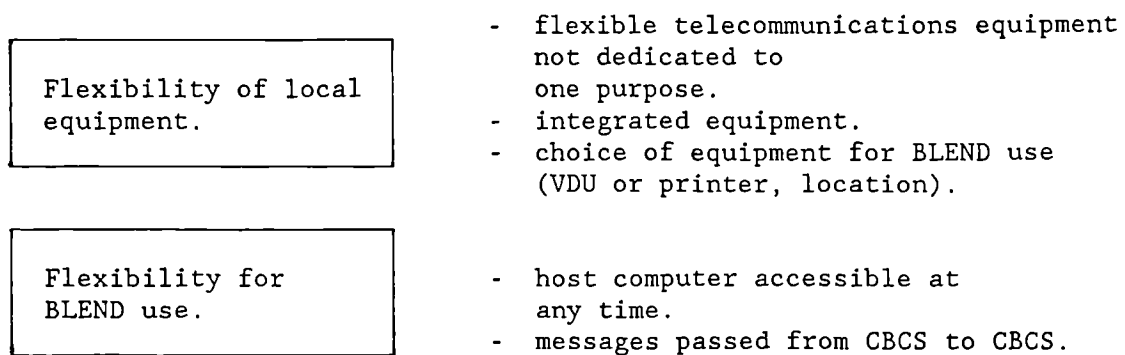
Figure 3.6: Areas of flexibility required in access to host computer as
             reported in the Thirty-five month survey.

If the local terminal equipment is viewed as a tool to gain access
to computer-based services, then the utility, usability and cost
effectiveness must be considered as part of the CBCS. The cost, as
discovered in the two surveys, is high in effort for a numbers of
areas, principally in negotiation with telecommunications equipment
suppliers, the organisation and colleagues. The return from use of
the equipment can therefore be increased in two ways; by increasing
the use of the local terminal equipment by giving it increased
flexibility to support a number of tasks and by increasing the use
made of the host computer system once it is accessed.

The features demanded of a system thus depend on the current
development of the telecommunications technology, the organisational
awareness and integration of external services, and the individuals
experience and learning.

3.6   High Users, Low Uses and Other Groups

What were the patterns of use among individuals in the LINC group?

From a cursory examination of how up-to-date users were prior to the
35-month phone survey and their reported frequency of use, a loose
description was made to describe various groups in the use of the
system.

Participants reported adopting different strategies for accessing
the system and the amount of time which they spent on it. These
differences may be reflected in a continuum of patterns of use or in
groupings. An investigation was carried out, including a detailed
look at the data, in order to find out whether different groupings
of behaviour were apparent or not.

It has already been seen that there is an approximate continuum of
the average number of sessions per week and of the proportion of the
weeks in which there was at least one access (Section 3.1). In
order to study the different patterns in which people access the
system, another two measures were considered, the average number of
accesses per week, given that there was at least one access in the
week, and the average time per access. Plotting the first of these
measures against the proportion of weeks in which individuals
accessed the system the users appear to fall into four groupings
(see Figure 3.7).
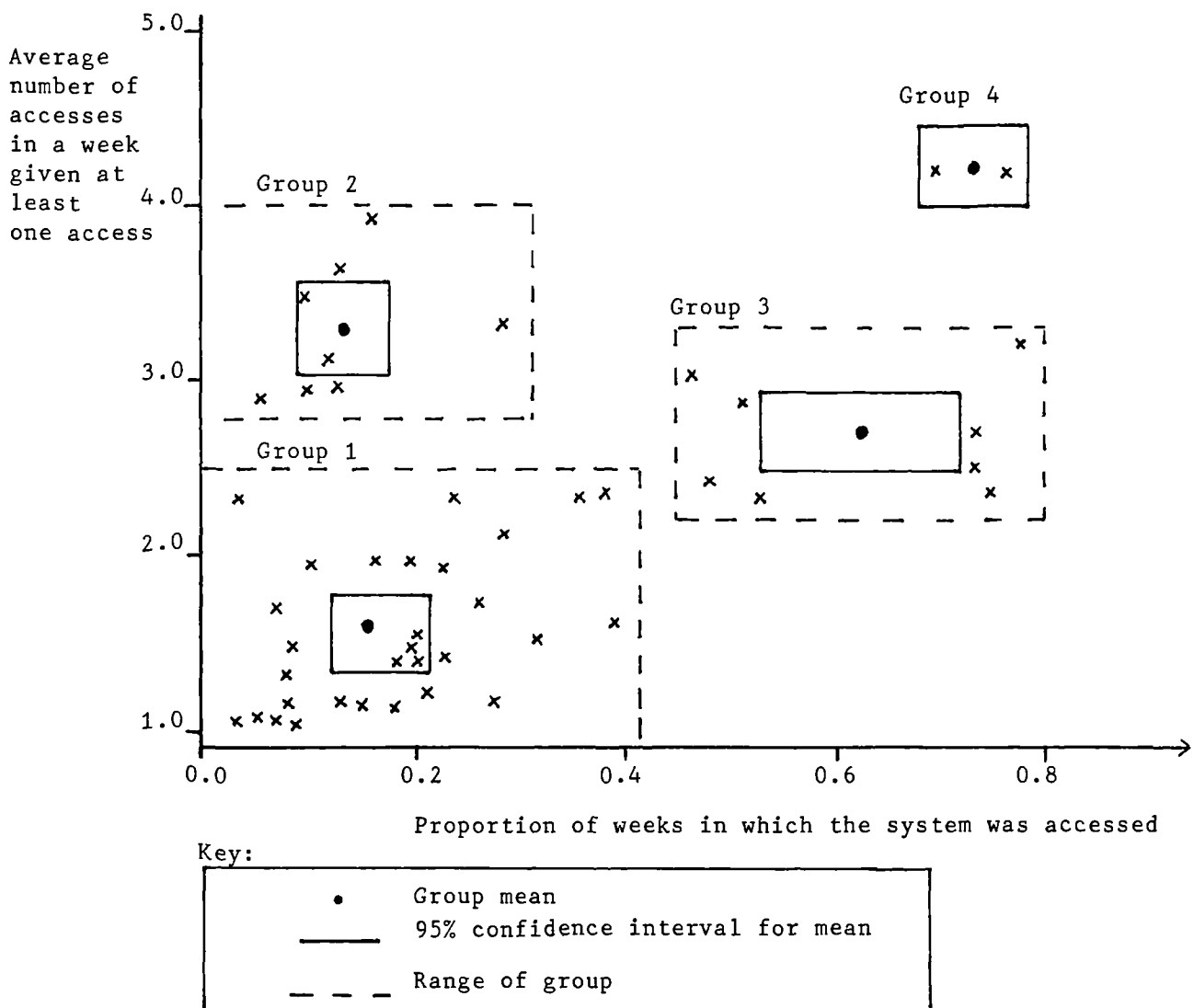
Figure 3.7:   The plot of the two measures for studying patterns of access

These groupings are characterised by:

1. Low number of weeks entered, low number of accesses in the weeks,

2. Low number of weeks entered, high number of accesses in the weeks,

3. High number of weeks entered, medium number of accesses in the weeks,

4. High number of weeks entered, high number of accesses in the weeks.

The gaps in the graph are also interesting, for there do not appear to be users who logged in nearly every week but do so just once, nor those who logged in alternate weeks (on average) and accessed the system nearly daily. It is particularly of note that one of the only two types of behaviour not observed was the former, on which the funding for the users was based.

The length of time that people spend on the system is another indicant of behaviour and the histogram of the average times per accesses given in Figure 3.8.

Number of accesses
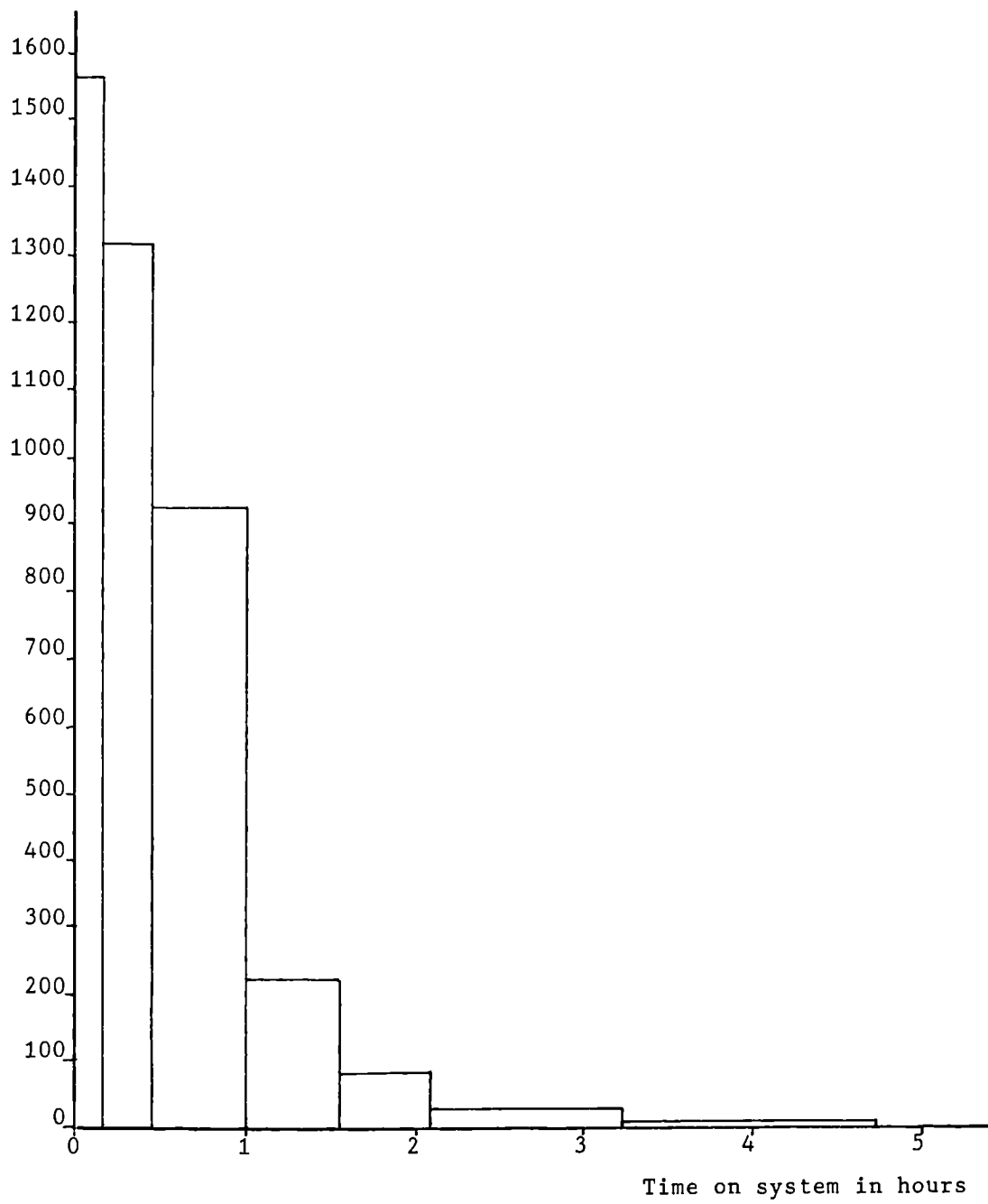
Figure 3.8:   Histogram of accesses against time

Looking at individuals' distributions of time per access, the majority had an exponential type decay distribution. However, four users had a much higher proportion of very long sessions than one would expect in an exponential distribution. These four users were part of the grouping in low frequency of access, low number of accesses in a week suggested earlier. The groupings are summarised in Figure 3.9. A full set of descriptive statistics are given in Appendix C.

GROUPS	AVERAGE PROPORTION OF WEEKS SYSTEM ACCESSED	AVERAGE NUMBER OF ACCESSES PER WEEK GIVEN SYSTEM ACCESSED IN THAT WEEK	AVERAGE TIME IN MINUTES PER ACCESS
1a	0.15, LOW	1.66, LOW	17.4, MEDIUM
1b	0.18, LOW	1.6, LOW	53.7, VERY HIGH
2	0.11, LOW	3.65, HIGH	8.2, LOW
3	0.66, HIGH	2.82, MEDIUM	20.8, MEDIUM
4	0.77, HIGH	4.61, HIGH	33.2, HIGH

Figure 3.9: Summary of user groupings

These five groups may be given a general description of the patterns of use as following:

1a. In this group the majority of members, did not access the system in very many weeks - about one in six on average, many made few accesses in those weeks, usually only one or two, and spent about 15-20 minutes in those sessions. These could be termed low-usage members.

1b. This group is the same as 1a. with the exception that the time per session could be very high and averages nearly an hour, i.e. this group was doing all its work in long sessions and only occasionally accessing the system.

2. This group had a low rate of entry in terms of weeks i.e. only in about one week in every eight was there an access, but in those weeks the number of accesses is high, three, four or higher and the time spent on the system is very low - with an average of less than eight minutes. This group did its work in short bursts in a week with long time intervals between the weeks.

<u>3.</u>   This group had a high rate of entry in weeks, i.e. about two
weeks out of three, makes about three accesses per week in
those weeks of entry and spent a medium amount of time - about
20 minutes on average, on the system. This group could be
termed high users.

<u>4.</u>   These two cases are really special examples of Group 3 with
very high numbers of accesses per week, almost daily.

From the problems experienced by users in both the Six-month and
Thirty-five month surveys, it seems probable that many, particularly
in Groups 1 and 2, never successfully managed to get a functional or
usable tool to act as local terminal equipment to the host computer.
All the members of Groups 3 and 4 had a large choice of local
technical equipment and telecommunication routes to the host
computer.

It is perhaps worth repeating that the results here do not reflect
total use of the BLEND system (see end of Section 3.1). There were
many more members who would be included in Group 3 and 4 but these
had joined as a result of the 1983 invitations and so were excluded
from the analysis. It is right that they should be so, as they
tended to be the people who already had suitable equipment and
familiarity with it and so did not reflect the long term development
of the group of users who started in 1980.

3.7   <u>Expectation and attitude to accessing the system.</u>

The state of communications in 1980 were such that some difficulties
were expected. Just how the participants anticipated circumstances
affecting their use of the system was explored in two questions in a
questionnaire sent out before using BLEND in October 1980 (see
Appendix D for full questionnaire). Users were asked to make a mark
on a 10cm line labelled 'NO' on the left and 'YES' on the right in
response to the questions; 'Do you expect to find the system
convenient to use?' and 'Do you expect to use it as much as you
would like?'. In 1984 the same questionnaire was sent out now with
the questions phrased for past use (see Appendix D).

The data for 1980 was taken in its entirety from all respondents and
that for 1984 was selected so that only those who were members of
the data studied in the patterns of use were included. This was in

order to go beyond the learning curve to data at a point of relatively stable use (Eason, 1983). The results show that the LINC members found the system far less convenient to use than anticipated (see Figure 3.10) and used it less than they would have liked, although this was anticipated (see Figure 3.11).

Do you expect to find the system convenient to use?
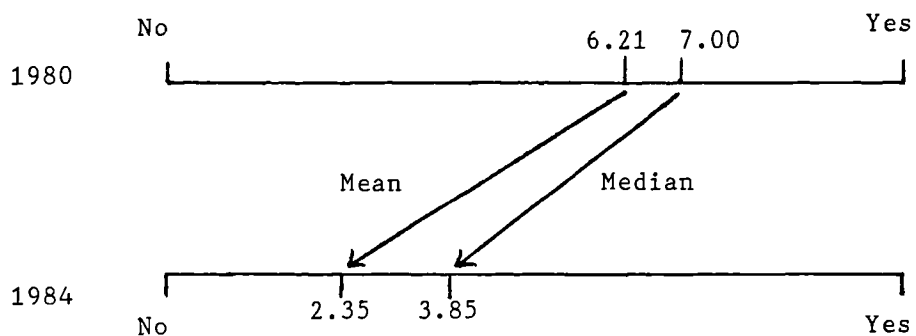
Did you find the system convenient to use?

Figure 3.10:   Rating scale response on convenience of use

Do you expect to use it as much as you would like?
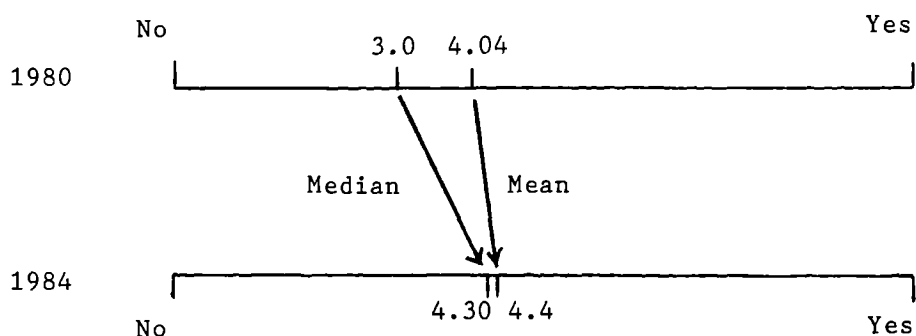
Have you used it as much as you would like?

Figure 3.11:   Rating scale response on desire of use

The results suggest that the users suspected that circumstances would indeed prevent them from using the system, but that access would not be a major problem. In fact the problems listed in the phone surveys indicates that for many access was a major problem. This is more clearly seen when breaking the responses to the rating scales into three equal sections (see Figure 3.12). Over half experienced major problems, but just over a third did not have problems, probably the TORCH microcomputer users.

Number of respondents in range

	0-3.3	3.4-6.6	6.7-10.0	
	No	Medium	Yes	
Have you found the BLEND system convenient to use?	9	1	6	n=16
Have you been able to use the system as much as you would like?	7	3	5	n=15

Figure 3.12: Yes/No distribution of responses on attitudes to access by long-term users of the system.

3.8   Summary and discussion

When the frequency of access of the long-term users of the system were analysed by week, the distribution found was the Negative Binomial Distribution. An explanation for this kind of distribution lies in there being many external influences affecting access week by week. In order to see what kind of influences there might be, a study was made of the problems and patterns of accessing the system.

As a result of early dropping use, a phone survey was carried out six months after the start of the experimental programme. One primary problem was found to be in the provision and use of local terminal equipment. In particular, after obtaining equipment there remained three areas of difficulty: there being no visible reminder to use the system, lack of access to local terminal equipment, and lack of access to the host computer system. The aspects in access to local terminal equipment and the problems with time of access to the host computer all contributed to the kind of external influence found in the distribution of accesses made.

The situation was modified by provision of local terminal equipment, by making access to the host computer easier and by providing prompts to remind members to use the system. Nearly two and a half years later a repeat phone survey was carried out. This showed an improvement in access for most of the participants, but there were still many problems. Those who had a choice of local terminal equipment and telecommunications routes were much more satisfied and used the system more. Their concern was how to increase the flexibility and integration of that equipment, to use it for BLEND with a demand for more flexibility of access to other host computer systems. Taking into account the high cost in effort, to obtain and learn to use such equipment the demand for the development of these two areas appears to be seeking a return on that investment.

The difference between users with and without choice of equipment show up in the patterns of access and the amount of time spent on the system. Access rates for many are considerably lower than expected, but for others much higher. When asked to give a rating on convenience and amount of use expected and obtained, the group clearly found the system much less convenient than anticipated on average, although the responses divided into the 'haves' and 'have nots'.

In the first place, then, the feasibility of a CBCS for scholarly communication depends on having a feasible tool, local terminal equipment, through which the system is accessed. For this, the following requirements should be met:

- the equipment should be in the same office, able to be used at any time and not shared with others;

- the equipment should be integrated with other types of . functionality required by the user and not dedicated to one purpose, and also be flexible enough to allow different kinds of use with the one system;

- the equipment should permit the use of familiar procedures at a time convenient to the user.

In turn these make demands on the service provided as a host computer or in a distributed network.

Our initial investigation of access patterns has led to another item
inserted into the framework for considering the feasibility of a
CBCS, accessibility. The difficulties experienced in accessing the
system may not be the only explanation for the patterns of behaviour
observed. Other factors may include the utility of the system and
whether or not use of the system fits into the working life of an
individual researcher. It is to these aspects that we now turn.

4.   THE UTILITY OF THE COMMUNICATIONS SYSTEM

When the researchers accessed the system, did they find it useful to
do so? One factor which might contribute to the particular access
patterns observed is the value that they received from accessing the
system, i.e. whether or not the act of accessing the system proved
to be worth it.

Since the system is designed to support communications, the utility
received will be from the act of communicating and in the
communications themselves; that is, from the way in which the system
supports and facilitates communication and the value received from
the communications. The communications considered are of two main
types, the longer article length pieces of text and the shorter more
ephemeral messages. The three types of scholarly communication
which were isolated for research in the literature review fell into
these two categories, the formal communication and the gray
literature being largely in the article length pieces of text and
the informal communication being largely in the shorter messages.
Consequently we examine how the system was used for these types of
communication and what the users liked and disliked about a CBCS
support for scholarly communication.

In order to do so, the users themselves must be considered, their
experience and need for communication, and the nature of the subject
in which they research. This is particularly important in the light
of the findings of Sheridan et al, 1981, on the lack of requirement
for communication found among the group that were experimenting with
electronic journals in the NSF-funded US programme of research.
Their attitudes to the normal primary communications procedures are
also of importance as these will affect attitudes to new systems, a
totally positive attitude perhaps indicating a negative predisposal
towards new ventures and one with negative aspect showing a positive
predisposal to exploring alternatives.

The second section examines the use of the CBCS for article
communication. Was it used? Did the system live up to expectations
of the users themselves? Does it live up to the sort of promise
proposed by those that see the electronic journal as the way forward
for scholarly publishing? The same type of question is addressed in

the following section on the more informal discussions and
message-passing habits of the users. Does the availability of a
communication system in conjunction with access to reading journal
articles encourage discussion? Does it encourage communication
between those who have access to the system?

In this chapter, the CBCS is considered as a support tool for
communication with two different implicit images. The first is a
'black box' through which communications are passed to others. This
is however a less dominant one than the operational image maintained
by the majority of the researchers in their descriptions of the use
of the system, the system as a 'repository' of communications,
whether articles or messages. It appears that the difficulties
already described in the previous chapter on the accessibility to
such host computer systems strengthen the latter image. Thus
although the system is not itself considered herein, there will be
many aspects of it that will emerge as important relative to the
communication process.

There are therefore three areas of questioning addressed in the
chapter; the contribution of the utility of the system towards the
observed access rates, the use of the electronic medium for scholary
publishing relative to the promise advocated by the protagonists for
it, and the way that the system itself supports the communication
requirements of the research community.

4.1   The Users of the system

The first group of users of the system were members of the research
community of which the Project Director was a member. Shackel,
1982a, describes the research area as follows:

> "The topic proposed for the first group of users may be
> succinctly entitled Computer Human Factors. This may be defined
> as the science and technology of human-computer-interaction
> (HCI). The topic is considered from both human and computer
> viewpoints, so this involves not merely the theory and
> measurement of human behaviour and performance in HCI, but also
> the study of computer system characteristics and performance in
> relation to human designers and users. The aim of this subject
> is to understand the relationship between people and computer

hardware and software during HCI so as to optimise system efficiency and human satisfaction (the system here being the combined man-computer system)."

This group of researchers had been identified by Shackel as one that could benefit from a communications tool and so in 1980 Professor Shackel invited all those known to him to be well established researchers in the human sciences or the computer and information-processing sciences to participate in the BLEND experimental programme. In the first few months, each person was asked to suggest names that might also be considered to be in the area ending the first group of users numbering 50. It was then with the optimism of developing the topic area and workers within it that the word 'community' was used to describe the users and so was formed the LINC, the Loughborough Information Network Community. Most of the group were not familiar with each other personally and it was hoped that they would become so during the BLEND experimental programme.

The number of other LINC researchers and the level of contact with them was explored in the pre-use questionnaire sent out in 1980, which was described in the previous chapter (see Appendix D for the full questionnaire). Of the 36 completed questionnaires, most reported only having heard of one-third of the other members by name, although there were smaller known groups in evidence. Most would pass on a paper, and regular contact was kept with up to six other people, although constant contact was enjoyed with up to only two others. A summary of these contacts is given in Figure 4.1.

None of the respondents knew all members of LINC and most (20 of 26) had had no communication with more than 30 members.

Most people (25 of 32) had heard by name of up to 20 members.

Up to 12 people were 'known by name to greet' by the majority of LINC members who responded (23 of 35).

Most respondents had had only one contact with up to 7 people (27 of 31)

Occasional contact was had with up to 6 people by 26 of 34.

Professional enquiries of up to 8 people were made by 27 of 34.

Regular contact was kept with up to 6 people by 29 of 32.

A paper would be passed on to up to 6 people by 29 of 32.

Regular contact (in organising seminars, etc) was kept with up to 4 people by 29 of 32.

Constant contact was enjoyed with up to 2 people by 30 to 31.

Figure 4.1:   Summary of the pre-BLEND communication between the LINC
                members

The wish for a greater amount of communication was very clearly
expressed in the group's anticipation that an electronic journal
with communication facilities would (a) aid discussions with authors
while important ideas were being formulated, (b) enable more
detailed and technical information to be obtained from specific
authors than is normally written up in journal papers and (c)
encourage interaction and community spirit in a group of researchers
(see figure 4.2).

```
┌─────────────────────────────────────────┐
│Electronic medium will allow discussion of ideas │        31%
│while issues are still 'alive'            │
└─────────────────────────────────────────┘


┌──────────────────────────────┐
│More detailed information      │                    22%
│particularly from certain authors │
└──────────────────────────────┘


┌──────────────────────────┐
│Community spirit and       │                        14%
│interaction in group       │
└──────────────────────────┘


┌──────────────────────┐
│Other Reasons          │                            11%
└──────────────────────┘
```

Figure 4.2: Reasons given for expectation of increased communication
             within the research community

The first two reasons given both suggest that the kind of informal
network that Crane, 1965, describes was not in full operation. It
suggests that the researchers often obtain their information from
journal articles when the work is completed and that they discover
it later when research has already been archived and the researchers
had moved on to other topics. One reason why this might be so is
that the members of LINC found themselves in many different contexts
and consequently published articles in the application context of
the work. The main division could be described as a split between a
human factors emphasis and a computer scientist emphasis with two
thirds of the members being associated in some way with ergonomics
and psychology departments in universities or research
establishments and one third situated in computing studies
departments. This means that the work on Computer Human Factors was
published in a range of journals of different subject areas. The
set of diverse contexts for publication suggests a rationale for
each of the three reasons given for participation: the electronic
journal would give them earlier access to journal articles, they
would be able to obtain more details from those engaged in similar
research, and they would be able to join in a group of people with
interest similar to their own and not feel so isolated in the place
of work.

The need to build informal networks in order to communicate what
work was currently being researched and the difficulty experienced

in obtaining relevant journal articles suggest that the primary
communication system was not fully operational for the research
community in the way that it was envisaged as a support for
scholarly work. Attitudes of the primary communication system had
been sought in the 1980 questionnaire. There, the LINC researchers
reported difficulty in finding material from the range of journals
in which Computer Human Factors articles were published and were
also frustrated by slow publication.

The group of scientists surveyed were asked to place a cross on a 10
cm line marked at each end with 'Like' and 'Dislike' to answer the
question "Do you like the present system of publishing in refereed
paper journals?". The median response of 5 showed their ambivalence
in recognising the value of print and certain aspects of the
publishing process. In particular, refereeing of papers is seen as
keeping the quality of the journals higher than they would otherwise
be, while, on the other hand, there is almost unanimously a strong
dislike to the slow publication process, specifically the delays due
to slow refereeing. Other dislikes included the restrictions
imposed on writing papers due to rigid standards of presentation;
the occasional arbitrary and unhelpful refereeing without the
possibility of recourse to the anonymous referee; and the
difficulty of locating relevant material in the multiplicity of
journals in the field. Figure 4.3 summarises the free comments
made.

Number of people
people making
comments on
likes and
dislikes

13 LIKE	DISLIKE 33

Comments on Editorial Procedure

LIKE		DISLIKE	
4	Evaluation by experts filters out rubbish	Referees - do not insure quality	2
		- arbitrary and unhelpful	7
1	Confidentiality of referees	- anonymous; no chance to respond	3
1	Delay allows reassessment	Slow publication with cumbersome procedure, esp. slow refereeing	30
1	Assistance from editors	Arrogance of editors	1

Writing and Reading

LIKE		DISLIKE	
1	Convenience of printed work	Rigidity in presentation restricts author	3
1	Permanence of printed work	Multiplicity of journals - difficult to locate relevant material	5
3	Availability of print esp. worldwide		
1	Predictability of presentation aids scanning	Retyping of papers for different journals styles	1
2	Satisfaction of seeing work in print	No 'forum' to air ideas in print	2
2	Multiplicity of journals - always somewhere for a paper		
1	'Community' readership in some journals		
1	Publishing procedure works		

<u>Figure 4.3:</u> <u>Likes and dislikes in present publishing procedure for refereed papers</u>

One indication of the acceptable time span for publishing articles
can be found in the reply to the question "What do you consider the
maximum acceptable delay between submission and 'publication' in the
'Electronic Journal'?" In an 'electronic journal' there need be no
printing queue if chosen, i.e. the papers can be published as soon

as they have been accepted by the editor. Whatever policy is
adopted by the editorial board in an electronic journal, since there
need be no restrictions on the size of an 'issue', a paper would
have only to wait until the next 'issue' to be published (if
'issues' are used). Thus the question also implicity seeks to find
the maximum acceptable time period for initial editorial processing,
to which the general reply is 3 months or under (see Figure 4.4).
There was recognition by some respondents that if re-submission was
involved, then a longer period may be acceptable.
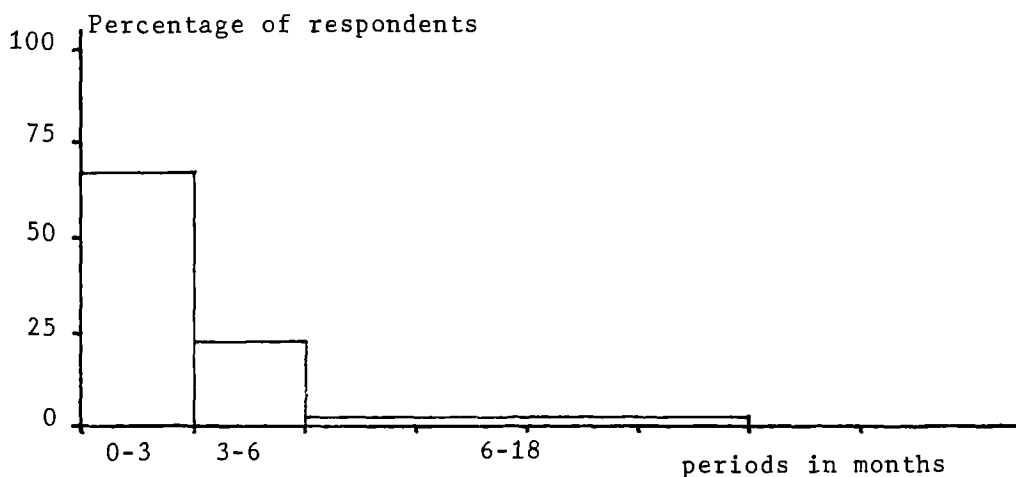
Figure 4.4:   The acceptable maximum length for publication delay in an
              'electronic journal' - a histogram

The research community was therefore seeking a fast publishing
cycle, perhaps with the ideal of developing interaction between
readers about the articles and with the authors about their work as
expressed in Figure 4.2 about discussion of ideas while the issues
were live. It was not always clear whether the discussion of the
ideas while they were still 'live' was a post-publication ideal,
aided by fast publication, or a pre-publication ideal, aided by the
communications system. If the latter was the case then the need was
for more informal communication than found, as the majority of
reasons given for increased communication would then be accomplished
by the informal communications.

A second doubt for the need of an extensive formal communication
system in this subject area is raised by the work of Garvey et al,
1971. In the associated subject of applied psychology, they did not
find the developed networks of article writing researchers as
described by Crane, 1965. They attributed this to the fact that
applied psychologists deal with a whole range of problems, rather

than the development of a paradigmatic science as in the process described by Kuhn, 1962. Since Computer Human Factors is an applied science taking into account psychological and behavioural as well as physical aspects, the researchers might behave in the same way as the applied psychologists. This suggests that the need for communication between researchers may not be as great as in those areas seeking paradigmatic development. This led to the need to establish the relative importance of formal to informal writing engaged in by CHF researchers.

In the interviews associated with the 1980 questionnaire at the start of the study programme, researchers were asked what kind of article they normally wrote and the relative proportions of the kind of articles. As a group they reported a 3: 2: 1 proportion for the number of conference papers, journal papers and general/popular press articles respectively. In the questionnaires when asked how many articles for refereed journals they had written in the previous year, 29 of the 36 (81%) had written at least one paper and 22 at least one in the subject of Computer Human Factors. The mean number for the number of journal articles written per researcher was 2.31 and in the field of Computer Human Factors 1.58. This suggests a writing pattern of about three conferences papers, two journal papers and one popular article per researcher. This does not reflect the distribution between the large number of low producers and the low number of high producers that contributed towards the mean. Two produced nine and twelve papers respectively and only one of those produced CHF papers. A graph showing the distribution is given in Figure 4.5. It is to be noted that 38% of those interviewed had not written a CHF paper the previous year and that they were undertaking to produce one longer and one shorter paper for each year of the project as part of the agreement for participation. (Shackel, 1982a).

Percentage of respondents

Number of papers written

——— Refereed papers
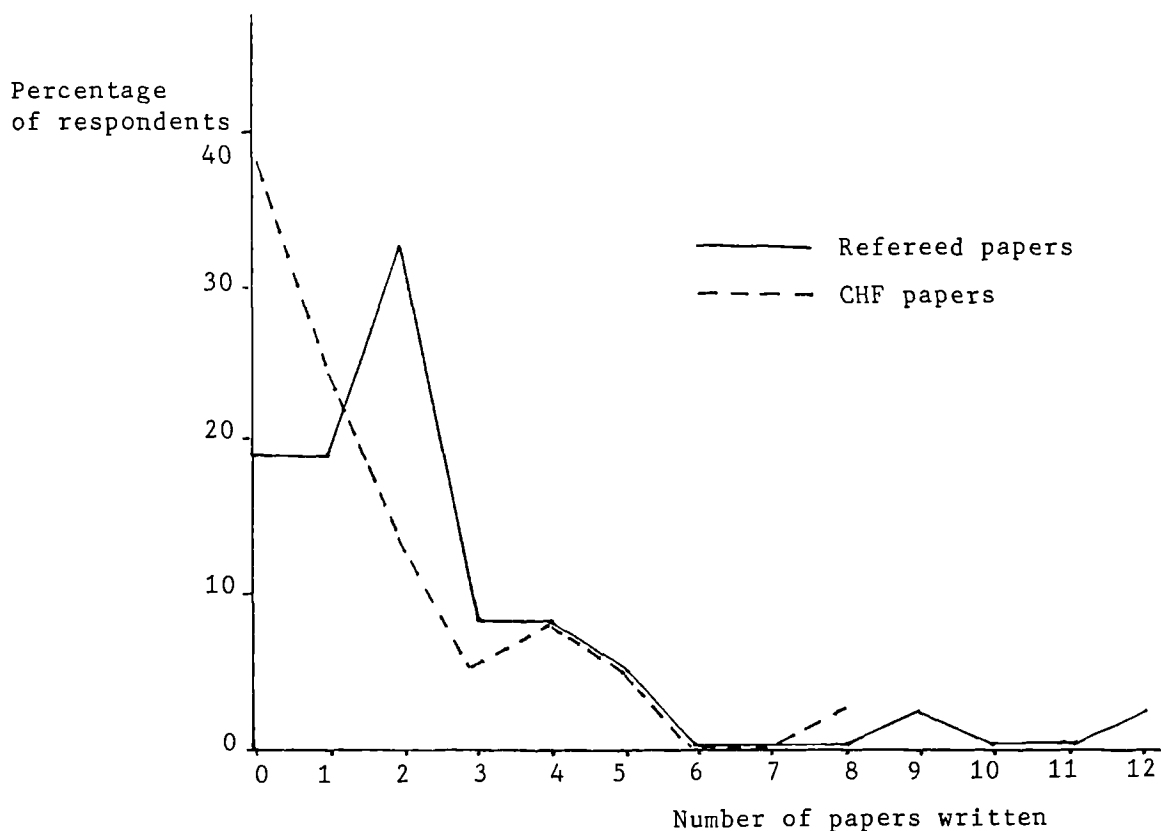
– – – – CHF papers

Figure 4.5: The number of refereed papers and CHF papers written by LINC members, as reported in the 1980 survey.

Indeed, such an agreement takes the entire mean product (of 1.58 papers) of the group's labours in the refereed papers area. In order to fulfil the agreement either the output from the group would have make a substantial rise or the high producers would be the ones to contribute and output remain fairly static.

82% said that they wanted their productivity to increase but only 35% expected it to do so with 16% being ambivalent and 48% not expecting it to do so. Upon what were they basing these papers? If the work was to be based upon the development of a paradigm for the area, then one might expect just such an explosion of productivity (Kuhn 1962). The researchers reported that they wrote papers based on literature reviews (9/27), isolating and describing problem areas (6/27), describing research group work and progress (10/27) and their general experience (3/27). Only 7 reported basing their writing on their own research programmes and 4 on interviews and other survey techniques. The high proportion of conference papers seems to reflect the need for within peer group communication in isolating problems, bringing research together and describing current work. The variety of places where the papers are published, the fact that so many are delivered in conferences and the content all reflect an emerging subject. There was therefore

little indication of the emergence of a paradigmatic reason for potential growth.

At first sight a refereed papers journal would not, on this analysis so far, anticipate much input unless the two higher producers and the three who write three to four papers each year contributed substantially to it. This assumes a relatively static level of the numbers in the research community or mean producers joining LINC. There is, however, one other possibility, the one anticipated in the proposal, that the subject area is itself generated by bringing a group together which gathers others to it. Crane, 1965, describes it as follows:

> "Periods of exponential growth can occur because research areas, although generally small, are capable of being expanded at relatively short notice if scientists with secondary and tertiary commitments to an area decide to shift their research priorities."

Precisely that occurred in the UK in the period 1980 to 1984. There had been a gradual and increasing awareness of the need to consider the human aspects of the introduction of computer systems and this was actively encouraged by the UK government under the Alvey programme, as is documented by Shackel, 1985b. There was an increased demand for productivity from those already in the field and an increased total productivity from the accumulation of numbers in the research community. This was reflected in the BLEND study programme in that many new members joined in 1983. Did this increase of numbers in the Computer Human Factors field and the demand for increased productivity, lead to sufficient growth to sustain an electronic journal? How the increased demand for productivity was channelled in some specific directions, for example in generating research proposals and speaking at conferences of increasing frequency, interacted with the increasing number of people in the community and their desire, or otherwise, to communicate using the BLEND system is the general subject of our next two sections.

In summary, the logical line has been along the following points:

1. There was a belief that the time was appropriate to develop a community of researcher workers in the field of Computer Human Factors.

2. Although few members of the research community knew many of the others, they hoped that communication would increase, particularly in discovering what work was being accomplished and in being involved in discussing that work.

3. The slow publication speed in the primary communication system and the multiplicity of publishing points for Computer Human Factors contributed to the difficulty of accessing relevant work.

4. Doubt is raised by the work of Garvey et al, as to the necessity for long-term formalised networks of researchers associated with publishing in this subject field.

5. The average quantity of papers generated by the researchers was exactly that demanded in return for their participation in the experimental programme. The electronic journal would appear to be feasible if either productivity increased and/or the numbers in the field increased.

The points raise the following questions:

1. Would a community be developed in Computer Human Factors?

2. Would communication among them increase?

3. Would faster publication and a source for reference to published articles help the primary communication system? Would the publication speed of the electronic journal match expectations, in particular, sufficient to encourage discussion when the issue was 'live'?

4. Is it possible to maintain Crane's kind of informal networks, through electronic media, when such developed forms are not found in applied psychology?

5. Would productivity either be routed via the electronic journal or increase sufficiently to make it worthwhile?

4.2 Articles and their associated communication

In studying how the system was used we look at the number of articles submitted, whether or not this number met the expectations of the participants and the discussions the articles engendered. In doing this we will be concentrating on the refereed papers journal and so we also examine whether or not the speed of publication anticipated as the minimum acceptable was achieved and if that which was achieved was found acceptable.

During the experimental programme a number of journals based on papers were run: the refereed papers journal, Computer Human Factors; the unrefereed papers journal, 'Poster Papers'; a collection of papers about the BLEND system which were not published elsewhere, 'Bulletin'; and a review magazine of software, 'Software Reviews'. As at 24th July 1984, a total of 88 articles had been received and their destinations are listed in Figure 4.6.

Total number of papers received from LINC members: 88 (100%)

Number made available to readers ....
in Computer Human Factors	18	(21%)
in Poster Papers Journal	22	(25%)
in Software Reviews	17	(19%)
in Bulletin	10	(11%)

Suggested for publication elsewhere   6   (7%)

Retained by author after transfer to the host
computer, rejected or in the editorial procedure   15 (17%)

    Position on 24th July 1984

Figure 4.6: The number of papers submitted to the BLEND system

Compared to the requirement to which the LINC members agreed in return for telephone funding, viz, one longer and one shorter paper a year, which would produce an expected total number of around 300, this number is not high. A total of 62 authors were responsible for the submission of papers, whether they were single or co-authored, with a few among them being high producers. The fact that only a few are high producers and most low is in substantive alignment with observation on normal paper-writing habits and that observed in the NSF-funded EIES experiment (Sheridan et al, 1981). This observation does not, however, relay the correct impression if it is to be claimed that the distribution of contributions to the system is

similar in pattern to that observed in the normal publication procedure for these users. For some high producers of articles on the system were relatively low producers in the normal primary communication system and, more importantly, some high producers of articles in the normal channels contributed little or nothing to the communication of the system. Some of the reasons for the differential response to the system have already been indicated in the problems of accessibility. In view of the problems encountered, was this number acceptable to the research community? In the thirty-five month survey, six months before the date on which the number of articles was recorded, the members were asked about the content.

Over a quarter of those responding thought the quality of the content was good (one noting the Human Factors bias in general) and a half thought it variable. The variability was not necessarily to be considered criticism, as one member noted, it is to be expected in just the same way as programmes are variable on T.V. channels. The quantity was considered good by one person but over three quarters thought that more was needed, especially in the Computer Human Factors journal. The reasons put forward for a high quantity was that more material would lead to more interaction and that the change in cost-benefit ratio would begin to make accessing the system more worthwhile.

Thus another factor in discouraging access to the system was that the amount of material on the system was not sufficiently large to warrant more regular logging in.

How much interaction was there as a result of reading articles? At the time of the thirty-five month survey it was lower than was expected and this was the pattern perceived by members. In 1980, LINC members had expressed their disappointment at the low response that they received from publishing work in journals, wryly commenting that papers were generally requested with appreciation of work from the East European countries, where photocopiers are less readily available, or by young researchers for other papers - apparently attempting to shortcut some of their literature search. Thus they anticipated having issues in the papers raised by readers and conversely raising issues with authors while they were still 'live' and current. In addition it was hoped that points in the

paper would be clarified and technical questions asked. The amount was in fact far less than that for which they had hoped. Figure 4.7 shows how their expectations of 1980 of exchanging ideas and views on refereed papers had been met by 1984.

1980	1984
Do you expect that the exchange of ideas and views on refereed papers been members of the BLEND Community will increase?	Has the exchange of ideas and views on refereed papers between members of the BLEND Community increased?

YES 84%   20%

MIDDLE 16%   5.5%

NO   0%   25%

n - 31   n - 20

Mean rating value 7.85   4.77
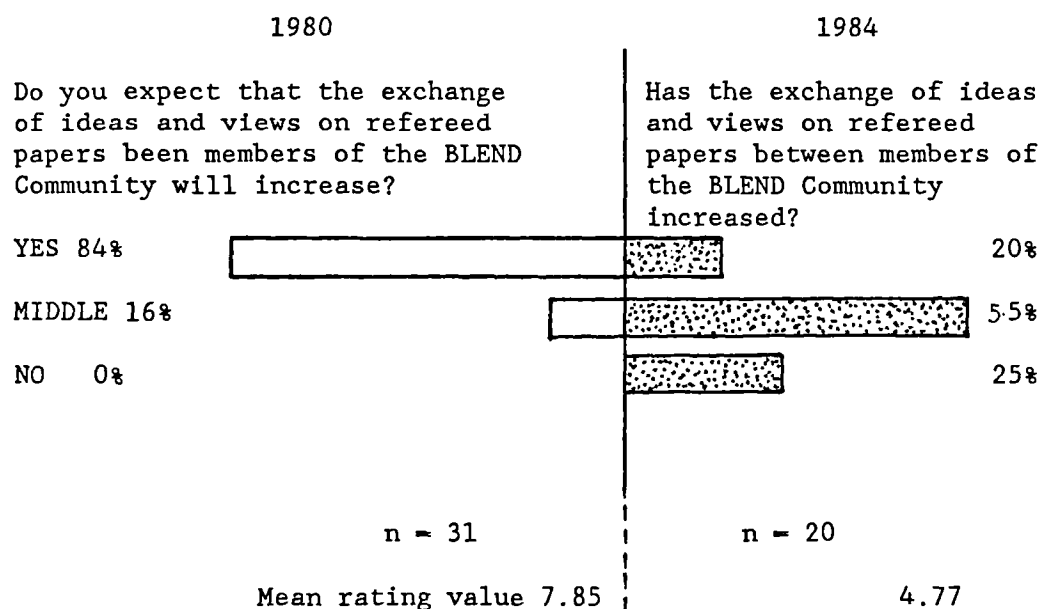
Here the 10cm rating line is vertical and the divisions correspond to the points 0, 3.3, 6.6 and 10.

Figure 4.7:   Rating the exchange of ideas and views in LINC

In the Computer Human Factors journal there were 16 full refereed papers, 3 editorials, 2 book reviews and 1 discussion paper. In the total of 69 public messages made by readers, 18 were about the discussion paper, 30 were associated with 10 of the full papers and the book reviews received one comment asking for more information. The remainder, mainly in the Editorials, were about the structure of the journal and the process of reading the articles on-line.

Nevertheless, that there was some response was most gratifying to the authors, as several commented in appreciation, and at least one paper resulted in members trying out new ideas in their place of work, which were then reported in the discussion a year or so later. This aspect of returning to the discussion, as long as the system is available to readers, contrasted with the difficulty of finding scattered references and tracing peer communication through the Letters to the Editor in printed journals. In relation to the response received with printed articles certainly some were satisfied with the amount of discussion (see Figure 4.7).

To allow the discussion of issues while still 'live' requires either a very rapid availability to readers of the issues presented in articles or half-formed pieces of work which are discussion documents. These are considered in turn. The speed of publication was not as rapid as the minimum that had been thought satisfactory by most of the participants. The median and mean times, in months from date of receipt, were respectively 8 and 9.75 months. In 1980 two-thirds hoped for a period under three months from when the paper was submitted to the Editor to when it was available to readers. One-quarter thought periods under six months were acceptable and some would accept periods as long as eighteen months. In 1984, after experience of the electronic journal, four-fifths hoped for periods under three months and over one-third of these for periods under one month. Some were still prepared to accept periods up to nine months (see Figure 4.8) but in general there was a shift towards requiring a much quicker publication.

Percentage of respondents
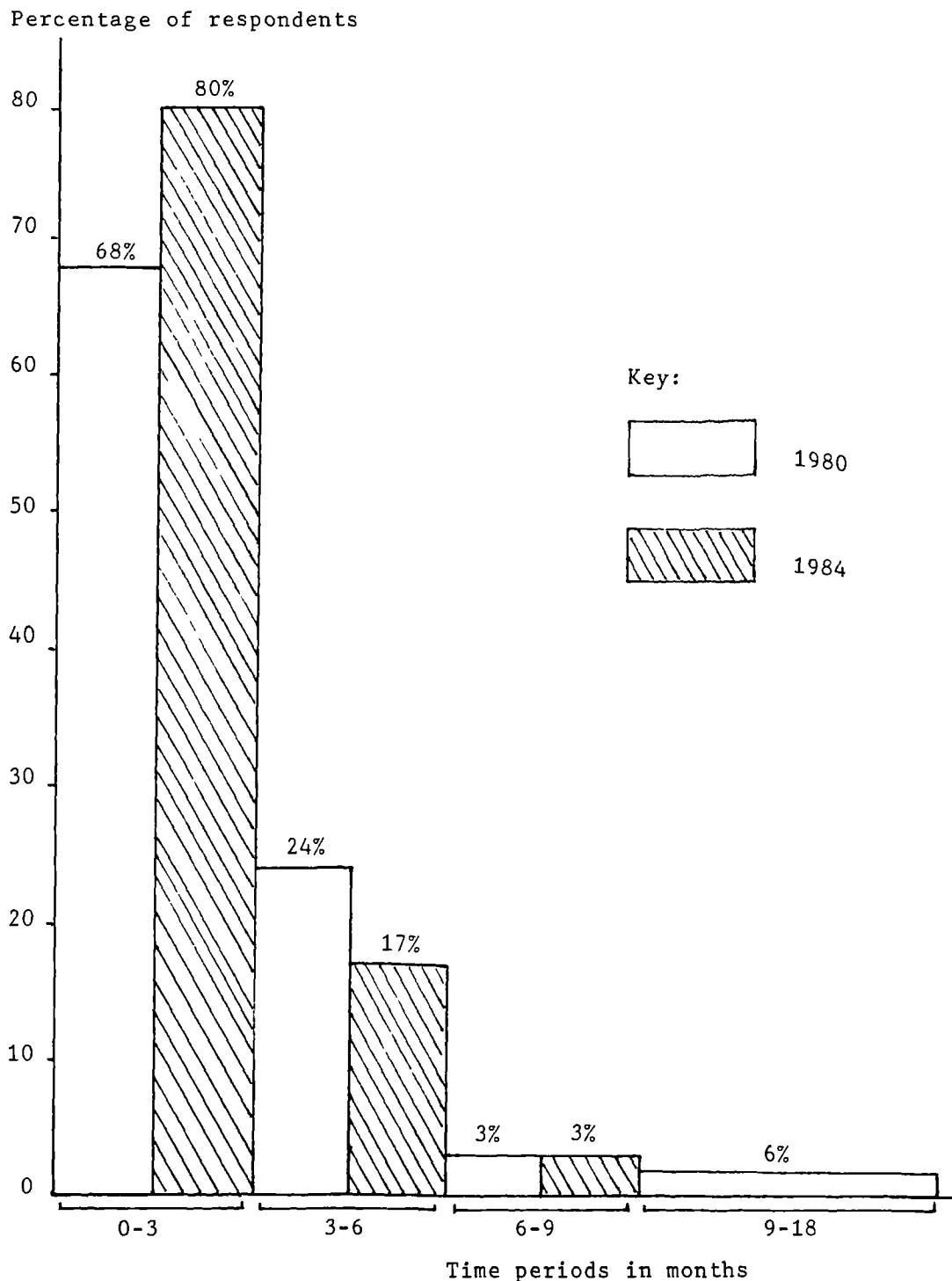
Figure 4.8 : Maximum acceptable delay in publication to LINC members

The reason why publication was slower than thought satisfactory
involved both the design of the system and the research community
itself. The system did not begin with the facilities for supporting
the production of a journal and those needed to be developed,
particularly in aids for Editorial work and refereeing (a full
description is given in Dodd et al, 1987). Secondly, partly because
the system was not fully designed for the editorial process, there

was wide-spread reluctance to take on the job of refereeing which in itself led to delays of around three months on average (see Figure 4.9)

Paper arrives at LUT

MEDIAN TIMES IN WEEKS

Transmitted to UoB

Referees assigned

Referees respond

'Publication'

0   5   10   15   20   25   30   35   40

'Publication'

Referees assigned

Referees respond

Transmitted to UoB

MEAN TIMES IN WEEKS

Paper arrives at LUT
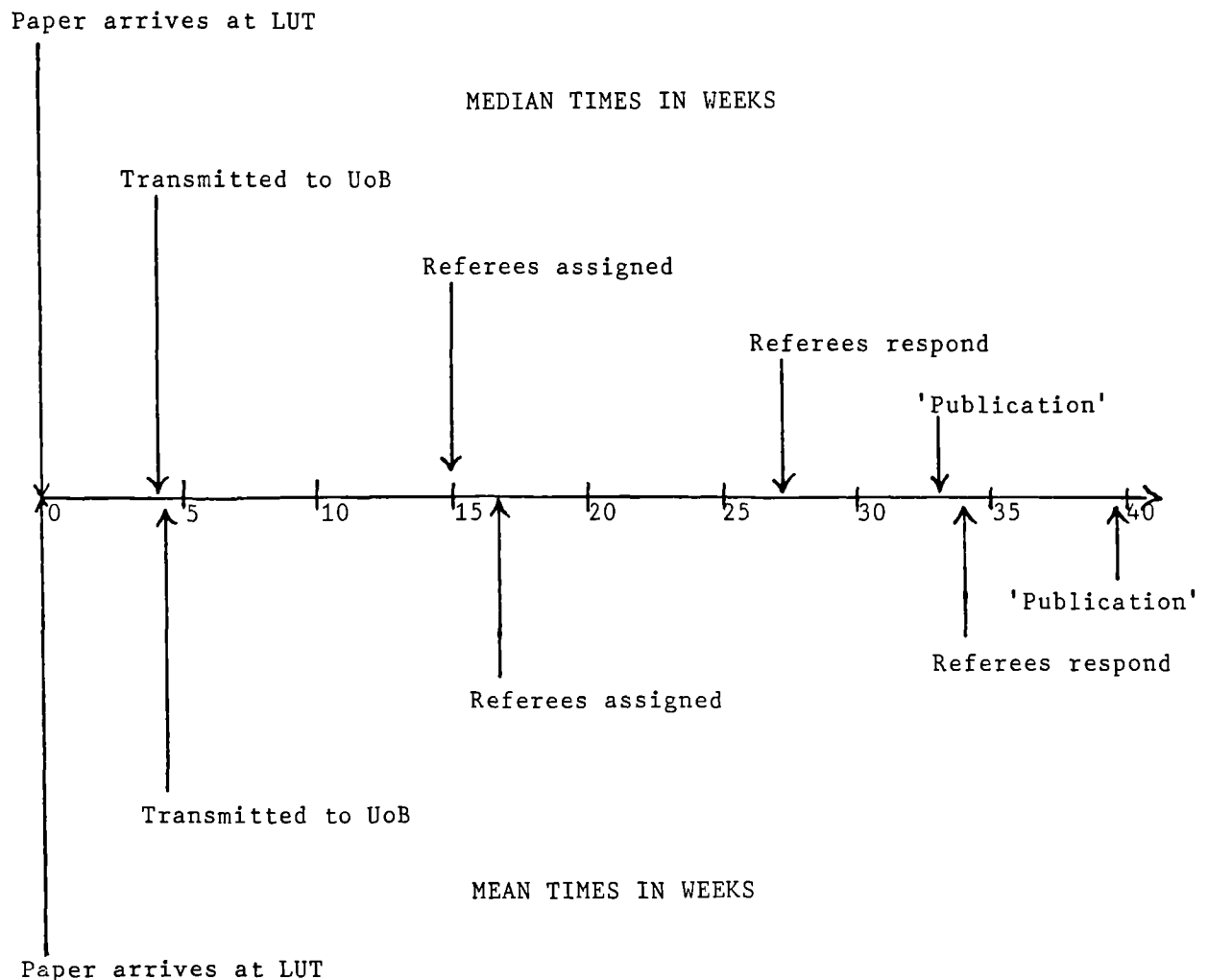
Figure 4.9:   The progress of the average *Computer Human Factors* paper through the editorial process

When the refereeing task was accepted it was no different in length than for a printed journal, i.e. around three to five months (Pullinger, 1983). Thus there is in the editorial process a time that is itself greater than the preferred maximum for publication. The need for peer review of this kind, and fast publication seem to

be mutually exclusive and suggest that the electronic medium may not be the place for articles refereed in the usual way.

Two other positions are derived when either of the two requirements are dropped. If the requirement for fast publication is dropped, then the way in which electronic medium could support discussion of 'live' issues would seem to be lost, as was perceived by the research community of the thirty-five month survey. On the other hand, if the peer review process is changed then so is the concept of the refereed journal. Before studying any conclusions from this line of reasoning, there is one other possibility, that the refereeing process might speed up with the development of suitable aids on the system. There is, however, no evidence that this would occur given aids as good as, or better, than those normally used for the task. It is in the best interests of the research community to invest time and effort into a fast editorial process, for they are themselves affected and frustrated by delays in the process, particularly those caused by refereeing. However the average period for normal printed journals is the same as observed on the system. We can find no reason to suggest that a change of medium will change the habits of the research community to the extent that all refereeing will take a shorter time if the task remains the same. Thus we conclude that the normal refereeing time, although varying between journals, will remain largely static within this community. We are left with considering that either there is a refereed papers electronic journal that does not make full use of the electronic medium in encouraging discussion while issues are still 'live', or that the concept of the peer review is itself modified. The results of the study programme show that it was possible to run a refereed papers electronic journal on-line, but they also suggest that modifications are necessary.

The members of the research community expressed an opinion that the journals ought to tend towards the more informal. In the thirty-five month survey members made many relevant comments on this matter and they tended towards the request for more informality. The comments are summarised here with the number in parentheses indicating the number who profferred remarks on the topic.

Members noted the experimental nature of the BLEND Experimental Programme (4) and also its uniqueness. The concept of an electronic

journal was a fascinating one and it was satisfying to be at the leading edge of information technology (2) and part of the excitement and 'froth'. In terms of directness and speed of access, the idea remained very attractive at a conceptual level (2) but in practice a number of problems remained (1). Two thought out that perhaps the climate was not yet right for the use of electronic journals (2), other that putting papers on-line is not terribly worthwhile (3), it would be better to concentrate on tele-conferences. The background for that seemed to be that they saw the content as being more ephemeral (1) than that which is found in academic journals, that such a system should be treated like a newspaper (1) or a mailbox (2) with additional facilities such as teleconferencing and bulletin boards (2).

The members liked the more newsy aspects of the information, with specific mention of the informal area and the monthly newsletter (5), Software Reviews (2), Bulletins (2) and the concept of the Reference, Abstract and Annotations Journal (6). These latter six also commented that the annotations themselves had not yet turned out to be informative, perhaps (as one member proposed) one needs a very large number of people making comments. Although two liked the Poster Papers, both thought that the text could be shorter and lighter, a point made more forcibly by seven members who suggested that Poster Papers should not be in formal article structure at all, but be short articles designed to elicit discussion and debate. One suggestion was to have a "paper of the month" in this form - whether the paper was initially 'published' on or off the BLEND system.

The research community thought that rather than maintain a full article journal on the system that communication of a more ephemeral nature should be encouraged and be of a form to elicit discussion and debate. This introduces a third factor to consider into the debate on a refereed papers journal communicated through the electronic medium. The three are the following:

- the need, or otherwise, for a 'traditional' peer review process,

- the need, or otherwise, for fast publication,

- the need, or otherwise, for full articles suitable for long-term archival.

From the evidence of behaviour and opinion, it does not seem viable
to maintain all three on the electronic medium. What are the
possibilities in the development of scholarly communication if some
of the needs are dropped as a priori requirements? The different
ways of viewing the peer review process on an electronic journal
have been considered by Woodward, 1976b, and by Roistacher, 1978,
among others and were reviewed in Chapter 2. Two main ideas were
presented: firstly, have a peer review process in which reviewers
go through the normal procedures and also allocate a rating to the
article and allow the reader to modify the rating; and, secondly,
to abandon the formal review process and publish everything offered
within the subject area of the journal and allow the readers to rate
the articles they read as a review process by peers. Evidence
suggests that the former is not possible if the current style of
review is adopted because of the time that reviewing takes, if fast
publication is also desired. Therefore a maintenance of the second
two factors and dropping the first, suggests that an electronic
journal on an electronic medium would only match some of the
readers' expectations if everything was published and readers
allocated a rating to the articles. However that gainsays the other
advantage of the review process identified in the questionnaire,
that the review process prevents the reader from having to filter
out 'the rubbish'. Nevertheless this remains a possibility. It is
not too dissimilar in concept to the Poster Papers Journal, where
authors could place their new articles at their own discretion.
Although widely read, the articles did not result in much
discussion, perhaps because they were similar in context, length,
format and style to the refereed papers but without the advantage of
a particular place on the system for discussion and debate allocated
to them. The request for more informality may not necessarily be
taken to be one for a release from article structure, in general,
but one in relationship to the Computer Human Factors journal. On
the possibility of peer review by readers, we cannot say much
further except propose it as one possibility to be explored in
future experimental programmes.

Dropping the second as an a priori requirement, places us back into
the earlier discussion, where the researchers could not see real
benefit in having electronic journal publication if it was not fast.
The only possibility emerging here is not one of the issue of the

speed of publication but of the completeness of publications in the area. The focus would then move from being able to discuss topics which 'live' to one of access to all the material in the subject area. Certainly those that used the References, Abstracts and Annotations Journal find this aspect of database useful (see Shackel, 1985b). As a publication process, though, there does not seem much possibility of dropping the need for fast publication and the members of the research community were more convinced of its necessity after use, than before (Figure 4.8).

The average number of words in the articles for Computer Human Factors was the same as authors reported they wrote in 1979, a mean of 5,750 words. The structure of the papers, in their logical layout, were also the same. The system contained articles that were of the same length, structure, content and standard as those found in printed journals. What would it mean to drop this as a requirement of the electronic journal? First, restricting it to covering the same number of articles but making them synoptic does not seem to have worked (Dugger et al, 1973) but there are indications that it might have more future in the UK than in the US (Meadows, 1979). This suggests the possibility of a reduction in size and a commensurate increase in frequency and hence numbers. This should provide the same level of coverage of the topic in scholarly communication as now, but reported more frequently in smaller pieces of communication. The reduction of the size and increase in frequency was exactly that which occurred in the development of the journal as a means of scholarly communication in the Seventeenth Century as discussed in Chapter 2. One conclusion from the research is to indicate the possibility of a parallelism in this respect as well as in respect to a new medium for communication.

Consideration of the three factors identified in the survey has lead us to consider three modifications for a refereed papers journal, derived from dropping each factor in turn:

- readers add a rating to the article by some appropriate procedure and peer review is accomplished cumulatively by the readers;

- the benefit of electronic journal lies not in the speed of
  publication but in the completeness of the material relevant to
  the subject area being available;

- the article size is reduced and authors publish more frequently.

These are discussed again in Chapter 11, when other considerations
have been raised from study of other parts of the use of the system.
Before communication via refereed papers is left to consider the
more informal communication, we note again that in the thirty-five
month survey, the lack of quantity of papers was itself a
disincentive to logging into the system. Thus the material on the
system affected the access patterns.

4.3   Discussion, teleconferencing and message-making on the system

One particular area of the system, a Project called NEWS, was
designed to contain discussions on points of topical interest, to be
a focus for information on to what was happening elsewhere on the
system, and to be the focus for advice and help on use of the system
and in which to hold discussions on specific topics
(teleconferences). This was the area in which most time was spent
and which the majority accessed when first logging-in. Indeed,
three-quarters of all the time spent on the system was spent in the
NEWS area of the system. The relative percentage of times spent in
the different areas is given in Figure 4.10, as collected by the
data collection program LOGBOOK.

In order to analyse the pattern of a 'typical' session on-line by
the group of long-term users, LOGBOOK was used again to produce an
analysis to determine an 'average' session. Four variables were
used: user; project accessed; session number for user; minute
number in session, and then a weighted measure calculated which was
based upon these variables.

The measure took each individual user and normalised the
contribution towards the distributions across the number of accesses
made to BLEND. For example, if one person logged in 20 times, then
for each minute that passed, 1/20 of a unit would be added to the
project that they were in that time for each session. Thus for each
person an average profile of Project entry would be created. Adding
each member's contribution together would result in a graph

displaying the average number of people in a Project at any time after the beginning of a session. The distributions at time zero then give the average number of people logging directly into a particular Project first. These were then summed together to give the number entering the more informal areas, the journal areas and the editorial processing (see Figure 4.11).

The graph displays the behavioural pattern of a 'typical' user in an 'average' session, i.e. at a certain time after the start of each session the probability can be calculated whether or not the user would be still in the session and what kind of communication area was being participated in. The statistics show that most of the communication took place in NEWS.

What were the users' views in the quantity of communication in teleconferencing? In the thirty-five months survey, we noted in the last section that over three-quarters of the 36 interviewed thought that more content was needed on the system, including particular reference to the journal. It was also seen that many of the suggestions were designed to elicit discussion and debate, because it was felt that there was insufficient on the system. Six people specifically suggested having more discussion groups and the lack of interaction so concerned five members that they put forward suggestions for situations where people would be forced to respond and participate. The lack of interaction also had the deleterious effect of seeming to produce a clique of those who did contribute (comment by two members). Partly this was explained by the high accessibility to local terminal equipment with several routes to the host computer system that some members enjoyed.

Two members objected to the evidently ephemeral messages which remained in the sequence of other types of discussion. They commented that even when the flow of discussion was not interrupted by those ephemeral messages that they experienced difficulty in entering a discussion already started and spoke of being 'overwhelmed' by the number of messages. They were not alone in mentioning the large quantity of messages, although others spoke in an apologetic way for only accessing the system occasionally.

TYPE OF COMMUNICATION	PROJECT TITLE	HOURS	PERCENTAGE OF TOTAL HOURS	PERCENTAGE FOR TYPE OF COMMUNICATION
Informal Communication	NEWS + NEWS 82 PROGRESS	684.2 9.97	74.5% 1.1%	75.6%
Journals	POSTER BULLETIN CHF 1,2,3 STACK- POSTER RAAJ SR CC1-2	30.5 23.3 55.5 0.283 20.8 41.2 9.45	3.3% 2.5% 6.0% 0.0% 2.3% 4.5% 1.0%	19.6%
Writing Papers	AUTHOR	25.3	2.8%	2.8%
Editorial Procedure	EDITOR REFEREE	0.67 17.7	0.0% 1.9%	1.9%
TOTALS	15 PROJECTS	918.9	99.9%	99.9%

Figure 4.10: Percentage of time spent in different communications 1982-1984

Percentage of users

Time in minutes after log-in

Key:

Journals — — —

Informal area ———

Authoring ········
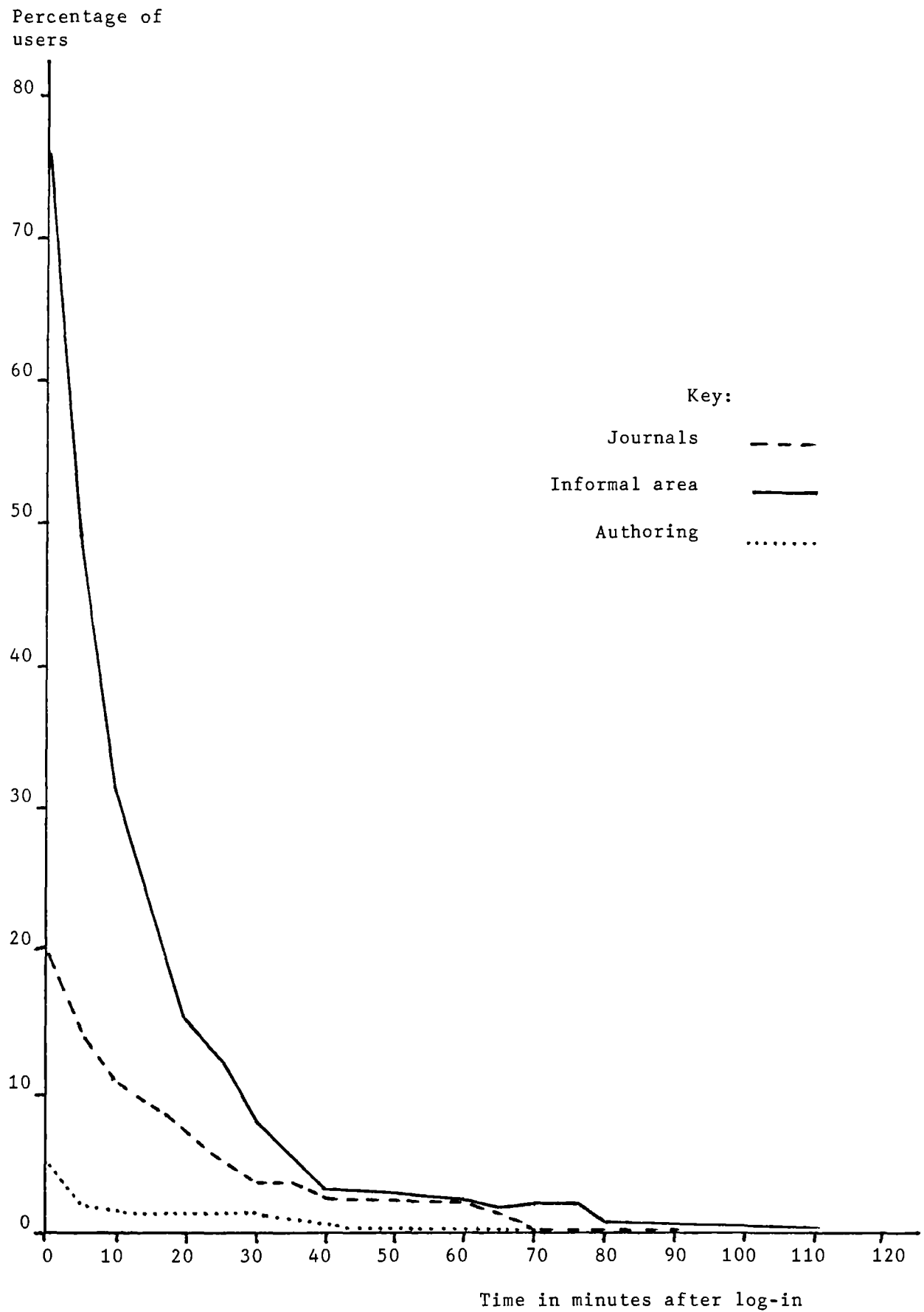
Figure 4.11: The relative percentage number of people in the informal and formal areas of BLEND

Two views were evident in the survey: one group were wishing to see a much greater degree of interaction with each other and a greater amount of discussion on a range of topics and another group expressed how they were put off by the number of messages that were available when they did access the system. Both groups indicated that the level of the communication in the research community on the system caused them hesitation in accessing the system, a barrier to use. What was happening that caused the two groups to respond so differently? Was it only a matter of different access frequency to the system?

Participant observation had indicated one interesting phenomenon, for which there did not seem to be any immediately apparent reason. Observation of the numbers of messages made in the informal communication areas of the system seemed to suggest that there would be periods of a relatively constant number of messages and an occasional occurrence of weeks with higher numbers. The latter weeks were often felt by the participants as those occasions when the conference 'took off'. A number of hypotheses were raised about these occurrences, including that they were peaks in a random Poisson distribution or that the peaks were artificially made by the same number of contributors making more messages those particular times. It was thought that an understanding of this phenomenon might aid an understanding of the reactions of the different users to the quantity of material on the system.

A listing of all messages in NEWS for various teleconferences (called Activities in the BLEND system) from 1st January 1981 to 30th June 1984 was obtained and in each week the number of messages made and the number of people making messages were counted. The data consisted of the numbers of messages and number of message-makers in each week for all weeks of the period and split into three intervals corresponding to the changes in software on the system.

Systematical statistical checking of the distributions obtained gave the following results (a full set of tables is in Appendix H).

1. The distributions were significantly different from a zero distribution; except for one Activity (which was however included in other data because the average distribution over the

three and a half years was significantly different to zero)
using a 1-tailed t-test.

2. The distributions of messages were significantly different from
    a Poisson distribution as determined by checking the dispersion
    indices with a chi-square test. In all cases the number of
    weeks with no messages were in excess of that expected with a
    Poisson distribution of the same mean, and there are more weeks
    with a very large number of messages.

3. The distribution of message-makers were likewise different from
    a Poisson distribution, there being more weeks with no-one
    making a message than would be expected and more with a high
    number of message-makers.

Thus the numbers of messages and message-makers were not drawn from
a Poisson random distribution and the observation was correct that
sometimes there were peaks of activity that were out of the ordinary
with the normal level of message-making. In them, both the number
of messages increased and the number of message-makers. The
non-random nature of the distributions suggests that the act of
message making was not an independent process, but that messages
encourage more messages and message-makers encourage more
message-makers. Studying the relation between the number of
messages, the number of message-makers and the average number of
messages made per message-maker showed that there were no direct
relations between any of them, all got larger when any one did, but
not at any rate calculable from the increment of the others.

In particular, the hypothesis that each message-maker had a constant
probability of making a message in any week and that the
probabilities are independent of each other (i.e. the Binomial
Distribution), was refuted. The accumulation of messages was
therefore not due to an accumulation of message-makers with a
certain probability of making messages in the different activities.

If message-making was not independent, what kind of distribution did
it follow? To test a number of distributions, the data for the
three and half years was concentrated for each activity, rather than
splitting it into yearly intervals. The whole range, from 1st
January 1981 to 30th June 1984 were thus treated as a data

population for each teleconference or 'Activity'. The distribution which gave an adequate description of nearly all Activities by a chi-square goodness of fit test was the Modified Geometric Distribution. A random variable x has a Modified Geometric Distribution (Johnson & Kotz, 1969, p.204 ff.) if

$$Pr \{x = 0\} = 1 - a$$

and $Pr \{x = k\} = a\ b^{\ k-1} (1 - b)$ $k = 1,2,3,\ldots\ldots$

i.e. a geometric distribution with added zeros. The expected frequencies were calculated in the various classes. Maximum likelihood estimation was used to find estimates for the probabilities a and b for each of the different Activities and they are in Figure 4.12 (Wetherill, 1981, p.53 ff.).

Activity	Estimate of a	Estimate of b	χ^2 Value	Degrees of Freedom	Statistical Significance
Messages	0.66	0.73	2.1	8	NS
Advice and Queries	0.20	0.78	4.7	4	NS
Chit-Chat	0.22	0.63	3.0	3	NS
CHF Questions and Answers	0.13	0.80	5.5	1	Significant at 5%

Figure 4.12:   Estimates for the probability a and b for the different Activities

One plausible model which could give rise to the theoretical one observed is that a message is made in any week with a probability a, which may or may not start a chain of message-making, with the probability of a response being constant (b) and not dependent on the length of the chain of messages. $a = b$ would give a geometric distribution.

This seems an attractive explanation which matches some of the observed characteristics of the data. For example, the probability

of a response rises steadily over the three years in each Activity, which is to be expected as the number of users also increased over the period. Moreover the very different probabilities between the Activities in making the first message bears out the observed behaviour of users.

There are several complicating factors in the real situation, which would possibly lead to a departure from the model, one of which is dependence between weeks on the number of messages, i.e. a large number of messages in one week could cause a follow over into the next. Evidence for this can be seen in one particular example (Project NEWS83, Computer Human Factors Questions and Answers), when all non-zero message weeks occurred in two blocks of 9 and 4 week periods respectively out of a total of 62.

It should be noted that the short period special teleconferences in NEWS have been excluded from the above analysis and so we now turn to them. The teleconference on Mail in 1983 was similar to the other Activities in that it was spread over the whole year and also fitted the Modified Geometric Distribution well, with $\underline{a}$ = 0.51, $\underline{b}$ = 0.92. However, the teleconference held on 4-8 October 1982 in NEWS82 was different, with most of the activity being made on the afternoon of the 8th October, when 41 messages were made. Examining the days 4-8 October and splitting the analysis into entries made in an hour, it was found again that the numbers followed a MGD. However, there was a strong cyclical time component with most messages being made in the periods 8-10 am and 3-6 pm. It seems that a MGD might also be used to describe these teleconferences, given the correct time interval and normalisation of the time interval over the day.

In summary, the behaviour of people creating peaks of conferencing activity was not due to either a random Poisson distribution nor to certain individuals writing an increased number of messages. A Modified Geometric Distribution gave the only reasonable fit for the observed data. This suggests that the probability of a person making an initial message is different and lower from the probability that a person who enters the system and finds a message will respond. The response is not to all the messages nor to all the people but, in general, appears to be contributory to the conference itself.

This helps explain the reactions of users to the quantity of material on the system. Considering for a moment the Messages Activity in NEWS, the highest used Activity of all on the system, we see from the estimated probabilities that one-third of the weeks will contain no new messages, in another one-third there will be one to three messages, and in the last third, three or over. This means for those who access the system in Groups 3 and 4, i.e. those who access on average two weeks in three and about four times in those weeks, they will not find any new messages for just over two-thirds of the time. On the other hand, those in Group 1, who log in once every six weeks will be expected to find twelve messages in this Activity alone. Their respective perceptions of 'nothing much happening' and of 'an overwhelming number of messages' are therefore both understandable.

The weekly analysis in the model, hints that the response to the messaging is itself on a week to week basis, i.e. that users respond to a sequence of messages in that week and not to the ones before. If this is true, then an interesting hypothesis is presented; in the informal messaging the group members have a strong sense of 'currency'. It was not possible to test this hypothesis with the data from this system without doing a content analysis of the messages to see what initiated them. However, in the group messaging systems which allow the reader to attach messages to another, thus creating chains or 'topics', this hypothesis could be tested (as in the systems developed and described by Palme, 1985 and Johnson-Lorenz, 1981). For some user's behaviour this hypothesis may form a good description. In the thirty-five month survey one user requested a facility on the system which would enable him to have an optional backdated point of entry, "for example a week", so that effectively all older messages are not viewed. His sense of currency was indicated to be a week. An alternative hypothesis is that the 'weekly' explanation is an average caused by a set of complex interactions between the frequency of access and the number of messages waiting upon access, and the response made by the user to the set of messages. Included in this set of possibilities are the hypotheses that users react to a set of messages, however old, by placing one on the system themselves with a different probability from that for initiating a message. The differential access rates might then be sufficient to

create the pattern observed. Participant observation indicates that
this does occur at times, but is far less frequent than the kind of
'currency' behaviour. This was not able to be tested on this system
although mechanisms for storing the data were considered
extensively. The data to be recorded would be the number of
messages awaiting each user at each access, the number viewed and
the number of messages made in response to the ones viewed. In the
computer conferencing suite it was not possible to obtain the first
of these. If it were possible to do so, the alternative hypotheses
could then be tested against the 'currency' one.

If the 'currency' model is a true one, then with this software and
access behaviour users are going to be dissatisfied whether
accessing frequently or rarely, both because of the quantity and by
the lack of 'live' discussion. What can be modified to make the
situation acceptable? Assuming first that the pattern of accessing
the system the sort that is observed in the BLEND system with the
LINC users, the following modifications can be made:

1. design of the software to facilitate communication handling for
    both high and low user groups of the system, and

2. modification of the content to facilitate communication for both
    the groups of users.

To handle the 'overwhelming' number of messages for the low user
group, the thirty-five month survey received a number of suggestions
for the design of the software which are listed following:

(a) Have ephemeral message with a marked life for automatic
    deletion. Examples of such messages include "The system is
    going down for maintenance this Friday".

(b) Eliminate serial numbered slots in each teleconference for
    origination of messages (as presented to the users) so that
    users do not have to perceive deleted messages.

(c) Because authors of messages are often responding to specific
    points raised by others, but find it cumbersome to make a full
    reference either to the Conference Entry or to the point,
    software should allow messages to be 'tied' to a previous one
    and a sequence of relevant messages followed by the reader.

(d) Facilities for skimming, scanning and flagging would reduce the
     necessity to look at all the messages and the need to act upon
     receipt or remember which messages were left to be dealt with
     on later occasions.

(e) Optional entry into a quantified list of messages, so that the
     time available to the user can be mapped against priority of
     interests.

(f) Have an optional backdated point of entry (e.g. one week) so
     that not all messages are displayed.

These suggestions contain three main factors: a modification of the
structure holding the messages, the creation of accessible groups of
messages of the same subject and an operational control of the
display of the messages, e.g. by date or to hold for later reading.
The suggestions are designed to give the reader more selectivity of
what is received and an increased flexibility in how they are
handled. This seems to be a call for a move away from the
structured centralised system to one where the structure is
determined by the members of the user group.

NOTEPAD was designed to deal with the problem of selectivity by a
separation of the store of messages into discrete and separate
stores called Activities, and all messages up to a number six
presented to the user automatically. All were stored permanently
for later access by date, by author and by character string search.
There were two resulting difficulties which were observed in the
BLEND system. First, the structure will tend to be some else's
filing system (whether the 'someone else' is an individual leader or
group consensus) and this poses a difficulty to the user in knowing
what message should be placed in which compartment and the
compartmentalisation was difficult to maintain meaningfully since
teleconferences frequently took a turn which would have made it
preferable (in hindsight) to have started the discussion elsewhere
or to include relevant messages from another compartment. Both are
apparent in the comments on communication in Figure 4.13. Secondly,
the character string search did not prove a reliable method of
access in pulling out sequences of messages made on the same two
subjects as message-makers would use different terminologies.

Q. <u>What do you most like/dislike (or find most annoying) about present interaction and communication with other members of LINC?</u>

<u>PERSONAL</u>:

(2) Lack of time

<u>GROUP COMMUNICATION</u>:

(3) Like immediate response and communication with others
(1) Some don't log in regularly enough - delayed response
(1) Interaction is impersonal
(1) Difficult to interact synchronously
(1) Small group, that is disappointing
(1) Most communication is outside BLEND

<u>TOPICS</u>:

(1) Can ignore topics in which one is not interested - good
(1) Topics change suddenly
(2) Discussion on some topics seems aimless and rambling
(2) Not sure where location of topics will be.

<u>Figure 4.13</u>: <u>Specific comments on the interaction with other members of LINC</u>

Another possibility is a single database of messages which are loosely grouped by the originators of the messages to create a series of 'topics' within the general sequence. This would permit the participants as a group to control the structure and to allow messages to be part of several topics where there was appropriate relevance.

This would also require an increased amount of information of the structure, for example by listing the topics and the number of recent messages available, and an increased number of handling aids, when compared to the pre-structured database.

Finally, the third way in which messages can be handled is in an individual way. A database of messages is stored which is viewed and handled solely from a single participant's window and whose handling effects no-one else. This is the general electronic mail model extant at present whereby each sender and receiver of messages chooses individually how to store and handle the messages.

It will be noted that the three general approaches above place quite different demands on the participant and that the suggestions above all refer to a reduction in the cost of the task of receiving information. Since all three general models work reasonably well

for different applications of messaging, it seems that a careful
appraisal is needed of the tasks involved in future integrated
communications, but that the group approach fits most closely with
the suggestions of those using the system. This is an area which
requires further research.

How can the content be modified to facilitate communication? In a
synchronous teleconference on 4-8th October 1982 on the system which
involved all the active users of the system, it was found necessary
to put little summaries of the position reached in order to help
those entering at different times. The summaries were modification
of the content in order to facilitate entry of participants into the
discussion and were introduced at appropriate points based on a
perceived access rate. The same technique could be used in all the
Activities, with summaries placed into the system at a frequency
corresponding to the different low use group access rates. The
correspondence may be chosen not to be one to one, but four to one,
say, so that the user would receive four summaries of the different
subjects covered in the access period. This could be one method for
reducing the 'information overload'.

Modification of the design and content of the system have been based
on the assumption that the access rates would be as differential as
those of this group of users have been. We argue that the access
rates are likely to remain as differentiated, but then go onto
suggest two other ways which may modify the access rates for at
least some users.

First, should the distribution of access rates be taken as the
pattern to be found in future systems? If it could be argued that
this is itself an experimental artefact with this particular
situation and that access frequencies would be more consistent
across any group of users, then making any substantial attempt to
modify the system based upon the differential access rate would be
fruitless. We suggest that this wide range of access rates to a
system will continue for two reasons. As we saw in Chapter 3, the
access rate was itself a product of the effect of the 'things of
life', the external priorities and circumstances. It is unlikely
that the prospective user will so interact with these to produce a
relatively constant rate of access. Secondly, discretionary users
have a choice whether or not to access the system. It is to be

expected that they will exercise this choice, thereby producing some
high and some low access rates. This is supported by the research
by Eason, 1981a, who found different use rates in occasional
discretionary users which he classified into 'disuse', 'distant use'
and 'partial use'. These were, respectively, where the user stopped
using the system, where another person operated the system on behalf
of the user and where only a few core facilities of the system were
used. These rates were found in equipment that had been
specifically designed for the users and available to them all the
time. Therefore, without the access problems and the 'things of
life', it can be expected that there will be differential access
rates to systems. We therefore suggest that modifications should be
made which account for a range of access rates, although not
necessarily these particular ones.

Two modifications may alter access rates, the purpose of the
communications tool, and the style of leadership found on the
system. The graph for the different parts of the system accessed
shows that one fifth of the long-term users logged in first to the
journals. Although NEWS was the most highly accessed, it did not
necessarily lead to an exclusive focus of activity through which to
pass to others. Thus the way in which the system was used reflected
the different levels of communication on it, and, as we have seen,
both the quantity of articles and the quantity of messages acted as
a barrier to use. One of the things that the research is unable to
address is the question on the relationship between the different
levels of communication and the access rates observed. A change in
tool to a more defined communications level may aid its use and so,
in relation to the number of messages, a differential but more
pertinent access rate would develop, or, on the other hand, it may
discourage access for some and differentiate users into higher users
and non-users owing to the lack of levels to encourage different
sorts of use. On the EIES system, Hiltz and Turoff, 1981, found
that the access rate changed in frequency so that users did not
encounter more than about six items to deal with in terms of
receiving or composing. The majority of users were dealing with one
or two levels of communication in passing messages in computer
conferencing. It is therefore possible that a change in the purpose
of the communication tool would result in a different distribution
of access rates loading to a greater degree of acceptability among

the users, i.e. that users might modify their behavioural patterns for access and session to meet one or two levels of communication. That appears less likely to occur in a system with many levels of communication where the users look at the worthwhileness of logging in to several different areas of choice rather than right across the system.

The style of leadership also could affect the number of messages and the rate of access. Hiltz, 1984, found "an almost perfect rank order correlation between the leader's effort as measured by time on-line and as measures of the overall success of the group", (p.81). She observed that if a conference leader went on holiday for more than a week at a time, then the activity tended to become disorganised and dropped off sharply. (This also supports the notion that week is a 'currency' unit in this kind of messaging.) The importance of leadership and allocation of roles was found by Maude et al, 1985, in a co-authoring group in the BLEND system. In particular, there was a need for an Absence Co-ordinator in order to establish when participants were not going to access the system and to help them into the discussion again. This kind of leadership also affected the access rate as participants had to declare when they were going to be absent and present in advance. Although there were different rates of access, they were able to be accommodated by a particularly strong style of leadership.

To review, we have suggested and briefly discussed four ways in which the quantity of messages received could be made acceptable to the group of users:

1. modifying the design of the system in aids to structure the database, select and handle the messages;

2. modifying the content by giving, for example, summaries;

3. make the purpose of the communications tool more explicit; and

4. modify the style of leadership.

It is hoped that future research programmes will be able to consider these and build them into the experimentation.

Did the communications tool facilitate communication between members
of the community? In the 1984 questionnaire they 'reported' on the
10cm rating scale that it had done so, with a mode of 10. For some
the level of increase had not been as great as expected as the mean
dropped, but the constant median between the expectation expressed
in 1980 and what was expressed in 1984 showed that the tool met
their expectations (see Figure 4.14).

Q.   Do you expect communication with other members of LINC to increase?
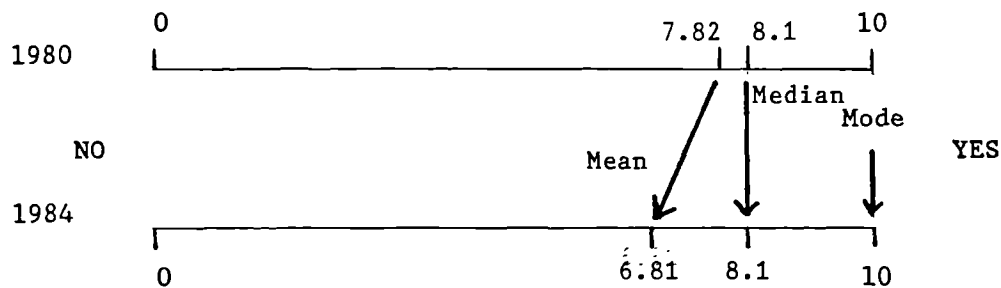
Q.   Has your communication with other members of LINC increased?

Figure 4.14:   Rating the level of communication with other members of LINC

In asking about their likes and dislikes about the interaction, once
again the difference between a system to support communication and
one upon which all the communication takes place is to be
distinguished. Thus the increase of communication between the
members of the community reported in Figure 4.14 may not necessarily
imply that all that increase took place on the BLEND system itself.
That it was perceived by the participants to be contributory to that
increase is clear.

4.4   Discussion of findings

The CBCS offered the user low utility compared with that expected
and required, particularly in regard to the refereed papers journal.
In itself, the latter is perhaps not surprising, for the journal was
the same in its content, structures and general appearance as a
normal print on paper journal, and therefore had not had the
development necessary to allow it to become suited to the new
electronic medium. Nor is it surprising that a new communications
medium would not supply the full utility that might be expected only
after much experimentation over a long period. The low utility,
however, was reported by the participants in the experimental
programme as contributing to the access rates observed. For many,

the utility proved to be a barrier to use as the quantity of
material placed in store on the system proved insufficient to
encourage a frequent log-in. For others the large quantity of
messages waiting to be accessed themselves constituted a barrier.
The barrier would develop differently over time in the two
situations. In the former, by delaying a log-in, there might be
expected to be more material stored on the system and so the barrier
would decrease. For the latter participants, the longer the
postponement of logging in, the greater potential number of messages
waiting and the so the greater the disincentive to log in as the
barrier would increase. This would tend to further separate users
into groups with different access rates of the sort observed.

What kind of utility would be appropriate for this research
community? The research on this suggests the need to modify both
formal and informal communication supported by the CBCS. In order
to make primary scholarly publishing more appropriate on the
electronic medium, we have proposed more study on the following
possibilities:

- the peer review system is modified to one where the readers
  themselves participate in the process and that articles are not
  delayed by long peer review systems that are currently existant in
  publishing;

- if the benefit of electronic publication does not lie in the speed
  of publication from origination to availability to a
  readership,then completeness of coverage, as found in many
  information retrieval systems, is more important;

- alternatively, the article size might be reduced commensurately
  with the content and the research work is described in a series of
  shorter articles with more frequent publication.

These suggestions, derived from the comments and behaviour of the
users, include the concepts of appropriateness in the electronic
medium of speed, completeness of coverage and topicality. Each of
these contribute to the type of expectation of an electronic system
that was described in the questionnaires and interviews by the
users, an expectation that would allow discussion of issues while

they were still 'live', and to encourage a forum for the generation of ideas.

The informal communication is also suggested as needing some modification. If there was little discussion because of the publishing procedures for the refereed papers journal, there was also less discussion than was anticipated in the teleconferences both because of the way that the system was perceived to fail to support particular patterns of access and because of the differential rates of contributing material. We have suggested that study should be made of four areas:

- the modification of the system design to facilitate communication handling for both low and high users of the systems;

- the modification of the content, to facilitate users joining into teleconferences;

- the way that the purpose of the communication tool may alter access rates;

- the way that the style of leadership may modify access rates.

The background concept behind these suggestions also seems to indicate the importance of enabling the users to enter into a topical and current discussion; topical in that the researcher could choose a topic of relevance and current in that the discussion would be structured and maintained so that the user could enter it and participate fully. These concepts suggest that a more appropriate support tool for scholarly communication could be provided if it fulfilled the following requirements:

- all communications were stored on the system quickly;

- there was a relatively complete coverage of material to be found on the system;

- the users could select from this completeness, a 'live' topic or line of discussion that was of interest;

- the software, leadership and content of the discussion were designed so that entry into discussion was easily accomplished for different access rates.

To establish exactly what was sufficient for acceptability for a research community would require another extensive programme of research and experimentation.

When the users were asked in the 1984 questionnaire what kind of electronic journal they thought the CBCS was appropriate for supporting, three main areas were named in priority order as follows; information, short informal items such as newsletters, or formal items such as abstracts; snappy summaries of research as found in Software Reviews or should be found in the Poster Papers journal; and finally journals such as <u>Computer Human Factors</u>. The aim should be to encourage discussion based on knowing the level and frequency of availability of a new material that the user would come to expect on the system. The suggestions for modification of the software supporting informal communication has already been extensively discussed. These both support the outline of a more appropriate support tool as listed above.

A partial answer has been provided to two of the three questions raised in the introduction to this chapter; the contribution of the utility of the system to the observed access rates and the way in which the system supports the communication of the research community. The final question relates to the way that the results of the programme related to the promise of the electronic journal as advocated by the protagonists for it.

In response to the expectations of those who see a bright new future for scholarly publishing in electronic journals, it can be said that a fully electronic refereed papers journal was demonstrated as possible, that discussion between participants about the content of papers was increased, and finally, that there was the expected increase in the level of communication among the research community.

One direction in which to look for the future are those who used the system extensively and to examine what they were doing on it. Access groups 3 and 4, the high and very high user groups, accessed the system almost daily when it was convenient to do so. Later members with good equipment also joined this small group. In essence they constructed a system similar to the suggestions made above. They formed a teleconference in which to discuss a particular topic, thereby removing any unwanted interruptive

subjects, sought to cover that topic by citations, agreed regular log-in behaviour and if that was not possible, arranged for leadership and content to enable absentees to catch up. This is, of course, substantially easier to achieve in a small group with a greater degree of consensus of task than in a large group taking into consideration all the different tasks of the users.

Another direction to look is in those who were entirely satisfied with their use of the system and the support provided by the system, but who nevertheless did not use it as much as many others. In order to discover the aims of those participants, we return to the interviews held at the start of the experimental programme in which they were asked about their reasons for participating. These are listed in Figure 4.15.

There are two areas which these kind of user were particularly emphasising, the making of new contacts and building up of old contacts, and the stimulus to produce papers which would not otherwise have been written. The lack of utility of the system may still allow both of these to be fulfilled by partial use. For the former, it was reported that after contact had been made between LINC members, a substantial part of the communication was then conducted off the system, partial use leading to an increase of communication to which the system had contributed. The same pattern was repeated in the matter of writing papers. If the reason for participation was the stimulus to increase productivity, then problems in the interaction with the system, whether in accessibility or in the utility provided to support the paper writing process, then the successful production of a paper that would not otherwise have been written was experienced as very satisfactory. Partial use of the system did not therefore necessarily imply dissatisfaction or non-participation. This might suggest that increased utility would indeed lead to increased access rates and an increase in satisfaction as rewards in addition to those already experienced as available to this type of user.

(Number of interviewees analysed - 21, numbers given for
appreciation of proportions)

10   CONTACT
      - To make new contacts and build up old contacts

15   CLOSED USER GROUP ASPECTS
      - see papers before publication
      - knowledge pool of ideas
      - develop and record ideas (& feedback)
      - closer touch with CHF (including access to previous
        published work)

14   PAPER PRODUCTION
      - BLEND system helps users to produce or publish   papers
        that would not otherwise have been done
      - if research in CHF is enhanced

8   ELECTRONIC JOURNAL EXPERIMENTATION
      - participation in experiment and what this tells us about
        electronic journals

8   GENERAL
      - if there is some return for investment of time
      - if users LIKE the BLEND system

Figure 4.15:   Expressed reasons for participation of LINC members in the
               BLEND experimental programme

Although the utility is reported as affecting the access rates in
some direct ways, this last finding suggests that the utility of the
system and access are bound up with more than this direct relation,
even after taking into account the accessibility problems. The
reason for participation is one such ingredient.   The two examples
of the different groups, one which used the system almost daily and
the other only occasionally, suggests that they might have different
working habits, one of which could more easily accommodate regular
logging into the system. This aspect, the work habits and whether
or not electronic communication would fit into them, and the
attitudes to electronic systems form the remit for the next chapter.
Furthermore, some of the suggestions for how to modify the way that
the system supports research communication are less to do with the
content and level of communication and more to do with the lack of
usability of the system. The low use of the system reflected in the
access rates may therefore be because the utility offered could not
be obtained because of the poor usability. This is explored in
later chapters. In summary, we have established that the lack of
accessibility to the system prevented its use and the utility of the
system was such that it also presented a barrier to use. Two other

aspects may also contribute to the access patterns observed: the working habits of the researchers may not permit the utility of the system to be incorporated into work, and the lack of usability may mask the utility to be desired from the system to support scholarly communication. The following chapters explore these latter two aspects.

5.   WORK HABITS AND ATTITUDES OF THE PARTICIPANTS

In Chapter 4, the use of the CBCS as a tool was studied, the communications and the members of the research community using the system. In this chapter we investigate the impact of the CBCS on the users, whether or not the use of the CBCS changed any of the users' work habits or how the work habits encouraged or discouraged use and how experience altered any of the attitudes towards such systems.

This kind of assessment forms an integral part of the longitudinal analysis envisaged by Eason, 1983, in his advocacy for any experimental programme using information technology being long enough to overcome learning difficulties and other initial responses and to settle into some kind of pattern of use. Sackman, 1970, argues not only for large scale social experimentation of systems but also what they provide _for_ the society. Hence the stress on the need for evaluation and public discussion of the influence that the systems have on communities of users. The US experiment funded by NSF had already received largely negative reactions from the users, as reviewed in Chapter 2, but one reason was that it was not run long enough to overcome the initial learning difficulties. In the event, the software and procedures were only ready six months before the end of the study programme (Sheridan et al, 1981). For these reasons the BLEND experimental programme was planned to run for a minimum of three years and evaluation of users, reactions to the CBCS included as an essential part of the research (Shackel, 1982a).

The increased productivity in article-writing, the increased communication in the research community, for which the participants were seeking,and the experience of the electronic medium might all have contributed to changes in work patterns. To investigate this, a pre-use data base was needed upon which to judge change. Consequently some details of access to information, reading and writing articles were surveyed before the participants used the

system and then after use. Conversely the maintenance of old work habits might themselves contribute to the particular access patterns observed.

Similarly, attitudes about the use of the system and aspects of the electronic medium were investigated by surveying the participants before and after use of the system to investigate whether or not the experience modified their views on CBCS for the use to which this system was put.

5.1 Methodology

All the experts in the subject area of Computer Human Factors who had agreed to participate in the study programme were sent a questionnaire, 'the 1980 Questionnaire' at the end of 1980 or beginning of 1981. The questionnaire was divided into five sections which were designed to establish the working habits and attitudes of the researchers in the following areas:

1. Attitudes to an electronic refereed papers journal,
2. Working habits in writing refereed papers,
3. Working habits in reading refereed papers and their retrieval and storage,
4. Communication in the research community,
5. Attitudes to the use of the electronic medium for general communication.

The basic technique for establishing attitudes was the use of a 10cm rating scale marked No on the left and Yes on the right, which was amplified by a prompt to add comments if so desired (following an overview on rating scales by Oborne & Clarke, 1975). The questionnaire on working habits and communication asked precise questions about, for example, the number of papers read, the number of other people in the research community known, or the hours at which they generally write papers. The full questionnaire is given in Appendix D.

The questionnaire was reported as taking approximately two hours to complete and was returned by 36 of the 50 participants.

The questionnaire was followed by a visit to 18 locations throughout the UK in which 30 participants were interviewed. The purpose of the visit was to check the facts given in the questionnaire and to lead on to ask other questions thought more appropriate in an interview.

The following areas were covered in the interview:

1. checking understanding of the general areas covered in the questionnaire, for example, on the storage of articles and the filing system used,
2. the experience or otherwise in the use of computer systems,
3. the general situation in which the interviewee worked and their relations with colleagues and the bureaucracy,
4. the techniques used for writing articles,
5. the reasons for their participation, what they considered would be a 'successful' participation.

Some of these areas are not relevant to the work described in this chapter or this thesis but have been included to indicate the context in which the questions were asked. Notes were taken of the answers and discussion, and if necessary, understanding of these were checked with the interviewee. All interviews were also recorded on tape for later reference.

The same written questionnaire, with appropriate changes in wording was sent off in July 1984 to all the participants registered as members of the LINC group of users. The questionnaire covered the same areas with exception of the fourth, which had proved problematic for some members to complete in 1980 and difficult to analyse other than in an indicative sense. Consequently this was removed entirely. 31 participants completed the questionnaire.

There are two methodological difficulties in the study of attitudes and work habits using a questionnaire sent out to this one group of users; the group was not constant in membership or size and there was no control group. In order to explore the long-term use of the system, the results have been analysed for both the total response in 1984 and for the smaller group of users who were classed as long-term. When the latter diverge from the totality of the group this is used and where appropriate the difference discussed.

A control group against which to monitor any changes in work habits and attitudes was considered very carefully. To satisfy the minimum criteria to be comparable, the group had to be one in an emerging subject area, in which not all the members were known to each other and among which there was a mixed experience of computer systems.

The first two criteria have already been discussed as background to the users in Chapter 4. The last is a result of the interviews. They showed that none considered themselves completely computer naive (see Figure 5.1). Although the proportion of human factors experts to computer system experts was two to one when analysed by place of work or departmental names, half the members were fully experienced in computer systems and described themselves as having a substantial background in computing. Half also had some experience in the use of telecommunications for data transfer but only a third use of a mail system using the public telephone network, the only one tried having been ARPANET. No-one claimed to have any experience with an interactive CBCS on a host computer system.

Computer Background:

Naive	0%
User Command Language and general appreciation	18%
Training component and use of language like BASIC	15%
Training and language like FORTRAN	15%
Full training and experience at all levels	52%

Telecommunications Background:

None	56%
Experience of telecommunications for data transfer	44%

Other Networks:

None	67%
Experience or single trial of ARPANET	33%

From a sample of 30 participants interviewed.

<u>Figure 5.1</u>:   <u>Proportion of LINC members with experience in
              computers and telecommunications</u>

Those criteria, reflecting aspects of the Computer Human
Factors research community, are considered important. In
an established subject area in which the community is known
to each other, there are established routes for formal
communication and it might be considered that there would
be less need for a communications system to be introduced.
The subject area also influences the type of communication
patterns that emerge in the community (Garvey et al, 1971).
Secondly, the Computer Human Factors research community all
knew about different aspects of computer systems although
they may have been naive as users. The mix of knowledge
and experience would affect both their work habits and
their attitudes to a CBCS. Three groups were considered
potential control groups; applied psychologists,
ergonomists and biotechnologists. The former two were
close in content to the work in Computer Human Factors and
the latter formed a new emerging subject area. Many
participants in the programme were trained as applied
psychologists and ergonomists and worked among those
research communities. Discussion with the Project Director
and others suggested that they would not form an
appropriate control group for this reason, i.e. that they
were not sufficiently distant from the impact nor

disinterested in the progress of this particular study programme. The biotechnologists proved to be a close-knit community well-known to each other and a group of them used the BLEND system later as part of the programme. The results of the questionnaire have therefore to be taken on their own. Any changes in work habit and attitude must be attributable to a number of factors which cannot be distinguished by any formal method.

In a longitudinal study, it should be possible to follow each individual and analyse the change within and between individuals. This had been the intention at the outset of the research. However, such were the many circumstances of each individual and their varied situations and contexts that there were too many factors in relation to the number of participants over the four years. The numbers were accepted as being too few to do such analysis except in the use of individuals as case studies. By participant observation over four years, observations are made with respect to individual circumstances and the changes experienced by them. However, the individuals can also be viewed collectively as a group, and a group studied as an entity which itself experiences change in circumstances, work habits and attitudes. This is the methodological approach adopted here.

Rating scale results can tend to cluster near the centre of lines or move to the ends (Guilford, 1954). In this survey, the respondents often divided into three groups, those making a definite No or Yes and those placing marks in the middle. Proportions of those answers falling into the three intervals 0-3.3, 3.4-6.6 and 6.7-10 are given in Figures and in addition the mean and median are sometimes calculated separately to reflect some of the unevenness of the distribution of answers.

5.2   Results: work habits associated with research communication

5.2.1 Productivity

In 1980, when asked how many papers for refereed journals
they had written in the previous year, 29 of the 36 (81%)
had written at least one paper and 22 of them at least one
in the subject area of CHF.   In 1984, 19 of the 31 (61%)
had written at least one paper and 16 of them at least one
in the subject area.   For a comparative distribution, see
Figure 5.2.   (Note that Figure 4.5 compared the number of
CHF papers written to all papers written. This compares
the change in CHF papers from 1980 to 1984.)   The mean
number of papers written was 2.31 and 2.08 respectively and
in the subject area, 1.58 and 1.22.

Percentage
of respondents

Number of papers written on the subject of CHF
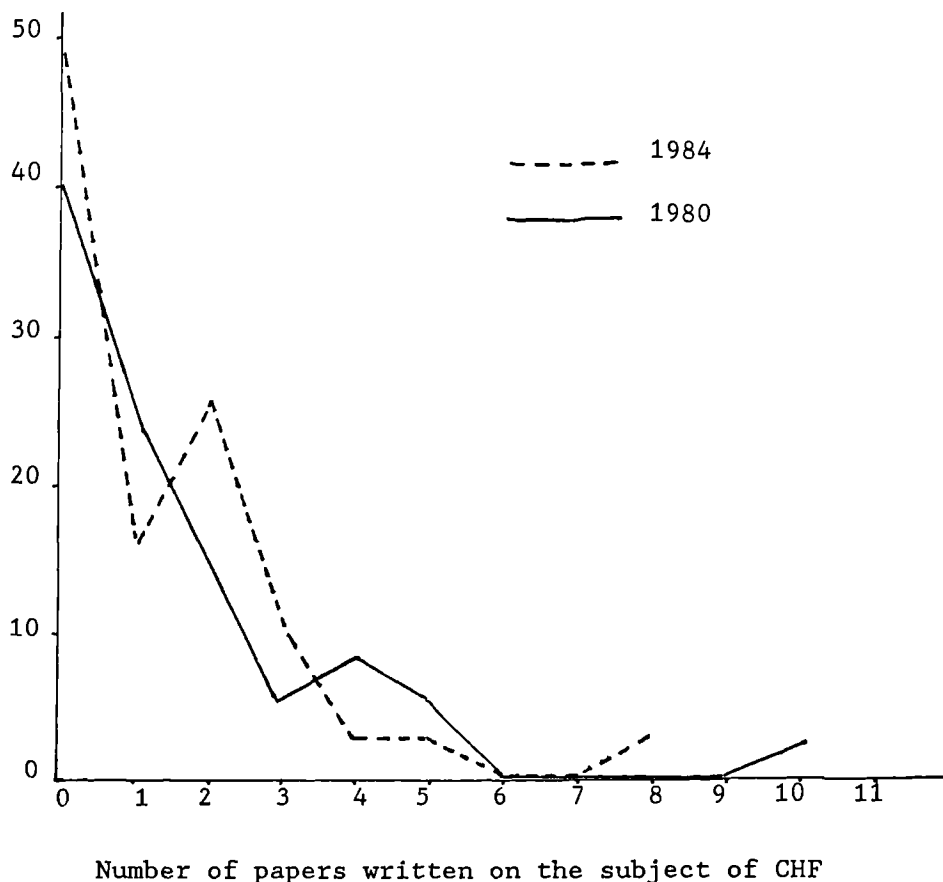
Figure 5.2:   The number of CHF refereed papers written by LINC
              members

The hypothesis that the electronic journal would encourage the production of refereed papers seems not to be proven overall, although it was true for those who expected it to do so, the number of researchers writing two or three papers doubling. In the bi-polar rating scales of attitudes, one-third expected their production to increase and reported that it had done so, those who were not sure found that it did not increase, and those who did not expect it did not find it (see Figure 5.3).

Do you expect/Has your production of papers increase(d)?	1980	1984 Long-term	
number in sample	31	14	25
mean rating	4.31	3.54	3.21
distribution as a percentage 0-3.3 : 3.4-6.6 : 6.7-10 No : Uncertain : Yes	48:16:35	57:0:43	64:0:36

Figure 5.3:   Rating the increase of the production of papers

The majority did, however, wish to write more papers, 82% in 1980 and 74% in 1984. That they had not done so was mainly due to "other commitments" (14 people and 1 person respectively), "the lack of time" (9 and 17), "workload" (4 and 1) and "the stage of the work" (4 and 0) and "interruptions" (0 and 1). The average length of papers was reported the same in both 1980 and 1984 questionnaires, about 5,750 words.

5.2.2 Writing hours and places

The place where and time when work was done was thought might influence the use of electronic medium and in turn the electronic medium influence that place and time.

From the description given in the 1980 survey, it was considered that 'normal' working hours covered the period 9 a.m. to 8 p.m. and, with this assumption, 23 people said

they usually wrote in 'normal' working hours and 23 outside. (The categories are obviously not exclusive.) When asked why they preferred a particular period, the responses fell in two areas. Inside 'normal' hours the reasons given were 'habit' and 'preference'; 'freedom from distractions' and 'other commitments' were the predominant reasons for writing outside 'normal' hours. Reasons such as being more alert, working better, less tiredness were evenly split over the two periods. Both within and without 'normal' hours, there was a general preference for writing at home.

The same patterns are evident in the 1984 data as in the 1980 data, with the greater proportion of work being done in the evening at home. The only reason for writing during 'normal' hours was for 'access to equipment' and the predominant reason for writing outside 'normal' hours was 'fewer interruptions'.

There seemed to be no change in the hours or place of work over this four year period for these researchers. There was, however, some change in who did the typing.

5.2.3 Keyboarding of articles

In the 1980 survey, typing of papers was reported as being carried out by a secretary or typist in 21 of 32 cases; the remaining 11 were typed by the author.

By the 1984 survey, the situation had changed, for only 7 out of 28 reported their secretary doing the typing, 6 indicating that the task was shared in some way and the remaining 15 saying that they did the typing. When and where the paper was written did not appear to determine who typed it in either survey, although there were indications of authors typing using work equipment in the evening. A comparison of the proportions is given in Figure 5.4.

Secretary
7/28

Secretary
21/32

Author
and/or
secretary 6/28

Author
11/32

Author
15/28

1980

1984
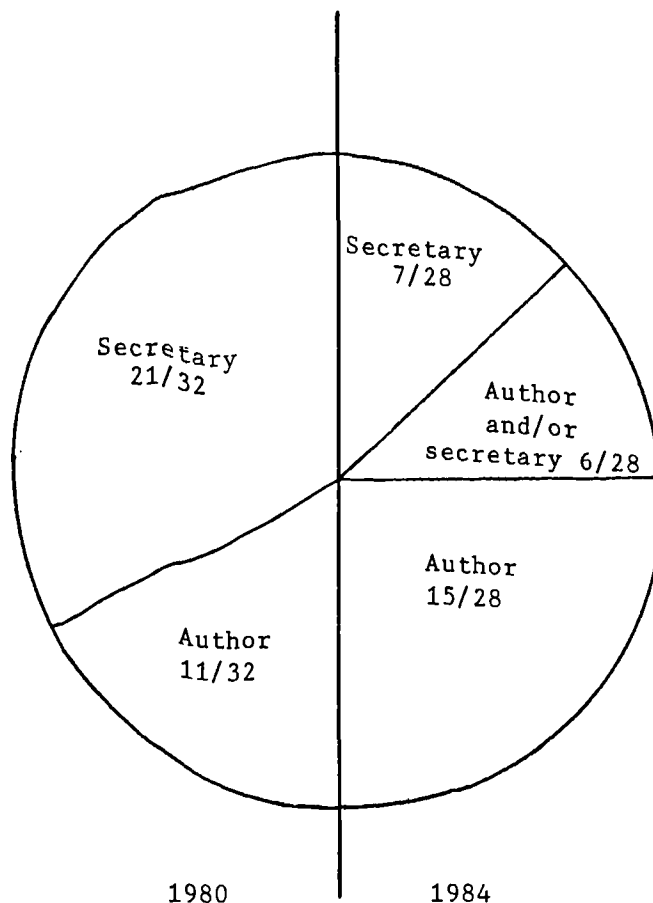
Figure 5.4: Proportion of 'who does the typing' of a refereed
             journal paper

5.2.4 Reading articles

LINC members reported that the number of journals which
they received personally was a mean average of 2.8,
although only 1.0 of these could be considered as being
directly related to CHF. Via the assistance of colleagues
or use of the library, they reported regularly searching a
mean average of 10.2 journals for papers of possible
interest, of which 3.4 could be considered as being
directly related to CHF. There proved to be little change
in this pattern over the four years. In 1984, a mean
average of 4.2 journals was taken personally, but still
only 1.1 were directly related to CHF. A slightly wider
searching of journals at the library and via colleagues was
reported with a mean average of 12.8 of which 5.0 were
directly related to CHF. The increase in the average

number of direct relation to CHF is most likely to be explained by the launch of the journal <u>Behaviour and Information Technology</u> in the UK.

There was, however, a marked change in the proportion of people reporting that they had difficulty locating CHF material. The change from 69% to 38% (statistically significant with p<0.01 using the Chi-Square test) was probably due to a number of factors, none of which can be directly related to the main premise that electronic journals would help. Rather, we would seek an explanation in the increased awareness of CHF in those years, in the fact that few LINC members knew more than one or two of each other at the start of the experimental programme but by the end had developed their own informal networks, and in the availability of the annotated abstracts journal on the system.

The storage of reprints or photocopies of papers, although perceived as important, rarely seems to be done to the satisfaction of researchers; expressions like 'dreadful' and 'absolutely chaotic' were used to describe filing systems. In 1980, the majority were filing by subject (65%), but in 1984, this was reduced (46%) and more filed primarily under author (29%). This change is statistically significant (p<0.01 using the Chi-square test). Heeks, 1986, reported that senior researchers are more likely than others to have bibliographic indices filed by subject rather than author, which suggests that the observed change might be due to the fact that a slightly higher proportion of junior researchers were included in the LINC group as the programme developed.

5.2.5 Change in work habits

Overall in the group there did not seem much reported
change in work habits relating to scholarly communication,
with a mean for the long-term users of 5.57 and 5.39 (see
Figure 5.5) in 1980 and 1984 respectively. However the
percentage of those anticipating that there would be change
and those not, were those found to have a slight move to
the ends as would be expected. In 1980 and 1984 the
percentages for No, Don't Know, Yes were respectively
29:16:55 and 33:7:60. The members of the 60% reporting a
change in work habit, as a result of using the system gave
three main reasons. First, that communication with others
was a source of ideas and a way of developing ideas.
Secondly, there was integration as part of the job so that
more time would be spent using the system and less using
the telephone or mail for communicating with others on work
issues associated with articles. Thirdly, two said that
they had to set aside time to read articles on the system,
one thought this an advantage in that much longer spells on
concentrated thought were encouraged, the other a
disadvantage in the amount of time that it took. In
summary, the main change for those who had experienced it
was in the discussion of ideas which was found stimulating
and the use of the system itself.

Do you expect/Has the BLEND system (to) change(d) your work habits?	1980	1984 Long-term	
number in sample	31	15	27
mean	5.57	5.39	5.00
distribution as a percentage	29:16:55	33:7:60	41:7:52

Figure 5.5: The rating of the change in work habits for refereed papers

5.2.6 Use of paper as a medium

The browsing and reading habits of users showed a preference for times in the afternoon, travelling and at home in the evenings. The times of day when respondents browsed and read journals suggested a use highly dependent on paper.

One third responded that they read and browsed any time but others had a clear preference. A certain amount was done in the afternoon at work and slightly more when travelling to and from work. The majority however did so at home in the evenings (see Figure 5.6). The difference between browsing and reading in the afternoon and travelling is partially attributable to the use of the library with requests for photocopies for full reading to be done in the evening.
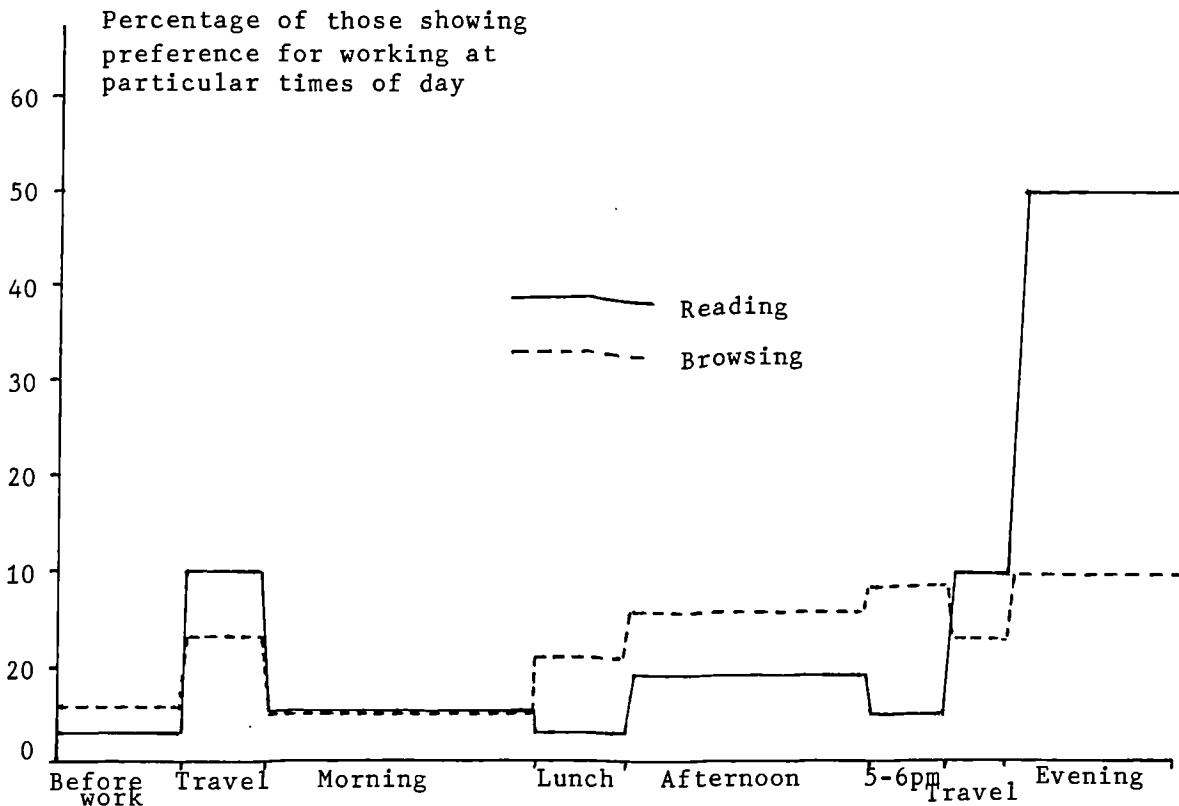
Figure 5.6: Times of day for reading and browsing

If, for this group of users, constraints on the electronic medium meant accessing the journal for browsing and reading during the day, this necessitates going against their normal working habits.

Did they feel that hard copies of refereed papers were essential? The majority thought so, although 30% were happy with the articles in electronic form (see Figure 5.7). They were happier about the absence of a bound journal, perhaps reflecting the low number of personal subscriptions to journals and the habit of requesting photocopies of articles which they wanted to read (Chapter 4).

Do you feel hard copies of refereed papers are essential?	1980	1984 Long-term	
number in sample	31	16	30
mean	6.80	6.5	6.37
distribution as a percentage No:Uncertain:Yes	23:13:65	31:13:56	30:10:60
Do you (expect to) find the absence of a bound journal acceptable?	1980	1984 Long-term	
number in sample	32	16	30
mean	4.90	5.4	5.81
distribution as a percentage No:Uncertain:Yes	44:13:44	38:6:56	30:10:60

Figure 5.7: Rating the essentiality of hard copies and
acceptability for absence of a bound journal

5.2.7 Attitude to limited graphics

Another aspect of current printed journals is the high
quality of the graphics. In the mid-seventeenth century
the first graphics were barely illustrative of the point in
the article, indeed Katzen, 1980 (p189), describes them as
more ornamental than informative and they had to be
produced using a different technology. Since that time the
technology has improved to an extent where high resolution
figures and diagrams are normal and many journals carry
full four-colour illustrations. Scholars are therefore
used to seeing visual material. On systems that are
Ascii-based in transmission of characters, as most CBCS are
at present, graphics are effectively limited to that which
can be accomplished on a typewriter without overprinting.
The users of the system found the lack of graphics a
handicap (Figure 5.8).

Do you (expect to) find the limited graphics facilities a handicap?	1980	1984 Long-term	
number in sample	36	16	30
mean	7.10	6.26	7.0
distribution No:Uncertain:Yes	19:14:67	25:13:63	20:13:67

Figure 5.8: Rating the limited graphics facilities

5.2.8 Was the electronic journal liked?

Was the BLEND system liked for the publication of refereed
papers? The answer is 'not as much as expected' (see
Figure 5.9). However, 29% liked the system with 43% in the
middle with some ambivalence. We can suggest several
reasons for this, the main one given by participants was
the difficulty of the publishing procedure for them as
authors. The attitude rating for this showed the largest
shift from the start to the end of the experimental
programme (see Figure 5.9). The shift down may be
explained by the additional effort required in formatting
papers, or by other difficulties such as the requirement to
check the paper after it is entered by the word-processing
operator, a function carried out by editorial processing
staff in UK journals. A third reason may be the highly
proceduralised series of steps needed when compared to the
sending of a normal typescript copy or copies to an editor
of a journal. A fourth reason is likely to be the delay in
publication. As we have already discussed above (in
Chapter 4), the publication process took longer than
members would have liked. However, the desire to see the
refereed papers journal continued on BLEND after the end of
the experimental programme did not diminish; in fact, a
slight upwards shift of mean attitudinal rating from 7.17
to 7.96 was recorded, with almost all the individual
contributions in the distribution moving in the positive
direction. This might indicate a recognition of the
possibilities of the journal, together with its present
limitations and hope for future development.

Do you (expect to) like the BLEND system for a refereed paper journal?	1980	Long-term	1984
number in sample	31	15	28
mean	6.56	4.65	5.18
distribution No:Uncertain:Yes	6:37:55	27:53:23	29:43:29
Do you (expect to) find the procedure for publication of papers on BLEND easy to use			
number in sample	31	15	23
mean	6.55	2.93	3.58
distribution No:Uncertain:Yes	10:33:52	73:20:7	70:13:17
Do you (expect to) wish the refereed paper journal to continue beyond the 3 year British library project?			
number in sample	31	15	28
mean	7.17	7.19	7.96
distribution No:Uncertain:Yes	3:29:68	7:27:67	7:18:75

Figure 5.9:   Rating issues associated with the electronic journal on the BLEND system

5.3   Results: general interaction with, and use of, the CBCS.

5.3.1 Ease of use and likeability of the system

The long-term users did not find the system nearly so easy
to use as they had anticipated and also considerably less
convenient to use (see Figure 5.10). This meant that many
did not use it as much as they would like, but others said
that they had done so because it was not easy to use and
inconvenient. Likeability of the system was evenly spread,
those liking it having been among those who had used it
more than others and for whom it had changed their work
habits. On the other hand, some of those who used it most
did not like the system, and they were probably judging the
CBCS against future more developed systems.

Part of the explanation of the spreading of opinion in the
likeability must lie in the individual circumstances for
the local terminal equipment identified in the telephone
surveys. In particular the positioning of the equipment
altered the convenience of use. Many of the additional
members who joined the research community on-line in 1983
already had appropriate equipment and they rated the
likeability of the system slightly higher than the
long-term users.

Do you expect/Have you found the system easy to use?	1980	1984 Long-term	
number in sample	34	15	29
mean	5.34	3.51	4.01
distribution No:Uncertain:Yes	29:32:38	56:19:25	55:17:28
Do you expect/Have you found the BLEND system convenient to use?			
number in sample	34	16	29
mean	6.21	3.86	3.94
distribution No:Uncertain:Yes	44:26:29	50:13:38	48:21:31
Do you expect/Have you been able to use BLEND as much as you would like?			
number in sample	34	15	28
mean	4.04	4.30	4.36
distribution No:Uncertain:Yes	62:17:21	47:20:33	46:18:36
Do you expect/Do you like the BLEND system?			
number in sample	34	16	29
mean	5.98	4.43	5.43
distribution No:Uncertain:Yes	15:44:41	38:31:31	28:24:48

Figure 5.10: Rating the ease of use and likeability of the BLEND system

Not only the difficulties of the equipment itself were recorded in the telephone surveys, but also of the individual in relation to the organisation. One question asked in the Computer Human Factors section but answered more generally was about interests of colleagues in the system. This was very mixed (see Figure 5.11) with some LINC members recording positive antipathy.

Do you expect/Have your colleagues expressed any interest in trying the BLEND system?	1980	1984 Long-term	
number in sample	34	16	27
mean	7.65	5.21	5.34
distribution No:Uncertain:Yes	15:29:56	31:27:44	33:22:44

Figure 5.11:   Rating colleagues' interest in trying the BLEND system

5.3.2   Use of paper

One of the larger changes in the research community was the acceptability of not having a hard copy of the content (see Figure 5.12). The move of mean from 3.46 to 6.22, median from 2.1 to 6.7 and mode from 1.0 to 10.0 illustrates the change in attitude to the need for paper for general communication. However it was still thought that for some communications paper was essential (see Figure 5.13).

If you use a VDU, do you expect to find absence of hard copy acceptable?
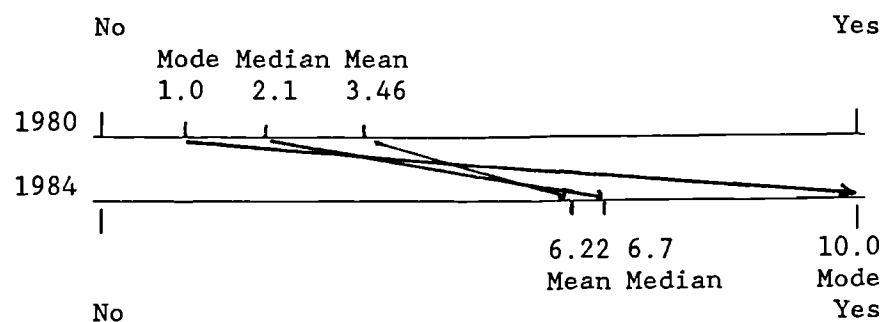
Have you found the absence of hard copy acceptable?

Figure 5.12:   Attitudes to the necessity of hard copies

Do you expect/Have you found the absence of hard copy acceptable?	1980	1984 Long-term	
number in sample	28	13	29
mean	3.46	6.22	5.62
distribution No:Uncertain:Yes	64:11:25	23:15:62	36:8:56
Do you think that hard copies are essential for some communications and interactions, although they are permanently stored in NOTEPAD?			
number in sample	36	16	29
mean	8.02	7.28	6.22
distribution No:Uncertain:Yes	8:3:89	19:0:81	24:14:62

Figure 5.13: Rating the acceptability, or otherwise, for not having hard copy

For what was paper considered essential? It was expected to be essential for four reasons: for quick reference (12 people); for detailed study (8); to pass on to others (7) and to avoid terminal problems (6). The long term users found hard-copy essential for quick access (3); for study (4); and because of problems with access to the local terminal equipment (2). Paper was therefore considered essential for two general reasons: access to it (speed and location) and for studying, including making annotations.

5.3.3 Change in work habits

No general change in work habits was apparent in the general communication. They rated the change lower than was expected, and it can also be considered lower than this once those very low users, who did not in general reply, are also considered (see Figure 5.14). For some, the use of the system had altered their work habits, sometimes this was in quite small ways, such as having to find and make time to access the system on a regular basis, sometimes the change was in relatively dramatic ways, two reported

working much more from home, one commenting on a much improved quality of working life thereby.

Do you expect/Has the BLEND system (to) change(d) your work habits	1980	1984 Long-term	
number in sample	36	15	28
mean	5.31	4.36	3.92
distribution	39:17:44	40:27:33	50:18:33

Figure 5.14: The rated change in work habits for general communications

5.4 Discussion of results

In discussing the results, seven conclusions can be drawn from the attitudes. They are taken in turn ending with the summarised conclusion. There was no real change reported as to how and when writing and reading were done. The same procedures were, in general, used and the same productivity levels obtained over the period, when the group is considered as a whole. However over half reported a change in how these were affected by the system. The main effect was by being able to discuss issues in the subject area with other members of the research community prior to writing papers. Other effects were in the need to use the system itself, which in work-related matters meant setting aside a period of time to concentrate on the material, not being able to put it down and take it up again as with paper, and in having to log-in regularly in order to communicate with others. There had been nearly half as much change experienced by the long-term users in general interaction than in the directly work-related areas. The system did, therefore, make an impact on some of the researcher's work lives. We may conclude as follows:

1. The main effect of the CBCS on the research community was to enable them to communicate with each other on work-related issues, which modified how they developed their thinking for scholarly work.

There is no indication that the CBCS is the medium for all the communication that took place. For some this was undoubtedly so (see for example Maude et al, 1985), while others reported using the CBCS as a contact and support medium to communication carried on by other media or by meeting face to face. Relatively low access rates of the CBCS itself may not pressage a tendency to dis-use nor dissatisfaction with it as a medium.

Associated with the increased contact with other researchers may be the large reduction in difficulty in locating relevant published material that was reported. Although an annotated abstracts journal was started on the system it did not have a large number of users, less than the number who would have had to change their difficulty rating for access to material in order to produce the decrease observed. Therefore, the contact itself must have helped the scholarly work in this way also. For those who accessed the annotated abstracts, this proved a valuable resource (see, for example, Shackel, 1985b).

2. Increased contact with colleagues in the research community may have contributed to a large reduction in the difficulty of locating relevant research material.

The one third of users who reported changes in work habits associated with general interaction include those who had used the telephone and postal service less and those whose lives had been transformed by allowing them to work at home. In the latter case it was the provision of TORCH microcomputer to ten LINC members that allowed two to develop this new working pattern and use of the local terminal equipment to satisfy many different requirements. The access to a CBCS seemed to allow them communication to relieve many of the other tasks being accomplished in their work lives.

3. The CBCS enabled some participants to use other communications services, such as the telephone and postal, less.

4. Local terminal equipment which was flexible enabled two
   participants to transform when, where and how they
   worked, and resulted in a perceived improvement in the
   quality of life.

Many had not expected any change in the way in which they
did the tasks associated with their work and many
experienced no change. For some, the lack of change was a
response to finding equipment difficult to access, the
system difficult to use or no benefit from it when it was
accessed. Others had started with high hopes, but local
terminal equipment difficulties, particularly those
difficulties caused by the telecommunications provider or
by their organisation, had not enabled them to fully
participate in the programme. For prospective use to be
considered positively, Figure 5.10 on the ratings on
general ease of use and convenience of use, illustrates
that local terminal equipment and the host computer system
must be readily accessible and both easy to use. The
proportion of those finding their local terminal equipment
satisfactory in the thirty-five month survey was far higher
than those finding the system convenient to use. This lack
of convenience probably reflects the lack of guaranteed
availability of the host computer system at all times and
the log-in procedures necessary.

5. That the CBCS should be available at all times to a
   research community, is strongly suggested, and the
   log-in procedures should be simple.

There was a general view that the system was not nearly so
easy to use as it should be. In particular, the
structure's modifications for use as a vehicle to carry
both teleconferencing (messaging) and a variety of journal
articles meant cumbersome operations both in the number of
commands and in the conceptual level at which the user may
give instructions to the computer.

The system was not only hard to use in its accessibility
and software. It was also perceived as difficult in its
procedures, particularly those for submitting a refereed

article to the journal <u>Computer Human Factors</u>. One
difficulty was the lack of clarity about who held the
responsibility for any alterations to the format. The
authors treated the system as they would other journals,
i.e. having sent an article they expected at most to have
to check final details. If the paper had been sent in
normal format, i.e. one-sided, double-spaced type on paper,
to the service to be key-boarded and submitted to the
electronic journal, then a considerable amount of
alteration was done in the course of re-formatting, for
example, splitting paragraphs to enable them to fit on a
screen. The editor expected the author to check this and
be responsible for it prior to submission to the editorial
process (Shackel, 1983b). The authors expected the
editorial process to be carried out prior to checking final
details, e.g. the authors were treating the re-formatting
as an equivalent to type-setting. This is one reason for
the one month delay in submission of papers to the
editorial process and the perception of a difficult
procedure.

The details of the procedure itself may not be at fault,
despite the numerous misunderstandings. It is possible
that any procedure would be considered cumbersome. If the
electronic medium has the general concept of 'speed'
attached to it, then it is possible that any procedure at
all which slows delivery of the article in relation to that
expected or hypothesised as possible, would be deemed as
cumbersome. Thus the reaction to the editorial procedure
could be either one about the procedure itself or about
there being any procedure of that particular type in the
publishing process. Only further research of the type
suggested at the end of Chapter 4 would clarify this.
There was however no hint of doing away with the
re-formatting service. The majority of papers were sent in
traditional paper format and were keyboarded and
re-formatted. This was a necessary task to make it 'fit
and proper for consumption'. Strawhorn, 1981, lists four
major functions that a publisher has, as the following:

- to define and locate information of interest to a
  significant number of people;

- to take steps to ensure the information has the highest
  affordable quality;

- to process the information to make it fit and proper for
  consumption;

- to bring the information to its proper market.

It is clear from the users' behaviour that there were no
objectors to the presence of the third function. The
second we have already discussed (in Chapter 4) and it may
be this in its interaction with the third that has caused
the dissatisfaction.

6. Editorial procedure for the refereed papers journal
    should be further explored with the aim of minimising
    delay of publication.

The absence of a bound journal was found quite acceptable.
This has often been noted in the past, but there seems to
be no way of making article publishing financially viable
in the traditional printing process (see, for example,
Singleton, 1979). Whether or not electronic publishing is
viable is the subject of Chapter 8. Is the absence of
paper itself acceptable? Certainly the large change in the
rating on the acceptability of the absence of paper shows a
move away from paper dependence. Paper does seem essential
for certain particular functions and in particular those
items required for rapid reference, such as lists and
agendas, and text which requires detailed study. Another
aspect mentioned was the need to store printout in order to
have access to it. This last might be considered a product
of the particular situation in difficulty of access to
either local terminal equipment or the host computer
system. The first two are not likely to be changed by
developments in local terminal equipment, unless a
portable, pocket sized microcomputer with communicating
facilities is developed to allow storage and personal
transport of the information. The second requirement for

paper, to study text closely, has a range of aspects of the
usability of paper which require further investigation. In
the meantime for successful use of such systems the need
for a printer is strongly suggested by the response of this
user group.

7. Whenever possible a printer should be available in the
    local terminal equipment, until such time as fully
    portable terminals allowing full reading functionality
    are available.

These seven statements contain a mixture of findings and
research areas that have been gained from the shifts in
attitude, assuming that the aim is to maintain a positive
attitude towards, and likeability of, the system.

How much change might one expect from the use of future
systems? To answer this question demands assessing the
interactions between work habits, those changes that were
forced because of limitations in one area or another and
those changes that were voluntarily made because of the
utility found in using the CBCS as a support for scholarly
communication.

At the simplest level, we could say that those who expected
change were prepared to accept change and those who did not
were probably less prepared to do so. The two cases are
considered separately. Changes in the work habits
associated with refereed papers journals included both
those that were voluntary and those that were forced by the
system. Those that were voluntary were because of the
utility of the system, particularly in pre-publication
discussion, and in co-authoring of articles. Those that
were forced were due either to the need to access the
system sometimes for long periods, or at times that would
not have been chosen. Any who had anticipated change but
did not in fact experience it, had perhaps not found
sufficient utility on the system to overcome the barriers
discovered in the access and usability. Since the changes
came either from the direct response to the utility of the
system or the modification of habits in order to fit in

with the system when the utility was perceived as sufficient, those who did not expect change but experienced it, must have perceived a high utility on the system, if indeed any of the participants fell into such a category. On the other hand, the case of those who did not expect change and did not discover any suggests that they might have expected the system to fit in with their working habits and, if it did not, then not to use it. Even if utility was present they would not have experienced it because its availability would not fit into their working patterns. There were certainly members for whom this was true, particularly among those computer scientists who already had established patterns of working with computer systems.

This view of the situation, based on the responses in the questionnaire suggest that established work habits, and the utility, accessibility and usability of the system all interact with each other in ways that will not be easy to disentagle in order to establish any causal lines from which to predict the future. The conclusions above, which include suggestions for improved access and usability, when taken with the suggestions for the potential improvement of utility made in the previous chapter, indicate the possibility of both lessening the barriers to use and removing the mask from potential utility. If the improvements were ratified as such then it might be expected that there would be increased changes in work habits in the future. Equally, if the utility was more clearly perceived, then any changes in work habit forced by adapting to the requirements in the procedures for accessing and using the system might also be expected to increase. The pre-disposing attitude in the expectancy of change may be altered only by a change in the perception of the utility sufficient to overcome any barriers in accessing and using the system.

The type of change experienced varied from complete life-style changes as for participant one working from home several days a week instead of going to the office, to

changes in one particular aspect, for example in using the
telephone and postal service less to communicate with
colleagues in the field. The changes one might expect from
an increased utility of the CBCS to support scholarly
communication would range from such a large change in
life-style to some small aspect of working life experienced
by an increased number of researchers.

6. ENHANCING THE USABILITY OF THE CBCS

In Chapter 4, the unusability of CBCS to support some of the promised utility was found a barrier to use. This suggestion was further supported by the indication that the potential utility may be either masked or frustrated by the lack of usability, as discovered in the previous chapter. Consequently we now examine whether or not the issue of usability was directly observed as a barrier to use by the participants and discuss those enhancements made to the computer conferencing suite as a result of the difficulties experienced.

In the six-month survey it was noted that one quarter of the people interviewed spent the longest time talking on the need for, and suggestions for, improving the system (Section 3.5.2). In total there were 46 suggestions made in this area and they fell into three main topics:

- the log-in procedure,
- restructuring the software, and
- the maintenance of an overview of the system relative to one's position.

Each of these will be considered in this chapter. We seek further evidence that these were problems for the users and that other areas may also have contributed to difficulties.

6.1   An analysis of requests for user support

Before examining the three areas of the system already identified by the six-month survey, it was necessary to examine whether or not there were other areas that should be included in a review for enhancement. This was accomplished by two methodologies; participant observation and an analysis of requests for user support.

6.1.1 Participant observation

Participant observation is a well established psychological
technique stemming from anthropological study. By placing the
researcher in the midst of the activity under study it is possible
to gain access to the rules which underlie the particular human
behaviour under study and to respond to the emotions generated by
those procedures, in a way which is not possible from outside
observation.

There are two dangers inherent in the approach. The first is to 'go
native', to be so identified with what is happening that one loses
observational capabilities. It is our opinion that the interactions
by Hiltz on the EIES system come close to this. In Sheridan et al,
1981, and Hiltz and Turoff, 1978, it is clear that the researcher is
a main user of the system and writer of messages on it. Thereby the
group processes could have been severely altered. We had a policy
of being participant in the use of the BLEND system, but largely
non-participant in its main teleconferences and in general message
making on the specialist subject area 'Computer Human Factors'.
Thus during the period of the development of the system and the
collection of the data, the following actions were undertaken by the
researcher in the LINC study:

1. Papers were not presented to the refereed or unrefereed
    journals.

2. Comments and discussion on papers were not participated in,
    either in the annotated abstracts journal, the refereed papers
    journal or the poster paper journal.

3. Participation in work teleconferences and discussion was
    restricted to points of information.

The other danger is to be so non-participative as to become a
non-participant observer and fail to realise what is going on.
Consequently the roles of on-line user support for the BLEND system
and editor of a monthly newsletter were accepted to give experience
for both helping others and to understand the question of the system
and the reaction of those under study. Other use of the system was
made as a member of the BLEND Project management team; invisible to
LINC members.

4. Participation in on-line user support and as editor of the monthly newsletter. Messages were restricted to these activities in the LINC community.

5. Use of the system as a management team tool for communication.

Much of the understanding and need for development come from the participant observation where the same access routes and procedures as the LINC members were used during the period of the identification of problem areas. Since alternative methodologies were also introduced for investigating problem areas of the system, participant observation was viewed as a complementary methodology. The observations and examples gained from this experience are included as and when appropriate throughout the thesis.

6.1.2 Requests for user support

Participants in the experimental programme were able to request advice and help by a variety of routes. LINC members were able to ask in the following ways:

1. By phone to the researcher at Loughborough;

2. By answerphone out of hours to the researcher with a promise of a working day's response, for this reason the answerphone messages were able to be obtained from distant locations by phone;

3. By leaving general messages for advice in areas on the system available to all LINC members;

4. By leaving messages addressed to individual members of the BLEND management team on the system;

5. By leaving an addressed message for 'HELPER' on the BLEND system, a team of people who took turns to reply within one working day;

6. By letter.

These arrangements provided a substantial amount of user support which was well received (Pullinger, 1985).

The requests for advice and help to the Research Fellow at Loughborough were recorded from 1981 to 1984 with the anticipation of using them to analyse their content. This was one methodology for getting at some of the problem areas of using the system.

6.1.3 Results

One hundred and twenty-four requests received were examined by content analysis. Each request was summarised by general and specific topics. They were divided into six general areas, which are listed in Figure 6.1, together with examples and their relative size.

Percentage of Number of Requests	Type of Request	Examples of Requests
31%	Log-in problems or requests	Log-in code. Password.
19%	BLEND Administration	How to submit for telephone expenses. Editorial procedure.
16%	How to accomplish a particular task on BLEND	Editing. Transferring files from a micro to BLEND. Using refereeing and reading programs. How to find and locate DEC files. Moving between areas on BLEND.
12%	Things reported as malfunctioning (though not necessarily being so)	Programs not operational. False indication of new messages.
11%	TORCH microcomputer user support	TORCH repair. How to store and send files to BLEND. How to install phone lines for TORCH.
11%	General information	Use of PSS and Midland Universities' Computer Network to access BLEND. Advice on modems. Tutorials for telecommunication. Adding participant names.

Figure 6.1: Analysis of 124 requests for user support

Requests for help in the log-in accounted for nearly one third of all requests. Although many of those were users forgetting their password, there were still many finding difficulty with the log-in procedure as a whole, either when the system was used interactively, or in trying to place the sequence of commands onto an autolog-in device. This suggested the need for further work on the presentation of the log-in and for an instruction sheet on setting up log-in dialogues.

Although the data was originally analysed in the form presented, it is to be noted that the final area 'general information', mostly concerns the local terminal equipment and telecommunications routes to the host computer. When taken in conjunction with the advice requested for the TORCH microcomputers, the second longest topic area was in the local terminal equipment, which continued to present problems for the users throughout the experimental programme.

The fourth area listed was of particular help to research in analysing the difficulties the LINC members were experiencing. Some aspects of the system were not operational, due to changes in the software shell or temporary system failures and complaints concerning these were helpful to those maintaining and running the system. Other aspects were reported as faults, although they were built-in features of the system. Thus it was possible to use these directly to note mis-matches between the users' expectations of the operation of the system and utility provided in those areas. Finally, the requests on how to accomplish particular tasks showed areas which either needed to be enhanced because they were difficult to use or which need additional documentation due to the lack of detailed guides to these tasks. Many of such requests were associated with the interaction between the system and the local terminal equipment, for example, in transferring files, in moving between areas on BLEND, and in reading on-screen or on printout. These will be considered next in addition to the other areas already identified.

6.2   Enhancing the usability of the BLEND system

6.2.1 Identification of the aspects to be enhanced

The six-month survey indicated three areas for enhancements and the
analysis of requests for help has shown areas of difficulty for the
users. With limited resources, the actual enhancements possible and
a prioritisation for those that promised to make most change to
usability was needed. Five aspects were identified as requiring
research and development. These do not, therefore, encompass all
that were necessary, but those that were thought to maximise
usability for this set of users within the time-scale of the
experimental programme.

The first aspect was the difficulty posed by the log-in. The second
was an apparent inconsistency in the dialogue design in the use of
terminators. This proved very frustrating for some users as the use
of the normal terminator in one location on the system logged the
user out.

The third aspect was a result of the use of NOTEPAD teleconferencing
for a large range of types of communication. The system was
designed so that a new log-in was required to accomplish these
different types of communication, for example if informal message
passing was the task, then the user would log in to that area and
then have to log out upon termination. If it was also required to
write a paper or read a journal article then the user would log-in
again to either of those separate areas. It was recognised very
early on by all members of the BLEND Project Management Team and by
many LINC members that this was difficult to do and time-consuming.
In view of the findings concerning the difficulty of the log-in this
seemed a particularly important aspect to be studied.

The structure of the system was also identified as the main aspect
to be improved in the Six-month telephone survey. Following the
spontaneous responses to the questions listed, further explication
was sought for why the structure proved to be difficult. Three
reasons were given:

1. the repeated log-in,
2. the fact that it acted as an imposed filing structure, one not
    necessarily shared by the user, and

3. the difficulty of maintaining an updateable overview of the
    contents in relation to where one was.

The fourth aspect also followed in part from the particular
implementation of NOTEPAD computer conferencing suite to act as a
basis for the electronic journal. The message structure of
teleconferencing was designed with the concept of a statement made
by a particular person at a particular time being placed into a
unique slot in the database. Exactly as a statement once spoken at
a conference cannot be unsaid, the statement could not be erased or
substituted. This was inconvenient when, for example, writing a
paper and various complex circumventions needed to be pursued in
order to do so (see Shackel, 1981). The user requirements for
advice on transferring papers from local terminal equipment to the
host computer and on the use of editing facilities suggested that a
more consistent functionality was required throughout the BLEND
system than had hitherto been implemented. This proved to be
closely related to the fifth and final aspect to be considered.

The last aspect to be identified for major enhancement in the
earlier stages of the experimental programme was how to read journal
articles on the screen. Traditional use on word-processors and
computer fields simply scrolled the text through to the point where
the reader wished to stop. However when using local terminal
equipment only capable of 300 baud (as was the usual standard in
1981) this meant that a 6000 word paper could take around 20 minutes
to be displayed. Moreover, academic users do not necessarily read
papers sequentially.

These five aspects were the main ones identified:

1. the log-in;
2. consistency in the dialogue;
3. modification of the structure, including facilitating an
    updateable overview of contents in relation to where one was;
4. a consistent functionality for transfer of articles and in
    writing and editing articles on BLEND;
5. what facilities to provide for reading on-line on a VDU screen.

These will be considered in turn, the last being covered in the
following chapter.

6.2.2 Author's role in enhancement of the system

The aspects described here were also among the many perceived to a lesser or greater extent by the members of the BLEND management team. However the main identification of these came from the methodologies described above which were enacted by the author. This provided a) a coherent framework in which to consider them and b) a justification for the enhancements, without which they are unlikely to have been developed further. In discussion and negotiation for the items which were implementable, the author was held responsible for ensuring the developments met the requirements for increased usability and consequently for the system specification. This led to some more detailed analysis which follows. When the modification to the software was made, the author was responsible for beta-testing the product and for further evaluation if necessary before its final implementation. Throughout the development of the enhancements, the author was responsible for the co-ordination of this work. In saying this nothing is taken away from the contribution made by other members of the team in their respective roles.

6.3 The log-in

Nickerson, 1981, singles out those engaged in intellectual tasks as being most disadvantaged by lengthy preparation to start work. Previously Licklider, 1960, had observed that those engaged in intellectually demanding work could spend a surprisingly large fraction of their time in preparation. The log-in could seem to exacerbate this problem:

> "It's too much trouble getting started. I have to dial a phone
> number get on a network, identify the computer I want to use,
> log-in on it, call up the software system with which I want to
> work, and retrieve my files before doing anything productive."
>
> (Nickerson, 1981)

His analysis confirms our finding that the log-in was a problem area that could interrupt productive work.

6.3.1 Methodology

We have already described two methodologies used to identify the log-in as a problem area, the Six-month telephone survey and analysis of requests for help. During the end months of 1980 and the beginning of 1981, the author travelled to 18 locations in the UK to interview LINC members. At that time he also sought to understand any difficulties concerning the first log-in, where there was suitable equipment installed. At several sites there were more than one person and consequently 20 first log-ins were observed, all using the telephone network, the only access route at that time. After interviewing the participant, the participant was observed logging into the system using the documentation provided and then given help if unable to continue. They were then encouraged to leave a message on the system. Thus the observation preceded some initial on-site training. Many of the first log-ins were recorded on audio tape for subsequent analysis.

6.3.2 Results of observational analysis

The results from the observation divided into two, the need for a further analysis of the log-in procedure itself and a realisation for the need to improve documentation. Until this point it had been thought that the sequence of instructions to the computer was relatively straight-forward. Observing the interaction of naive users with the system showed that there was a complex set of rules which users found hard to understand.

For most users, after dialling the telephone number of the computer index appropriate to the speed of transmission, there were seven to nine steps before reaching the actual use of BLEND. The first three of those were to log into the DEC 20 computer, the next to access BLEND software and the final steps to achieve entry into the software (see Figure 6.2).

	Telecommunications Modem	Gandalf Switching Machine	DEC20	BLEND SOFTWARE
Log-in Steps:	1	2	3, 4	5, 6, 7-9
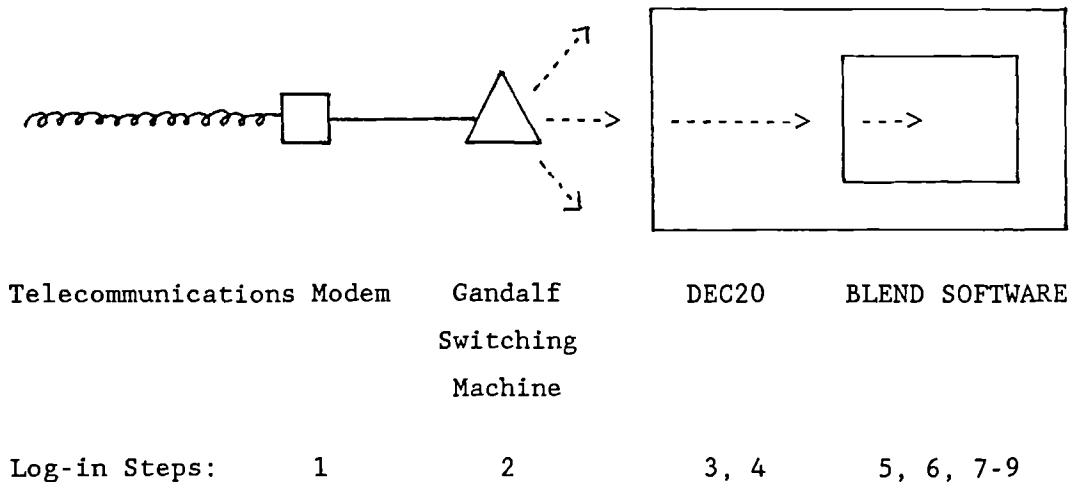
Figure 6.2: Visual representation of the log-in steps

In those steps, several problems were noted.

a. Time limit

There was a time limit in the accomplishment of completing the
first three steps. If the time was exceeded then the user was
automatically cut off. The time limit was reported to be 20
seconds by the Birmingham Computer Centre but measured to be
around 12 seconds.

It was observed in several naive user log-ins that care was
taken to do every action correctly, thereby taking much time
over it. If then (as has happened) the computer automatically
logs the user off with the time limit exceeded, the naive user
uses more care the subsequent time, reading the documentation
more carefully and is thrown off again. This cycle is repeated
until he gives up trying or memorises the commands sufficiently
to speed up and give the commands within the time limit.

b. No early indication of whether the computer is running or not.

There was no indication in any of the procedure of the first
three steps to indicate whether the computer was running or not.
Indeed the message provided, 'Service unavailable', might have
meant that or that there were no ports available to give access
to the computer. No response to one of the commands was the
best guide to the user of the fact that the computer may not be
running, but it was not clear how long one should wait in order

to determine the accuracy of a hypothesis that it might be down - as it might only be considered a little slow.

c. Start again if unsuccessful.

If the computer did not accept any single one of the first three commands, the user must disconnect the telecommunications line and restart the procedure. Beyond this point it was not necessary unless more than two errors are made in steps 5 or 6.

d. You can type ahead if you know what to do in some places, but not others.

In steps 1 and 5 onwards, if the users knew that they entered the wrong sequence of characters, they could just enter the correct sequence without waiting for the computer to display the error message and prompt. Frustration is built up by having to wait, when the user knows exactly what is wrong and what to do about it.

e. What is typed is echoed back in some places but not others.

In steps 1, 4, 5 and 7, what the user types is echoed back but not in the other steps.

f. Aural prompt

In step 4, if the user does not give a command, then after about 7 seconds a bleep is sounded on the terminal as a prompt (i.e. a 'Control G' sent from the computer in response to silence).

g. Not all instructions end with the same terminator.

All instructions except Step 3, require a terminator of a 'Carriage Return'. This however was not a serious error and only confused the user.

h. By-passing parts of the dialogue for experienced users.

It is possible to combine steps 5 to 7 or 9 into a single instruction line if so desired.

i. Choice of routes in the dialogue.

At Step 7, one or two responses put the user into an additional
two steps which was often unexpected.

The eight macro-elements of the log-in are listed in Figure 6.3.
The existence or absence of each is found in the seven to nine
steps.

---

1. Pacing
   - the computer requires a sequence to be performed
     within a set time limit.

2. Bells
   - non-textual prompts.

3. Echo
   - user action is reflected back onto the screen.

4. Waiting
   - the user has to wait for a response before the next
     command can be made.

5. Terminator
   - the same terminator is used for the end of each
     consistency command.

6. Dialogue choice points

7. Actions dependent on the results of 'errors'.

8. Alternatives for naive/experienced users.

Each of these may exist in the way described above or in its
opposite, for example there might be no pacing nor dialogue choice
points.

Figure 6.3:   List of the macro-elements found in the log-in

6.3.3   Documentation for the log-in

The presentation of the log-in in the documentation assisted the
user with some of the macro-elements described and hindered in
others. Most noticeably it hindered the users when they had trouble
locating the position on the page for the next command when in the
paced section of the log-in. It was also found unclear when there
was an unexpected response as a result of one of the two answers at
Step 7. Most of all, however, the problem was what to do with a
situation where an error has been made and the system had responded
with a message not in the presentation of the log-in. All these
problems might be considered to do with early learning and so they
are. But if the user does not get into the system through the

log-in successfully, the the system is not accessed at all. Thus it
was possible that there was requirement for two aids, one for the
naive user in the learning stages and the other as an aide memoire
for the more experienced user.

Is the naive user likely to learn and understand the steps of
instruction and response? A casual glance at the dialogue in its
most simply presented 'play' form (Figure 6.4) indicates that it
seems to have constituent form of a conversation. From observation
this apparently makes coherent meaningful sense to an experienced
DEC user, makes a partially understood dialogue to an experienced
computer user, and can make no sense at all to the occasional user,
even after a considerable period of time.

```
1.      user: Return
   response: *

2.      user: 20 return
   response: SERVICE 20 START

3.      user: Control C
   response: The University of Birmingham .....
             @

4.      user: LOG BL.BLEND Password Return
```

Figure 6.4:   The first four steps of the log-in in 'play' form

Indeed the dialogue is part of the whole structure of the command
and response sequences on the DEC 20 but this is never realised by
users only involved with BLEND software, since nowhere else will it
be seen or experienced. The 'carriage return' (user action 1) is a
command to 'wake the Gandalf system up' and common to many systems,
the '20 carriage return' (user action 2) is a reply to an unwritten
question 'which service would you like to enter?' and Control C
(user action 3) is the command for waking up the DEC system.

The documentation for the experienced and relatively naive user may
then have different requirements. The experienced DEC user needs
only a reminder and a statement of the dialogue and its purpose, and
then the structure and feel for it should become clear. The
experienced computer user will likewise probably understand the
processes occurring and grasp the essence of the dialogue. However
the more naive user, for whom any presented dialogue is likely to
remain obscure in structure, wording and meaning, needs substantial

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aid from documentation, particularly when the dialogue itself, as in
this case, cannot be especially modified for this class of user.

In the documentation, decisions have to be made about each of the
macro-elements. It might, for example, be considered sufficient to
design the presentation well enough that the pacing required in
steps 1 to 3 is not experienced. These and other issues were
considered. Macro-elements were not the only ones to present
problems in the presentation of the log-in. The macro-elements
present some other difficulties which vary again according to
whether the user is experienced in DEC and computer dialogues or
not. These include notation for: a 'carriage return' (this
presumes inclusion of a 'line feed' in the dialogue here, and in
documentation is often referred to as a 'newline'); a space and its
interaction with the acceptance by the software of missing them out;
a 'control command', which most users had not met before use of
ASCII; and upper and/or lower case acceptability. These are
summarised in Figure 6.5.

---

1. Absence or presence of a carriage return at the end of a
   command and its notation.

2. Presence of a necessary space and its notation.

3. The acceptability or otherwise of case changes (e.g. from
   upper to lower).

4. The explanation of control characters and their notation.

5. The acceptability of abbreviation of words or expressions.

Figure 6.5: List of micro-elements of the log-in that need to be
           considered for documentation

Both macro and micro-elements of the dialogue are to be considered
in the context of the psychology of the user, who does not act as a
machine but is purposeful in creating theories and hypotheses to
explain the response to commands, particularly if error messages are
encountered.

Whether the user consciously or subconsciously does this, there is
strong evidence to support that this is a mode of behaviour for
interaction with any equipment. The user seeks a consistent
description of his interaction until it is proved wrong. This can
be described as the process of learning but, as has already been
noted, the dialogue may be too short to enable this and so does not

allow the user to come to a 'correct' understanding of the dialogue
even after many experiences of it.

Possibilities in the presentation of log-in dialogues

The possibilities in the presentation of a dialogue and hence of the
instructional documentation of such dialogues are limited by a
number of factors, most of which are associated with the textual and
sequential presentation on a two-dimension medium, including such
factors as paper size, cost and the anticipation of users
photocopying it.

Let us consider first the separation of the user action and the
computer response. It has already been noted that, as in the case
of human dialogue, these may be concurrent and need not be
sequential, and that some user actions may be echoed, others not.
Thus one may present the actions these not necessarily being
identical. For an example see Figure 6.6. The similarity or
otherwise of the sequence of actions and what is displayed on the
screen allow or inhibit different possibilities in their
presentation on paper.

(A)   User Action/Computer Response   What is on the Screen

Step 1   User: Carriage Return
          Response: *   *
Step 1   User: 20 Carriage Return   SERVICE 20 START
          Response: SERVICE 20 START
Step 2   User: Control C

          Response: The University of   The University of
                       Birmingham ...   Birmingham
                       @   @

(B)   Step 5 Computer: Last name: Last name: Smith
               User: Smith   Password:
       Step 6 Response: Password:

               User: Secret
       Step 7 Response: Good. Are you using   Good.   Are you using ..
                          a terminal which   paper?
                          prints on paper?
               User: Yes   Yes.

(Note that in steps 5 to 7 all user actions end with a carriage return)

In Example B, apart from the unechoed password the two look very
similar, unlike Example A.

Figure 6.6:   The difference between user/computer dialogue and what
               appears on the screen.

To this point, we have used the 'play' form for the presentation and
description of the log-in.   This is not the only possibility and
others have been used, for example, descriptive steps in prose, flow
chart diagrams and specialised linguistic forms (e.g. 'go to'
instructions).   In these the consequences of errors may be included
together with varying descriptions of the choice points.   Figure 6.7
summarises these presentation alternatives.

1. Prose description of steps.		
2. Play-form of user action/computer response.	With	1. What the screen displays.
3. Flow-chart presentation.	or	2. Integration of error messages
4. Special linguistic form.	Without	
5. Some combination of the above.		3. Possibilities at choice points.

Figure 6.7:   Possibilities in the descriptive presentation of the log-in.

These descriptive presentations offer between and within themselves possibilities for distinguishing between user action and computer response: labelling; partitional separation; colour; font and other attention drawing devices (Figure 6.8).

1. Labelling, e.g. 'User:' 'Response:', etc.

2. Positional separation.

3. Attention drawing typographic aids, e.g. colour, font, shading, boxing, underlining, etc.

4. Formal differentiation, e.g. flow-charts.

Figure 6.8: Methods for distinguishing user action

At the microlevel of presentation, one can ask about the actual symbols used. Figure 6.9 lists the nomenclature used in some of the manuals surveyed in 1981. The inconsistency of just three commands can be noted, even within a single supplier. This aspect also needs to be considered in detail.

6.3.4 A pilot experiment

Given the range of presentations that are possible from the combinations listed above, it was felt necessary to do a pilot experiment on several log-in procedures. Four presentations were prepared, which can be found in Appendix E. The one limitation imposed was cost. This led to a need to prepare the text on a word-processor with a daisy-wheel printer.

NOMENCLATURE FOR 'CARRIAGE RETURN' OR 'NEW LINES'

Symbol	Source
CR	Computer Software and many manuals
(Nothing)	Most Manuals
⟨CR⟩	Computer Software
(RET)	DEC Documentation
Ⓡ	O.U. Guide
RETURN	PET Manual
NEWLINE	Videogenie Manual
↵	U. of York User Guide
⟨	NOTEPAD and Version 1 Users' Guide
◀	NOTEPAD Users' Guide
ENTER	Tandy TRS-80 Users' Guide

NOMENCLATURE FOR CONTROL COMMANDS

Symbol	Source
CONTROL E	NOTEPAD Manual
Ctrl E	DEC Manuals
↑E	(DEC literature and VECTOR Guide
Ⓔ	(" " " " "
^E	DEC Guides
CTRL/E	DEC "
CTRL E	DEC "
CNTRL E	
Ctrl	University of York User Guide
Bell 9	Applesoft Tutorial, for Control G

NOMENCLATURE FOR SPACES

Symbol	Description	Source
▭	'open-box'	1st course on Algol 60
⊔	'bottom of box'	BLEND Version 1
∧	'up arrow on line below'	BLEND Version 2 and LUT User Guides
	'nothing'	most common
▽	'down triangle'	O.U.
SPACE	'space bar illustrated'	CBM User Manual
____	'underline'	LUT and U. of York User Guides

Figure 6.9: Nomenclature for some micro-elements of the log-in to illustrate the lack of standardisation

Those four log-in procedures were given to nine subjects. The nine were a reasonable sample of the potential users (1) because three were members of LINC, (2) because each was working in Computer Human Factors, as were all of LINC, (3) although all had familiarity with

computers, three were experienced users in being programmers (cf. 26/64 of LINC being in Computer Science Departments).

All the comments were analysed (see Appendix E) and one particular procedure resulted in being substantially more popular. That procedure was presented as a sequence of statements by "User" and "Computer", and might be described as 'play-form'. In subsequent conversation with subjects, the reasons why this 'play-form' was preferred were that it was easy to understand and (above all) had a 'feeling of spaciousness' due to the white space on the page. Most subjects made suggestions for each of the presentations and, as an experimental observation, quite small differences seemed to make a lot of difference to the preference. Indeed, this was explicitly stated by one subject. Several thought that a flow-chart presentation would be useful for experienced users, and indeed two LINC members had already requested such a form.

Using the suggestions, the most preferred log-in was accordingly modified and used in the next manual to be sent to LINC members, and an improved flow-chart presented for experienced users (see Appendix E).

6.3.5 Summary and discussion

In the six-month survey and in observation of first log-ins, a set of problems was identified associated both with the users interaction with the log-in itself and with the documentation. The particular characteristics of the BLEND log-in were studied and shown to be more complex than many would expect. Therefore, the need for a clear presentation of the log-in on paper was of paramount importance.

An analysis of the possibilities led to a consideration of four log-in procedures, subject to the production of them on a word-processor. Those were piloted on nine users and the most preferred, improved by suggestions, was used in the subsequent manual. After this pilot trial, it was planned to carry out further research based on the analysis and to conduct experiments in a factorial design with different documentation presentations.

There is little published literature to guide the writer of documentation on the issues involved here. Examples of published work fall into four main areas:

- General technical documentation research using prose; Gould et al, 1976, is one example where a study is made of following instructions presented in different kinds of language, procedural, descriptive etc.

- Research into alternatives to prose; Wright et al, 1973, has studied alternatives to prose where there are many different routes .and choice points. They discovered that visual encoding was both useful and requested. In particular, two issues were contrasted, the execution of the presentation and the process whereby it is moved to memory. Flow-charts have also been studied for the comprehensibility of programming.

- Understanding software program structure; computer documentation was studied by Shneiderman et al, 1977, with a series of experiments on the utility of flow-charts, stemming from a concern for modular programming. The focus of this area is, however, to support the programmer and so is not directly applicable.

- Documentation development; one paper in this area of particular relevance is Winbush and McDowell's on the procedure whereby the usability of computer manuals can be increased (1980). They suggest four ways of testing a manual before system use.

1. Publication Inspection Test; test subjects identify which parts of the manual are difficult to understand.

2. Written Test; to examine subjects on information which they should have understood.

3. Task-oriented Test; to test procedural tasks in a simulated environment.

4. Additional Questionnaire; to rate various aspects of the manual, particularly its usability.

The pilot trial followed 1 and 4, and the plan was to implement and test a variety of log-in presentations using Task-oriented Tests,

simulated log-ins with all the aspects of pacing and other macro-elements identified.

A second stage was to examine the problem of how and when the log-in was moved to memory, as suggested by Wright and Reid, 1973 and the transfer effects between different log-in presentations. The plan was therefore as follows:

1. Using macro- and micro-elements analysed, prepare a set of presentations;

2. Present to different groups in a statistical 'between group' design and measure success of log-in and understanding of log-in procedure;

3. Measure recall of log-in (memory);

4. Request subjective comments;

5. Measure recall one week later (memory);

6. Allow user to get used to log-in by regular practice, measuring changing number of errors;

7. Ask for interpretation of the conceptual structure;

8. Transfer to alternative presentation and compare with 1-4 above;

9. Request subjective comments on the presentations seen.

However, within the 'action research' methodology other problems were also presented which needed experimentation and it was reluctantly decided to leave this despite the continuing need for research. The announcement of autolog-in made the need less pressing than other areas of research for which the users did not seem to be so easily aided. The existence of autolog-in facilities does not remove the need to understand in detail the sequences involved in the log-in. The analysis was found invaluable for establishing the correct code sequence to be incorporated into the autodial and autolog-in of the TORCH microcomputers. Neither did the problem of log-in vanish, as will be seen in the following section.

6.4   Consistency in command structure

We address only the question of the terminator here as there has
been other research and recommendations on the design of dialogue
itself, for example, Martin, 1973.   In one particular place there
appeared a problem following a numbered list of Activities (for the
present it need not concern us what these are), the user was invited
to select one. The selection was made by typing a number of the
list, say 6, followed by hitting the 'Return' key.   Keying only the
'Return' was taken as the empty command and logged the user out of
the system. This in itself was appropriate as users may well have
logged into the list for the information that it gave and then
chose to log-out. At another point in the system, there is also a
place to choose an Activity, when wishing to move between them.
Once again the number of the Activity is typed, followed by pressing
the 'Return' key if the user has remembered which numbered Activity
in the list is required. If he has not, then pressing the '?' key
retrieves the list to allow a choice. Note that it is not the '?'
followed by the 'Return' key. If the latter was done then the list
was displayed and the computer stored the 'Return' in its read-ahead
facility as the next instruction to be implemented, which it did -
thereby logging the user out of the system. This occurred
relatively frequently and users were evidently using a conceptual
model of the command at that point which included the 'Return' as a
terminator.

By detailed and prolonged discussions with computer experts on the
DEC host computer, the problem was able to analysed conceptually.
The DEC computer experts end commands with the 'Return' key, but
before doing so may invoke help facilities and use control commands
for information or editing purposes, but these are not counted as
commands. In the DEC all ASCII control characters and the question
mark to call help facilities are not thought of a commands. Thus
the DEC expert would arrive at that point, wish to view the list of
Activities and would consider it a help facility and so give the
question mark.

Discussion with less sophisticated users revealed that this was not
their idea of how the system worked. All commands ended with
pressing the 'Return' key, except, as they learnt, the ASCII control
characters. The question mark was an ordinary character. What were

the options open at this stage? The question mark as a caller of
help facilities was a basic feature of the DEC system and this could
not apparently be changed. The options seemed few, and yet the
conceptual framework for naive users was so strong that it seemed
impossible to transform their thinking. At all other points the
same concept applied but there was less need to invoke it so
frequently and adding the 'Return' did not cost as much. Indeed it
is worth recalling that the cost at this time was having to log-in
to the system again, already a problem for many users.

The resolution was found in negotiating a solution that allowed both
to keep their conceptual frameworks at only a marginal cost to the
expert DEC users. The system was enhanced to allow a user to type a
question mark followed by a 'Return', and this Return was trapped
and filtered out. If, however, there was no 'Return' then the
filtering programme waited for a short time (about two and a half
seconds) and then displayed the list. Thus both were allowed to
keep their conceptual framework but at a slight cost to the expert
DEC user.

This also necessitates not allowing the use of the empty command at
the first list of Activities encountered. This was resolved by a
new facility in another series of problems associated with the
modification of the structure to which we return in section 5.4.4.

The importance of this example we believe lies in a) the refusal to
accept such a fundamental transgression of a user conceptual
framework and b) the negotiation with computer programmers to find a
way in which the system could be made more usable for both groups
with their different conceptual frameworks.

But is its significance so important? Surely any naive users have
this problem and they become experienced and so this kind of problem
is the kind that vanishes? We argue not.

First, the users of the system, as discussed in Chapter 4 do not
access the system often, many once in six to eight weeks. This kind
of user is described as 'occasional' or 'casual'. Cuff, 1980, has
discussed the dialogue requirements for such users, particularly
addressing those users who are computer naive. He emphasises how
they are prone to forget much more than the dedicated user and in

particular to forget details. Moreover, they "often would like to specify their needs vaguely, using the system's output to understand their own requirements better and to build confidence". The case in hand is one in which the user is likely not to learn to build confidence on the system and a detail likely to be forgotten. Therefore it is argued that occasional users are not likely to learn to become experienced in this kind of detail.

Secondly, it is not only naive users who are occasional users. Among the LINC members were many computer scientist researchers who were occasional users of the BLEND system, many of whom had not used this kind of DEC system. Their frustration was not only equal to that of the naive users, but it was also received more volubly in complaints. The form in which the latter were received and observation of the first time log-ins and use of the system suggest a reason. Experienced computer users coming to a new system already have learned many different command structures. To invest time and effort not only learning another command structure but also to distinguish it from the others, was reported a high cost. Therefore, they would try to use their existing knowledge in the situation. This meant that they knew exactly what they wanted the system to do conceptually, but frequently had the frustration of not knowing which commands to give to make it do it.

Therefore in the LINC members there were three groups of users, the experienced DEC users, the computer naive users and the occasional computer expert user. Their potential difficulties are diagrammatically represented in Figure 6.10.

----

experienced use

```
                               |
Users remember what things are |        The computer system expert
to be done but not how to do them. |
Expect consistency with other  |
similar types of system.  Both can |
lead to frustration.           |
                               |
                               |
occasional user----------------|------------------regular user
                               |
                               |
System is opaque and users often |      None of LINC is likely to
have inappropriate mental models, |     fall into this category
coupled with low typing ability |       which in general would be
and unfamiliarity with keyboard |       the 'data entry' users.
use etc.                        |
                               |
                        naive user
```

Figure 6.10:   LINC community members can have problems whether naive or
               experienced in computer systems.

Some of these occasional computer expert users were among those who
complained at being logged out of the system by the inclusion of the
'Return'. Thus we argue that all occasional users are likely to
experience this kind of problem, whether they are naive or computer
expert, and , as we have seen, many of the BLEND users fell into
this category.

6.5   Modification of the structure

6.5.1 Modification of the structure

The suggestions for modification came via the six-month survey, user
requests and participant observation. What was the problem?

The structure of NOTEPAD computer conferencing was so designed that
each commercial organisation or group would have a separate secure
area, with a password, called a Project containing many Activities
(conferences).

The BLEND Project Director initiated a structure which placed
different types of work activity in different Projects, for example
writing papers in one, reading journals in another, exchanging news

in yet another. Almost immediately it was discovered that while
some users did separate out these different functions operationally,
others would log-in and wish to be provided with a facility to
enable easy and rapid passing between these Projects. The latter
requested the modification to the system.

What were the alternatives? Because of the concept of separation
inherent in NOTEPAD it was not anticipated to be easy to modify
aspects of the system, particularly the log-in from the point of
accessing the BLEND software (steps 5-7 or 9 in Figure 6.2), and
discussion with the author of the software confirmed that steps 5-7
or 9 had to remain the front access point of each Project. Steps
1-3 of the log-in were to reach the host computer, the DEC. This
left the only room for manoeuvre to be in step 4, the log-in to the
host computer. The information given here consisted of two parts,
the name of the Project which was to be accessed and the Password to
that Project. The user could be returned to a point in the DEC just
after giving information at this point. This allowed a number of
possibilities. Could the user be returned to that point and give
the two items of further information in order to access another area
or could the information given be changed so that the user be
returned to a point just after it and access another with only one
item of information, the name of the Project?

The latter required further exploration in the functionality of the
programmes in the DEC to implement it. Consequently a test was made
of the former to discover if the investment in time and effort was
worthwhile (see Figure 6.11). The response was immediate and
positive to this intermediate modification.
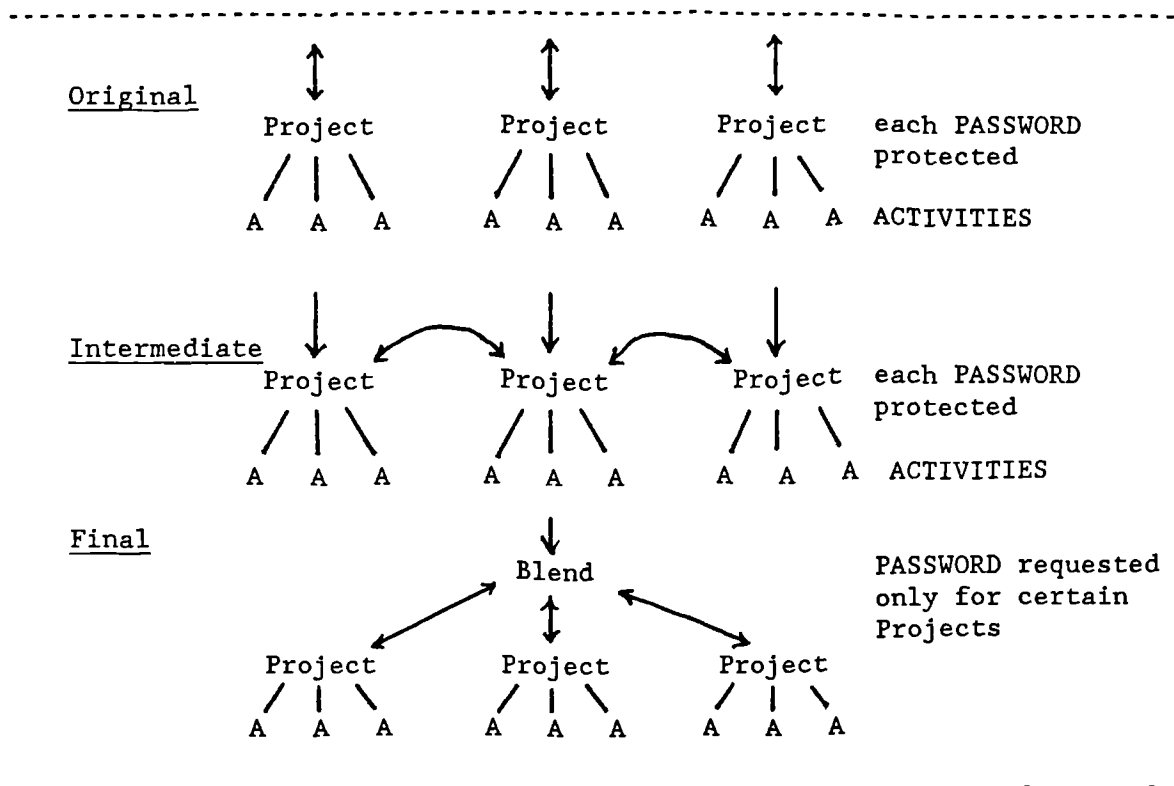
Figure 6.11: **The modification of BLEND structure.**

Plans were therefore made to explore and develop the system so that
at Step 4, the items of information given were a general access name
BLEND and a password which suffice for all areas except those deemed
to have special need for additional password protection. An
additional step was inserted at which the user gave the Project
name. This increased the number of steps for the initial log-in,
but reduced the need to log-in again and decreased the steps from
the intermediate solution if accessing more than one Project in one
session.

6.5.2 Evaluation of the modification

Data Collection

Was the final development necessary? Did users access several
Projects in one session as they claimed? To study this, LOGBOOK
included data collection on which Projects and Activities were
accessed by each user in each session on the BLEND system. After
recording for test purposes in 1981, data were collected from 1982
to June 30 1984 for the LINC members.

Treatment of data

The Project and Activity accessed were unequivocal data, but the definition of session length needed to be clarified. A number of contributing factors could lead to the premature termination of a session; getting stuck in the software and terminating the telecommunication link; a noisy telecommunications line stopping communication because of an operator interception or crossed line; local terminal equipment error or failure, to give some examples. After a premature termination the user might then attempt to log-in immediately or make a cup of coffee or some similar activity before trying again. It was considered therefore that some sessions would be made of a number of accesses as recorded by LOGBOOK. The question then was how long a period to allow before the next access was to be considered a separate session.

The behaviour of users in response to a premature termination of a session had been reported by anecdotes and so a minimum of five minutes was notionally agreed as a starting point. Next the transcripts of LOGBOOK were studied for intervals between accesses being in the range three to twenty minutes. There were a number of access intervals that were less than ten minutes and then none observed until intervals of around twenty minutes. It was decided to allow an interval of 12 minutes or less to define the concurrence of two accesses to be part of the same session.

(It should be noted that the same definition applies to the word 'access' as used in Chapter 4 as to 'session' here, but the description retained until this context).

It was not possible to do any complex counting of the number of occurrences of different patterns of accessing different Projects across the session. The huge data size precluded that particular operation with any programmes that could be developed for it. Two pieces of evidence are brought forward to evaluate the modification. Examples and a small analysis from LOGBOOK of different patterns of behaviour, and a minute by minute analysis of which Project the users had accessed in an average session.

In the former we take one month samples from the users in the long-term group under study and analyse for the proportion of

sessions in which the user moved between Projects. The month was chosen randomly. In the latter, each session was recorded and data prepared so that the data had the form 'user', 'minute after log-in', 'Project', 'session number'.

Example

One participant's access patterns to different Projects in February 1984 illustrate both single Project access and use of the new structure for moving between Projects:

Session Number	Date	Projects Accessed
1	7 Feb	News
2	7 Feb	News, Poster
3	9 Feb	News
4	10 Feb	News
5	12 Feb	News, Bulletin, SR, RAAJ, News, Author, RAAJ
6	13 Feb	RAAJ
7	13 Feb	RAAJ
8	26 Feb	News, CHF2, SR, RAAJ

Results of analysis of one months sessions

In February 1984, 23 LINC members accessed the BLEND system. Of these 11 accessed more than one Project in a session at least once. There were 123 single Project sessions, 21 two Project sessions and 12 sessions with numbers of Projects accessed ranging from 3 to 8. In summary, 48% of the users moved between the Projects and 23% of the sessions contained accesses to more than one Project.

Results of analysis of overall use

Summing across all users and sessions on the system and plotting for each Project the number of sessions accessing that Project at that time gives the graphs in Figure 6.12. Those places in which the graph rises after falling, as in 'Software Reviews', 'Poster', 'CC1-2', 'RAAJ' indicate that the users must have joined there after accessing other Projects. For example, there is a peak of accessing Software Reviews after 7 minutes of use of the system. Thus overall evidence, despite being smoothed by the summation of all the effects, does show that users moved between Projects.
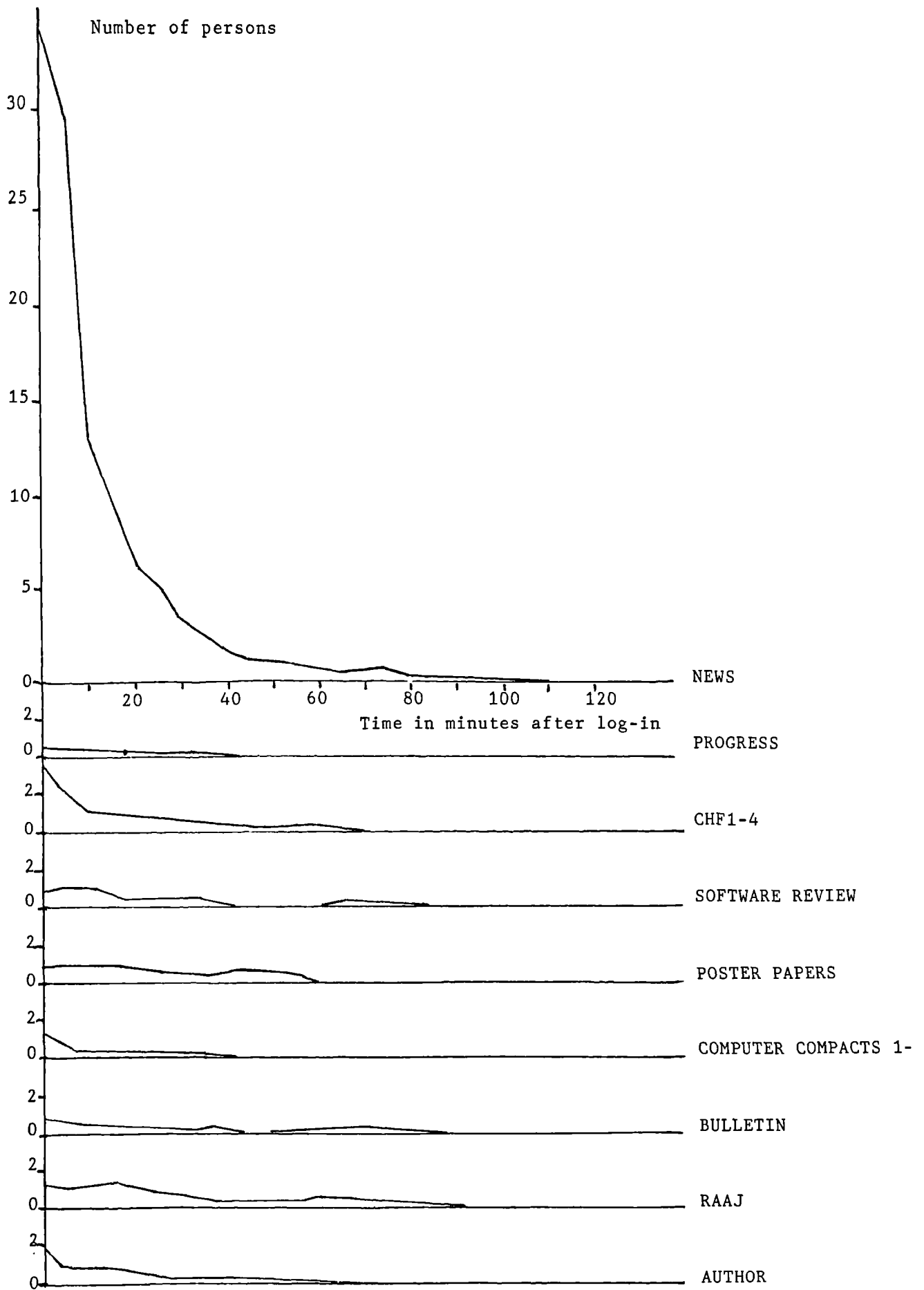
Figure 6.12:   The average number of persons in each Project by minutes after log-in

Conclusion

It is thus concluded that the modification made to the structure in response to expressed user need was found useful.

6.5.3 The Sense of location and direction in the database

Knowing where one is and where to go in a 2-level hierarchical tree structure may seem a trivial problem. However, one experiment in viewdata illustrated the difficulties of searching with goal acquisition in just two levels which caused much distress to the subjects (Van Nes and Van der Heijden, 1980). It does seem, though, that a two level system appears optimum for moderately sized hierarchical systems both from a small user survey (Cole 1981) which showed that this is the preferred number for many office filing systems and from an experiment on menu-based on-line search (Miller 1982). The number of Activities and Projects in BLEND form a hierarchical system of comparable size to those investigated in the studies, which indicate that breadth is preferred over depth for an increase in the number of items.

The problems of databases in information systems are increased in the type of BLEND system by the addition of new text in many places: 'where does the user find it?' and 'how does the user keep up to date?' The interactive nature of computer teleconferencing that allows users to write in many places also leads to the difficulty of remembering where some message was written or received in a previous session.

As a response to a call for help received from some new users, who reported the system malfunctioning, data records were carefully studied and analysed. The user had experienced exactly the difficulty of remembering where he had placed the message. (see Figure 6.13).

ACTIVITIES

           1   2   3   4   5

First session
logs in ------|----->
              Reads last
              4 entries-------------------------------->
                                                     Writes note 1 (N1)
                                                   Checks N1 there
                                        <-----------

                            Reads all
                            Entries
                            Looks for N1
                    <----------
                  Reads some
                  entries
                  Looks for N1
                  (in 4 ways)
logs out <----|--------------|------

Next day
logs in ------|----->
              Writes N2
              (see next page)
              Writes N3
              Checks both
              there
              Checks again
logs out <----|-----

Few days later
logs in-------|--------------|----------------------------->
                                                 Writes N4 (see next
                                                 page). Checked and
                                                 got N1, N4. 2nd
                                                 check & got N1, N4.
                                                 Looks for N2, N3.
                                                 3rd check.
logs out <----|--------------|--------------|----------|-----

Next day
logs in-------|----->
              Checks notes
              & gets N2, N3
              Rechecks notes
              and get N2, N3
logs out <----|-----

Few days later
logs in ------|----->
              checks notes &
              gets N2, N3
              Writes N5 (see
              next page)
              Synchronous help
              Communication
              with organiser.
logs out <----|-----

Thereafter logs in to see if there are new Entries (No message making).

NOTE N2

DEAR ANDREW
I WROTE YOU A NOTE YESTERDAY BUT WHEN I RECALLED IT, IT SEEMED TO HAVE BEEN
LOST! DID YOU RECEIVE IT? HOW WILL I KNOW YOUR ANSWER?
BEST WISHES,
        BEN.

FROM NOTE N4 RE N1

THE NOTE I HAD WRITTEN YESTERDAY CONCERNED FRED'S PREDICAMENT. WHEN I
RECALLED IT I WAS SUCCESSFUL AT THE FIRST ATTEMPT, BUT NOT ON A SECOND. IT
THEREFORE SEEMED LOST AND I WAS WONDERING IF YOU HAD IN FACT RECEIVED IT.

NOTE N5

-GOOD MORNING ANDREW.
-MORE DETAILS OF THE LOST NOTES!
-THE NOTE WAS WRITTEN AND ENTERED USING CONTROL Y. WHEN I USED 'Z' TO
 READ THE NOTE, IT WAS VISIBLE THE FIRST TIME BUT NOT WHEN I TRIED ON A
 SECOND OCCASION. IT SEEMED TO HAVE DISAPPEARED.
-HOWEVER ON THE NEXT DAY IT HAD REAPPEARED AGAIN!!
-IS THERE SOMETHING I AM MISSING IN RECALLING NOTES WRITTEN BY ME?
-BEN

NB: Names have been altered for privacy.

Here the user does not find the system he expected and goes on later to
continue believing he did all the correct actions and that the system is
unreliable

Figure 6.13: A user 'losing' his messages owing to a conceptual
           misunderstanding.

It is easy to underestimate the difficulty that seems to result from
the database structure. During observation of naive log-ins, and
the questioning of experienced users, it had been noted that the
difficulties do not necessarily diminish with familiarity. Even
when one 'knows where one is', there might still be difficulty
incurred in getting to where one then wishes to go. This was
particularly true in the original structure, whereby the question of
moving between Activities at the bottom of the tree structure was
entirely different to moving between Projects, which necessitated a
log-out and log-in.

Handling both the conceptual structure of the database and the
commands necessary proved awkward for some users. Further 'knowing'
difficulties lie in the nature of the tasks performed on the system:
sending and receiving messages, writing papers, editing, refereeing

and reading. By long-term adaption to both the tools and the
process of using paper, people glance at pigeon-holes to see what
mail there is, with the envelope size, shape and colour frequently
enabling assessment of the priority of dealing with the contents
even before opening. A skim through a journal will give us the idea
of how much effort (time, difficulty etc.) will be required for
reading a particular paper. This and other tasks are easy to stop
temporarily in the middle and, with another glance, see how far we
are through and estimate the time to the end of the task and then
pick up and continue again.

The computer medium does not allow many of these procedures
developed between man and his tools over many years and it poses
problems that are only now beginning to be considered.

Electronic mail has treated some of these problems by having a
mailbox presented to the user when he logs in with informative
envelopes (see for example, the discussion in Uhlig 1981). The user
may then place the message in his own categorisation and database
(including a waste-bin if desired).

Several substantial attempts have been made to improve the
locational sense of databases that many people build into their
office systems with the aim of knowing what there is, and where and
how to travel to it. (Bolt 1979, Spence and Apperley 1982).

Computer teleconferencing with its concept of an ongoing discussion
with conference Entries gradually accumulating over many hours or
several years has a rather different structure from electronic mail
and personal filing system and presents difficulties for users with
many Activities. The computer conferencing suite COM has a flexible
order of Activities with those containing messages being placed at
the top (Palme, 1980) thereby combining the notion of what there is
to see with the actual structure of the database as it presented to
the user. Some users of the system, however, have complained about
the directness of the system and of never quite knowing where you
are (received in observation of use of the system).

To summarise the results of the difficulties expressed in the
six-month survey, there can be difficulties for the user in:

1. knowing where one is

2. knowing where and how one can go to what there is

3. knowing what there is new to see and whether one has seen
   everything

4. knowing what-there-is-to-see involves

5. knowing where one previously saw something.

Some of these difficulties were hypothesised to increase when the
structure was modified. Previously the user had had to decide
consciously which area to access and then go through the lengthy
log-in procedure. Once in the system a single Project was all that
was accessible, and the example above shows that problems were
experienced even in such a small database structure. With
additional access of many Projects without that first conscious
thinking of which Project was about to be entered, it was thought by
the management team that there could be increased difficulties.

What aids can be given to the user in this area? Some aspects of
systems that users experience are located within the system but are
themselves not addressable by the user or extractable to another
location. This is true, for example, of the coffee stain on a file
within a set of files. Although it can be used to identify the
file, it is accomplished by sequential search, i.e. there is nothing
addressable about the stain, unlike, say, a sequence of codes marked
on the files. Nevertheless, such aspects aid in the building of a
model of the space in the users. We call such non-addressable
aspects 'cues'. We will call addressable aspects of a system
'information', in the context of developing a locational sense for
the database and moving about it. This means an aspect of the
database which can be identified with, and distinguished from, other
aspects. Thus if a set of files are stored in date order, then the
set of dates and one date are both 'information'. In this example
the information allows the user to implement strategies to retrieve
the file required. It should be noted that the information is not
tied to any form of operation by the user, i.e., that the set of
dates is its 'information'. When information is tied to user
operation, we will call 'instruction', thus 'get me the files

between such-and-such date and another' would be an instruction.
These three aspects, cue, information and instruction form the basis
of a conceptual understanding of what was required for the user.
The need for help in the structure of BLEND expressed by LINC
members was usefully analysed using this basis. For example,
'knowing where one is', can be helped in each of the three ways: by
building cues into the system so that a locational sense is
developed in the users by knowing whence they have come and where
might go; by giving information on request as to their current
location; and by giving an instruction to show their location in
relationship to other locations. Bolt, 1979, and Spence et al,
1982, have built systems to be highly instructional in this one area
of 'knowing where one is', by allowing the user to 'zoom' in and out
of locations based on a map of the database. Palme, 1980, on the
other hand, has abandoned the locational sense in favour of a system
that is <u>pre-instructional</u> to provide the user with what is new.

However, the arrangement with the provider of the suite for the
BLEND system did not permit extensive change to the software. This
meant that the kind of approach taken by Bolt or Spence et al could
not be considered. Indeed the only changes possible were relatively
small ones in the areas shown in Figure 6.14. They are summarised
in Figure 6.15.

	CUES	INFORMATION	INSTRUCTION
1. Knowing where one is	location within d/b	location within d/b	
2. Knowing where one can go and how one can go to what there is	structure of d/b	content of d/b how to move around d/b	moving about d/b
3. Knowing what there is to see and whether one has seen anything.	new content in d/b	new content in d/b	
4. Knowing where-there-is-to-see involves	effort in accessing content		
5. Knowing where one saw something previously	reinforcement of memory.		

NOTE: database shortened to d/b

<u>Figure 6.14</u>: <u>Enhancing locational sense in the BLEND system; the
possibilities.</u>

1. CUES:
    -About the database structure
        -repetition of Project-Activity pairs whenever possible
    -About the sense of location
            -when entering each Activity, the name of the
            Project and Activity were repeated and labelled.
    -About what tasks would involve
        -the length of articles were given in the number of
        lines and number of paragraph-length pieces of text
    -About new content
        -as a feature of NOTEPAD teleconferencing when
        entering a Project, an asterisk was placed next to each
        Activity when there was new material present within it.

2. INFORMATION

    -On current location
        -a facility introduced whereby the computer would respond
        'You are in Project..., Activity...'.
    -On location of items in the database
        -a specified Activity in a specified Project was set aside
        to store information as to the content of all Projects and
        Activities. This storing of the information was done
        manually.
    -On whether there was any new material
        -information on any substantive new content, such as a
        newsletter or article was placed in a specified Activity in
        a specified Project.
        -On location of new material
        -as above
    -On how to move around the database
        -new on-demand help facilities were provided to include
        information on moving around the database.

3. INSTRUCTION

    -On moving around the database
        -the modification of the structure involved command
        sequences to enable the user to move around the Projects
        and Activities within the structure of the Projects and
        Activities.
        -a 'get me to a known place' command was introduced,
        operational within almost all places of the system.

Figure 6.15:   The changes implemented in the BLEND system

In negotiating the changes the general rules were followed:

1. Negotiating for the change to be as far to the instructional end
    as possible.

2. All the changes should be consistent with each other in
    reinforcing the database structure.

The former gave the user more control and the latter the ability to build up a model of the database. By these changes it was hoped to meet some of the users' requirements   in maintaining an updated overview of the contents of the system.

6.5.4   <u>Evaluation of locational aids</u>

No formal evaluation was made of the changes. There were observations of use of the facilities. In particular, the last one itemised in Figure 6.15 proved itself by several participants using it on a regular basis. Observation of use showed that naive users in the stages of learning the system and the occasional computer experts both used this in their sessions. One naive user wrote and specifically mentioned the usefulness of the facility.

Despite the changes, in the thirty-five month survey conducted by telephone to the thirty-two LINC users suggestions on improvement often made reference to the program for changing Projects. The reason for this is that the use of the program had, from the users' viewpoint, added another level into the system. This resulted in the perception of the level of interaction being too low and was most strongly noted in the Project structure necessitating a separate log-in of name, personal password and terminal-type - steps 5 to 7 or 9 - (10 people), and in only becoming aware of new information when entering into a Project to find out whether there were any new messages (9 people). This Project compartmentalisation meant that people reported getting confused because they are "not sure what is where" (4 people). These were some of the changes that would have been made following the first analysis had it been possible to do so. Six comments observed that because NOTEPAD teleconferencing suite was not designed for electronic journals it was "generally cumbersome" and a change in the level of interaction was required. The comments were do with 'instructional' functionality. So there were further direct requests for increased 'information' and increased 'instruction'.

6.6   Developing the system for longer pieces of text

From the surveys and observation, the requirement was established
for the development of a consistent functionality for transfer of
articles from microcomputer to host computer and in writing and
editing articles in the host computer system. We have already
identified the need to be able to access and replace paragraph-
length messages containing part of the text for an article.
Henceforward in this discussion these will be called 'paragraphs',
for this was their usual form (see diagram in Figure 6.16).

Host Computer

```
 _____
|                                                        |
|     NOTEPAD Activity                                   |
|                                                        |
|     _____                           |
|    |                        |                          |
|    |1...Paragraphs...       |                          |
|    |2...............        |                          |
|    |3...............        | <--------- TEXT          |
|    |4...............        | ---------> EDITOR         |
|    |5...............        |                          |
|    |6...............        |                          |
|    |7...............        |                          |
|    |_____|                          |
|                                                        |
|_____|
```
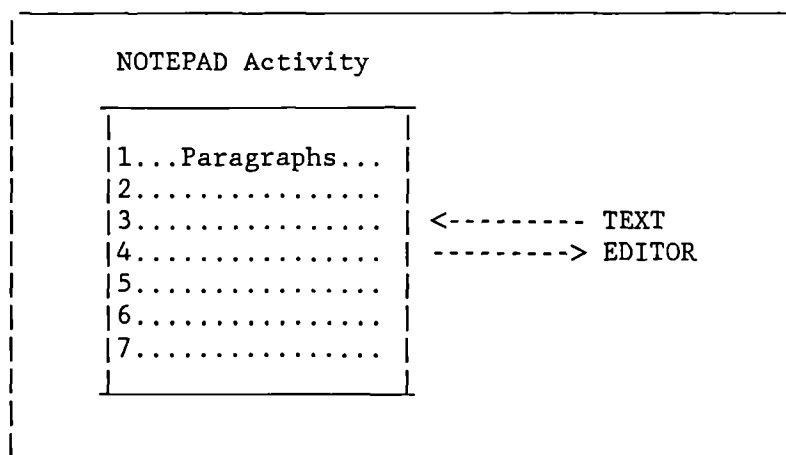
Figure 6.16:   Requirement for accessing and replacing paragraphs in an
                article on the system

But it was also possible to originate text in the text editor. The
question was whether or not there was a mechanism for indicating
where the paragraphs should fall once it was transferred to the
NOTEPAD Activity. This in itself was purely a functional problem
and before attempting to solve it, the management team agreed that
the aspect of articles containing paragraphs could be examined more
closely. First, what was the functionality required from the system
as a whole?

1. Users write text in a NOTEPAD Activity which they wished to edit
    retrospectively.

2. Users write text in the text editor which they wished to
    transfer to a NOTEPAD Activity.

3. Users write text on their local terminal equipment and wished to transfer to a NOTEPAD Activity with optional editing.

The basic structural unit of the article in the BLEND system was a paragraph (Shackel, 1980). Thus the functionality required was to maintain the paragraph structure within the article as it was transferred in the three situations described above. What was the rationale behind the specification of this functionality? It was that the way that the system was used in relation to the structure of an article should appear consistent whenever the article was handled. This will be labelled conceptual consistency to distinguish it from the consistency recommended for dialogues (for example in, Martin, 1973, Gaines and Shaw, 1985). Moreover this principle of conceptual consistency then affects other operations in the system. Conceptual consistency is associative in the mathematical sense. If the insertion of an end of paragraph in the text editor is to be consistent with the ending of a paragraph when writing in NOTEPAD, which is exactly the same operation as writing a message, then the normal message ending operation has to be the some as the operation for inserting a paragraph in the text editor. That is but one example of the consistency then required across the three categories a) writing formally or informally in NOTEPAD, b) writing in a text editor, c) writing in local terminal equipment. Since the transfer of articles from the local terminal equipment to the host computer was restricted to being file transfer, for functional reasons the concept of an intermediate file was introduced. This enabled a consistency of concept for the movement of articles as diagrammatically represented in Figure 6.17. After lengthy negotiation, discussion and research into the host computer operating system, one character was designated and implemented as an end-of-message instruction and as a paragraph separator (the ASCII code Control Y).

No methodological tool was considered direct enough to measure conceptual consistency separately from other measures. Each route was used for writing papers and the use of local terminal equipment to prepare material for the system subsequently increased.

1. Writing text in a
   NOTEPAD Activity ────────────►

```
 _____
|                                         |
|  NOTEPAD        File    Text Editor      |
|  Activity                                |
|   __    __     __ __    __ __            |
|  |  |  |  |   |     |   |     |           |
|  |  |  |transfer|  |   |  |   |  |        |
|  |  |  |-------►|  |   |──►|  |  |        |
|  |  |  |content |  |   |◄──|  |  |        |
|  |__|  |as file |__|   |__|   |__|        |
|                                         |
|_____|
```

2. Writing text in a
   text editor in the ───────┐
   BLEND system

```
 _____
|                                         |
|  NOTEPAD        File    Text ▼ Editor    |
|  Activity       __ __    __ __           |
|   __ __        |     |  |     |          |
|  |     |       |  |  |  |──►|  |          |
|  |  |◄─|       |  |  |  |◄──|  |          |
|  |__|  |__|    |__|  |__|   |__|          |
|                                         |
|_____|
```

```
        ┌── file transfer ───┐
        |                    |
Local terminal |          ▼
equipment      |  NOTEPAD     File    Text Editor
  __ __        |  Activity
 |     |       |   __ __    __ __    __ __
```

3. Writing text on ──►| | | | | |◄─| | |◄──| |
   local terminal |_| | | | | | | |──►| |
                             | |__| |__| |__|
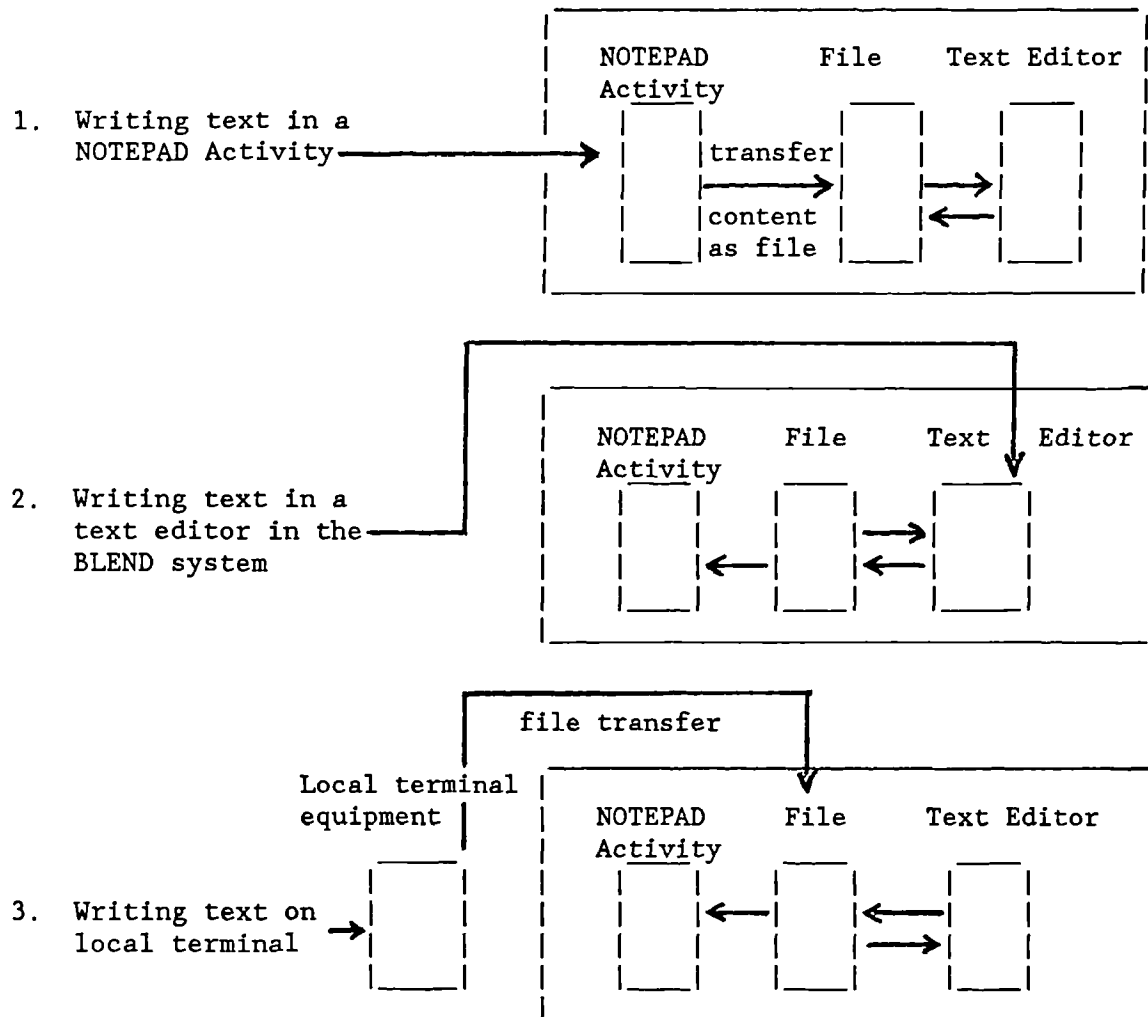
Figure 6.17:   The routes for editing articles.

6.7   Summary

In this chapter we have examined five areas of the host computer
system that were identified from survey techniques of the users. In
the first, the log-in, many problems were identified as a result of
the detailed analysis. This helped train and support users and
provided technical knowledge for autolog-in devices. As a result of
the study, the documentation was improved, by identifying
presentational elements and testing them in a small pilot trial of a
representative sample in an inspection task. This work would have
been continued had there not been other more important areas to
investigate. The experience suggests that detailed analysis of key
areas of dialogue is essential in support of the users, technically,
in training and in documentation aids.

The second aspect studied the users' model of the command structure
and the way in which groups with different experience of computer
systems had two different models. It has been claimed that it is
important to support the models for occasional users and it was
demonstrated that it was possible to do so for differently modelled
command structures.

The third area was one in which the structure was modified to allow
freer movement around the database structure that the users could
access. Data collection showed that this was widely used. Closely
related to the structure was the need to provide the user with a
clear updated overview of the changing contents of the system and a
sense of location within it. A framework for making changes to the
system was presented: cueing, information and instruction. Although
the changes implemented were small ones made mainly in the cues on
the system, there was appreciation expressed for the instructional
facilities. There is need to match and develop further the
informational and instructional elements.

Finally we dealt with a conceptual consistency in designing the user
interface. A small example was provided to show how user reaction
led to extensive modifications to the system operation.

In each of these areas, there has been an initial concentration on
detailed analysis of the system's operation coupled with a careful
analysis of the users' requirements as they were expressed or
experienced through difficulties and requests for help. In
stressing an importance in analysis, our hypothesis is that a
clearer understanding of the interaction and its possible
improvement can be achieved. Where there has been evaluation, the
methodology seems vindicated.

The four areas reflect theoretical issues which have yet to be fully
explored. Analysis of the kind presented here must only be
considered the first step. The log-in has been demonstrated as far
more complex than appropriate for users only accessing one piece of
software on the computer system and therefore without the
opportunity to learn how to participate meaningfully in its dialogue
form and language. How can such a log-in be altered for future
computer systems while maintaining the flexibility and security
desired? If such a log-in cannot be circumvented in future, how can

it best be presented? The difficulties in the latter have been
analysed. They form part of the off-line support that must be
presented to the users in order for them to build up operating
models of the system that are sufficiently close to the system's
operation so as to allow users to carry out their tasks.

The other areas likewise presented theoretical issues, some of which
have been further researched by others, for example moving around
a database structure, and others which have not, for example the
conceptual consistency for handling writing and editing. Is it
possible for two or more groups of users to access a common piece of
software and maintain different models of the command structure?
Where that difference is small, we have demonstrated such a
possibility. The question has to be addressed as to whether or not
this can be extended to, say, command structures associated with the
database structure. The suggestions for 'higher level instructions'
indicate that one group of users might call for a command structure
that could be at variance with that of others. Note that we do not
talk of additional help facilities in the kind of structure
                          whereby naive users have available many
more commands taking smaller conceptual steps than experienced
users. Neither that kind of embedding, nor parallel systems such as
menus as an alternative to commands, form the alternative command
structures that were found to be in conflict. However, they may
each prove to be so. For example, in the move from a menu based
system that does not require a 'return' to be typed after the menu
choice to the commands that do (c.f. some Viewdata systems). The
challenge would be the same as ours, whether or not it would be
possible to arrange for the system to maintain consistent user
models of the command structure.

In two other areas, it was the task that needed supporting; users
wanted to engage in more than one type of communication in one
session and they wanted a conceptual consistency in handling
articles. The theoretical issues in the former remain largely
unexplored and, as we have indicated, require experimentation before
the questions can be focused further. The latter raises some
interesting application as well as theoretical questions. It is
clearly possible to design systems with a task-oriented consistency,
in which the task is handled similarly whatever the context in the

overall system. The solution presented here is one such illustration, albeit on a small scale. When the new proposed international standards on the exchange of documents in, for example, the Office Document Interchange Format, are introduced, questions are raised as to whether text editors and file handlers will themselves be developed to handle the text structures or treat the documents as text files.

Finding ones way around a database continues to be important as an increased number of databases are introduced into organisations throughout the world. Several experimental systems, especially those controlled by pointing or touch, e.g. Bolt, 1979, combine cueing, information and instruction. We have suggested that where this is not possible to implement, nevertheless movement around a database can be facilitated by the introduction of cues, information and instruction consistent with a user model of the database. Some traditional computer programming has emphasised the instructional level without supplying the cues and information to support it, consequently without the formation of a database model. From the starting point of the NOTEPAD software, a development of the instructions is recommended but so also is a maintenance of the cueing and information.

In summary, these areas of research suggest a development of the system to the task-oriented instructional level with information for support and sufficient cues and off-system help to allow a conceptually and operational consistent user model to develop.

No satisfaction rating was directly sought on the usability of the software in the thirty-five month telephone survey. Nevertheless, there were many positive comments, with three members saying that the software was quite easy to use and that they were happy with it. Two others specifically noted the vast improvement over the three years and that they thought their observation was genuine and not just a matter of getting used to the 'nasties'. One 'nasty' remained as a main area to investigate - reading articles on-screen. This is the subject of the following chapter and forms part of the search for increased usability of the CBCS.

7.   READING ARTICLES ON SCREEN

As the general usability of a CBCS increases, more fundamental
problems in supporting scholarly communication became apparent. One
of these problems lies in reading text on screen. That this is
likely to emerge as a long-term issue in usability of a CBCS follows
from the substantive change in attitude toward the positive
acceptability of the absence of hard-copy (see Section 5.3.2).
However, hard-copy was still thought essential by some for close
reading of text. This chapter explores the enhancements made to the
CBCS to increase short-term usability and the theoretical issues in
the development of reading soft-copy on screens.

7.1   Introduction

For many people the expression 'electronic journal' conjures up the
prospect of reading their favourite magazine displayed on a
television screen. It is the very idea of reading text displayed on
a cathode-ray tube screen that seems to them to make the concept
unusable. This chapter contains the fifth aspect of enhancing the
usability of the CBCS, an exploration of reading text displayed on a
screen. Although the concept of the electronic journal that is
under investigation in this thesis is far removed from 'reading
one's favourite magazine on a telly', there is probably much
resistance to reading on-screen. The onus is therefore on the
system provider to demonstrate to a prospective user the system's
usability for the reading task. If, after all the work of
origination and editorial processing the end communication is not
usable, the system as a support for scholarly communication will
have failed.

The question of reading on-screen is therefore considered in some
detail. The chapter describes a developing understanding of the
issues and an experiment to explore some of those raised. As far as
possible, those issues selected have largely been independent of
technological development of the display technology and rely only on
the basic assumption that the computer-based system will have some
kind of screen upon which text will be displayed from a store of
information and that the reader will be able to control that

process. Many of the developments are informed by the difficulties of on-line access to a host computer system.

The experiments were run in co-operation with others who also assisted in preparing software according to specifications in running the experiments and in some of the data analysis. In the second, larger, experiment described, a colleague also introduced one of the factors which is not fully described here. I therefore acknowledge their active assistance in the accomplishment of the experiments, but their conception, design and the interpretation of the results remains the author's responsibility. Throughout this chapter, the word 'article' is used for that type of formal communication used by researchers, of length about 6000 words, in order to avoid confusion between paper as a medium and paper as a vessel for that communication.

7.2   The focus of the usability issues in the reading research

What is the source of the apprehension expressed by those imagining journal text on-screen? We suggest initially that the use of VDU screens is inconvenient for reading, often the equipment is poor and the user expects there to be problems. Secondly terminal equipment is often poorly situated for reading, has poor seating, reflections on the screen and is poorly maintained. The neglect of ergonomic practice contributes to the difficulties (see Cakir et al, 1980). Indeed in experimentation Muter et al, 1982 and Waern et al, 1983, found terminals very poor for reading. Thirdly, the display itself of text is often poor, some lacking, for example, proper descenders on the characters and in general the font, line length, line-character spacing, leading (or interline spacing), inverse presentation, the curvature of the screen probably all contributes to the difficulty for the eye locating and interpreting the screen display as text. There are also distractions in the task, often a moving cursor is present and can take the eye away from its movements on the text. Bevan, 1981, showed an interaction between the reading speed of the subjects and the speed of the cursor that suggested it proved a distraction.

For reasons like this, Gibber, 1982, found that apprehension was expressed before a reading experiment in his subjects anticipating slower reading off the screen than off paper. However he was not

able to show that the difference in reading speed between text on screen and paper was measurable using a simple comprehension task. Kak, 1981, was also unable to demonstrate the difference. However, in the search and identification of small elements of text for an editing-like task both Wright & Lickorish, 1983 and Gould & Grischowsky, 1984, found their experimental subjects taking 30% more time when using text on the screen.

The work of Hansen et al, 1978, suggests a wider set of apprehension and uncertainty. When they found their interactive exam system taking up to twice as long when compared with print on paper they suggested four reasons: uncertainty as to subject matter; uncertainty as to how to control the medium, uncertainty as to what the system will do; and uncertainty about what the system has done. It is this area of confidence in use generated by a high degree of usability that is the focus of our research and specifically the matter of how the text is brought to be displayed on the screen, encompassing the last three of Hanson et al's four uncertainties.

The standardisation of scrolling has had one very big advantage in developing usability of textual computer-based information. The limitation of aids to simply forward,or forward and back,has meant that those with the minimum of computer expertise can approach,with a certain amount of confidence,a text file stored on the computer. This is a learnt skill, however, and unlike previous experience with media for written communication. Previously used media, for example stone, papyrus and paper have shared one thing in common. It is apparent what you do with them: stone one looks at; papyri scrolls you unscroll until you find the correct place; and in paper there are usually pages to turn over. These actions suggest themselves even if the viewer is illiterate i.e. the media carries the general operational message, not the content. The content then determines the specific operations, for example, a telephone directory and a dictionary are handled in a manner different from a novel. So the media suggests the general operational movements required and then the way the content is structured into the medium affects the specific operations for its use. Looking at a terminal screen itself does not inform the user of the general operational movements for handling the text. Thus whatever is to be done as a task

requires more learning than previous media used for textual communication.

If it is a learnt operation, then the greater degree of standardisation that there is will result in a greater degree of confidence in the user approaching the computer. Thus the standardisation of the minimum manipulation of the text as 'scroll forwards' has been advantageous to users of small text files. Moreover observation of the content itself will suggest the specific operation of scrolling, if it is not then apparent how to accomplish it. In scrolling lines of text, the sentences are likely to be broken at the top and bottom of the screen indicating material above and below it. The single vertical column suggests that there is no material to the left or right. Therefore scrolling may be deduced. For larger files, users have previously been accomplishing other tasks throughout reading, commonly editing, and the file is placed into a text editor and then other tools are available to the user. This has required a substantial amount of computer knowledge in the general operating language of the computer system and knowledge of a particular text editor and can be considered an advanced use of textual files.

There is apprehension about reading on screen expressed by those who <u>have</u> perhaps had some experience of scrolling text files on computer. People express their belief in the limitations of the system by such comments as the following: 'But I like to skim through the article first', 'I like to start at the back'. Their feeling is that the system will not allow them to do what they wish.

Finally, there could be uncertainty about what content is stored in the computer. With physical objects one can see the quantity and type of information with one glance, a small window into the content does not in general give any indication of what else there might be.

The research in the chapter focuses on the problem of getting the text for display. What sort of instruction is useful? Misusing the word, we will describe this as 'manipulation' to distinguish it from other software aids that might also be applied. What kind of manipulation aids generate confidence in the users so that they can control the system, anticipate what it has done and enable them to read articles in the way they wish?

7.3   Background

7.3.1   The problem experienced with the host computer system

In order to dispel the initial uncertainties the content and
structure of the articles in the BLEND system was kept as near as
possible to the traditional form and layout so that users might know
what to expect and for what they were searching.   There were however
some changes required to the meta-content by the use of the medium
itself and by the manipulation aids.

Using a host computer to store textual files which is accessed by
telecommunication lines presents particular problems in reading
text.   With the use of scrolling and speeds of transmission of
typically 30 or 120 characters per second, an article of 6000 words
would take approximately 20 or 5 minutes to scroll on the screen.
By placing an article in the structure of the computer conferencing
suite, in the way described previously in Chapter 4, section 7, it
was possible to maintain the paragraph structure.   Each paragraph
was stored in a unique slot for a message, or 'conference entry' as
NOTEPAD terms it.   This allowed the extraction of paragraphs of text
from an article and indeed was one of the reasons why the particular
software was chosen (Shackel, 1980).   However the facilities for
viewing such messages were designed for reviewing past conference
entries, for finding something that one remembers having read,
rather than for reading something new.

The four main features upon which messages could be retrieved were
the author's name, the date of origination, the unique slot number
in the sequence of messages in a conference and all the text
elements could be accessed using a character string search.   In an
experiment by Browne, 1981, it was found that the relative
proportions that these were used were the following: 13%, 6%, 64%,
17%.   In an article, the former two aids were removed because the
article was submitted at one point of time by one author, and the
latter two suffered from the difficulties associated with it being
unseen text and so neither the location of the content could be
easily identified nor the content for the kinds of terminology used
in character string search.

A second difficulty was in the specification of which messages or paragraphs to display having made a selection. This was restricted to a separate identification of one or more in a date ordered list fulfilling some condition in the selection criteria or by a pre-determined numbered sequence, for example: all those containing the expression "reading" would be displayed in a date ordered sequence; paragraphs retrieved by number would be pre-specified either individually or in a series 1, 5, 6 or 12-16.

7.3.2 A small survey of the way in which articles were read

Were the general facilities provided by the system sufficient for the users? When 30 participants were interviewed at the start of the study programme (see Chapter 5 for a full description), they were invited to comment on their usual behaviour in a number of aspects of writing and reading. The one that concerns us here is the answer to the question about the normal reading behaviour of articles.

A few senior and well-supported staff replied that they do not take any initial look at a journal. Their awareness of what was available was maintained by research staff, by exclusive use of abstracting services or by use of an information advisory service. The remainder reported three primary strategies in proportions of exactly a third each:

1. The general pattern of filtering through the stages - Title: Abstract: Results/Conclusions: References: Full Text: Possible photocopy at end of the filtering process.

2. A preliminary filter of Title and Abstract followed by a request for a photocopy for later reading.

3. Skimming through articles for new ideas without particular note of the article's overall content.

Although it is to be noted that the second strategy is contained within the first, it has been differentiated because those who use it never go on to access any other part of an article before making the decision whether to obtain a photocopy. Those using the first category may go on to read the full paper, or as much as they will

ever do so, in the course of their filtering process, or
alternatively request a printout at some stage.

Pugh, 1975, has differentiated both the general strategies for
reading, such as the ones above, and the particular interactions
with the text into five categories: scanning, to locate a
pre-determined visual symbol or word; search reading, to locate a
topic which includes a variety of purposes, for example deciding
whether or not to use the text, or reviewing after reading;
receptive reading, to discover what it is that the author is
conveying; and responsive reading, in which the meaning conveyed by
the text stimulates thinking in the reader. In an observation of
silent reading, he distinguishes between these by the amount of
movement and time taken within the text and its elements. The
analytic elements considered are the sequence and linearity of the
text. The sequence is the order of sections of the text, linearity
of the words, sentences and paragraphs of the text, and movement
defined by backwards and forwards jumps. The defining relationships
between these and the strategies are given in Figure 7.1.

Strategy	Linear	Sequential	Back & Forward Jumps	Time
Scanning - locating known symbols	X	X	✓	Rapid inspection occasional close inspection
Search Reading - locating topic, unknown symbols	X	✓	✓	Rapid inspection with close inspection
Skimming - deciding whether or not to use text - deciding how to approach text - gaining overall impression - gaining advance organisation - reviewing after reading	X	✓	✓ especially within a double page	Variety
Receptive reading - discovering what author is conveying	✓	✓	a little B	Continuous close inspection
Responsive reading - responding	✓	✓	a little B	Close inspection occasionally leaving text

Figure 7.1: Strategies used in silent reading (after Pugh, 1975)

In relation to Pugh's strategies for reading, we can now consider what type of reading task needs to be supported for the three strategies identified in the survey. In reverse order, the third is skimming and so requires aids to go through a text sequentially but not linearly. The fact that a double page is the item which determines the non-linearity suggests a visual task done rapidly over a large visual area. One question is whether the visual area determines the strategy or when if the visual area is smaller, then the same strategy would occur but with non-linearity within the smaller area. Provided that the CBCS can support the speed of display required for rapid inspection, then skimming by Pugh's findings could be supported provided that the answer to the question

is that the non-linearity is maintainable as a useful strategy within a small screen display of typically 24 lines of text. Further the control of the display requires jumping backwards and forwards within the sequential structure of sections.

The second strategy using just a preliminary filter can be supported more easily, because the abstract usually follows the title.

The first strategy involves both skimming to decide whether or not to read the text and non-sequential reading of the text. This may be followed by either receptive reading or responsive reading.

Thus all the demands possible are made of the system in order to maintain existing reader strategies. The reader has to be able to jump backwards and forwards both within the line of the text and sequence of the structure, has to be able to do both rapid inspection and continuous close inspection and may wish to sit and leave the text while working on responses stimulated by it.

The survey raises two questions:

1. Can software aids be so designed that they can support the strategies used by readers of articles?

2. Are these appropriate or are there different and better software aids to provide?

But first we have to address the improvement of the CBCS at the lowest level to support any of the reading strategies.

7.3.3 The enhancement of the BLEND system

Before studying the support of general strategies, the first development was designed to support a local non-linear reading strategy. Readers often return to a previous section of text to re-read it in the light of the following section. Every one of Pugh's structures involve jumping backwards in this way. The limited number of facilities available, setting up a pre-specified list of paragraphs or of selecting single paragraphs, precluded such a strategy except at a considerable number of commands and key-strokes. For example, if reading a sequence of entries corresponding to a section of text, say numbers 10 to 15, one wished

to re-read the previous paragraph, say, paragraph 11 while on paragraph 12, the following sequence of actions were needed:

1. What number paragraph am I on?
2. Subtract one and remember
3. Stop sequence of paragraphs (4 control commands)
4. Specify wish to read paragraphs (2 keystrokes)
5. Recall number and specify (3 keystrokes).

The procedure above seemed to users to be disruptive of the reading process.

The first new facility introduced in the BLEND system to aid reading of papers was built into the Notepad software by Infomedia Corporation at the request of the BLEND management team. On setting up the list of paragraphs to be read, the users could also specify if they wished to use the 'step' function. This allows them to step backwards and forwards through the article. After each paragraph was displayed, the user had the option of going to to the next entry, back to the previous one, repeating the one already displayed (used, for example on reading the paragraph, if they realised a printed copy would be useful) or aborting the reading session. The main differences between this and other usual facilities were the following:

1. the facility to move backwards in the text;
2. the facility to stop the reading process in the middle of a list of paragraphs or an article;
3. the text was displayed paragraph by paragraph instead of stopping when the screen gets full;
4. for recognised terminals, the screen is cleared and the text displayed from the top, this means that the user reads stationary text, not continuously moving text.

At the same time additional functionality was placed into the system to enable the user to specify a page size on their printer and the article could be printed with a running header and page numbers.

Although the step function provided some additional facilities, it did not facilitate the users easily adopting their reading strategy for articles on paper. Consequently in addition to the facilities provided in the Notepad step function, a command was implemented to

allow the reader to access any entry by giving the paragraph number. Thus the user could have 'random access' to the whole article, in a 'read' mode without constantly having to specify that at each stage.

The command to go back to the previous paragraph has the meaning 'go back to the paragraph most recently displayed' and further use of this command displays the entry displayed before that one until the original first paragraph. A string search command was also introduced which searched the first two lines of the paragraphs. Thus is it possible to go straight to "conclusions" for example. Three additional facilities were therefore added:

5. the facility to jump around the text;
6. a command to return to the previously displayed paragraph of text;
7. a string search on first lines of paragraph to enable jumping to named section headings.

This program allowed readers to use reading strategies approaching their normal ones. For those that go through the paper in a routine order, the sections of text may be called up by use of the string search command. The search examines the text on the first two lines of each paragraph thus avoiding finding references to the title in other parts of the text. The facility to go back to the paragraph of text previously displayed may be used when looking at another part of the text and then returning. For example, checking a reference, diagram or figure and then returning to the text from where it was referenced. This might be considered the electronic equivalent of keeping your finger in the page. A summary of the commands provided is shown in Figure 7.2.

Abort	- End running of program
Forward, Return	- Display next entry
Back, Previous	- Display entry most recently seen
Repeat	- Display current entry again
Number of entry	- Display the entry of that number
"Quoted string"	- Display next entry with the title containing the given string
"	- Repeat last string request

Figure 7.2: A summary of the commands provided in the reading program

7.3.4 Modification of the articles in the BLEND system

What the three reading strategies identified have in common is the use of reader expectation about the structure of the article and the various typographic cues which will be available to aid the searcher, whether in finding a section or scanning the headings or diagrams. In the BLEND journal 'Computer Human Factors', consideration of these two aspects, reader expectation of the structure and the use of typographic cues also contributed to the particular editorial policy adopted on the design and presentation of the articles.

The limitation on the number of lines of text visible on a VDU screen (Cathode Ray Tube) was generally about 24 and so authors were requested to break the article into pieces of text limited to this number of lines, thus preventing the text from scrolling off the top of the screen (Shackel, 1983b). These text segments were the entries to which we have referred. Indeed, the Editor's recommendation to the author in this design went further in stating that each paragraph should be considered a separate accessible piece of text to be displayed on a single screen. There was good reason for adopting this recommendation, as an adherence to the normal syntactical structure of English should guarantee a partial conceptual closure in the logical argument of the content. Alternatively, an extension of this reasoning also suggested that if each section in an article was shorter than 24 lines, then several short paragraphs could be displayed on the screen with greater conceptual closure of the section.

The lack of typographic cues such as larger point sizes for lettering in headings and other facilities for easy skimming and scanning and the limited VDU screen size of 24 lines which caused a typical printed journal page to take 2 to 2.5 screenfuls meant that even when the structure of the paper is designed so that readers may access "entries" containing text, they would still now know where to locate parts of interest. The particular initial solution to this was to collect together all the major headings and figures into a contents list to be placed at a fixed point near the start of the structured article. The reader then always had the option of a search strategy based on knowing where this contents list was and consulting it for direction to other parts of the text.

Thus the design decisions by the Editor for the structure of
electronic papers were to start the article with the title,
contents, summary and introduction respectively, followed by the
main body of the article. At the end of the article there were to
be conclusions, references and the author's full address. The start
of this structure can be clearly seen in Figure 7.3, an example from
the LINC Members Manual.

Computers and People
by
A. Smith
Department of People, Computer University.

(3) SUMMARY

3   The problem of
....
....

(4) INTRODUCTION

4   As a result of
....
....

Figure 7.3:   The structure of the start of an article in the Computer Human
              Factors Journal (from Shackel, 1983b)

    One of the main impeti for the development of software to enable the
reader to move more easily around the text came from a consideration
of how readers might want to access references or diagrams.

Using paper there are at least two strategies for handling pointers in the text for references and diagrams, and several ways of presenting these pointers. For example, some journals use footnotes with the text marked with numbers superscripts; another use of numbers is in an ordered sequence of references numbered at the end of the article and marked in the text as superscripts (e.g. Scholarly Communication) or as a number in square brackets (e.g. The Computer Journal). Another strategy (e.g. Behaviour and Information Technology) is to have an alphabetic list of references at the end of the article and the text marked with the author and year of publication with an additional lower case letter when the year proves insufficient identification.

Given this variety of pointing devices it seemed desirable to stick with whatever would be familiar to most readers. The electronic journal Computer Human Factors is concerned with the study of development and design of hardware and software to make systems more usable, the interaction between computer based systems, people and organisations, and the psychological attitudes and responses of users to systems. Already in this area there were seven main journals available as printed publications. These were:-

Applied Ergonomics
Behaviour and Information Technology
Ergonomics
Human Factors
IEEE Trans. Systems, Man and Cybernetics
International Journal of Man-Machine Studies
Journal of Applied Psychology.

Six of these journals point to the reference by author and date, for example ("Shackel, 1982") and the other by a numbered sequence in square brackets. There is a reference list at the end of each article, but this is organised differently in the journals. The six have reference lists which are essentially organised alphabetically with various differences (and inconsistencies) in the numerical ordering of the year of publication and its interaction with an alphabetic ordering of co-author(s), for example, in some "Poulton and Brown (1968)" might precede "Poulton (1969)". In the other case the numbered sequence may be in numerical order, or alphabetic order

or broken into separate numeric lists within topics with headings, e.g. "Mathematic Theory" and "Applications".

Besides the Guides for Authors there have been many publications recommending the different systems, see for example Royal Society of London (1974), ASTM Committee on Publications (1973), Chemical Society (1961), American Institute of Physics (1973), Institution of Mechanical Engineers (1973) and Karger (1981). The latter, in particular, recommends only the two reference citation systems found in the journals in Computer Human Factors field. The reference lists should be an alphabetic ordering in which single authorship and chronological order take preference over the alphabetically ordered co-authors. It was therefore decided as early editorial policy to recommend authors to adopt the author and date reference citation with an alphabetic list and references.

There is less variety in the pointers to the figures, diagrams and tables, and by far the most frequent is to have two independent sequential numberings of figures and tables. However, there is great variety in the numbering system and actual form of the pointer. The text is usually marked with a reference to the figure or table, for example "(see Figure 4)".

Nowhere, however, were seen more clearly the limitations of a enforced linear structure and a relatively slow display speed in an electronic journal than in pointing to the references and figures in this way. Consider the task of the reader when a pointer to a reference or figure is found in the marked text:

1. Note details of pointer.
2. Display contents list to note where reference or figure may be found.
3. Display reference or figure.
4. Search for reference or consult figure.
5. Return to section of text.
6. Possible return to reference or figure for further information.

Putting aside, for a moment, the complex nature of the commands necessitated by the early versions of the software in these circumstances, it will be readily apparent that the memory load is high and that both the pointer and the section of text have to be

remembered accurately. Consider the difference between this and using the 'keeping a finger on the page' strategy with printed pages where the reader can flick between two sections of text.

A change of the pointer in the text to include the entry number in which the reference or figure is to be found, the use of a single entry for each reference and the command to return to the text previously displayed reduced the searching and memory load on the reader considerably. Thus each reference from Computer Human Factors issue no. 4 appeared as, for example, "(Pullinger 1984 [E37])", and each figure as "(see Figure 4 [E12])". The task for the reader has now been reduced to -

1. Note details of pointer.
2. Type number to display reference or figure.
3. Type B for Back to return to reading place.
4. Typing a further B will retrieve the reference or figure again.

As applied to references this change can be seen to be a combination of the two recommended pointing strategies, numbering and the author and year of publication. The latter has been maintained for its inherent additional information given to the reader.

Thus to review the usability issues:

1. The Editor decided to keep as far as possible to a traditional article format,
2. however the article was broken into paragraph lengths of text with the lines displayed on the screen numbering less than 24,
3. and a contents list of the sections with the corresponding paragraph number was placed in a constant position;
4. the software was enhanced to facilitate the familiar strategies of reaching on their almost normally structured text,
5. and to access the contents list, figures and references,
6. and in so doing, the text was modified to make reading easier in relation to the program used.

The limitation of only being able to display a small section of text, a paragraph, led to the following:

- information on the set of paragraphs able to be accessed (contents list),

- information on the location of a single paragraph to be accessed
  (reference or diagram),
- functionality to extract single paragraphs and move freely among
  them.

7.3.5 Evaluation of the changes

The use of the programs for reading was discretionary and,
therefore, the manner in which sections of text were accessed and
the commands given, reflects on their usefulness and usability.

The facility was used in this manner design and Figures 7.4a to 7.4d
describe some examples of observed behaviour with hypothesised
strategies. These examples were taken from Computer Human Factors
and were recorded by a program for collecting data for later
evaluation.

The different strategies need different commands and this was
reflected in the type of command used. For a largely sequential
reading (Figure 7.4a) the reader stepped through the article using
the Return key or 'F' for Forward. The reader accessing the results
and figures in the article described in Figure 7.4b used the
character search string command e.g. "results" and "figure" followed
by " to give repetition. Jumping to different sections in the
example in Figure 7.4d was largely accomplished by use of the
command giving the entry number to access the section and contents
and stepping through using the Return key or F. The example in
Figure 7.4c, although only 9 steps, shows the use of all commands
except giving the Entry number.

We may summarise this observational evaluation of this program suite
by saying that the readers of Computer Human Factors made use of the
flexibility to skip around the text and used appropriate commands to
do so.

Entry numbers
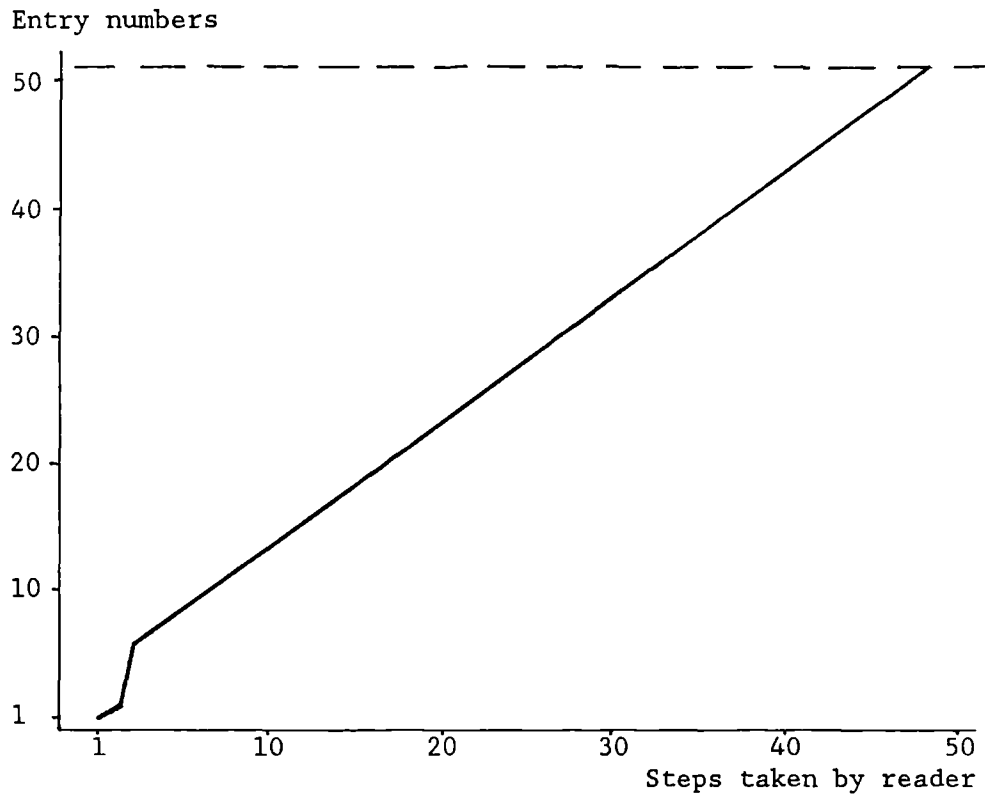
51 Entries in article (Hartley & Frase, 1983) 8m 29s taken to read.

Order of Reading

1	
2	Contents
6	Skipped summary & introduction
7	
8	
:	
51	Address

48 steps

Hypothesised strategy: to skip summary & introduction but skim the rest sequentially and completely

Figure 7.4a: Example 1 of using the reading program on BLEND

50 Entries in article (Cohill &
Willeges, 1984) 4m 0s taken to read.

Entry numbers

Order of Reading

1	
2	Contents
3	Summary
24	Results & discussion
25	"
26	Reference to figure 4
28	Figure 4
31	Figure 5
32	Reference to figure 6
33	Figure 6
34	Reference to figure 7
35	Figure 7

12 steps
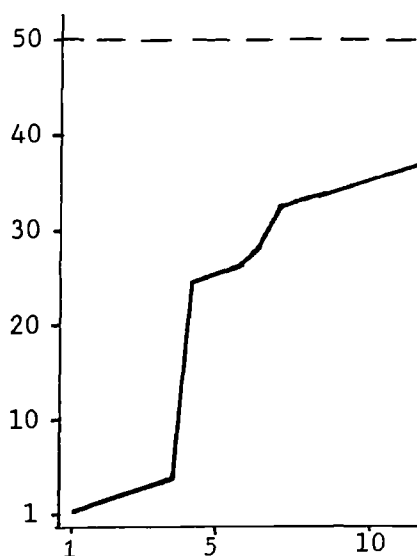
Hypothesised strategy: read summary, start reading "interesting" result but
give up (not all text in this section was read).
Just step through figures instead receiving text
references to figures unintentionally.

Figure 7.4b: Example 2 of using the reading program on BLEND

Entry numbers

45 Entries in article (Morrison &
Green, 1984) 7m 10s taken to read.

Order or Reading

2	Contents
3	Summary
36	Conclusion
3	Summary
4	Introduction
5	"
6	"
6	"

9 steps

Steps taken by reader
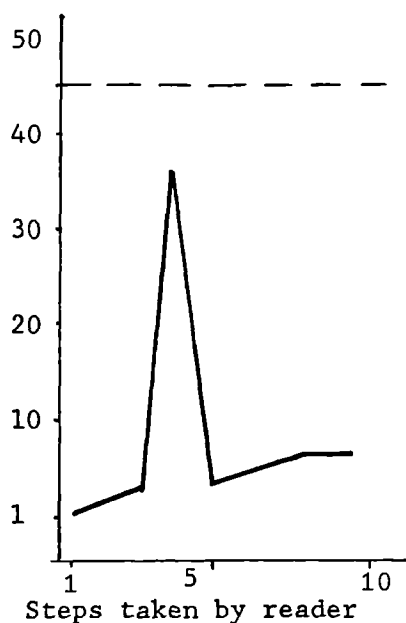
Hypothesised strategy: Read summary & conclusions first then start on rest
of text. Decided it was not worth reading after the
introduction.

NB In this early article entry 6 is greater than 24 lines, the repeat 6
was probably to re-read the top 3 lines which vanish after you "Strike
CR to continue".

Figure 4c: Example 3 of using the reading program on BLEND

47 Entries in article (Shackel et al, 1983) 4m 29s taken to read.

Entry Numbers

Order of Reading

1	
2	Contents
1	Title
47	Authors' addresses
2	Contents
23	Progress Overview
24	"
2	Contents
9	British Library
10	Electronic Journals Project
11	Next section
2	Contents
43	Conclusion
44	References

14 steps

Steps taken by reader

Hypothesised strategy: Find out where interesting bits are by returning to Contents and finding the number. Once at the section step through it until you hit the next section or have remembered how many entries to read from the Contents.

Figure 7.4d: Example 4 of using the reading program on BLEND

Figure 7.4: Examples of using the reading program on BLEND
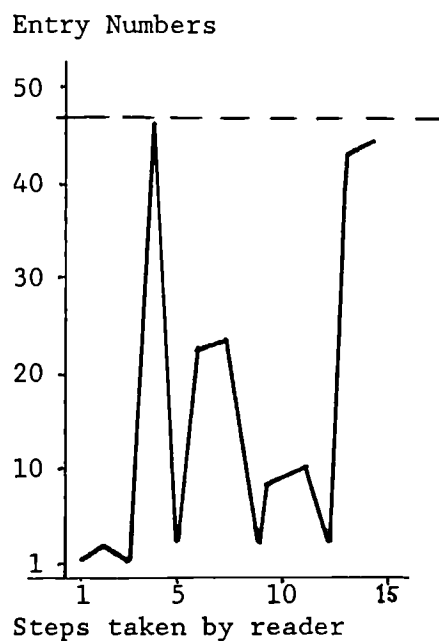
7.3.6 Discussion

The development was instituted with one fixed element, that the text should be modified as little as possible. But one might question this assumption in the light of Baron's analysis that computer mediated communication lies between writing and speech, (1984). It is similar to writing in that there is text pre-stored and available, but similar to speech in that only a small part of it exists at any one time recreated from codes stored elsewhere. In its reception, therefore, the communication may be made more usable by modifying it according to some techniques used in transmitting information in speech and especially, in its telecommunications form, in radio.

In the UK, Radio Four has developed a particular strategy for transmitting news items. They first announce all the major headlines, then give the one-paragraph accounts, then a sequence of more in depth studies of each, perhaps also bringing in additional minor news items. In other words, they have developed a successively more developed account of the news, appropriate to the medium. The listener may switch off when the required amount of detail is reached. It has been suggested similarly that, due to the restricted visual space of present CRTs, the articles could have a succession of developed summaries. First the title, then the summary or abstract followed by a summary of each section followed by the full-text of each section (Line, 1981). Additional textual matters would be added into the content to aid the reader. The approach adopted hitherto has been one of considering the complete text as existing and new ways of manipulating the text onto the screen will be the aid required for readers.

In this suggestion of text restructuring with the increasing filling of summaries, it is claimed that we cannot handle the text as an existent piece. Thus two viewpoints are represented which are summarised in Figure 7.5:

1. That the content is modified by adding to it and few software aids are used,

2. that the content is unchanged and that new software aids are added.

The former implies that the operational use of the system could be simplified and the latter that more flexible operations are possible.

```
        View 1                    Text                    View 2
  ┌─ ─ ─ ─ ─ ─ ┐                                    ┌─ ─ ─ ─ ─ ─ ┐
  │ ┌────────┐ │                                    │ ┌────────┐ │
  │ │Content │ │  ◄─────────────────────────►       │ │Unchanged│ │
  │ │added   │ │                                    │ │content  │ │
  │ └────────┘ │                                    │ └────────┘ │
  │            │     Software aids for manipulation │             │
  │ ┌────────┐ │                                    │ ┌────────┐ │
  │ │Aids    │ │  ◄─────────────────────────►       │ │Software │ │
  │ │unchanged│ │                                    │ │aids     │ │
  │ └────────┘ │                                    │ │increased│ │
  └─ ─ ─ ─ ─ ─ ┘                                    └─ ─ ─ ─ ─ ─ ┘
```
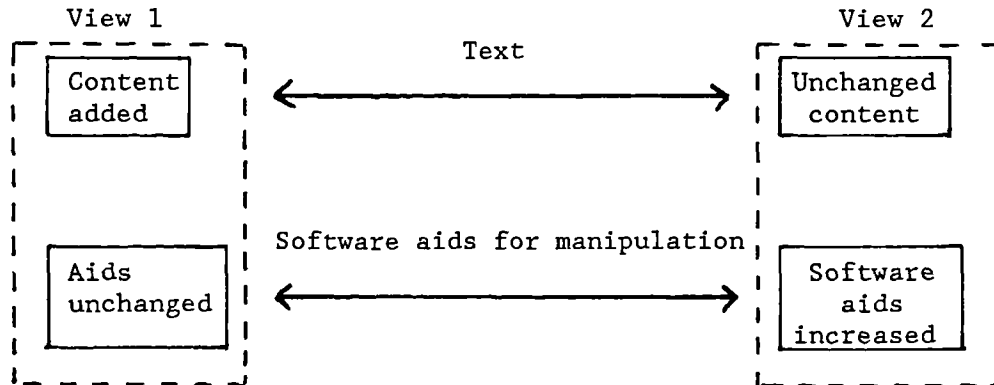
<u>Figure 7.5</u>:   <u>Two views on the development of reading text on-screen</u>

Moreover Line, 1981, claims that the redesign would result in easier browsing of the text. An opportunity to test this came in a small experiment in conjunction with another research centre, which is described in the next section.

7.4   <u>A pilot experiment comparing manipulation aids with text changes</u>

7.4.1   <u>Background to the experiment</u>

In response to the suggestions of Line, 1981, the Primary Communications Research Centre, University of Leicester were awarded a grant to test the feasibility of providing the readers of electronic journals with the means of some form of analogue of the browsing process. It was proposed to do this by providing an intermediate stage between the basic information carried by an abstract and the full text of an article.

The author was invited to be an adviser on the experimental design and when the Project Head withdrew to move to another job, he jointly took over the supervision of the project. The responsibility for the experimental design, the running of the experiment, the data analysis and the interpretation given here were therefore the author's. The restructuring of the text was undertaken by the research work at the University of Leicester. It is fully reported in Hills, Hull and Pullinger, 1983. This led to the

introduction of a factorial design which was intended to test
whether restructuring the text or provision of aids to jump around
the text were better for the task of browsing envisaged.

7.4.2 Experimental design and methodology

The material prepared for summary was from the set of articles on
the BLEND system. Each section was summarised and placed in a
sequence at the start of the article so that the total linear
sequence of the article appeared as: Title, Contents, Precis of
Abstract, Precis of Introduction,......, Abstract,
Introduction,......, References. Thus it had the content structure
as illustrated in Figure 7.6.

---

1. Title

2. Contents

Precis: 3. Abstract 4. Introduction 5. Method .... 10. Discussion

Full Text: 11.Abstract 13.Introduction 18.Method 28.Discussion

.

38. References

39. Full address of author
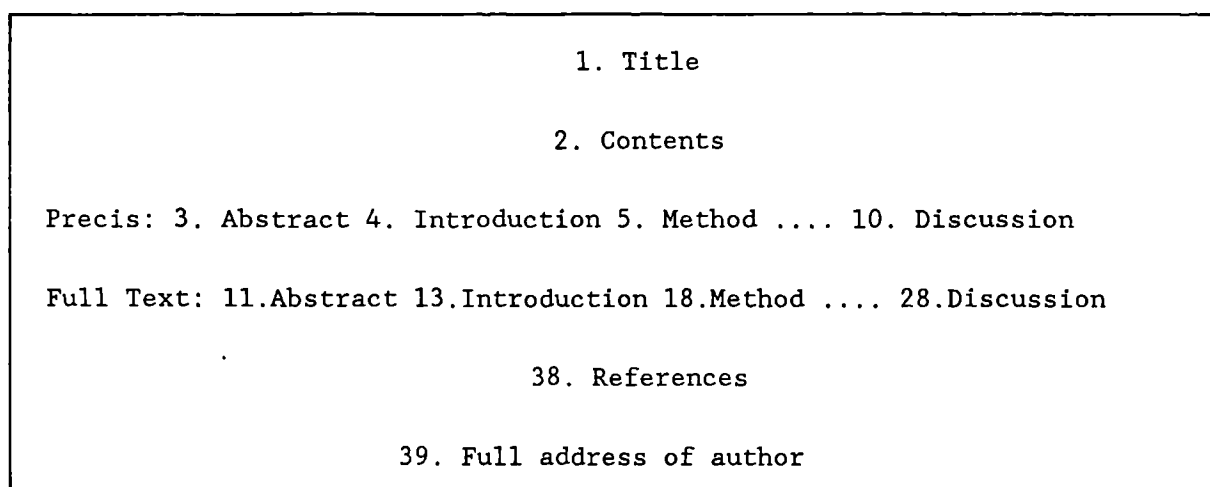
Figure 7.6:   Content structure of re-structured article

Sections from one of the examples used is given in Appendix F. The
text re-structured in this way and the original non-restructured
text formed two of the conditions in the experimental design. The
other two conditions were the presence and absence of software aids
designed to test whether jump facilities would be beneficial.
Accordingly two closely related aids were provided. Both had the
function to step forwards and backwards and one also had the
function to jump around the text by specifying the number of a
paragraph. Thus four conditions were obtained:

Straight text: Articles as provided for Computer Human
                 Factors journal in BLEND.

Text with Summaries: Articles with an additional set of
                      section summaries before the full
                      text.

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Straight Reading: The provision on BLEND for stepping back and forth through an article, paragraph by paragraph.

Facility to jump   The addition of a provision around article: to jump to any numbered paragraph as well as stepping back and forth along a sequence of paragraphs.

These were arranged in a 2x2 design (see Figure 7.7).

2 x 2 Design	Facility to jump around article (READA)	Straight reading (READB)
Straight Text	1	2
Text with Summaries	3	4

Figure 7.7:   The four Conditions

The Subjects

The following locations agreed to encourage their staff, M.Sc. Students and Undergraduate Students to log-in to BLEND, access the papers and be prepared to act as experimental subjects:

- Leicester Polytechnic Department of Maths, Stats and Computing.
- University of Birmingham Engineering Production M.Sc. Course.
- HUSAT Research Centre, Loughborough University of Technology.

The Task

12 computer human factors papers were made available in two Projects in the BLEND system. A random sequence of pairs of conditions was generated, and subjects were assigned to a pair of conditions in this sequence as they arrived to take part in the experiment. If possible, each subject was to experience two different conditions.

Subjects were told that the task would take about half an hour
(although in fact there was no time limit, so that subjects could
carry on reading papers if they wished to do so). The transmission
speed used was 1200 baud.

Before subjects started reading, the experimenter logged in to the
computer and to the project condition assigned to each subject.
Subjects then sat at the terminal, where a menu choice of papers was
displayed, and were asked to select an article which they might find
of interest to read (Figure 7.8). They were given an instruction
card showing how to read the article using either the READA or READB
program, depending on which they had been assigned, how to select
another article, and how to abort the program if they wished to stop
at any point.

Project: P.C.R.C. experimental project A

Open Membership

1. Pearce BG - Ergonomics and the terminal junky.
2. Reynolds CF - Was 'John Smith' a farmer?
3. Wright P - Skips and steps in searching an index.
4. Hartley J, Rogers A, Trueman M; - Qualifying verbal quantifier
5. Dodd WP et al - Prototyping language for text processing.
6. Edwards E - REFLIST: A computer-supported bibliography.

Figure 7.8:   Extract from the menu choice of papers

A two-part questionnaire was presented to subjects each time they
selected an article. The first part of the questionnaire appeared
before the title and contents list of the article they had chosen,
and the second part appeared at the end of the article. Appendix F
contains the text of the questionnaire which accompanied the 'jump'
program (the questionnaire accompanying the 'straight' reading
program was identical except that the Return command was not
available.)

Having ensured that subjects understood their task and the
instructions on the card, the experimenter left them alone for
approximately 20 minutes to read the article they had selected.
After this time, the experimenter returned, and if the subjects had
finished reading at least one article under that condition, asked if
they would change to another condition. If the subjects agreed, the
experimenter logged into the appropriate area, gave the subject
instructions for running the other read program (where appropriate)

and again left the subjects to read the article(s) of their choice. After completing this task, subjects were paid and the experimenter recorded any additional comments they made about the task.

Method of Analysis

Four analyses were to be made:

- Content analysis of expectations as expressed before reading the article.

- Content analysis of comments as expressed after reading the article.

- Analysis of number ratings given in comments.

- Analysis of suggestions.

These provided initial data for:

- Trends for before and after reading of the article in content analyses.

- 2-way analysis of variance on number ratings in the 2 x 2 design.

- Recommendations based on suggestions as to possible improvement in design of articles and software aids for reading on-line.

7.3.3 Results

Twenty-three articles were read by 13 subjects (7 male, 6 female) in the 3 locations. Due to the randomisation of presentation order the number in each condition was as follows (Figure 7.9):

	READA	READB	
Text	7	6	READA has 'jump' facility
Text with summaries	4	6	READB has no 'jump' facility

Figure 7.9: The number of trials in different conditions

There was no significant difference found in a 2-way analysis of variance in time spent reading the articles, nor any trends that would indicate that there might be so with more data (see Figure 7.10).

	READA	READB
Text	14.44	14.28
Text with summaries	17.22	14.20

Figure 7.10:   Mean times in minutes and seconds

The reasons why similar amounts of time (on average) were spent reading text as provided and text with additional summaries was discovered by analysis of how much of the article was read. In the former condition, all subjects except one read all the article straight through. When summaries were provided before the full text then all subjects (except one) read all the summaries and then 2/3 of the readers aborted reading the full text before reading the end.

Text Only

13

Number

of

Readers

0   Amount of full text read

Text with Summaries

10

Number

of

Readers

0   Summaries   Full Text   All

Amount of text read
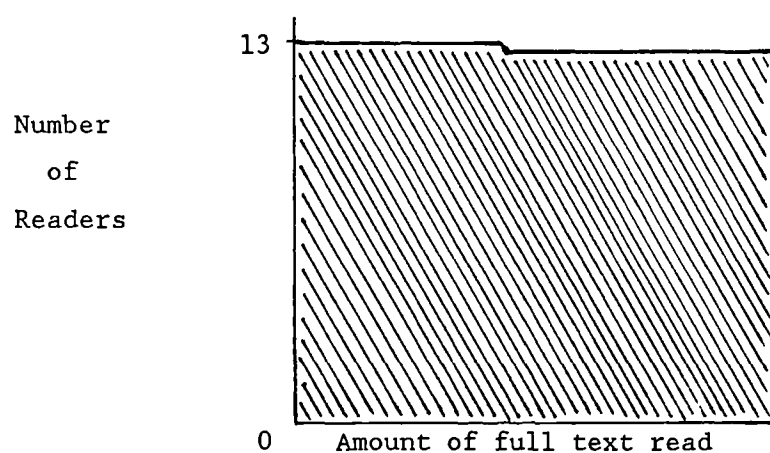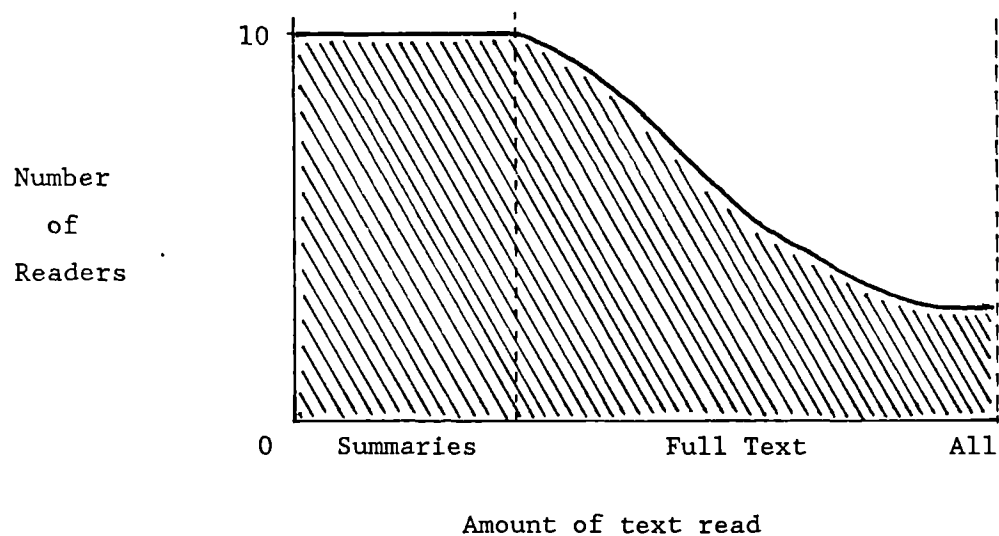
Figure 7.11: Proportion of text read by readers in the two conditions

The subjects subjective rating of the different structures of the article were also analysed and there was little indication of a preference towards one (see Figure 7.12):

	READA	READB
Text	7.71	7.50
Text with Summaries	7.75	7.00

Figure 7.12: Mean subjective ratings (0-10) for structure

The appended comments to the question "Did you find the structure of the paper easy to understand and helpful relative

to the content?" related to the content, general structure of the article and the summaries. Comments about structures and summaries are presented in the following figure (7.13):

General structure of articles

- Contents list helpful
- Prefer longer introduction and conclusions
- Liked sectioning of article with headings
- Idiosyncratic layout of paragraphs.

On the difference between 'text' and 'text with summaries'

Full Text Only: Well laid-out and presentation
                      reasonable (3)

                      Structure clear and less 'bitty' than
                      having summaries

Text and Summaries: Liked having summaries - useful (3)

                      Repeating tables in summaries
                      confusing

Figure 7.13:   Comments from question on structure

The subjects did not find the job of reading too onerous and the following table (Figure 7.14) illustrates that about half found the content of direct interest to their work.

		NUMBER
Those not expecting interest and not finding it	(NN)	7
Those not expecting interest and finding it	(NY)	2
Those not sure and not finding interest	(?N)	4
Those not sure and finding interest	(?Y)	3
Those expecting interest and not finding it	(YN)	2
Those expecting interest and finding it	(YY)	5

Figure 7.14:   Number of papers read which related to work   interest

Even among those that expressed that they did not find anything of direct work interest, most noted in the previous question one or points which they did find interesting.

The subjects all seemed willing (time permitted) to read more than one article on-line and seemed keen to do so even returning to the place of experimentation for this purpose. This observation comes from the experimenter who received the following comments as subjects were leaving (Figure 7.15):

- Several subjects said that they found the articles interesting and worth reading.
- Two subjects said that they did not like reading on a VDU from previous experience.
- One subject noticed a lot of difference between conditions when changing from Full Text only to Text with Summaries.
- Several subjects said that they would like a facility to jump around when they did not have it (and sometimes even when they did).

Figure 7.15:   Summary of comments that the experimenter received

The comments given to the experimenter about a facility for jumping around were reflected in the subjective ratings requested in response to the question "Did you find the commands that were available to help display the text easy to use?" (see Figure 7.16).

	READA	READB
Text	7.57	6.83
Text with summaries	7.25	5.60

READA has 'jump' facility

READB has no 'jump' facility

Figure 7.16: Mean subjective ratings (0-10) for display command

The difference here as analysed by a 2-way ANOVA, was just outside obtaining significance at the 0.05 level. This indicates that there may be a trend towards expressing the need for a 'jump' facility, especially where the text also has summaries.

A general question "What changes would you make in order to aid viewing papers on-line?" received answers which were divided into three areas: article design and format; presentation of articles; and manipulation and commands to read papers (see Figure 7.17).

Articles design and format

It was helpful to have articles divided into discrete chunks.
Keep articles short.
Add pointers to other parts of text where applicable.
Have consistent layout of paragraphs so as not to disrupt flow of Reading.
More details list of contents.

Presentation of articles

Keep pages less than one screen length (3) [Note: one or two paragraphs ran over a screen].
Have text of a narrower width (more like a column) (2)
Have screen-clearing between each part of text so more like a page Display (2)
Have typing better spaced out on screen (2)
This particular CRT difficult to read
Reading papers on the screen seemed satisfactory.

Manipulation and commands to read articles

Part of screen optionally reserved for menu list of commands (4)
'Flick through' facility - fast backwards and forwards scrolling (3)
Screen stopping facility when text looks as if it might go off screen
Better access to locate beginning and end of article.

Figure 7.17:   Comments in answer to Question "What changes would you make in order to aid viewing papers on-line?"

Summary of Results

The pilot trial was run satisfactorily and brought out some interesting facts. Readers spent on average about the same time on articles whether they included summaries before the main text or not. It was discovered that this was because they did not read all the full text after having read the summaries. Subjects found the articles of interest, half of direct interest to their work and others indirect points of interest. They were quite willing to read full articles on-line.

No particular preference for either condition was expressed, some commenting that they found the Full Text only condition well laid out and clear, and others liked having the summaries, finding them useful. One indicant in the experimental trial was the preference for having a facility to jump around the text, which seemed of particular importance when summaries were available. Another facility suggested was a fast scroll backwards and forwards but implementation is at present limited by the technology protocols of on-line transmission to many different types of terminal. Other

comments indicated ways that the experiment might be tightened and extended in future.

7.4.4 Discussion

There were limitations in the number of papers available to read, in the number of subjects and in the range of options able to be studied. Limited though this study was, three features are noticeable. The fact that two thirds of those who had summaries did not read the full text indicates that summaries have a value independent of reading times and preferences. This gives some support to advocates of synopsis journals and suggests that for most electronically accessible texts a short version might be adequate for the majority of users, provided that fuller text was available if called for.

Secondly the enthusiasm of many of the subjects was noted by the experimenter and, although this could be attributed to the enthusiasm that might attend any novel experiment, there was a surprising lack of antipathy towards the experiment that might have been expected to be attendant on an experiment involving the viewing of text on screen.

Thirdly, although the actual figures of times and preference ratings are inconclusive, the comments of users indicate that considerable modifications and improvements could usefully be made when articles are prepared for use on-line. Further, although the ratings are statistically inconclusive, there was a trend towards having the 'jump' facility rather than summaries in the text.
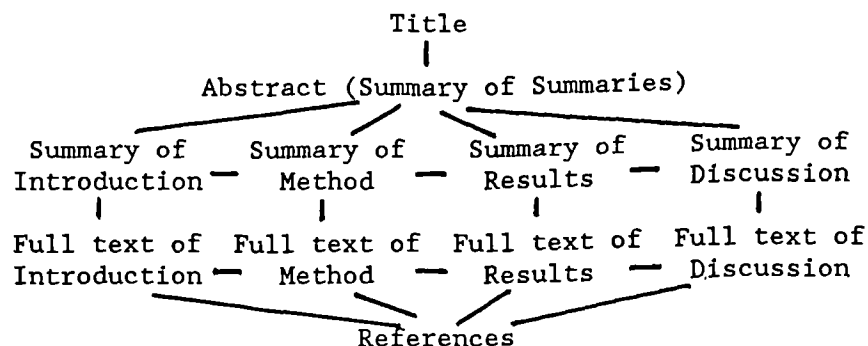
Figure 7.18: Structure as envisaged by Line, 1981

Although the summaries would be considered as altering the structure (Figure 7.18), it can only be so if the aids enable freely moving

between levels as well as within levels. This became effectively possible only in the condition of text with summaries and using the reading program with 'jump' facilities. Although most users seemed to adopt a 'Radio Four' technique in the text with summaries condition, observation of the subjects and the lower rating to the general usability of the manipulation commands suggested that some subjects were trying to move between levels. If so, then the aids that are available modify the way in which users access and read the text.

The results and comments indicated that more experimentation was worth doing with the inclusion of other conditions suggested by the subjects.

7.5   Development of a framework for reading research

In the developments on the BLEND system and experiments we have taken two starting points: the logical linear structure of the article as is familiar to the communicants and the paragraph structure of the text. For usability of these, in order that the readers could use familiar search strategies, we added some manipulation aids. But in the experiment three subjects suggested a 'flick' through facility, perhaps by fast forward and backward scrolling. The development of the particular manipulation aids therefore needed testing against some other possibilities, fast scroll back and forward being one of them. The work 'flick' suggests the operation with pages of holding a block of pages and letting them go in rapid succession so that a small amount of the page is seen at an observed speed of about 3-4 per second. Indeed, one of the cries heard about the lack on computers is precisely that there are no flicking facilities. But would an operation designed exclusively for print on pages be useful in the computer environment?

The appropriateness of manipulation aids required further exploration. We therefore raise the first area for research consequent upon the studies:

1.   Development of readers' manipulation aids for displaying text.

Present printed text reading habits include jumping around the text, allowing parallel entry into it by referring to two distant pages,

perhaps for a diagram, note or reference and flicking through the pages. On the electronic medium the manipulability may vary from zero (the reader receives the particular generated sequence of text) to a high level which would enable the reader to display easily any part at any time. What kind of manipulation aids are appropriate for reading journal articles?

In the development of the reading program, we saw how it was advantageous to modify the pointers to the figures and the diagrams, and the use of the contents list. Was this enough, could more be done? Bhasin, 1983, explored the provision of more information to the reader as to what was available in the article and the paragraph numbers to where those sections were placed. This was done by providing either a contents list at the start of the article, a summarised contents list at the end of every section, or a contents list available at every point upon request, with an arrow marking the position of the reader in relation to the sections of text. The introduction of an index at the end of every section negatively affected performance and the provision of information at every point upon request increased the confidence of the users, although it was not well-used. This suggests that more work is needed on removing the uncertainty of use and giving the reader locational information both to the content and for the reader in relation to that content. A second area was therefore identified for further research:

2. Development of cueing, signposting and routing to other parts of the text. These are the aids to the reader to indicate the structure of both the system and the particular article. They may include typographic cues such as headings, bold print and colour as well as references to other parts of the article and indexes as to the choice of reading routes at any point.

Following Line, 1981, an experiment was carried out into adding summaries into the text with the aim of re-structuring the information package from a linear full text sequence to one where the reader could first access the summaries. In the limited way in which this was established, there did seem to be benefit for a certain amount of information packaging.

Viewdata systems, such as British Telecom's Prestel, offer a structure for offering an increasing amount of text and diagrams to

the information-seeker as they descend the levels of the
relational-net. In this kind of system, it is necessary to drop the
starting point of maintaining the linear structure of the article,
owing to the system not able to accommodate such a large piece of
text. The basic linearity in Prestel is restricted to 26 frames of
information of one quarter the typical paragraph in BLEND which in
turn is about two fifths of a typical A4 page of type. This defines
another area for research:

3. Development of the structure containing the textual content.
   This may range from the serial structure used in print to tree
   structures for browsing, or free 'blob-like' structures where
   parts of the text are not logically linked in the storage. The
   development of these will reflect the writer's conception of how
   component parts of an article are linked.

The concept of a paragraph as being the unit to be displayed on the
screen was an initial decision in the BLEND system and one that
seemed supported by comments in the pilot experiment:

"It was helpful to have the article divided into discrete chunks."
"Have screen-clearing between each part of the text, so more like a
page display."

The hypothesis for this was that displaying one or more complete
paragraphs would aid understanding of the text and manipulation of
the display of the text. It would help understanding because the
display contains a partial closure in the logic of content as well
as the syntactical structure of the text. Since all the sentences
relevant to one point would be displayed on the screen, there would
be no difficulty in having to read split sentences over different
screens. The manipulation of the text would be improved because
each block should be an entity in its own right and could,
therefore, be called upon from other parts of the text for
clarification of understanding, or maybe the manipulation program
custom-designed for reading in an individual's preferred order.

On the other hand, there is difficulty in locating where one is in
relation to other items of text and where to go:

"Add pointers to other parts of the text where applicable."
" More detailed list of contents."

and evidence from Bhasin, 1983, that with the availability of more information the subjects felt more confident. One way that readers normally obtain information about the structure of the article, hence where other sections of the text are in relation to them, is by the headings. A normal journal article double spread contains several headings which give orientation in this way (Waller, 1979). A contra hypothesis could then be raised, that filling the screens with text would aid prediction and orientation. Prediction, because each page would consist of an equal amount of text so that estimates could be made more easily of aspects such as how far one was through the text, and whether or not the next section was in two or three pages time. Orientation, because more text was visible and therefore more context and an increased likelihood of a heading being displayed on the screen.

Research was then considered appropriate for an examination of whether paragraphing the text had been correct. Other suggestions were also forthcoming on the actual format of the text displayed:

"Have consistent layout of paragraphs so as not to disrupt plans of reading" [i.e. paragraphs of same length]
"Have text of a narrower width" [i.e. shorter line length]
"Have typing better spaced out on screen" [i.e. increased leading].

A fourth area for study was therefore identified:

4. Development of presentation of text in relation to the content. This is the traditional task of a sub-editor, in examining and deciding on the content and appearance of a page, in font, amount of white space, headings and other aspects of style.

There was a small amount of evidence for a modification of readers' strategies according to which condition the subject was using. If, the research on appropriate aids, cues, structures and displays for the electronic medium was to show a difference to those used for print on paper then it is to be expected that strategies will to some extent be modified. How they are modified and to what extent they might be taught provides a fifth area for study:

5. Development of readers' strategies appropriate to the electronic medium. In response to changes in manipulation aids from those

normally used for paper, the readers' strategies are also likely to be modified.

The addition of summaries into the content of an article, although not modifying that which the author had written, suggests that the electronic medium may also handle certain types of content more effectively, i.e. that short summaries may be more appropriate than long logical expositions. We know that the type of material affects the reading strategy. If the range of reading strategies is restricted to a smaller sub-set that is supported by the system, there may well be material more suited to the machine than others. The types of material might also be affected by the limitations of the display, consider for example, the complex annotated footnotes in legal publishing. For a number of reasons we may suspect that certain types of text may prove to be more appropriate.

6. Development of the content of the text appropriate to the electronic medium. The author may wish to modify normal semantic and syntactic structure if the text is to be viewed on-screen.

These six areas formed the basis for establishing the experiments into making on-screen text more usable for the reader and are listed in Figure 7.19.

1. Development of readers manipulation aids for displaying text.
2. Developing of cueing, signposting and routing to other parts of the text.
3. Development of the structure containing the text.
4. Development of presentation of text in relation to the content.
5. Development of readers' strategies appropriate to the electronic medium.
6. Development of the content of the text appropriate to the electronic medium.

Figure 7.19   The six areas identified for further reading research

7.6   An experiment into reading journal articles on-screen

The pilot experiment and analysis of results led to consideration of six areas for research. In those areas some specific questions had already been raised:

1. What kind of manipulation aid is it appropriate to give the reader for handling this kind of text?

2. Was the intuition to handle the text in discrete chunks in paragraphs correct?

3. Would another experiment with tighter control and larger numbers of subjects confirm the results in the pilot study of the efficacy of aids or of summaries?

An experiment was proposed that would study these questions with two constraints:

- the experiment was able to be completed within a year.
- the aspect studied should make the maximum input to the usability of an electronic journal.

The first constraint implied that studies focusing on reader's strategies were not able to be implemented, for these take many years to develop, and the second suggested that finer differences in cueing and signposting would not make as significant a contribution as other areas. In the area of the presentation of the text a study on coloured headings was considered in order to investigate giving the user information of the level of the text in the logical structure. However the computers available were not able to handle the display satisfactorily.

7.6.1 Experiment preparation, design and procedures

Preparation of the text

In this experiment the text was also controlled. Because it was
expected that the type of text affected reading and the reader's
strategy, the text was included as a condition in the experimental
design. Three texts were chosen of differing types: 'Abstract', a
description of a piece of computer software (Dodd et al, 1982);
'Concrete', a description of a set of problems in recording data
that were easily imaginable (Reynolds, 1982); and 'General
Interest', an essay on reading itself (Perry, 1959). Each had been
used in previous reading experiments. Summaries were prepared for
each text and revised to standardise their sentence length and
consistency of grammatical structure. Examples of the text are to
be found in Appendix G.

Preparation of manipulation programs

Four manipulation programs were used for accessing the text:

SCROLL   -   use of the up arrow and down arrow to move the window
                 over the text up and down line by line (see Figure
                 7.20).

PAGE   -   use of the up arrow and down arrow to move 'pages' of
                 text onto the screen, page by page. If finger was held
                 on one of these keys, then an effect like flicking
                 through the pages of a book was made (see Figure 7.21).

READ   -   use of the BLEND READ program to step through text and
                 to jump around it by commands
                 F or Return for next page
                 B   for previously displayed page
                 12 (say)   to jump to page 12
                 "References" to search for section heading
                              references

RPAGE   -   READ and PAGE combined.
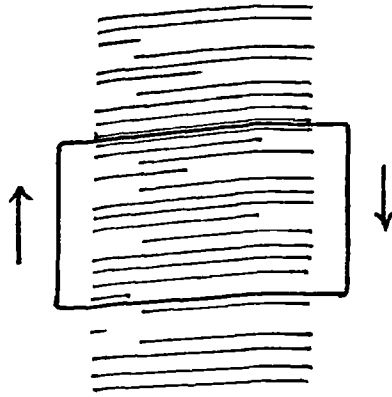
Figure 7.20:   SCROLL manipulation
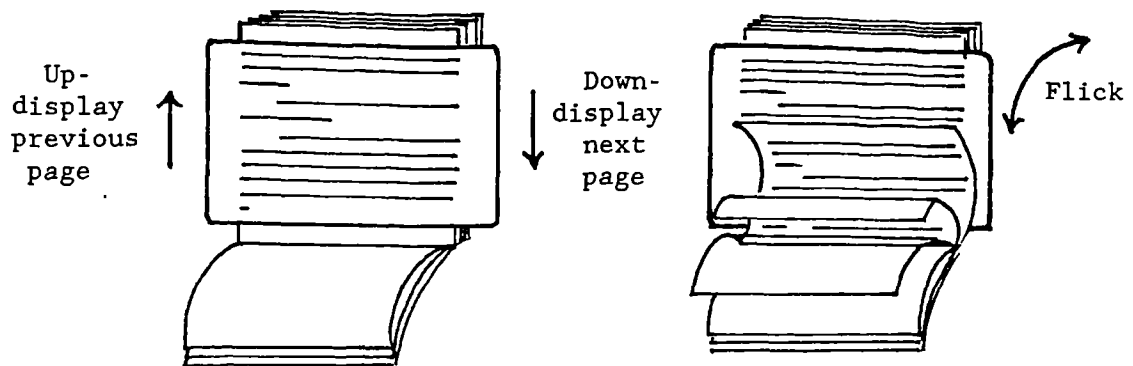
When flicking, only the
first four lines of each
page are visible.

Figure 7.21:   PAGE manipulation

Preparation of textual presentation

A comparison was to be made in the presentation of the text between
filling the visual space, i.e. the screen, and presenting
syntactically complete and partial logical closures of text in the
form of paragraphs or short sections. To this end the three
articles used in the experiment were taken and after every 24 lines
a page break and a number were introduced, making sure no widows or
orphans were left. (Widows and orphans are single lines of a
paragraph on the first and second screens respectively.)

Paragraphs or groups   24

of small paragraphs   lines
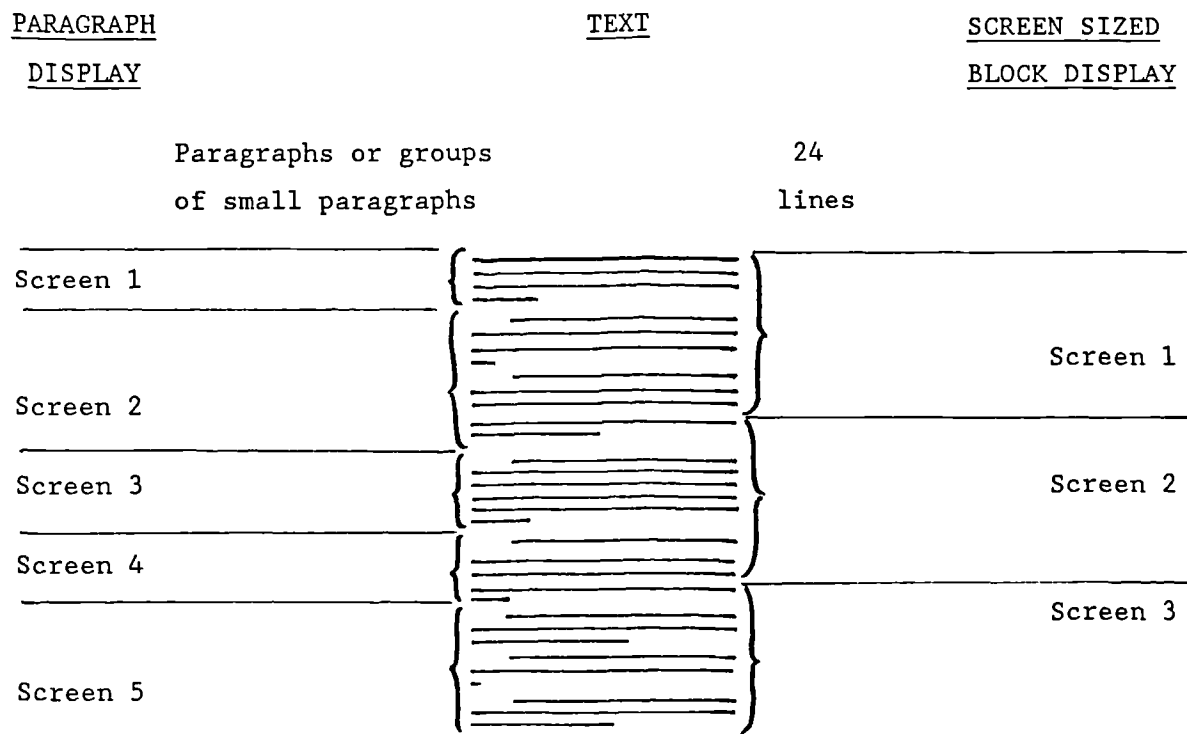
Figure 7.22: **Presentation of the text in paragraphs and screen**
sized blocks

Thus text could be presented to the reader in paragraphs or in
screen-sized blocks (see Figure 7.22).

Experimental design

For one of the four manipulation programs (SCROLL, PAGE, READ,
RPAGE), subjects were asked to read the three texts (abstract,
concrete, general), one in each of three different presentations
(ordinary BLEND text, with summary, in screen-sized blocks). This
meant that before randomising the order of the material presented to
the subjects, six persons for each of four programs would give two
measures to each cell (see Figure 7.23).

SCROLL or PAGE or READ or RPAGE	TYPE OF TEXT		
	ABSTRACT	CONCRETE	GENERAL INTEREST
Text with summaries in paragraphs	A B	C F	D E
Ordinary BLEND text in paragraphs	C D	A E	B F
Text displayed in screen-sized blocks	E F	D B	A C

Figure 7.23: The Experimental Design

The results could then be analysed in a split unit design for each of the programs or in a factorial (between subject) design for each of the texts. The latter was chosen and so the results were analysed by an Analysis of Variance on a factorial design (see Figure 7.24).

TEXT ABSTRACT OR CONCRETE OR GENERAL		TYPE OF MANIPULATION			
		SCROLL	PAGE	READ	RPAGE
Comparison made across means ↗↘ Comparison made across means ↗↘	Text with summaries in paragraphs				
	Ordinary BLEND text in paragraphs				
	Text displayed in screen-sized blocks				

Figure 7.24: The factorial design for analysis of variance of time data

Subjective assessment of the different manipulation programs was made after this part of the experiment was complete. A copy of the questionnaire is to be found in Appendix G.

Measurements of reading

There tends to be an emphasis in reading experiments on speed of reading and comprehension of content. Whilst it is not the purpose of the present work to measure individual abilities in these

aspects, there is some benefit to be gained in measuring both dimensions.

Firstly, the measurement of time taken was likely to generate a range within the expected distribution, and this could be used if one were then to redesign the articles to facilitate further efficiency. This will, however, tell us absolutely nothing about the process itself. In order to establish whether the reader has 'gained' from the experience of reading the article, one needs to measure comprehension. The measurement of comprehension can render information relating to the 'level' at which the reader approaches the article (reading the lines, between the lines, or beyond the lines). This in turn generates an image of how well-constructed were the ideas of the author by the reader. One might use a variety of techniques, but should arrive at a point where one is able to judge the reader's success in evaluating facts, values, inferences and generalisations.

Unless an activity such as this is carried out, we cannot know explicitly whether the subject 'read' the article at all, and how precisely. Therefore, for subjects that may not be familiar with the subject area (in contra-distinction to the previous pilot experiment), it was decided to do both a time measure on reading the text and to do a comprehension test. The overall time was recorded for each reading of a paper in seconds. Also the time was recorded for each stationary display of text as the reader manipulated the article, but this was for comparative analysis with other work on reading in the BLEND system. Each subject was asked to write a synopsis, which was compared and graded against a model precis prepared by researchers. The following five point scale was used:

1. no grasp of theme or in error
2. basic grasp of article
3. model precis
4. model precis, with extra detail
5. critique, too opinionated to demonstrate grasp.

Data from subjects with scores 2,3,4 were used, 1 and 5 being discarded entirely. Data accepted could then be said to represent the times spent reading the texts to an adequate level of understanding.

This methodology has been previously used by other researchers although we have to acknowledge that the task of summarising requires the use of organising powers other than memory (see, for example, Kintsch & Kominsky, 1977).

Experiment siting

The experiment was hosted largely by the University of Birmingham Centre for Computing and Computer Studies (CCCS) in the microcomputer laboratory. Further experimentation was done in the HUSAT Research Centre, Loughborough University of Technology. Apparatus required for the experiment consisted of five IMS5000 micros, a printer and access to the University of Birmingham DEC 20. Software written for this study was carried on floppy discs. Four of the IMS micros were used by subjects, the last was retained for printing out statistics and file transfer to the DEC 20.

Advertisements were placed around the campus of the University of Birmingham in order to obtain appropriately qualified subjects. These made appointments with a secretary in the CCCS and were paid normal subject rates for an experiment lasting between one hour and an hour and a half. Anyone over age eighteen with at 'O' Level standard of English was deemed eligible for this study. No special knowledge of those areas referred to in the experimental texts was sought - those subjects who were familiar with any of the texts were not used as it was reasoned that their familiarity might affect the nature of their reading of the text. Subjects were drawn in the main from the campi of the University of Birmingham and Aston, and from HUSAT Research Centre.

Experimental procedure

Subjects, on arrival, were randomly assigned a text manipulation program and seated at the appropriate VDU. They were asked whether they were familiar with computer keyboards and whether they knew about the BLEND project. It was explained to them that articles in electronic journals may soon play an increasing part in the life of an academic or student, the BLEND project was given as an example. In order that future electronic journals should be matched to the needs and wishes of readers, the experiment sought to investigate some of those factors that might affect reading speed, both to increase and decrease it.

The three experimental variables were described - three texts were to be read, each was of a different level of difficulty and each laid out in a slightly different presentation from the others. They were to use one text manipulation program that allowed them to move through the text in certain ways; this was then demonstrated.

The demonstration text was called up from disc along with the named program. The subjects were told they were to read the experimental texts as if they were normal academic papers and to do this they had the program features described. Each of these features was first demonstrated; the subject was then encouraged to use and become familiar with them to a point where the subject was reassured that they could not crash the program and keying errors were a minimum. A list of program commands and their functions was left by the subject for reference.When satisfied, the subjects were presented with the questionnaire they were to fill in after reading each text. It was explained that they should read normally and expect to be able to fill the space left on the form with a short precis of the main points of the article. As soon as they had finished reading they were to press A and Return to end the experiment, the questionnaire would then follow.

The first of the three texts was then called up from disc and the subject was asked to type in his or her name. They were advised that the experiment was to start on pressing Return and reminded to press A Return as soon as they had finished reading. They were then left undisturbed until they requested help or had finished the text.

Pressing A Return caused the statistics on reading times, etc. to be saved to disc and a message to be displayed telling the subject to call the experimenter. At this point the first part of the questionnaire was filled in, this was generally done by the subject with some direction from the experimenter. When completed, the second text was called up and the subjects told to do exactly as before. The whole process was repeated for the second and third texts.

On completion of all three texts, further questions were asked relating to the subjects' opinions of the program used and the different text layouts. The other three text programs were then demonstrated, the subject therefore having the opportunity to use

all four programs. Questions on which program they would prefer to use were then asked. The experiment was concluded at this point.

Subjects

Seventy-eight subjects participated in the experiment, of which nine were eliminated in the comprehension tests and one was eliminated due to an experimental artifact. All questionnaire results on attitudes were used, up to 68 measurements have been used in the descriptive data but only 60 used in the analysis of variance due to the factorial design.

Reading Times

The differences in text length were compounded by the fact that the text formats and summaried text formats were especially lengthy because of the extra lines of the summaries themselves. This was corrected in two ways: (a) the page and paragraph format data were modified by expressing them in terms of time per 100 lines; and (b) the entry and summarised format data were modified by correcting the times of the shortest text to be equivalent to, the length of the other two texts. These two texts had a very similar length, see the table in Figure 7.25.

TEXT PRESENTATION	ABSTRACT (DODD)	CONCRETE (REYNOLDS)	GENERAL (PERRY)
With additional summaries in paragraphs	500	332	500
Ordinary BLEND paragraphs	417	251	411
In 24-line screen sized blocks (pages)	398	279	390

Figure 7.25: Number of lines in the articles

Expressing the times for the summaried text per 100 lines could not be justified as reading time differences may have been equally due to the differences in text length or the extra ease (or difficulty) in understanding created by the summaries. The results of the Hills et al experiment clearly showed this effect in operation as average reading times were the same, but the amount of full text read differed. The data was, therefore, treated in this way and the results can be seen in Figure 7.26 and illustrated in Figure 7.27.

TIME MEASURE	READING TIMES/ SECS/100 LINES						READING TIMES/ SECS/TEXT					
PRESENTATION	PAGE			CONTROL			CONTROL			SUMMARIED		
PROGRAM TYPE TEXT	1	2	3	1	2	3	1	2	3	1	2	3
SCROLL	245	302	247	246	313	320	1011	1296	1335	1211	794	928
READ	241	236	202	215	130	240	883	890	1000	995	793	1101
PAGE	253	308	392	281	161	231	1154	1098	965	1311	1429	981
RPAGE	254	252	267	259	201	209	1065	1371	873	1389	1256	910

The control condition of ordinary BLEND text in paragraphs has been treated both ways for comparative purposes.

Figure 7.26: Mean reading times after treatment of data

These factors and data were then subjected to an analysis of variance and significances noted are given in Figure 7.28.

		TEXT TYPE		
		1	2	3
Experimental	M PP	NS	$p < 0.01$ $p < 0.01$	NS
Factors	M PS	NS	$p < 0.05$ NS	NS

Key: M   — Manipulation program, 4 levels.
         PP — Text formats Page & Paragraph.
         PS — Text formats Paragraph & Summaried.

Papers: 1 - General
         2 - Concrete
         3 - Abstract

Figure 7.28:   Analysis of variance results for statistical significance

Significant differences were noted in the cells using paper number 2. Within this text the choice of program (factor M) always caused a significant difference in reading time. Also there was a significant difference in these times due to the two text formats, page and paragraph. There were no significant interaction effects.

Comprehension test scores

The precis were analysed according to the five point scale described

Key:
—————— Page display   —————— Control
- - - - Control   - - - - Summaried text

PROGRAM
TYPE

TEXT 1

TEXT 2

TEXT 3

Reading time per line in seconds

Reading time per text in hundreds of seconds
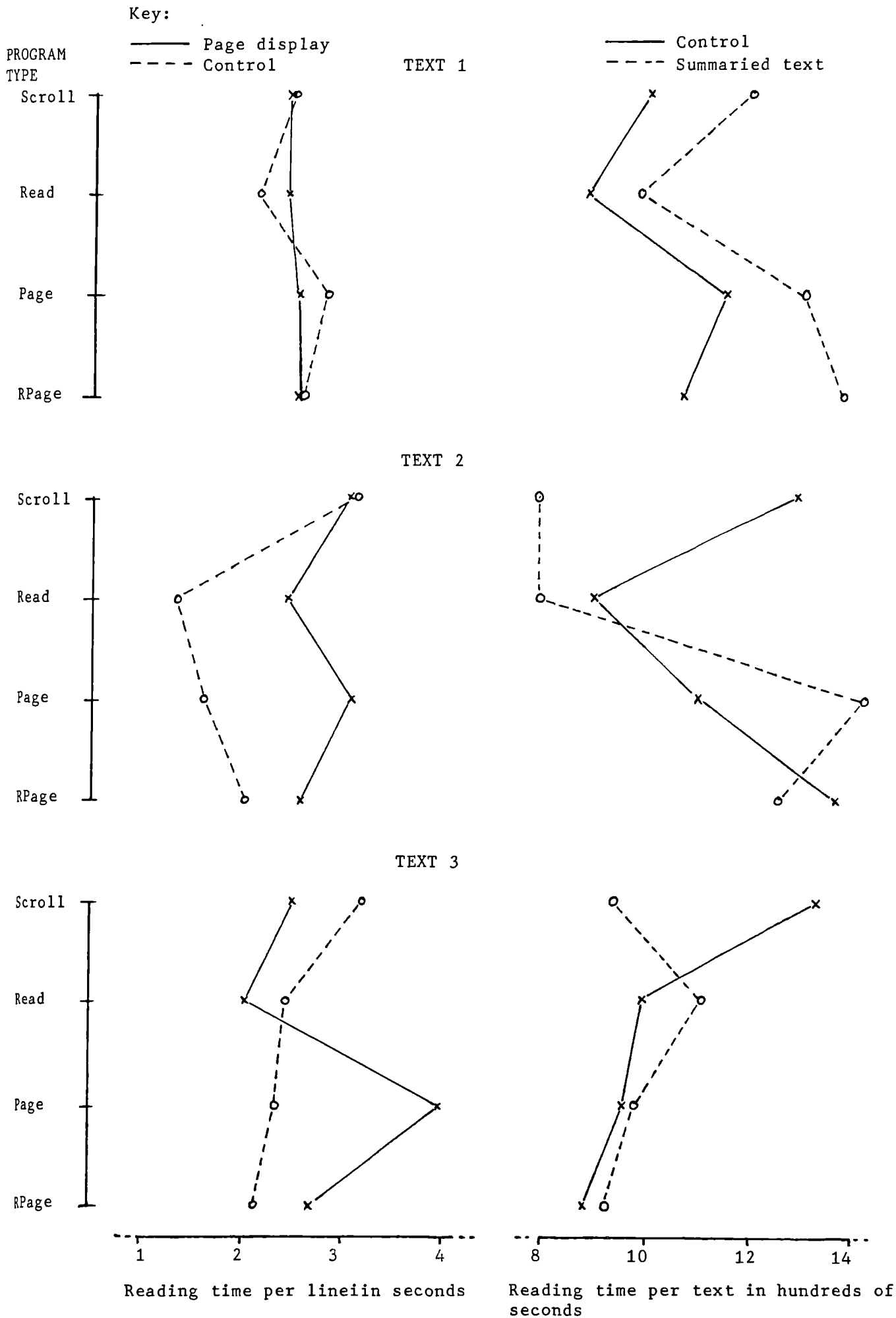
Figure 7.27: Graphs of the time data in the different experimental conditions

previously. Typical examples from the subjects of the summaries
accepted in grade 3 are the following:

Reading skills

Students read for approximately 1000 hours/year.

Less emphasis placed on tuition in mechanical skills, more on
flexibility and purpose in reading.

First test - students read chapter of history book, 90% read from
start to end, although summary at the end.

Second test - two examination answers in marking, students shown
to be directed to correct goals.

"John Smith"

Relates to the problems of mapping amorphous and ambiguous data
from historical documents onto a computer using conventional
software.

Details 11 problems or typical difficulties.

Lead to the development of CODIL language to overcome these.

ATOL

Describes advantages of software prototyping and requirements of
such a language for text processing applications.

ATOL is described and comparison between its facilities and those
of an idea prototyping language is made.

The only application of this language is mentioned.

Only nine subjects were rejected due to the brevity of their preces.
Brevity was a prevailing trend but the rest of the comprehension
tests were judged adequate (see Figure 7.29).

SCORE	1	2	3	4	5
Number of Subjects	9	110	84	17	0

Figure 7.29: Number of comprehension tests in the
different score categories

Preference for manipulation program

After demonstration and use of all four manipulation programs,
subjects commented on which they would prefer to use. The following

table (Figure 7.30) shows the number of times each program was ranked as first, second, third or fourth choice.

		CHOICE			
		FIRST	SECOND	THIRD	FOURTH
PROGRAM	SCROLL	0	3	9	33
	PAGE	1	11	30	2
	READ	7	28	7	3
	RPAGE	41	4	0	0

Note: Some programs were rated equal first, second or third.

Figure 7.30: Subjects' preference for manipulation

The majority clearly preferred the READ facilities with the PAGE facilities added in. The reasons given for this are presented in Figure 7.31. Comments made about the programs prior to seeing others are listed in Figure 7.32. Additional features suggested for manipulation programs are given in Figure 7.33.

RPAGE most preferred because
- most options for manipulation (32)
- easy back and forth control (5)
- string search (1)
- whole page display & jumping (2)
- stationary screen (1)
- simple approach of paging with optional sophisticated facilities (1)

SCROLL least preferred because
- least options and basic (19)
- slow (17)
- not able to jump to contents or elsewhere (3)
- hard on the eyes (6)

Other single person comments:
- would have liked scroll and search together
- preferred READ most of all because of the simplicity with sophistication
- did not find PAGE very quick or clear
- preferred PAGE most of all because of familiarity and simplicity

Figure 7.31: Preferences for manipulation programs

```
SCROLL    - Difficult to review                                    (1)
          - Wanted to jump through text                            (7)
          - Wanted to display page at one time                     (2)
          - Smooth scroll would be better                          (1)
          - Facility to go backward a line is good                 (1)
          - Liked flicking through quickly                         (1)

PAGE      - Wanted to jump to beginning, end and middle            (6)
          - Wanted to control page size                            (2)
          - Wanted line by line scrolling                          (1)

READ      - 'Back' command liked                                   (7)
          - Number jump liked                                      (8)
          - Search liked                                           (1)
          - Word search wanted in text                             (2)
          - Fast scroll wanted                                     (1)
          - [Better than book-fast skimming and scanning]          (1)
          - Wanted a dictionary of words searchable                (1)
          - Wanted to have more context in display                 (3)
          - Wanted a 'map' of article                              (1)

RPAGE     - Liked 'Back' command                                   (3)
          - Didn't think 'Back' useful                             (1)
          - Liked search - wanted dedicated key for it             (1)
          - Wanted more powerful search                            (3)
          - Liked jump command - especially contents               (8)
          - Wanted visible record of movements on screen           (1)
          - Liked small number of commands                         (1)
```

Note: These comments were raised in answer to the questions: "If you were not able to read satisfactorily, what caused most problems and why?" "Which manipulation feature did you find most helpful?" "Are there any extra features that you would have liked to have had?" "Any other comments about the program?"

Figure 7.32:   Comments about the features in the manipulation programs

```
Cue to size of text or section                      (4)
Visible record of movements in a paper kept         (1)
Two page display - particularly for index display   (6)
Highlight text/underlining                          (5)
Bookmark facility                                   (4)
Graphics                                            (1)
```

Figure 7.33:   Additional features desired in manipulation programs

The rating scale results

In answer to the question "How readable was the article?", subjects thought negatively about the abstract paper and most positively about the concrete paper (see Figure 7.34). There was no difference in the replies to readability when they were analysed by manipulation program, all the means being in the range 0.03 to 0.06.

Q. How readable was the article?

Difficult   Easy

Means: -0.19 Abstract
        1.10 General
        1.22 Concrete
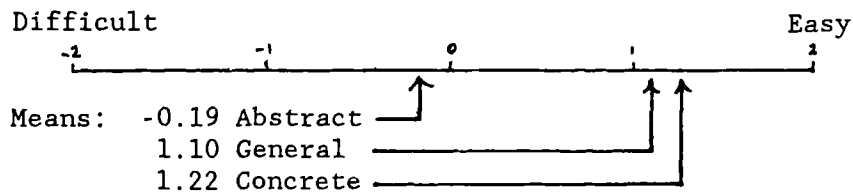
Figure 7.34: The means of the rating scale replies for
              readability of articles

Considering the layout of the text in summaries, screen-sized blocks
of text (pages) or normal BLEND paragraphs, showed that subjects
were still highly influenced by the content (Figure 7.35), but
clearly did not prefer the page display (Figure 7.36). These
expressions in Figure 7.35 probably reflect the perceived difference
in the internal structure of the articles themselves.

Attitudes to layout not content

Dislike   Like
  -2   -1   0   1   2

Means: -0.24 Abstract
          0.42 General
          0.81 Concrete
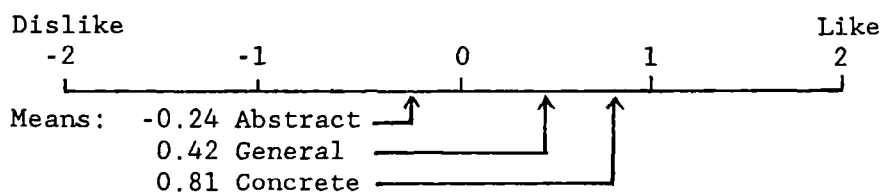
Figure 7.35: The difference between articles as expressed
              in attitudes to layouts

Attitudes to layout not content

Dislike   Like
  -2   -1   0   1   2

Means: -0.02 Pages
          0.48 Summaries
          0.52 Normal Paragraphs
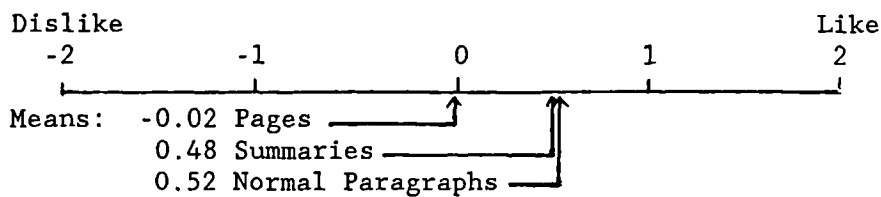
Figure 7.36: Attitudes to layouts

A summary of comments and reasons for the attitudes expressed here
are found in Figure 7.37.

Screen Display of Text:

Full screens daunting - more white space - liked shorter
    blocks of text   (21)
    (particularly this is forced with SCROLL 2)
Dislike too small a piece of text on the screen   (3)
Did not like different sizes of text on screen   (3)
Should not have split sentences/logical breaks over pages   (3)
Wanted right hand justified text   (2)
Narrower text
Ability to change to one and a half or double spacing or
    enlarge half as in CEEFAX   (3)

Preces

Precis bad   (5)
Precis good (especially with few jargon words)
Precis good but preferred after text
Too many summaries and a little repetitious   (3)

Other Comments

Numbered paragraphs smack of bureaucratic documents
Would have liked expanded contents list
Like to have had visual cues such as font changes and bold   (2)
The better manipulation of text in electronic medium high-
    lights poor writing

Figure 7.37: Comments about layout of text

Do particular text formats combine well with certain text programs
and work together nicely?

Use of screen numbers tied to paper structure   (3)

Use of jumping programs READ and RPAGE with preces and
other paragraph based text, e.g. the concrete text used
in the experiment   (3)

Use of better page layout possible with RPAGE   (3)

Note: Sometimes these were originally expressed in converse, e.g.
didn't like scroll with preces.

Figure 7.38: Specific comments about combination of text
              presentation and manipulation programs

Finally space was given for any comments on the interaction between

the display, type of text and the manipulation program, the results

of which are summarised in Figure 7.38.

Statistically significant differences in the rating scales

The readings obtained in the two rating scales studying the

readability of the different texts and the layout and presentation

were tested for statistical significance using the Mann-Whitney U
Test. Tie correction was not used and a Z transformation on U
applied so that the levels of significance discovered are for the
standard normal variate and are on the conservative side rather than
the hopeful. All probabilities were tested under the one tailed
hypothesis.

The differences observed (see Figure 7.28) showed very highly
significant differences in attitudes to the text between the
abstract paper and the two others:

	A	C	G
Abstract	X		
Concrete Images	p<.00003	X	
General Interest	p<.00003	NS	X

Similarly the dislike expressed of pages (see Figure 7.36) was
statistically significant around the p<.025 mark:

	S	N	P
Summaries	X		
Normal paragraph display	NS	X	
Page/Screenful display	p<0.025	p=.029	X

7.6.2 Summary of the results

Three types of text, abstract, concrete (i.e. able to be easily
imagined) and general interest were used in the experiment. The
concrete text was perceived by the 79 subjects to have had a very
high degree of internal structure in the way in which it was
written, the general interest article a reasonable amount and the
abstract article the least structure.

There are statistically significant differences in the reading times
for the concrete paper between the different manipulation programs
and the different presentations of the text, but not for the others.
There is no difference in the SCROLL program between 24-line page

and paragraph displays, as expected, but where whole screens are able to be displayed by other programs there is a shorter time taken to read the article. With the summaries added into the text at the start of the article, SCROLL is used much more effectively, but PAGE, without the jump around facilities, is not. These results for the concrete article suggest a degree of interaction between the presentation of the content and the way the text is manipulated in order to read it.

Overall, the manipulation program most preferred was RPAGE, having the jumping around facility together with flicking through the pages, the reason given being that it had most features. However, it is the jump facility that is preferred. SCROLL was generally least preferred because it was slow, hard on the eyes and had least features. Some additional features were suggested, such as being able to mark the text for later reference, especially in the context of this type of overview task.

The abstract article was found much harder to read than the others with the concrete article being preferred - 'down-to-earth' as the latter was described. The general interest article was found readable but the lack of structure was perceived.

Summaries at the start of the text were liked by some and not by others, their content being critical, and the program used to manipulate this kind of text was preferred to be a jumping one. This replicates the results from the previous pilot experiment.

In general, there was criticism of the screen display of the text, particularly when the screen was full. This could be improved if RPAGE was used, headings kept at the top of the screen and the way text manipulated embedded into the paper structure. This was strongly suggested by the concrete paper where this worked successfully.

7.6.3 Discussion

Reading times
There is little doubt that a huge range of reading times is always

to be expected in reading research, particularly in a study where
the text is not standardised to some low level and where jargon is
prevalent. This is the reason why in the graph (Figure 7.27), some
of the differences look different but are not sufficiently so for
statistical significance to be obtained. When statistical
significance is achieved, it is clear that there is a common trend
for most of the subjects across all the range. It is right
therefore to consider the aspects which might contribute to this
difference and to examine the figures more closely.

The means of the mean times for the different times spent reading,
after being normalised for length and text respectively as
previously described, are illustrated in Figure 7.39.

SCROLL	308	1045
PAGE	235	1264
READ	135	846
RPAGE	227	1314

seconds per 100 lines   seconds per normalised text
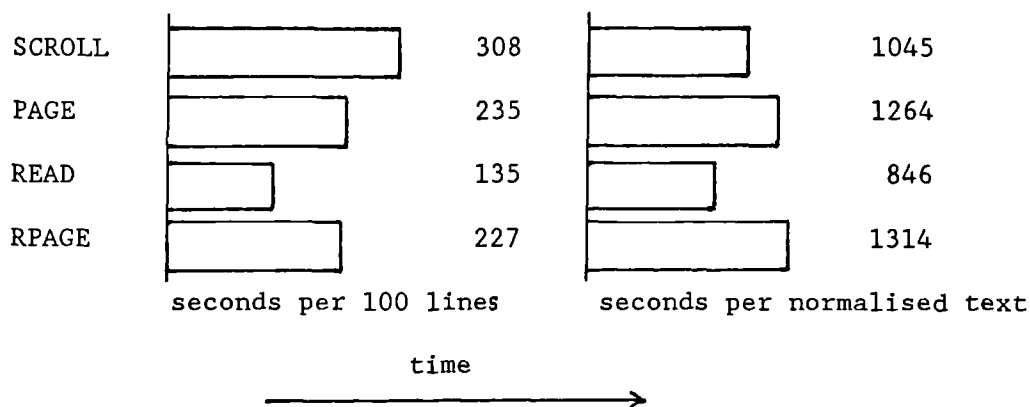
time

Figure 7.39: The means of the time taken using different programs

The same pattern is not repeated in both situations with the speed
of programs being

1	READ	READ
2	RPAGE	SCROLL
3	PAGE	PAGE
4	SCROLL	RPAGE

The order of the speed of the programs, when compared per hundred
lines, is almost the same for all three papers and accords well with
the preferred pattern of use. The additional time taken by RPAGE
may be due to the extra facilities provided and the increasing
decision-making required to decide which command to use given the
choice (see Figure 7.40). One might expect this a) to diminish with

further use and b) be clearer when detailed analysis has been done
on which commands were used in RPAGE.

In the program RPAGE, the subject had a choice of commands, for
example the Return key (CR) and down arrow key would both move
forward one page and going back 4 or 5 pages could be accomplished
by either 'flicking' back by holding down up arrow key, or by
jumping back to the numbered page or paragraph. An example shows
some different uses of the commands in the text with the summaries.

Command	Screen Number command		Then later	Screen number
-	1		↓	21
↓	2		↓	22
4	4		↓	23
Back	2		"Con"	34
CR	3		↓	35
CR	4		Back	34
CR	5		Back	23
B	4		↓	24
B	3		↓	25
B	2		↓	26
CR	3		↓	27
CR	4			etc.
CR	5			
CR	6			
CR	7			
CR	8			
CR	9			
	etc.			

Figure 7.40: Use of RPAGE with summaries showing different uses of
              commands

The order of the speed of the programs changes however from text to
text when it is compared for whole text with summaries. This seems
to be because different strategies are used by readers when
summaries are present. Of particular note here are the two very
much quicker times achieved with SCROLL on the concrete and general
interest articles. An initial study of the data on the strategies
used suggests that since SCROLL as a program is hard on the eyes and
full text on the screen is disliked, then the preces are read
carefully but the rest is skimmed or aborted entirely. This would
be consistent with the strategies observed in the pilot experiment.
The increased times for the more sophisticated programs may also
reflect strategies that increase overall time, i.e. subjects might
try to go from a precis to the full-text matching it. They had no

way of so doing without going via the contents list. This was observed, see Figure 7.41, when one reader kept reading the summaries or preces of the text and parts of the full text, particularly the conclusions.

Command	Comments	Screen Number	Command	Comments	Screen Number
-	Title	1			
↓	Contents	2	11		11
3	Summary (Precis)	3	1	Jumps to 1	1
4	Introduction (Precis)	4	4	:	4
↑		3	↑	:	3
↑	Gets back to Contents	2	↑	Then back to Contents	2
8	Jumps to full text	8	22	Full Conclusions	22
↑	Steps back through Summaries	7	1	Now reads through	1
↑	:	6	↓	Summaries again	2
↑	:	5	↓	:	3
↑	...and then forward again	4	↓	:	4
5	:	5	↓	:	5
6	:	6	↓	:	6
↓	:	7	↓	:	7
↓	:	8	2	Contents	2
1	Jumps to 1...	1	22	Full conclusions	22
↓	To find contents	2	↓	:	23
11	Jumps to section	11	↓	:	24
12	Listing the 11 problems	12	↑	:	23
13	:	13	↑	:	22
1	Jumps to 1...	1	Abort	:	-
↓	To find contents	2			
7	Summary conclusions	7			

Figure 7.41: One reader using RPAGE to jump around text with summaries in

Display of Text

We have already noted that strategies used with the preces of text appearing before the full text were similar to that found in the pilot experiment. The comments about whether they were liked are also similar, being very mixed, with the same type of comment referring to the usefulness of non-jargonised summaries and dislike of the repetition caused thereby. The comments suggesting that this would go well with the jumping programs reflect the figures suggesting this from the previous study, but there needs to be a variety of levels of summary tried before any conclusions can be drawn. In particular, the question needs to be addressed whether it is the information that is the important concern, over-riding the

author's style, or whether the two should be kept integral as in present article writing. It is, however, clear that filling the screen with text was disliked.

What has the experiment told us about these two hypotheses raised previously in section 6.3.4? There is support given for them in free response comments:

a) - did not like different sizes of text on screen   (3)
   - wanted more context in the display   (3)

b) - full screens of text daunting   (21)
   - should not have split sentences/logical breaks
     over pages   (3)

Before coming to any conclusions, there are a number of general display issues that contribute to why full screens of text are daunting, which include present day design of Cathode Ray Tubes as well as the design of the display. Other comments relevant to this discussion were the following:

-      wanted right hand justified text   (2)
-      wanted narrower text   (1)
.-   wanted better spacing of text (leading)   (3)
-      wanted more 'white' space   (1)
-      would have liked visual cues such as bold   (2)

as well as the two who mentioned that they wanted to control the page size and have 'maps' of the article displayed to them.

This suggests the following:

1. Better design of the text on the screen is needed, especially in leading and other traditional presentation issues such as line length and amount of 'white' space.

2. It is preferable to have all of a paragraph on the screen rather than split, but to try and make the visual displays of one or several paragraphs on the screen approximately equal in length.

3. The use of fixed size of page of this length is not sufficient to give the reader the orientation needed and other aids to context need to be developed.

In particular it is to be noted that the design of the display of text is facilitated when it is considered in terms of a manipulation aid to display a screen rather than one using scrolling. This was

suggested by several subjects when used in conjunction with programs such as RPAGE.

<u>Preference for manipulation program</u>
The one that offers most options for manipulation might be expected to be preferred, although it is interesting that some (11) preferred equally, or more, the READ program. As one reader commented, the advantage in RPAGE is that one could use the up and down arrow only in order to flick through the text and then use the more sophisticated facilities later.

However, it was evident from the comments by the subjects before seeing the other programs that the use of READ and RPAGE led to requests for more sophisticated facilities (see Figure 7.31). These included more powerful search facilities, a visible record of movements about the text maintained on screen, 'maps' of the article, etc. Some of these requests appear to be generated from experience of text editors, for example the more powerful search facilities and the control over a variable page size. Others are as yet unresolved demands for knowing-where-one-is when the physical cues have been removed and when less context is available in the display. The emerging technology of windowing will certainly aid this process. High-lighting, underlining and bookmark facilities are available in some advanced editing systems.

It is clear that the requirements for reading will to some extent be determined by the experience of readers with more advanced text editors. These increase continuously in the market-place and most reading on the screen is done using these text editors. Indeed, the common manner in which computer scientists read others' text from a computer file is precisely this since no other reading aids have been available. It should be the case that slightly different demands are made in the two cases and that one cannot assume that readers will also be text editors in the long term. The development of reading programs should, therefore, follow that subjects' comments with which we started, viz. that it should be possible to read on-screen text with just one or two commands and then use more sophisticated facilities when more experienced.

7.6.4 Learning from the experiment

The experiment was designed to replicate the pilot experiment in summaries and to answer the other questions raised. In doing so, the subjects reactions and comments suggested further areas for research and other dislikes. In providing manipulation aids, it is the jumping facility that is most useful. Replication of the page flicking found in view of books is liked and well-used, but is not so good as jumping. This is not perhaps surprising for page-flicking is a technique developed for print on paper and jumping uses the computer high speed search and retrieval functionality.

Secondly, headings were found useful, as was a detailed contents list. Both can be seen in terms of removing uncertainty about the content and reassuring the reader about that which they can access and the screen they are viewing at that moment. The contents list and cues to figures, references to and from summaries to full-text also can be considered in terms of reducing the uncertainty of the location of material. For this reason, as many as possible of these cues should be expressed in instructions for the manipulation aid being used.

The findings of the pilot were replicated and not substantially advanced by this study. There is more confidence in the assertion that summaries are useful when the reader is constrained in manipulation aids to scrolling. The hypothesis of Line's that it is also useful for browsing text more generally needs to be tested by further modification of the text by listing full-text cues as manipulation aid instructions using the jumping facilities or by placing it into a structure with menu choice facilities.

There was complete justification of the initial editorial decision to display paragraphs of text in the conference entries of the BLEND system. The dislike of unequal lengths of paragraphs is of interest. Following the 'reduction of uncertainty' principle again, it could be explained by saying that users do not like the uncertainty of what they receive in presentation as well as content. With the scroll facilities this presents no problem, as the reader receives just the next line. With page display however the quantity of material is unknown every time any page is accessed. This

suggests the notion of uncertainty in readers being an important factor as suggested by Hansen et al, 1978. There is also work required on the screen presentation. This, however, is highly technology-dependent, for 'white space' particularly on the left margin, requires space characters which take the same time to transmit on-line as characters of text. Thus better presentation has a cost in the time to display a paragraph of text and the whole article. This matters proportionately less when using high speed communications.

There were signs of the modification of readers strategies with different texts and manipulation aids, and these require further long term investigation. To suggest one small example: we could raise a hypothesis that the search for the references, say, at the end of an article on pages in print contributes to the knowledge of the structure and hence to the usability of the text, despite it being clear that the primary task is identifying the reference itself. On a computer system, as we have shown, it is easy to provide the reference at the touch of the screen or a key press. How much are tasks of reading and locating of material integrated in normal use of documents and how can aids be provided, not to replicate, but to develop strategies for the support of the reader engaged in reading?

Finally, we did not attempt to answer questions on the type of text appropriate to the electronic medium, but it was clear from the comments by subjects that the abstract text was more difficult to use and so to gain an overview. Whether it was more difficult than if it had been on paper is a matter we cannot answer. One hypothesis would be that it was so. If the reader has no large visual field from which to construct a framework on which to build an overview, then it has to be built more in memory. This would suggest that texts with higher memory demands in this way would be relatively harder to comprehend when read on-screen. Those that would be easier would be those whose image in the brain can be concretely constructed and hence maintained over a sufficient period of time until the overview of the article is built.

This learning is summarised in Figure 7.42.

1.   Manipulation aids

      Aids for jumping around the text are preferred to either sequential
      page flicking or scrolling.

2.   Cueing, signposting and routing to other points of the text

      Frequent headings found useful.
      A detailed contents list useful.
      Cues and signposts to be provided in manipulation aid instructions.

3.   Structure containing the text

      Summaries found useful but not fully enough investigated in a
      hierarchical structure. They are useful when limited to scrolling
      or a manipulation aid.

4.   Presentation of text in relation to content

      Paragraph display preferred, but a paragraph or series of
      paragraphs, should be about the same length from screen to screen.
      Page display preferred.
      More work on width and spacing of text required.

5.   Readers strategies appropriate to the electronic medium

      Some sign that readers adopt different strategies with different
      texts and aids, this needs further investigation.

6.   Content of the text appropriate to the electronic medium

      Easily imagined (concrete) texts are preferred.
      Structure the text well, in short sections.

Figure 7.42: Learning from the reading experiment

      The experimenter noted that reading on-screen was considered

      positively by many of the subjects (Appendix G) and, as with the

      pilot experiment, there is no suggestion that, with proper design,

      reading will not be acceptable on screen.

7.7   Annotating text on-line

      Several of the suggestions made by subjects in the reading

      experiment related to the provision of a facility which would allow

      them to mark, annotate or highlight the text in some way for later

      referencing. This is an essential part of the refereeing task.

      Buckley (1983) found that referees make both annotations, meaningful

      expressions in the margins, and other marks which may have no very

      precise meaning but are there to act as a reference. Others in

their reading of text also make a variety of markings in the text. Neilson, 1984, found that students show a rather high use of highlighting but few additions in textual comments. A few liked to take detailed notes on separate pieces of paper. He concluded that one problem was the lack of margin-space in books in which to make meaningful additions to the text.

Both for refereeing and reading it had been thought necessary to explore whether this kind of aid might be provided on an on-line system. It was decided to keep the paragraph structure and to work within that conceptual consistency and therefore to develop a reading aid to allow marking a paragraph and making comments which would be tied to it. The main purpose of each, however, is that they are searchable and accessible separately from the content of the text itself, i.e. the marks that a reader makes become the items that are searched.

Consequently a program was developed to allow on-line reading of text in this way for referees of articles in the BLEND system. Each paragraph could have one or both of a mark or comment attached to it. · As well as creating and deleting these items, the paragraphs were searchable forwards and backwards looking for the next paragraph or previous paragraph which was marked. The comments were searchable separately by moving to the next or previous one and by doing a character string search on their contents. Finally all the paragraphs marked and all the comments made were accessible as a sequence separately or together. This enabled the printing or storing in a computer file of content desired by the reader. The structure is diagrammatically represented in Figure 7.43. The reader knows whether a paragraph has a mark or comment attached to it by a short message displayed before the manipulation aid prompt.
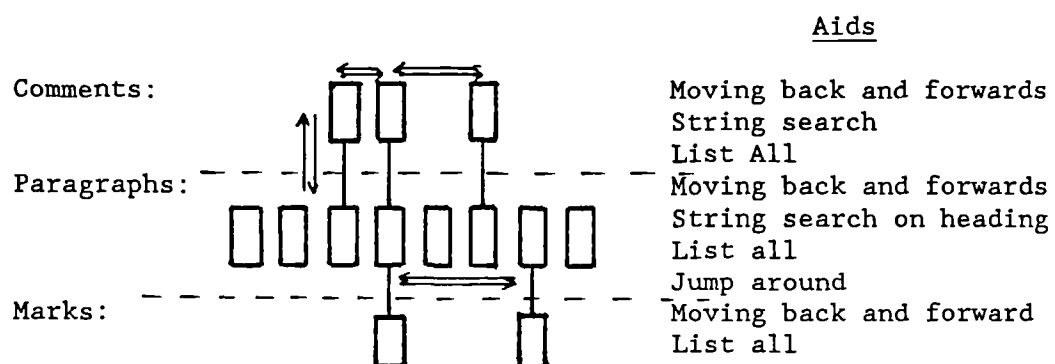
Figure 7.43: Paragraph, mark and comment structure for reading

This kind of aid, already functioning on stand-alone systems, will benefit from more sophisticated facilities on the local terminal equipment. This is one demonstration, and no more, that such aids can be provided on a system with a very small amount of interactive functionality in the interface itself.

7.8   Learning about usability in the development of an
        electronic journal system

How one reads on-screen has been considered in a fair amount of detail. This has been a long detour from the main aim of developing the system's functionability so that it is viable for the task of supporting scholarly communication. We have argued that it is an essential one and it is one that has been little investigated. Even accepting that many would wish to have hard-copy articles for the reasons illustrated, viz. that much reading is carried out in travelling time or in the evenings, if the system is not to become one in which printout is requested from a title and maybe abstract (i.e. 'on-demand publishing'), then the user will have a requirement to view text on-screen. The focus of this research has been to demonstrate ways in which that task can be made more usable for the reader. It has left many questions unanswered, in particular with reference to the appropriate type of content for the media and the development of the reader's strategies for on-screen viewing. Nevertheless it has been demonstrated that certain kinds of manipulation aids are better than others and that the subjects who used them in the experiments were by no means antagonistic to the idea of reading off the screen for long periods.

We have also spent a considerable detour on the topic because, as the background survey showed in Chapter 2, the development of the electronic journal has a genesis from several starting points and, in the progress from current developments to future systems, it might be expected that at least some of them may involve a host computer system or network in which text is accessed on-line as well as on-screen. Thus the developments described here will provide background for research and implementation for at least some of the future experimental programmes.

In studying on-line and on-screen use of information we were led by the surveys of the users to investigate four other areas; the

log-in, in which to gain access from the local terminal equipment to the host computer using the public telephone network; the consistency of the command structure, when it was interpreted in a different framework by the expert host computer system users and others; the structure of the database and moving around it; and the conceptual consistency of transferring and manipulating an article in a paragraph structure. The emphasis has been upon analysis and development in order to reduce the number of reasons why the system might not be usable.

In our investigation of the lower than expected rate of access to the system, a major difficulty was identified in accessibility to the system caused by difficulties in the local terminal equipment. A second area was identified in the difficulty of using certain aspects of the host computer system. Both led to developments, the former in provision of computer equipment, installation of telephone lines and modems where appropriate, and the latter in the research and development of the usability of the system. This is summarised in Figure 7.44.

Area identified for investigation	Local Terminal Equipment	Host Computer System
Area in the feasibility model	Accessibility	Usability
Analysis of requirements from the difficulties experienced by users	1. Equipment installed 2. Easy access to equipment 3. Visibility of equipment 4. Easy access to host computer	1. Log-in understood and simplified 2. Consistency in command structure 3. Development of CBCS structure 4. Conceptual consistency in handling articles 5. Development of aids to read articles on screen

Figure 7.44: Development of help required for local terminal equipment and the host computer system

These are only a few of the usability issues identified during the research programme and consisted of those which had been prioritised

as able to be researched and some ameliorative or development work done. Other areas identified in the Thirty five month survey, included, for example, the restructuring of the database of messages so that it reflects more the manner in which it was wanted to be used, including information on all new messages throughout the CBCS. This type of functionality reflects the existing working habits of researchers who received all their post in one place to be handled and do not require much enactive effort in the receipt of telephone calls. The way that the CBCS matches the working habits of the researchers also affects the perception of the usability of the host computer system or distributed network. We have also seen how the utility and the work habits of the users can be affected by the accessibility and usability of the system which in turn further affects the access rates and patterns of the users.

How important is usability of the CBCS for the future of electronic journals? Sheridan et al, 1981, and those authors associated with the NSF-funded US experiment all thought usability the biggest barrier, including the lack of utility caused by the project time-scale and the particular group of research scientists chosen to participate in the experiment. They implicitly claimed that the utility could not even be tested because of the lack of accessibility and usability and the very difficult and cumbersome procedures for operating the EIES system that were needed to support scholarly publishing. This is not to imply that all EIES dialogue design was difficult to use, but those required as a support for this function .

It therefore seems reasonable to assert that the manner in which the BLEND experimental programme was initiated to take this learning into account and to create a continuous support programme for usability enabled the development of working electronic journals to take place and for the different aspects of the utility of electronic journals to begin to be discussed. Both experiments emphasise one aspect of usability for a CBCS, that we don't yet know what that usability is to be in all it's aspects. Certainly some are well established, for example, the need for good dialogue design, a dialogue design that is consistent throughout the system (including the log-in); others are still in exploratory development, such as how to handle imposed filing structures for a database, but

how best to handle new possibilities in the integration of informal and formal communication we do not know. Furthermore, we cannot know it. The development of usability follows from a developing utility, and utility follows from sufficient usability. For example, it is only with a software program to support some task for the user that we may begin to discuss appropriate human-computer interaction that would make the program usable or not. Conversely; we might only have been able to develop that program if the interface had contained sufficient usability in order to make the utility usable at all, consider, for example, word-processing in Japanese or Chinese. Thus the development of usability goes hand in hand with that of utility.

Because we do not and cannot know the extent of the usability required to support the utility, nor the utility that is supportable by the usability, this means that the development of electronic journals require an iterative cycle of research, which is conducted in a milieu of usability consideration, of maximizing opportunities presented by the current utility by the optimisation of the usability at each and every stage. The enhancements that have been studied here are just such a cycle, in which the 'action research' methodology has been used to maximise the opportunities presented by the changes in usability.

How does usability affect the access rate? After the enhancements, access increased, although we cannot claim this to be a direct causal link. In particular, because of the changes in accessibility for the existing LINC members, the addition of many new participants and the analysis over the last period, we cannot answer any direct questions on whether increased usability resulted in changed individual access rates for the same number of existing users of the system or whether increased usability enabled more participants in the experimental programme to access and use the system. Therefore an answer to the direct effect of usability on access cannot be given. Informed speculation is offered in the penultimate chapter.

A closely related question is how the cost of using a CBCS affects the access rate. This has been raised as a question at a number of points previously and the start of an answer forms the following chapter.

COST APPRAISAL

A CBCS for an electronic journal has shown itself possible, even if in its present form it is not necessarily optimal for scholarly communication and has yet to be developed in any final form. Is this development worthwhile, will the cost to readers prohibit its use even if it is successfully developed? Any commercial electronic journal will have to cover its costs by charging individuals or institutions, and to do so within some specified timescale in order to be considered a viable alternative to conventional publishing. While it is clear that the traditional publishing procedures are becoming strained financially under the rising costs of production and distribution, coupled with a decreasing market, it is not clear if electronic publishing might be a viable alternative (Royal Society, 1981). This chapter explores the question of cost to the members of a research community. The feasibility of cost to a group of researchers using a CBCS for communication in their context not only needs to be addressed at a group-system level but also needs to be individualised. Two questions therefore interlink; 'Will the system be supportable by its members with the kind of use that the BLEND system suggests will occur?' and 'Will the individual researcher pay for the service?'. These are the questions raised by our individualisation of the feasibility in Section 2.4.3 (see Figure 2.5).

The investigation of the covering of the costs is therefore conducted within this framework and so we speculate on how the adoption of a certain cost policy might affect use of the CBCS. In its extreme form the electronic journal may be too expensive for the individual because the strategy for recovering the costs results in usage patterns that become too expensive for the utility provided.

8.1   Introduction

There have been a number of studies of the economics of electronic journals. Among the most notable are those at the University of Toronto (Senders, Anderson & Hecht, 1975) and the large study by King Research Inc. (King & Roderer, 1978). For the most part these have been theoretical studies, which aimed at comparing the costs of large scale implementation of electronic systems with the

conventional hard-copy alternative. By their nature they were not able to look at the economic issues associated with the establishment of electronic journals within an electronic communication network, when that system itself is placed in a publishing environment still dominated by the print-on-paper form. The study programme investigated was an electronic journal established within a CBCS, and so the economics will be considered in a different way from those of large-scale alternative publishing systems. There are also important differences from normal printing and publishing.

In conventional commercial journal publishing, typically about two-thirds of the cost lies in preparation and one-third in producing the copies (e.g. Singleton, 1979). Obviously this proportion can vary considerably, depending on the size and circulation of journal and other factors (e.g. King & Roderer, 1978, for costs of USA journals, which have a higher average circulation than those in the UK). In the UK, these costs are normally recovered from subscriptions, paid in advance of the year of publication. Thus a healthy cash flow can be maintained. However, for a new journal it may take five years or more before the number of subscriptions has built to a level where the journal is running profitably (Campbell, 1981).

Electronic journals entail the use of telecommunications and computer equipment by authors, readers and others at many stages of the publishing process. End-products are not necessarily multiple copies of journal articles on paper; they may be just single copies stored in a computer accessible on demand. Thus it is immediately apparent that we cannot express costs in the way we did for conventional journals and that costs and prices of electronic and conventional journals are not directly comparable. The two forms and modes of use are different and even the extent of what is meant by 'electronic journals' is as yet not clearly defined. Electronic journals can, but need not, have author-to-author or reader-to-reader communication, for example. In a sense, therefore, electronic and conventional systems are not strictly alternatives, although clearly they can overlap in some of their functions.

8.2   Methodological approach

When the government funds such study programmes, any commercial viability has not been tested in the market-place. The manner in which financial support might develop remains hypothetical. The degree of speculation, however, depends on the methodological approach taken. In this examination of the cost we base both the analytical approach for economic viability and the hypothesised results on the structure and actual use of the CBCS itself. Thus we examine a hypothetical quasi-commercial context in which the costs must be at least partially recovered from income. The number of variables that can be considered is high and so the decisions and assumptions on the approach are made clear as the examination progresses through the chapter.

8.3   Facilities in an electronic journal system

The traditional document input-output model for publishing is a uni-directional one with the relationship between author and reader hidden. These models involve an input or origination function with some processing function culminating in an output or end-use.

The BLEND electronic journal does not so readily fit into this type of model because of the integration with the communication facilities of the software system. Thus the text that a reader can access may not only be the product of a uni-directional process, but also include discussions and comments on the paper by other readers. It is useful, therefore, to review the facilities that might be provided by an electronic journal in an electronic communication environment. In this section, facilities are considered which help people to enter articles into the electronic system, and enable readers to access the articles. From the review we construct a general framework in which to consider the costs of the BLEND programme.

We start with the simplest model in which the author sends a normal typescript copy to someone for entry into the system. It is stored on an electronic system and available on-line for readers to access. The author accesses the text just as a reader and all communications between the relevant people are accomplished by existing services, such as mail. This is how many electronic publishing services start

their lives, often as a by-product of storing the text in machine-readable form for print output. Some electronic journals are created in this way with an off-line editorial process.

The next development is one which allows authors of text to enter it themselves. In fact, it is useful to consider a variety of text entry methods in order to enable authors to send their text in a way that will not present them with a discouraging barrier as found in the NSF-funded experiment (Shackel et al, 1983). Hence, for the BLEND system there were four methods of entry established and a number of others used:

- direct typing in the electronic system;
- preparing text in a microcomputer and sending in a block to the electronic system;
- preparing text for an Optical Character Reader
- sending a normal typescript copy for formatting and entry
- sending various microcomputer floppy disks;
- sending magnetic tape.

It is to be noted that some of these require the use of a text editor on the electronic system if the originator of the text is responsible for its final appearance. The preparation procedure itself for the electronic system, in contrast to that for paper, depends on which input process is used.

The concept of the Editorial Processing Centre suggested in the Seventies incorporated the use of a communications facility so that the editor of the journal, the referees and the authors could communicate with each other, passing copies of the article and messages on-line (Bamford, 1972; Woodward, 1976a; Woodward *et al.*, 1976).

The reader may or may not be given access to such a facility. Perhaps the reader might send a letter to the journal editor, which could appear in the same area of the journal as the article. When the reader is allowed communication with a large unspecified set of other readers, a bulletin board or computer conferencing system is required. This permits discussions to take place about an article and allows journals to generate computer teleconferences. The end-use of the article may be within the CBCS, if read on-line, or

without, if printed. The former require software aids guiding the reader to relevant material and then through it.

These functions cover the basic ones that need to be provided in an electronic journal and have been identified as the following:

1. Origination (writing).
2. Input process (including sub-editing and re-formatting articles).
3. Editorial processing (peer review and authorisation).
4. Preservation (storage and its management).
5. End-use (searching and reading).
6. Communication.

The nomenclature and differentiation of function are close to those used by King and Roderer, 1978, in their comparison of large scale systems. They distinguish five generic functions, as follows:

i *Origination*. The Origination function includes those sub-functions, activities and processes in which information is generated and organised so that it can be expressed as a message. This function can be thought of, for example, as authorship of a journal article. The principal participants are scientists as authors and their colleagues.

ii *Recording*. The Recording function concerns the processing of a message with the intention of distributing multiple copies of it through a particular medium. The message may be screened for acceptability and review (e.g. editing), after which a master record is created (e.g., galley proofs of a journal article). The master record is then replicated (e.g. printing or photocopying of the master image of an article) for distribution to users or intermediaries such as libraries. The principal participants in recording are publishers, including societies, editors and reviewers, and others who are engaged in publishing activities.

iii *Preservation*. The Preservation function involves maintaining a message (journal article) so that it can be used at a later time. Preservation includes storage, inventory control or management of storage, and retrieval, or the process used to retrieve items from the storage and transmit them to users. The

principal participants in preservation include scientists
(authors and users), libraries, publishers and other entities
such as abstracting and indexing services.

iv *End-Use*. The End-Use of scientific and technical information
includes decoding the message so that it is understandable,
evaluating the message to determine its value or usefulness, and
applying the communicated information. The principal
participants are scientists as users. Special use can come from
other entities such as abstracting and indexing services.

v *Transmission*. In order to perform the four functions on a
message (e.g. article, manuscript, etc.) it must be transmitted
from one participant to another. The Transmission function then
involves sending the message, routing it, and receiving it. The
sending is usually performed by telephone, mail or personal
delivery; and receiving involves another participant such as a
publisher.

They fit these in an input-output model, which emphasis the
interaction of the Transmission function at its centre (see Figure
8.1).
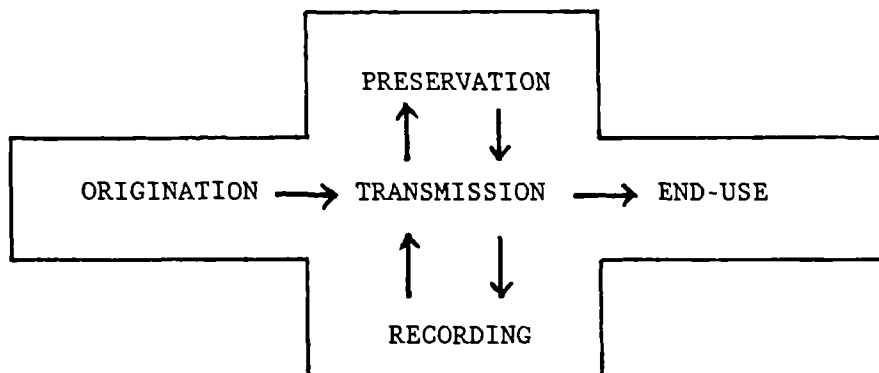
Figure 8.1: Five generic functions in formal scientific communication

The structure we have adopted varies from this model in a number of
small but important details, as sections of the functions move their
location within the model. The Input Process has been identified as
an area where the Editor thought of it as Origination and the
authors as Recording (Chapter 4), hence it has been separated out.
The Input Process has been differentiated in this way for another

reason. Electronic publishing is largely seen as a secondary
activity when material is stored in digital form as a by-product
from another process. It is claimed that electronic publishing has
financial viability only if the cost of the input process is not
included in the cost of the service (Gibbons, 1984). A second way
in which the list of five generic functions differs from our list is
in the role of Transmission. In using a CBCS for a publishing
activity, the role of communication becomes even more central. In
particular, it is used not only to access the store of information
but also allows end-use to modify it or to generate a new item for
it, as in discussions that lead to co-authored articles. Thus our
model includes bi-directional arrows for the movement of
communication within itself (see Figure 8.2).
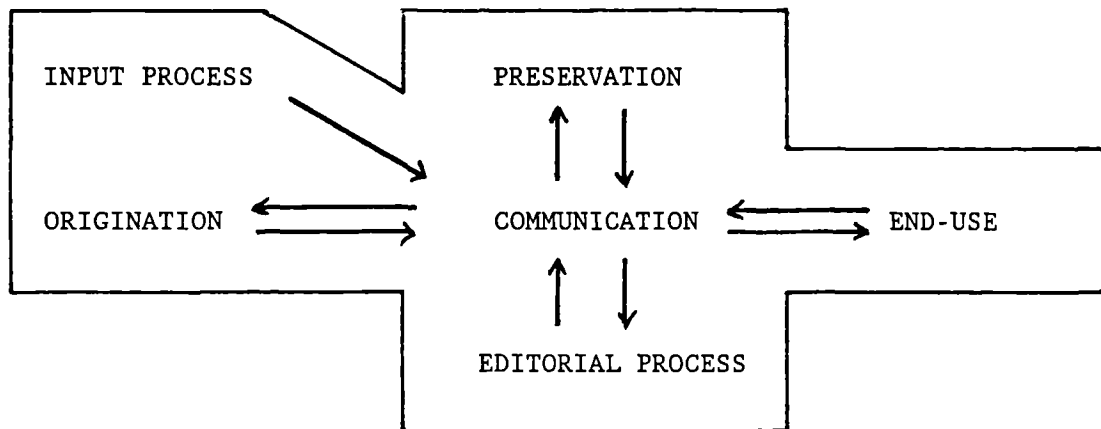
Figure 8.2: Six functions studied in the cost analysis

The expression 'End-use' in this context is taken narrowly to mean
reading and discussing articles and not the entire end-use of the
CBCS.

We will also consider an additional seventh category which covers
the high costs associated with some aspects of an electronic system
in the present development phase. They include support in learning
to commission and use new equipment and training on how to write in
new formats and for new media. We can expect them to be prevalent
for a decade before they are subsumed into other areas as found, for
example, in academia, where graduate students working for a
doctorate are expected to learn the procedures and appropriate style
of writing for journals.

The starting point is the provision of a system, of a host computer system, if that is the particular system implemented, in its hardware, its software to enable the electronic journal to operate and its telecommunications. We consider the cost of these and the functions identified in the following section.

8.4   Cost of functions in the BLEND system

There are two immediate difficulties in isolating the cost of the functions, first we cannot identify what users are necessarily accomplishing on-line, for example, whether they are writing an article or reading, and secondly some costs are directly measurable and others are not, these are called 'direct' and 'hidden' respectively. Evidently there are differences between the direct or hidden costs in traditional publishing and those in electronic publishing. In particular, certain items such as reading may be partially direct when reading on-line, but are always hidden when using hard-copy.

.

		PROVISION OF SERVICE	SYSTEM ADMIN & USER SUPPORT	SOFTWARE DEVELOPMENT
		Sterling pounds	Man-Months per year	Man-Months over 3 yrs
A:	Initial Outlay and maintenance	49,901 Software + 2,000 Modems + 600 p.a.	0.9	-
B1:	Origination	-	0.6	7.2
2:	Input Process and maintenance	33,680 + 4,580 p.a.	4.7	2.2
3:	Editorial Authorisation	-	1.0	5.3
4:	Preservation Storage	6,300*	0.6	0.8
5:	End-use	-	1.5	14.4
6:	Communication	-	1.5	-
7:	Publishing Activities	-	3.3	4.2
			TOTAL 14.1	TOTAL 33.1

* Equivalent cost in sterling pounds of 31.5 MB used by the LINC community on BLEND

Figure 8.3: Direct costs for system provision

For the initial analysis the direct costs were studied. Those explored are listed in Figure 8.3. There are different measures in use: number of man-months, for personnel and a standard estimate time-cost in man-months for the writing of programs (using a measure developed by Boehm, 1981). The equivalent cost of the storage used for communications by the LINC community is also given.

The initial costs of the DEC2060 itself were not included, as the machine had been bought by the University of Birmingham and was in full use as a campus computer. The costs and running expenditure were estimated by the university and are listed in Figure 8.4.

```
Cost of BU DEC2060 computer        £500,000      +  £60,000 p.a.
Air conditioning plant             £150,000      +  £10,000 p.a.
PSS Gateway                        £  3,000
Electricity                                          £10,000 p.a.
Staff - 1 Computer Manager/Systems Support           £20,000 p.a.
      - 1 Operator/Communications Technician          £12,500 p.a.
```

Figure 8.4: Approximate figure for costs of DEC2060 at Birmingham

The amount of use of Central Processing (CPU) time of the Birmingham
DEC2060 can be considered trivial and the amount of filestore about
5%. (The average CPU used per session was 140.9 msec.) This led to
a suggestion that a smaller machine would be quite satisfactory to
run such electronic journals. To keep the costs comparable for the
purposes of this evaluation, one might consider the smaller DEC
machine (a 2020), with hypothesised *pro rata* running costs as given
in Figure 8.5.

```
Cost of DEC2020                    £20,000       +  £ 2,400 p.a.
Air conditioning plant             £ 5,000       +  £   330 p.a.
PSS Gateway                        £ 3,000
Electricity                                          £   400 p.a.
Staff                                                £16,000 p.a.
                         TOTAL     £38,000           £19,130 p.a.
```

Figure 8.5. Approximate figures for costs of a smaller DEC machine

8.5 Ways of recovering the cost

Having established the basic costs of running some of the functions
of an electronic journal on a CBCS structured like the BLEND system,
how is it retrievable? Who will pay for it? Although the costs of
the functions would be independent of the way in which a journal is
financed, this is no longer true of cost per participant. Here, the
money flow through a particular system depends on a policy decision
and directly affects the costs to a participant.

Decisions based on science policy or social policy will affect the
relative costs to authors and readers. For example, there are
differing views on whether the main financial burden for
communicating the results of research should fall on the authors or
the readers/subscribers. This is at the heart of the page-charge
debate in the USA. Some journals charge authors per page for the
publishing of the paper in the journal and the electronic journal
could force a reconsideration of the issues. If it is decided that
the main burden be on authors, then this not only directly changes

the costs to authors and users but can also do so indirectly, e.g. a reduction in cost to users could result in an increase in their number, thus increasing income, and then, depending on the extent of the various changes, this increase could itself feed back to allow a reduction in the cost to authors.

Thus, the costs to participants in the system are not 'mechanically' related to the direct costs of their use, but are crucially dependent on the policy decision on how much of the indirect costs is to be borne by each party. This applies as much to electronic journals as to conventional systems. Here we consider only the first step, whether an appropriate cost can be borne by one or either of the parties.

In the UK and Europe, the *subscriber* has borne almost all of these costs. In the USA, in some fields (e.g. physics and biology) the author bears a considerable part of the burden through page charges. Although we may wish only to compare the electronic journal with a conventional UK system, the various systems for *access* by the user to the electronic journal increase the options for charging (e.g. by article, or by subscription). This makes a consideration of these points important and perhaps necessitates a future comparison of costs in several different systems or economic models.

There is a variety of ways in which readers and organisations might be charged for their access to and use of available articles. Several models are currently in operation and more are discussed and hypothesised. Here we reflect on the issue in relation to some of the facilities which can be made available.

We might consider the relative burdens borne between author and readers to be dependent on the strategy adopted to cover the expenses of certain functions, together with a *pro rata* component of the administrative book-keeping necessary.

For example, journals that pay a reasonable fee for the article effectively cover the author's actual expenditure in preparation and sending, i.e. typist's time, paper, typewriter running costs and postage. When no fee is paid, then the author pays for all of that and covers the editing, though not editorial sub-editing, functions. The use of page charges is intended to cover all the pre-run costs

and hence, equivalently, would cover in an electronic system all the sub-editing and formatting and perhaps also the storage costs (see Figure 8.6). It could be argued, although it is not included in the figure, that a system like Prestel Viewdata expects the Information Provider, equivalent to an institutional author, to pay for the search and reading aids also, since the pages of information are themselves routing pages. The reader then covers the access costs by paying a small charge for the administrative book-keeping and running of the service.

For the moment we leave the ambiguity about which parts of the editing and sub-editing of the article are done on-line or off-line. This will depend on the input process as well as on which facilities are available and it may well be that electronic journal publishers will move to a situation where the academic author becomes financially responsible for the production of the document and pays up to the boundary between text-editing (including publishers' sub-editing) and storage.

We have referred to the general practice of subscriptions for receiving money from readers and its benefits, which include a healthy cash flow to the publisher and a once-off payment and no continuous expense to the payer. Current electronic system practices, however, tend towards charging by use, partly because it is possible when a user is logged into an electronic system to do so, and partly because it is believed the high system costs should be borne by those making high use of it. Some of the ways of charging which might be considered are the following:

- by time logged into the system
  (i.e. use of the telecommunications port, etc.)

- by processor time (CPU)
  (i.e. use of the actual computer and amount that a user slows down others)

- by storage space used (i.e. amount of file space; in the BLEND system one particular member used a high amount and one particular group of people used substantially more than others)

- by function used
  (i.e. to cover cost of provision of the function, e.g. OCR entry of text, text editing, etc.).

It is clear from our comments that one reason for adopting a charge by this kind of criterion would be to discourage a single user from
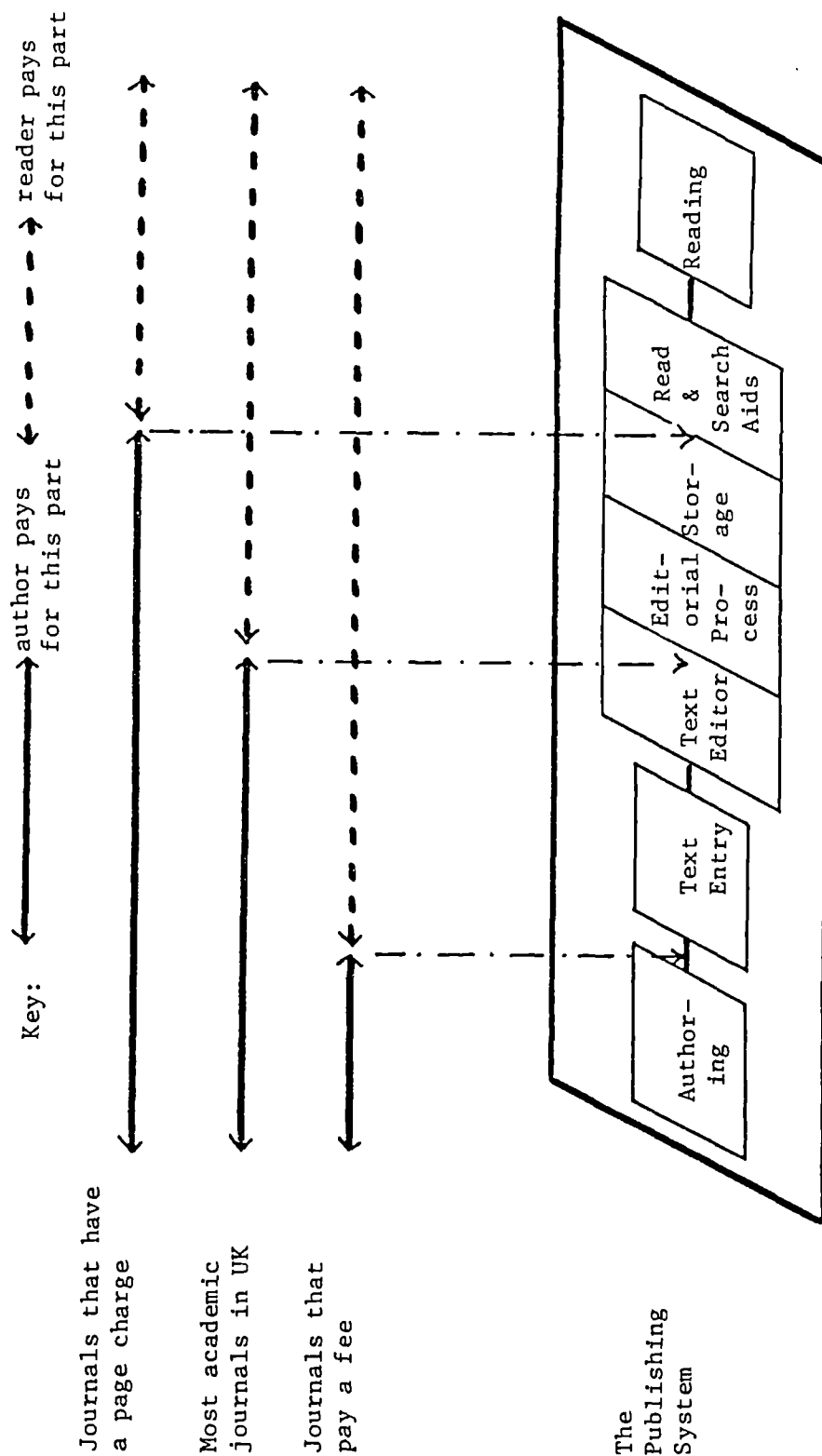
Figure 8.6: The relative burdens borne by author and reader in different situations

too much use of telecommunications ports, processor time or storage
space in relation to the general use made. This is because of the
jump in add-on costs caused by the provision of additional ports,
power or memory respectively.

Thus we can consider various income sources:

  (i)   authors

  (ii)   users on subscription

 (iii)   users on access and

  (iv)   any of the four combinations of these, in varying
          proportions of contribution.

8.6   Pricing strategies and user psychology

It seems attractive to ask those who necessitate additional
expenditure on system provisions to pay for them, in particular,
those whose use calls for add-on costs for ports or memory.
However, we have to ask whether this is most appropriate for the
task of scholarly communication and if there exist alternatives
which would better support the process of communication.

First, many people adopt a personal cost/benefit analysis of the
task which they do, including expense as well as the cost in effort
of using the system (Eason, 1981a). Within such an analysis they
are implicitly, but continually, asking questions of the form 'Is it
worth my spending 5p a minute to look at these routing pages if the
material for which I search is unlikely to be there?' or 'Is it
worth my spending 5p every 20 seconds to look at this article when I
can print it out more quickly and save myself some money?' This is
evident in long distance telephone calls, and increasingly
emphasised within organisations (as, for example, exemplified by
such journals as *Telecommunications Manager*).

When many of the systems that have contributed to the genesis of
electronic journals were being developed a decade ago, optimism was
high and telecommunications costs were widely predicted to fall at
about the same rate as the cost of computing power (see, for
example, King and Roderer, 1978). They have not done so, although
the high tariffs maintained by the Post, Telephone and Telegraph

(PTT) services of the different countries do look increasingly likely to fall relative to the cost of living indices. This perception of the relatively high cost may also influence those who seek to use telecommunications for such work.

Secondly, the cost of the use of telematic services has often been underestimated. The main reason is because of the low usability of the service, as for example, found in Prestel, the British Telecom viewdata service. It was designed as an easy to use system with menu choice access to the items in the datastore. However studies with naive users showed that the average increase in the number of routing pages used, over that designed and optimal, was 60% (Pullinger, 1980), while others found greater average increases in a range of 60 to 190% (Goillau and Stewart, 1978). The average time searching for each item was just over three minutes (188.3 and 198.5 seconds, in Pullinger and Stewart et al, respectively). Even without the individual page costs this was a much higher cost to the user than had been allowed for in the initial estimates of the viability of the system when it was being launched (Short, 1980). In participant observation of the BLEND system, the same could be said, that it took much longer to do many tasks than had been anticipated in the planning stages.

Thirdly, we consider the tasks in scholarly communication, reading, browsing and refereeing and also of communicating via shorter messages. The use of journals is to be encouraged rather than discouraged, both in numbers and in coverage. The average readership of a journal paper in a library has been cited as 1.5[*] and we have already referred to the inability for a researcher to handle all the relevant material that is being published in any area of specialisation (Licklider, 1966). Now the reading of scholarly articles entails a variety of strategies, already reviewed in Chapter 7, and among them are close reading of the text, in which there may be long pauses of reflection, also an unstructured skimming, as two ninths of the survey reported, in which researchers browse for anything of interest, in order to generate unexpected trains of thought. It is perhaps these moments of insight, the serendipitous discovery, that need protecting. We speculate in this, but it is not far-fetched to assert the possibility that serendipity would be affected by the constant cost-benefit analysis

*Meadows A J 1984 in "Electronic Publishing in the UK"

of on-line use by charge. Many academics may not choose to pay for the majority of items that they receive or browse in journal articles, but they might also receive that one stimulus a year from those very papers that initiate a new rewarding line of enquiry. Those with the browsing strategies looking for ideas would seem to support that. Refereeing, too, requires reflection and an unhurried assessment of the work that is being studied.

Those things asserted for close reading could also apply to the reading of more informal communication. The suggestions for the increase of utility to handle messages, by tagging and dealing with them later, suggests that some items cannot be answered or addressed immediately on the spur of the moment, but require reflection. This might be particularly true of the discussion that many found helpful in the development of their ideas prior to the writing in articles.

Thus we argue both from participant observation, but also from the suggestions for alterations on the system and questionnaire responses, that the task of scholarly communication is not one that can be easily justified on a cost/benefit analysis. Indeed, it can be argued that one purpose of the universities is precisely to allow research to be conducted in an atmosphere which permits and encourages serendipitous thought and discussion that generates new ideas as well as ongoing planned research. Consequently if the users of CBCS are forced to adopt such an analysis as they use a system, whether or not this is explicitly perceived, then it seems possible that the task of scholarly communication may be deleteriously affected.

We therefore propose that any costs to be recovered are done so by charging subscriptions for at least the access and use of journals, rather than a charge by use, however those charges are calculated. For this reason, we consider only a recoupment of costs by subscription in the analysis which follows. We therefore choose to cost subscriptions for journal use rather than a charge by use.

8.7   Subscription costs

We turn now to considering the recovery of costs based on the discussion above and upon the costs of the experimental programme.

Here we discuss the price to the user in relation to the need to pay for the service. The following assumptions are made:

1. The software development necessary is already accomplished.

2. The system and administration can be covered by staff with time as detailed in Figure 8.3.

3. Editorial and input operators are local to the computer.

4. A smaller computer is used with one staff member to cover system control and the telecommunications.

Based directly on BLEND figures in 1980, the initial outlay will be of the order of £63,500, excluding the cost of the software but including all central host hardware, telecommunications and input devices, including OCR and word-processor (see Figure 8.7). The software is excluded because of the special circumstances which led to a licence cost of £49,901 for the NOTEPAD pacakage and a development cost of £73,000 (44 man-months).

```
COMPUTER
     Computer                  £20,000
     Air conditioning plant    £ 5,000

TELECOMS
     Modems                    £ 2,000
     PSS Gateway               £ 3,000

INPUT PROCESS                  £33,680
                    TOTAL      £63,680
```

Figure 8.7: Initial outlay for a centralised host with BLEND-type facilities

In 1985 the prices of all these items are relatively cheaper than they were in 1980, compared to the Retail Price Index, and some, e.g. OCR and equivalent word-processor, actually cheaper in purchase cost. A 1985 figure for air conditioning has been used.

The amount of storage required depends on decisions about how long different types of material are to be stored. Our assumption is that all material will be permanently stored for the first few years. This is an overestimate but one to err upon. Thus using the actual figures for the main period of the BLEND study, January 1983 to June 1984, this would require an annual increase of 4.7 megabytes (MB) for the journals, and 3.8, 1.0 and 1.0 MB for informal

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communication, writing areas and the editorial process, respectively (see Figure 8.8).

	1.1.83	1.7.83	1.1.84	30.6.84	Mean Annual Increase
Editorial processing	3.1	3.3	4.4	4.7	1.0
Author's writing	3.7	4.4	4.9	5.3	1.0
Informal communication	4.3	5.7	7.7	10.0	3.8
Journals	4.3	6.8	8.8	11.4	4.7

Given to 2 significant figures in MB

Figure 8.8: Filestore used in BLEND for different levels of communication

Ten per cent has been added to allow for the increase in peripheral filestore used in advising users of new content and routing them to make a total of 11.5 MB increase annually.

The recurrent costs include the maintenance, running and administration of the equipment and support of users by the provision of manuals, advice and help. The estimate used is one in which one person is required to maintain and administrate on a working computer system for up to 20 communities, that the secretarial/clerical assistance for inputting material would increase linearly and that the need for the user support function would increase slowly in relation to the number of communities being serviced. We are aware of the gross simplification which this involves, not least in ignoring the fact that a small team will tend to accomplish more than individuals. The major recurrent cost not considered is office rental for staff.

Based on experience, the help required in supporting communities of users is taken to be the following. Using Figure 8.3, help in Origination and Editorial Authorisation will need to be given *pro rata* for each community (1.6 M.M. per community) and that for End-use, Communication and Publishing Activities will be sufficient for 5 communities (6.3 M.M. per 5 communities). The administrative support for the Presentation has been subsumed into the one person required for running the computer system.

These assumptions give a set of recurrent costs - itemised in Figure 8.9.

	Number of Communities using BLEND-like systems			
	1	5	10	20
1. Central host mainten- ance including one staff member (from Figure 8.5)	19,130	19,130	19,130	19,130
2. Input process hard- ware maintenance (from Figure 8.3)	4,580	4,580	4,580	4,580
Input operator working 4.7 M.M. per community costing £10,000 p.a. (from Figure 8.3)	3,920	19,580	39,170	78,320
3. Filestore 11.5 MB per community at equivalent cost £200 per MB	2,300	11,500	23,000	46,000
4. Editorial and User Support of Communities at 1.6 M.M. per Com- munity and 6.3 M.M. per 5 Communities or part thereof costing £20,000 p.a.	13,170	23,830	47,670	95,330
Total excluding input process 2	34,600	54,460	89,800	160,460
Total including input process	43,100	78,620	133,550	243,370

M.M. refers to person months of work.
Figures given in pound sterling.

Figure 8.9:   Recurrent costs for a centralised host system with
              BLEND-type use and support

In starting a journal, a publisher expects to make losses in the
first years - even where there is   little new investment in staff
or equipment.   The publisher will price the journal not to gain an
economic return in the first year, but at a 'competitive' level.
However, most publishers will have a rule of thumb on how long it
will take to recover costs and make a profit.   Typical figures are

3-5 years to recover costs, 5-7 years to make an overall profit.
Campbell, 1981, studied some of Blackwell's journals in their
profit-making and growth in subscription level. He found the growth
in new research journals launched independently of any society to be
smaller in the period 1972-1977 than 1968-1974. We use these
figures as appropriate ones for a base-line in our considerations of
growth in subscriptions to an electronic journal. The decrease in
the period has been hypothesised to continue and accordingly a
proportional decrease in the number subscribing has been calculated
for the period 1980-1985 (see Figure 8.10). This is an entirely
hypothetic extrapolation and may be considered as resulting on the
small side. Interestingly, the derived figures are reported to be
similar to those of a new journal in Computer Human Factors started
in the period (Taylor & Francis, 1984).

PERIOD	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6
'68 - '74	440	550	600	660	680	700
'72 - '77	280	370	430	480	510	530
'76 - '81	178	249	308	349	383	401
'80 - '85	89	167	221	254	287	304
Cumulative number of subscriptions for '72 - '77	280	650	1080	1560	2070	2600
Cumulative number of subscriptions for '80 - '85	89	256	477	731	1018	1322

To compare periods, the first six-year period 1968-1974 has been treated as
a five-year period 1968-1973, then one-year overlaps have been considered
to give us the period 1980-1985, in which the BLEND system operated.

Figure 8.10:   The figures used for growth in subscription rates
                (following Campbell, 1981)

Number of Communities	1		5		10		20	
Input Process	Included	Excluded	Included	Excluded	Included	Excluded	Included	Excluded
COSTS:								
Initial Total	63,680	30,000	63,680	30,000	63,680	30,000	63,680	30,000
Recurrent Total	43,100	34,600	78,620	54,460	133,550	89,800	243,370	160,460
Per journal, initial	63,680	30,000	12,736	6,000	6,368	3,000	3,184	1,500
Per journal, recurrent	43,100	34,600	15,724	10,892	13,355	8,980	12,168	8,023
YEARS — Number of subscriptions collected: Optimistic: 1972-1977 / Hypothetical: 1980-1985								
4	151.3 / 323.0	107.9 / 230.4	48.5 / 103.5	31.8 / 67.8	38.3 / 81.8	24.9 / 53.2	33.2 / 70.9	21.5 / 46.0
5	134.9 / 274.2	98.1 / 199.4	44.1 / 89.7	29.2 / 59.4	35.3 / 71.8	23.1 / 47.1	30.9 / 62.9	20.1 / 40.9
6	124.0 / 243.8	91.4 / 179.8	41.2 / 81.0	27.4 / 54.0	33.3 / 65.4	21.9 / 43.0	29.3 / 57.6	19.1 / 37.5

Costs from Figure 8.7 for Initial Outlay and from Figure 8.9 for Recurrent Costs.
Subscriptions from Figure 8.10.

Figure 8. 11:   Costs of Subscriptions for Break-even Points after 4, 5 and 6 Years

We can now calculate the cost per subscription in order to cover the costs assumed based on an agreed breakeven point. Following the publishers' 'rule-of-thumb', we examine three breakeven points, four, five and six years, and calculate the cost of the subscription for running 1, 5, 10 or 20 communities on one computer system. They are listed in Figure 8.11.

Some of the subscription costs for slightly larger groups of communities are not substantially different from those charged to subscribers for journals covering the same kind of topic in the U.K. For example, the annual subscription to the journal *Behaviour and Information Technology* was £50 in 1985 and £65 in 1986.

8.8   <u>Limitations and cost to the participant</u>

The extrapolation is limited by a great number of factors and we have done no more than take one use of one experimental system, calculated some of the costs and hypothesised on the number and cost of subscriptions required to cover these costs. One particular area that remains unclear is the consideration of costs that derive from reaching the limit of the computer's capacity to handle a number of communities, or the additional input equipment and telecommunications ports required to serve them. It is not envisaged this will occur with up to 20 journals, extrapolating from BLEND data, but it is known that the amount of overall use encourages the amount of individual use. It is, therefore, possible that the use of such a system, incorporating general electronic mail and teleconferencing as well as the electronic journals, might increase to such an extent that the limitations of the computer would be reached. The model adopted is a very simple one based on minimal staff and equipment to service a small number of communities running electronic journals.

The subscription, however it is charged in practice, is not the cost to the participant. This cost needs to take into account personal equipment and telecommunication costs. The latter can be calculated for an average participant. If we take a slightly optimistic view and consider a mean access rate and pattern amounting to one hour every two weeks and use 1985 PSTN telecommunication rates, then at

'normal' telephone rates (i.e. afternoon) the additional cost would be in the order of £250. The users only spent one fifth of their time on the system in the journal areas, so that an additional £50 would be required. The telecommunications cost could be much reduced using computer networks.

If we assume that use will be made of existing equipment at no additional cost to the user, then that places the subscription into a total cost of around £87.50, taking the six-year break even point and excluding the input process. On the price of the B.I.T. subscription, that is an increase of 75%, but this figure is very sensitive to the number and cost of personnel to run the computer and editorial processing functions and the cost of telecommunications. King and Roderer, 1978, in their large scale analysis of the whole of scientific and technical publishing in the U.S., discovered an increase in the cost per use of each article to the reader. Their hypothetically extrapolated figures for 1985 were $19.55 per use and an additional $7.15 per use to the individual subscriptions, an increase of 36.6% (p.98 and 109). Their own calculations were also stated to be very sensitive to the communication routes used for the transfer of information and the costs of telecommunications which they hypothesised somewhat lower than found.

The cost to the user, when calculated by subscription, is higher than for normal journals, when compared with publishers' accepted breakeven points. It was also hypothesised as higher in the comprehensive scenarios by King & Roderer, 1978. In both the results are sensitive to the cost of communications. Any cost-effectiveness of electronic journals seems therefore to depend on two main assumptions: that users will have appropriate local terminal equipment used for other purposes and that telecommunications will be minimal, by their relative reduction in charges or by use of sponsored services, for example the Joint Academic Network (JANET) in the U.K.

8.9   Conclusions

We have made a gross simplification in calculating the costs of a
system to run a BLEND-type journal with BLEND-type use. In meeting
these costs by subscription, we have calculated an increased cost to
the user caused by the high cost of telecommunications even with the
assumption that the user has the appropriate local terminal
equipment. The results must, however, be taken within the
limitations of the study and the assumptions have been spelled out
accordingly. In particular, the number of people required in order
to run such a journal centre is beyond any experience in the world
and so has been hypothesised from BLEND experience. Since this
forms a major part of the costs, any results will be sensitive to
these particular assumptions. We conclude that the
cost-effectiveness of electronic journals is dependent on widespread
easy accessibility by individuals to local terminal equipment
already provided for other functions and on development of the
telecommunications infrastructure.

This is, however, not a pessimistic conclusion, despite the need for
large capital and development investment before the financial
viability of electronic journals. The present primary communication
system is supported in just these ways by an extensive system of
support by government, directly and via institutions, or by
industrial/commercial resources. At an individual level, one person
could not afford to take all the journals browsed, or read and, as
we have seen from the LINC researchers, the number taken is often
only a quarter of those regularly accessed. Instead, the
organisation invests in a single set for many to access, paying not
only for the product but also for its storage and facilitation of
access to it. In this sense, it could be considered that equivalent
support would be local terminal equipment and telecommunications
costs. Secondly, the informal communication associated with
scholarly communication is also supported by the organisation in
provision of a postal service, both in its cost and handling by a
central agency, a telephone service, both in cost and by a
switchboard, and by paying to some extent for attendance at
face-to-face meetings. If the telecommunication task in using
electronic journals is supported so that the individual researcher
is not made liable for the cost, as for other services now generally

deemed necessary, an electronic journal system does appear to be feasible, within the limits of the investigation here. We have also argued that any telecommunication cost dependence for the individual would inhibit the scholarly communication task and result in usage patterns that become too expensive for the utility supplied.

DISCUSSION AND CONCLUSIONS OF THE THESIS

The research has led to three foci: the methodology used to
investigate the feasibility of a large-scale telecommunications
based experiment; the human-computer interaction; and the
exploration of electronic journals themselves.

Consequently the final three chapters of the thesis looks at each in
turn. With so many factors emerging as important to the users of
the system, various issues are considered from a number of angles
within the chapters in order to seek a way forward for the three
foci.

9 METHODOLOGICAL CRITIQUE

9.1 Introduction

The methodology used for examining the feasibility of electronic journals has been one of action research associated with a particular experimental programme, which has therefore been similar to a case study approach. In order to guide the research, the methodological approach for examining feasibility has followed Shackel, 1983, in which the four aspects of usability, utility, likeability and cost-effectiveness, have been considered. This has formed the basic outline for the research and is integrated into the chapter structure of the thesis. In order to analyse each aspect, many methodologies have been used which are standard in the human sciences including experiments, questionnaires, interviews and various transactional analyses. These are reviewed in Figure 9.1. The major questionnaires and interviews are listed in time sequence in Figure 9.2.

Chapter 2   Electronic Journals: The Promise and Methodological Approach to Investigation

Methodological approach argued: action research
feasibility framework
individualisation

Chapter 3   Accessing the BLEND System

Computer recording of access (using LOGBOOK)
Statistical analysis of distribution patterns in access.
Structuredtelephone survey.
Attitude rating on level and difficulty of access.

Chapter 4   The Utility of the Communications System

Attitude ratings established journal practices.
Manual recording of time events in editorial procedure for refereed papers.
Attitude ratings on electronic journal expectation and experience.
Manual recording of message-making.
Statistical analysis of message-making distribution.
Attitude ratings on informal communications using a CBCS.

Chapter 5   Work Habits and Attitudes of the Participants

Questionnaire and face to face interviews on established patterns of journal paper writing and reading.
Questionnaire on connectivity within research community.
Attitude ratings on expectations and work habits associated with formal and informal communications.

Chapter 6   The Usability of the CBCS

Analysis of requests for user support.
Participant observation.
Detailed systems analysis.
Enhancement evaluation.

Chapter 7   Reading Articles On-Screen

Interviews on reading articles.
Design and evaluation of reading program on the CBCS.
Pilot experiment on reading on-screen.
Experiment on reading including objective and subjective data.

Chapter 8   Cost Appraisal

Manual collection of data on costs.
Projected modelling based on system usage.

Figure 9.1:   The main methodological tools used in the research

1980	Sept	CBCS (BLEND) software mounted on host computer for initial trial use.
	Oct	Questionnaires sent out to participants ('Pre-use Questionnaire').
	Nov-Dec	Interviews (face-to-face) with participants.
1981	Jan 15	CBCS running with 64 named participants.
	Mar	Systems analysis preparatory to system enhancement.
	Jun-Jul	Structured interview survey by telephone ('Six-month phone survey')
	Aug	Design of data-recording software (LOGBOOK).
	Jul-Sept	Detailed analysis and pilot trial of log-in presentation.
	Oct-Dec	System and user support development.
1982	Feb 15	Software version 2 (enhanced).
	Mar-Jul	Evaluation of changes to the system.
1983	Jan-Mar	Pilot experiment on reading on-line.
	Nov	Structured interview survey by telephone ('Thirty-five month phone survey').
	Nov-Sept 84	Reading experiment.
1984	June 30	End of data collection on on-line use.
	July	Questionnaires sent out to participants ('Post-use Questionnaire').
	July-Aug	Statistical analysis of computer recorded data.
	Sept-Dec	Analysis of questionnaires/requests for user support.

Figure 9.2:   Time sequence in data collection and analysis events

This chapter reviews the main methodological approach, the use of action research, the case study investigated, the feasibility framework and comments on a few features in the other human science methodologies.

9.2 Action Research

It was argued at the outset of the research that an action research methodology was most appropriate in evaluating the feasibility of a tele-informatic system (Section 2.4.1). Has this approach been vindicated? We suggest that is has for one main reason, the study has confirmed that there is no way of getting ahead of the technological development in order to evaluate the potential usage made of it. By such a statement, we mean not only that the limited state of the technology moulds the use made of it, but also that, given any technological state, there are many organisational and behavioural patterns which need to be created or modified in order to accommodate the technology before its full potential impact can be evaluated. Moreover, those latter changes were not able to be anticipated beforehand and the elimination of their discovery by other more controlled experimental environments would have meant losing some important research evidence. In turn, this evidence was able to be used to modify the real-life situation, to provide terminals and improve the availability of the CBCS, and thus to explore further aspects of the use of the CBCS to support scholarly communication.

9.3 Limitations of a case study

There are many aspects within the user-system-task framework that cannot necessarily be transferred to other situations, i.e. learning that is context specific. Because only one context has been studied we cannot be entirely certain which they are. These uncertainties are now spelled out and described in the light of the research.

In this case study of one implementation of an electronic journal there are many unanswered questions. These form part of the context in which we have considered the interaction between the components, user, system and task, and hence we cannot examine the interaction between the three components and the context. At the group level, where the questions about the feasibility of the electronic journal were originally formulated, each of three components, the group, the electronic medium and communication, have their own contexts forming part of the overall scenario. The components cannot therefore be examined in detail. All we have done is to describe and reflect on possibilities.

As a group, the researchers did not know each other well beforehand
and indeed part of the purpose was to introduce them to each other
and to create a research community. The increased communication
found in the 1984 questionnaire was proof that this was successfully
achieved. However we cannot extend any generalisations on the use
made of the CBCS by the group to other groups. Two hypotheses can
be argued; that use was made of the system because of the need to
get to know other members of the group, and that less use was made
of the system than there might otherwise have been because there was
such low connectivity existing within the group at the start. The
latter is supported by Hiltz, 1984, where the total number of hours
spent on-line by a group member throughout the whole use of the
system was most strongly predicted by the number of participants
previously known in the group. It is also suggested by the
behaviour of the users in their reluctance to initiate messages. On
the other hand, the large number of participants who made occasional
accesses to the system, without contributing many   messages
suggest a strategy of finding out 'what was going on' and 'who did
what kind of research' before possibly communicating with them via
other media. These may have been non-users in a well established
community. To establish whether established groups or isolated
individuals who wish to form groups make different quantitative and
qualitative use of a CBCS requires research with a number of groups.
Hiltz' analysis cannot be transferred from group work to a gammut of
scholarly communication.

Secondly, the nature of the subject area determines different kinds
of communications within it. The main need for communication
content, identified by this survey, was mainly information on
current progress in research programmes, and identification of
problem areas. Neither form the core material of refereed papers
journals. Thus we cannot distinguish the inappropriateness of this
kind of communication in a refereed papers journal from the
inappropriateness of refereed papers as a communication on an
electronic medium. In our previous discussion in Chapter 4, the
need for development of refereed papers was within the context of
the expressed requirements of this particular group and subject
area. However the arguments based on the suggestions of a perceived
'sense of speed' of the electronic medium in its communications
support the view that refereed papers may not be most appropriate

form of communication. On the other hand the inappropriateness
might also stem from the lack of a need to develop the informal
networks of author groups, identified by Garvey and Griffith, 1971.
The agreement on the relative importance of problems and their
development to a point where it is agreed that they have been solved
does not appear to occur in applied behavioural sciences. The field
is likely to spawn new problem areas continually, not because they
are as yet undiscovered scientifically but because they emerge as a
problem for people as technology develops. They are often generated
in sufficient quantity for there not to be agreement on their
relative importance before the next lot are thrust upon the experts.
The solving of this kind of problem is situation-dependent thus
precision may not be obtainable in the manner associated with
'harder' sciences. Thus the need for collaborating authors to form
into competing groups, (Hagstrom, 1965), is not perhaps necessary in
this kind of subject area. What is necessary and agreed among the
researchers is to publish ideas quickly and identify the problems in
such a way as to alleviate them in the situation in which they
occur, before that situation moves on. A hypothesis can therefore
be raised for the applied behavioural sciences requiring a different
type and speed of publication for this purpose.

The third component is the CBCS in the context of electronic media
for communication. The requirements specified for this CBCS cannot
necessarily be extended to other systems, for they may be a user
reaction to a combination of experiences. Other than in those areas
where we have done experiments, for example in reading research, we
do not have sufficient confidence in the detailed enhancement of the
system to predict what can be carried over in system requirements.
Hence only a few more general ones have been considered in this
thesis which are more likely to prove worthwhile in other similar
systems, for example the conceptual consistency in handling a
document in a particular way, or in allowing two frameworks for the
command structure to operate in the system at the same time. The
lack of development possible in the area of support for group
discussion means that no pointers can be given other than the
absence of facilities to support the sort of task that the users
wanted to do.

The users' strong image of accessing the computer as 'a place where
communication takes place' suggests that a distributed CBCS might
have very different requirements expressed by the users as the
result of the different image. As in a distributed CBCS, other
systems may be developed which do not make the assumption that the
long-term storage medium of communication is the same as the
short-term other than it is held in digital form, nor that they are
necessarily processed on the same machine in the same way, nor that
access to them are accomplished by the same route. Such changes
might also be expected to result in different requirements from a
CBCS and forms another set of possibilities where one implementation
cannot shed light on the appropriateness of the particular CBCS for
scholarly communication other than in a descriptive sense of its use
and the users' reaction to it.

The thesis is an analysis of one particular situation in the rapidly
developing context of both the electronic media and research
community and the relatively stable one of scholarly communications.
That stability provides us with the focus of the research and allows
the exploration of its transfer to other media and groups. Despite
the limited research possible in a case study, this particular use
of a CBCS for a refereed paper journal remains the only
demonstration hitherto of its possibility and one upon which
research can be based.

9.4   The 'feasibility' approach

The feasibility approach proposed by Shackel was adopted as a
framework for the research programme in order to study the
interaction between the elements of the group-CBCS-communication
system within its context. The methodology focused on questioning
whether or not the system was feasible in support of scholarly
communication and was initiated by studying the utility, usability,
likeability and cost-effectiveness. It was argued that this also
had to be individualised (see Section 2.4.3). The main reason for
the choice of the framework was that it provided a comprehensive
coverage of the areas in which there were potential drawbacks to the
implementation of electronic journals.

In the research, it was found necessary to expand the categories of
the framework by one, accessibility, in order to explain the lack of

feasibility when prospective users had difficulty with access to the system. Theoretically this might have formed part of the original conception of usability, 'can the research community use the CBCS for scholarly communication?', the use or otherwise of the host system to be identified separately. For CBCS and other tele-informatic systems, accessibility is likely to continue to be of importance until the telecommunications infrastructures are developed and organisational structures support the infrastructures as services. There are many signs that these moves are beginning.

In stressing accessibility it might seem that a distinction is being made between the CBCS and its implementation at an organisational level using the communications infrastructure available. While the systems approach has been considered variously in the literature, and often indeed as all human tasks associated with a tool, here we have hitherto considered the system as all of those technical, organisational and human parts that seek to provide a tool for scholarly communication to the researchers, while not including the researchers themselves. What seems now to be distinguished are the whole of the technical, organisational and human parts that form such a tool, from the technical and organisational parts of the telecommunications infrastructure as it is provides a basis from and upon which the tool is created (see Figure 9.3).

```
┌─────────────────────┐    Accessibility      ┌─────────────────────┐
│                     │    of system          │ Communications      │
│  Group of users     │ ◄──────────────────►  │ organisation and    │
│                     │    for scholarly      │ infrastructure      │
│                     │    communication      │                     │
└─────────────────────┘                       └─────────────────────┘
         ▲                    ╭─────────►╮              ▲
         │                                              │
Likeability            Cost-effectiveness       Usability
of system              of system                of system
for scholarly          for scholarly            for scholarly
communication          communication            communication
         │                    ╰◄─────────╯              │
         ▼                                              ▼
┌─────────────────────┐    Utility of         ┌─────────────────────┐
│  Scholarly          │    system for         │ System to           │
│  communication      │ ◄──────────────────►  │ support             │
│                     │    scholarly          │ scholarly           │
│                     │    communication      │ communication       │
└─────────────────────┘                       └─────────────────────┘
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Figure 9.3:   The inclusion of accessibility into the feasibility model

Just as the task of the users is differentiated from the users
themselves in this approach, so might the CBCS to support the task
be distinguished from the other uses to which the organisational
infrastructure for telecommunications might be put. The CBCS for
scholarly communication does not include all the use of the
telecommunications organisation and infrastructure, but rather is
one use of it, just as scholarly communication is one task of many
that the group of users seek to accomplish. This view is supported
by the telephone surveys, especially the thirty-five month survey,
in which users requested flexibility in both choice of route to the
CBCS supporting scholarly communication and to the content of the
CBCS, in having its content passed from CBCS to CBCS. The users
seem to be viewing the system as one tool available upon the
telecommunications infrastructure and in organisation relative to
the infrastructure available. It may therefore be helpful to modify
the main components given in Figure 2.4 to those found in Figure 9.3
for future research.

The examination of the utility of the system to support scholarly
communication provides many pointers to future developments,
discussed in Section 4.4. Here is both one of the strengths and

weaknesses of such a methodology. In examining utility, the other
components, accessibility, usability, likeability and
cost-effectiveness have been distinguished from it, though each
bears upon it. This is its strength. Its weakness however, lies in
the fact that the utility is communication, that it is difficult to
distinguish the utility of the system in its support for the task
from the task itself in such a case. In considering other
tele-informatic systems, for example, viewdata systems, the task to
retrieve the required information is more easily distinguished from
the utility of the system in support of that task. This is
particularly to be emphasised in the developmental stage of
electronic scholarly communication, when the appropriateness of
form, style and procedure are yet to be established. Thus the
research examined what was done on the system and compared it with
what users claimed they wished to do pre-use and what they expressed
they would like to do in the future. In order to move forward with
more concrete research results from this methodological approach,
there needs to be enough experimentation with different system
organisations and types of scholarly communication so as to compare
the utility that may, or may not, be able to be provided by a CBCS
for the tasks wishing to be accomplished by the users. Without such
experimentation, the danger is either that the utility is evaluated
against the established pattern of primary communications, or that
the CBCS utilities provided entirely mould that which the users wish
to accomplish. Eason's 'most desirable project' (Section 2.4.1)
recommends a time-scale sufficient to pass through these stages and
to develop new possibilities that transcend old ways of doing things
using other media. Thus too Licklider, 1966, argued for a few
experimental networks of "significant size to develop the
facilities, methods and the 'software'".

Perhaps the most difficult component to grasp methodologically in
the research programme is 'likeability'. In our description we have
used it as a peg for the concepts of matching work habits and all
sorts of attitudes to the system. The original sense was one of the
system "perceived or felt as appropriate and suitable for supporting
the task". Inspection of the 1984 questionnaire data shows no
evidence of strong correlations of "Do you like the BLEND system?"
with any other question. Thus it does not indicate any one measure,
such as a change of work habits or convenience of use. These two

were, however, the closest in correlation to the question, with correlation coefficients of 0.64 and 0.53 respectively. The numbers in the group of long-term users (16) is rather small for going on to multiple regression techniques to explain the variance observed, although this would be informative for the methodology when the numbers in the sample are sufficiently large to do so. Methodologically, there seems to be no other single expression used in the analysis or data collection to replace 'likeability'. Moreover, it was expressed as a reason for successful participation in the 1980 interviews by one LINC member, "... if I _like_ the system".

In order to investigate this further in future studies, the investigation of the change of work habit would need to be refined. The question asked 'Has the BLEND system changed your work habits?', included two sets of answers that pointed in different directions in likeability. Both were changes required to use the system, one a voluntary choice because of the benefits and the other a forced one because of the restrictions in its use. The former included those who logged in nearly every day as part of their normal working day and the latter those who in order to log in, even occasionally, had to make a large effort in order to do so. Thus, some answering, e.g. the former, would indicate a positive likeability. Methodologically, the range of questions on work habit change, convenience of use and likeability should all be further refined.

Finally, the feasibility approach adopted here includes cost-effectiveness at both individual and group level. By its inclusion, it is clearly indicated that decisions on cost policy may affect the use made of the system and also that each of the task, user, system and context affect the cost-effectiveness. In other words, it interacts with all the components just as do other aspects of feasibility considered. Because the experimental programme was financially supported by government, as Sackman, 1972, had argued that such experiments needed to be, the cost-effectiveness could not be treated in the same manner as the other components. Thus a theoretical treatment was made, based on the findings of the use made of the system, linking potential effects on that use.

In summary, as a framework for investigating the feasibility of a system, the methodology seems to have led successfully to the

maintenance of the investigation of all areas of the group-system-task, but to fulfil such a methodology for a communications tool, it is suggested that a substantial amount of experimentation is included, to allow analyses across many conditions that were not possible in this case study.

9.5   Other aspects of the methodology

Within the case study undertaken in an action research methodology with a framework using the feasibility approach, there have also been research areas which have generalisable findings. The enhancements to the CBCS to support usability and utility are, in particular, potentially generalisable to other systems. Included in these are the importance of conceptual consistency for handling documents, and the need to make a CBCS to be used for occasional as well as regular use as simple as possible. The accessibility of a system to support a particular task of a group of users also suggests itself as generalisable. However, the main item of generalisable work is that on reading because it stands independently of the case study and hence its limitations. The results of this series of experiments may therefore be used with considerable confidence for users in another environment, subject area and system.

There were also a few smaller aspects of the methodology that proved of significance in the research and interpretation of other parts of the research programme. The timing of the subject on which the interviewees spent most time talking during the two telephone surveys, was most useful and fairly robust as a methodology for what was concerning the interviewee most. In particular, there was observed a considerable degree of consistency between the two surveys in this respect, the same interviewees concerned largely about the same issues except for those moving their concern from accessibility to usability.

Secondly, the program LOGBOOK, installed very early on as a fail-safe recorder of transactional data on users of the system, proved necessary when the problems of the supplied data recording and analysis package became apparent. It was, moreover, used to observe trends in behaviour on a quarterly basis so that other

investigations could be prompted, for example the timing of the thirty-five month telephone survey.

Thirdly, the process of interviewing the prospective users after their questionnaires had been completed was of value for two reasons. First, the respondents tended to express the theoretical state of affairs: 'No, there is no problem sharing a terminal', 'I store all my photocopies of articles and reprints in an alphabetic filing system' rather than the actual: 'Well he's writing just now, so I can't show you the terminal. That's sometimes a bit of a nuisance for me' and 'These stacks are the articles I've not yet filed. Yes, over a half sit there, I guess its been like that for a year or two. I just look through the stacks'. This background information was used in conjunction with the dropping use of the system to prompt the six-month survey and several of the other types of investigation, for example, the exploration of an annotated abstracts journal which is not described herein. After the considerable effort undertaken to complete the questionnaire and the majority of the interview was complete, it was felt that both the interviewer and interviewee had learned sufficient of each other's approaches to ask the main questions on the reasons for participation and what would be judged as a successful outcome.

Fourthly, the use of statistical methods, some rather complex, to analyse distribution data proved informative in suggesting what the users might be doing. Much general data with means and standard deviations are proffered for system usage, but it seems important not to analyse 'the average' but to determine what is happening.

It was this variety of small parts of the methodological approach, adopted from several disciplines, which provided the necessary monitoring and collection of data for the action research. Not only can one not get ahead of the technology, but it would have been hard to monitor the changes that were happening without either the feasibility approach to bind the different investigations together and the cross-disciplinary approach in the smaller parts to maintain the research data flow. The one single most important item lost from the data, due to the inoperability of the data collection package supplied with the software, was the individual attitude change correlated with all the other factors that affected access rate and use. Nevertheless the general methodology can be

recommended for further use, with the provisos considered in this chapter.

10. DISCUSSION: THE 'BARRIER' FRAMEWORK

Everything seems border-line. The cost appears just feasible given certain conditions, reading on screen does not look an impossibility with more research and development, the usability of the system is tolerable, and the regular users (in Groups 3 and 4) hint at a future where the system is used, is liked and where creative work is accomplished. Having looked at a number of areas associated with feasibility and examined the methodology used to accomplish the research, with all its provisos and caveats, the question now addressed is whether or not the future looks better than border-line.

The research has covered many areas and so it is reviewed for the reader in Figure 10.1, summarising chapter by chapter the main findings. During the research many barriers were experienced by potential users. In this chapter these are brought together in a framework that contributes an understanding to what needs to be developed in order that electronic journals are feasible. In the methodological approach leading to a comprehensive coverage of feasibility, the prospect of these barriers in future experiments and implementations appear certain unless they are addressed in such a way that the main issue studied in future is the utility of the CBCS to support users in their desired tasks.

10.1 The 'things of life' - a summary

The particular implementation of journals on a CBCS has demonstrated that it is at least possible to run refereed and unrefereed paper journals on-line. However the amount of use by the research community and the number of accesses were much lower than might have been expected. One explanation proposed for the particular access pattern was that all the 'things of life' got in the way (Chapter 3). In our study some of those 'things of life' have been identified and some explored in more depth.

CHAPTER	CHAPTER TITLE AND MAIN FINDINGS AND CONCLUSIONS

2   Research directions

1. Can the CBCS be developed to support researchers in their scholarly communications?
2. What will the effect be on scholarly communications?
3. Will use of a CBCS help handle the information explosion?

3   Accessing the CBCS

1. The pattern of accessing the system was dependent on what is going on around users.
2. Identification of the difficulty of accessing system.
3. The different patterns of access rates. (5 groups.)

4   Utility of the CBCS

1. The average number of articles in CHF generated by researchers was exactly that demanded for participation in the experimental programme.
2. Participation stimulated research and articles.
3. Refereeing took same length of time as for other paper journals.
4.   80% hoped for publication in under 3 months.
5. To meet speed and style of publication requirements, some change has to occur in
   a) the peer review system
   b) the speed of publication
   c) the article size and frequency research reporting.
6. In informal messaging, the probability of a person initiating a message tends to be lower than the probability that someone will respond to it.
7. Users behave as if there may be a feeling of 'topicality' in the discussions of around one week.
8. To help users in computer conferences (discussions), some changes could be effected in
   a) the design of the software aids
   b) content (e.g. by adding summaries)
   c) purpose in communications
   d) the style of leadership.
9. There was increase in informal communications between the researchers as a result of using the system.

5   Work habits and attitudes of the participants

1. Main effect of CBCS on research community was to enable them to communicate with each other on work-related issues, which modified how they developed their thinking for scholarly work.
2. Increased contact may have contributed to the large reduction in the difficulty of locating relevant material.
3. CBCS allowed some participants to use other communications services less.
4. The lives of two people were transformed by the use of the CBCS.

6   Enhancing the usability of the CBCS

1. Five aspects of the CBCS were discovered to need enhancement
   a) the log-in
   b) consistency in the dialogue
   c) structure of the software
   d) consistency in the handling of articles
   e) reading articles on screen.
2. Evaluation indicates that enhancements were beneficial to users and use increased afterwards.

7   Reading articles on screen

1. Software aids for reading text did not support half the strategies normally used in reading.
2. Six areas were identified for further research and experiments focused on the development of 'manipulation' aids for reading.
3. The experiments showed
   a) the facility to jump around an article was more efficient and preferred
   b) the facility to 'flick' pages was also useful
   c) paragraph presentation is preferable to filling the screen up
   d) some like summaries prior to full text.
4. Reading is possible on screen and can be made acceptable to users.

8   Cost appraisal

1. Costs cannot be directly compared with traditional publishing.
2. In the variety of ways in which costs can be recovered, some may be more acceptable than others to the user; charging by use in reading journals may be counter-productive.
3. Subscriptions may not be unreasonable for a BLEND-type system with BLEND-type use for a group of 10-20 journals.

Figure 10.1:   An overview of the research directions and findings

First, the participating research community itself had high demands placed upon it because the agreement for participation was to supply the average number of articles that they wrote, i.e. the entirety of their average productivity. Secondly, the subject area Computer Human Factors went through a period of rapid expansion with a high demand placed on the researchers for their time and productivity. Thus the first barrier was in the availability of the participants time and effort. Thirdly, the promise of electronic journals was that a new medium, the computer-based communication system, would transform communication within a research community (Chapter 2). The CBCS would offer new advantages and support new types of communication, perhaps freeing the community from the need to distinguish so carefully between authorised publication in the form

of refereed papers and the dissemination of papers without
preliminary peer review. The scenario envisaged by the proponents
of the electronic journal was one in which a CBCS would be widely
available (Hiltz and Turoff, 1978). Following the hint of
difficulties experienced in the NSF - funded U.S. experiment (Tracz,
1980), and initial experience in the use of this particular CBCS,
this was examined at an individual level. The system was not
accessible to each individual and this inaccessibility proved a
major barrier to the use of the system. Four requirements were
identified as part of avoiding such a barrier:

1   Having suitable local terminal equipment.
2   Visibility of the equipment.
3   Easy access to the equipment.
4   Easy access to the host computer system.

These requirements were sufficient to enable a participant to access
the host computer system, but did not seem sufficient to facilitate
a high use. Part of the answer was related to the need to cater for
easy access at all times, placing a demand on the host computer to
be available and another part in anticipation of the malfunction of
certain components in the local terminal equipment and
telecommunications infrastructure, thus having the requirement for a
variety of terminals and telecommunication routes. These two parts
were related to the connection between the individual user and the
CBCS in use.

5   Host computer available at all times.
6   Flexibility of equipment and telecommunication routes.

Another part of the answer lay in a wider domain, the general use
made of electronic media and the demand that the accessibility of
the CBCS was integrated with equipment for other uses. This
suggests that any feasibility of CBCS systems for scholarly
communication rests not only on the accessibility of the CBCS to the
users but also on the electronic media that the groups use and wish
to use:

7   Integration with other electronic medium facilities.

Having accessed the CBCS, was it found usable? Again, earlier
experience with the US experiment had suggested this was an area

that required special attention (Senders, 1980). 'Usability' was incorporated into the BLEND study programme, but even so several areas were identified which proved to be a barrier to use of the system: the log-in, the command structure, the structure of the store of communications, the transfer of documents to and within the system; and reading articles on-screen. The analysis, developments, experiments and reactions of the users to these areas suggest the following requirements so as not to present a barrier to using the system:

8   Log-in made invisible to the user.
9   The command structure made consistent for different groups of users if necessary.
10 The structure of the communication store developed for easy use.
11 Document structure made conceptually consistent at all points in the system.
12 Aids developed for reading text on-screen.

Two further areas were identified in the final surveys but not explored. The first was the expressed essentiality of a printer for two types of communication; those to be used in different situations from office and as a quick reference, and those to be studied in close detail.

13 A printed output should be available.

The second was the need to develop aids to search and browse a store of documents in contradistinction to those for a single document:

14 Aids for searching and browsing a store of documents.

The lack of availability, accessibility to and usability of, the host computer system was reported as presenting three barriers for the participant. Certainly, the lack of local terminal equipment and telecommunications routes prevented use however much the user desired to access the system. The usability aspects were reported as preventing use in other ways. The difficult log-in, especially interacting with the perceived command structure, and the structure of the communications store caused much time to be taken in accessing the system. Then finding information and reading it also took more time than expected in relation to both how the system was designed and how it could optimally have been developed. The lack

of facilities to do precisely what the user wanted also took the users' time. The participants reported that these features prevented use of the system and hence communication with others.

Another barrier was reported to be the communications themselves. The earlier surveys revealed discouragement in accessing the system because of an insufficiency of stored material and later surveys discouragement in submitting refereed articles because of the procedural difficulties and slowness, and discouragement in accessing the system because of too many or too few messages waiting. That suggests that an adequate store of research communications is required. There is also a requirement for the stimulation of group discussion and the development of a system for this. Finally, participants should be able to access the system and enter a current discussion, with a currency that seems to be about one week.

15 An adequate store of information: discussions, news, abstracts, articles.
16 Encouragement for, and software to support, discussions and their storage.
17 Participants able to access the system and join in a current discussion with support in access to its history.

The tension between the desired speed of publication of refereed papers and the peer review process which exceeded that desired period, perhaps indicates the need to develop the communication along lines suggested by others, for example, Woodward, 1976, and Roistacher, 1978:

18 An exploration of alternatives to the refereed article.

This was planned in the proposal (Shackel, 1982a) but a re-prioritisation in the study programme towards accessibility and usability led to less exploration of that utility (Shackel et al, 1983).

10.2   A framework for understanding what prevented use of the CBCS

Four barriers have therefore been identified as part of the 'things of life' that prevented greater use of the system. We summarise them in Figure 10.2.

This barrier framework for understanding the observed irregularity of log-in, which showed more clearly in the later statistical interpretation of the distribution of accesses to the system, has emerged from the methodological approach adopted to study feasibility. As such, it forms a comprehensive coverage of many issues which have only been studied in a piecemeal fashion previously. For example, in the EIES experiment, each different writer and commentator on the electronic journal failure attributed different main reasons: Guillaume, 1980, and Senders, 1980, on the usability of the CBCS; Tracz, 1980, on having access to a terminal; Sheridan (in Sheridan et al, 1981) in the lack of an international dimension; Turoff and Hiltz, 1980, in the users and their lack of need for communication; and Moray, 1980, on the lack of usability in the journal. Rather than Senders', 1981, conclusion 'I have seen the future and it doesn't work', it is shown that there are a set of barriers which prevent proper study of the future, that is barriers which prevent studying the utilities which provide the benefits of using a CBCS for scholarly communication. If this is representative of the attempt to introduce CBCS for other applications then it is important that it is studied. The particular set that has been identified here are specific to the application and this experimental programme, as the methodological critique has made clear. The approach and types of barrier are likely to occur in other applications.

Availability

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┌─────────────────────────────────────────┐
│               Barrier 1                  │
│                                          │
│           Participants' time             │
│        Participants' productivity        │
└─────────────────────────────────────────┘
```

Accessibility

```
┌─────────────────────────────────────────────┐
│                  Barrier 2                    │
│                                               │
│    Getting local terminal equipment (LTQ)     │
│                Access to LTQ                  │
│              Visibility to LTQ                │
│               Access to host                  │
│           Non-availability of host            │
│             Inflexibility of LTQ              │
└─────────────────────────────────────────────┘
```

Usability

```
┌───────────────────────────────────────────────┐
│                   Barrier 3                     │
│                                                 │
│                    Log-in                       │
│          Inconsistent command structure         │
│        Structure of software hard to use        │
│          Inconsistent document handling         │
│              Reading on-screen poor             │
│                (Printer needed)                 │
│     Update on all information on system needed   │
└───────────────────────────────────────────────┘
```

Utility

```
┌────────────────────────────────────────────────────┐
│                     Barrier 4                        │
│                                                      │
│           Inadequate store of information            │
│        Too much/too little informal communication    │
│     Inadequate encouragement/leadership for discussion│
│   Refereed articles not appropriate for electronic medium│
└────────────────────────────────────────────────────┘
```

Figure 10.2:   Summary of the four barriers to use

One primary use of the framework has been in the identification of areas of access, usability and utility for which research and development may ameliorate the effects of the barriers. An example isthe system management response to the barrier of accessibility. The issues in usability and a few in utility were likewise studied and developments made. From these actions, it is clear that some may be removed or, at least, partially ameliorated. Others may be expected to change as the technological environment changes.

It will be clear, however, that even with a perfect technical system, many of the problems will still be met, for example, those peculiar to the users, in the organisation of local terminal

equipment, in the maintenance of the content and in the utility of
the system. That presents a _prima_ _facie_ case for studying the
human-computer interaction of such a system. Neither a study of the
technical system, nor of the human system are sufficient to identify
all the barriers to potential use and benefit.

Moreover some of the barriers are real ones for which there are no
immediate solutions, for example, how to handle and read articles in
large databases of journals, or to change an article form to
something shorter with research reported more frequently. These
remain research questions. One reason that they were not able to be
examined is because of the barriers which precede them in the user
operational sequence. There are other potential barriers which have
not been examined but which we discuss as possibly appearing if the
earlier barriers are removed. These include the effect of the
mismatch of organisational images which are adopted by the different
groups that are associated with the CBCS. The other main potential
barrier, which has already been argued, is the effect on use by the
strategy chosen to recover costs. In particular it has been
suggested that charging the user for time spent accessing the
journals would alter the access patterns in such a way as to present
a barrier to certain kinds of potential use.

To argue that it is important to study the barriers as a whole,
means that the effect of each cannot be said to be treated
separately, i.e. that the effects relate to each other in a way that
their relationships are not purely additive. If the barriers
interact in non-additive and dependent way, can the removal of some
lead with any probability to an increase in use? The use of the
barrier framework to identify areas of difficulty for which action,
research and development could be used for amelioration, indicates
that it was believed that some benefit _would_ accrue from the removal
of some of the barriers. There is one piece of evidence that
suggests that some benefit does result from a removal of some
barriers and which also points to the inter-relatedness of barriers.

In the two telephone surveys, a range of users and non-users of the
system were interviewed and the matter which gave them most concern,
in that they spent longest time upon it, was noted. In both
surveys, the barrier model seems to work in that many spent most
time stressing difficulties in availability and access to the

system, fewer in the usability and fewer still in the communications, the utility of the system. There is a slight move in the second survey from availability and accessibility to usability (see Figure 10.3).

	Availability and Accessibility	Usability	Communication
Six-month Survey	57	30	13
Thirty-five Survey	48	37	15
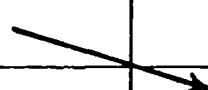
Figure 10.3:   Percentages of LINC members and the barriers about which they spent most time talking

This suggests that tackling the barriers of accessibility and usability may indeed make the utilities of the system more available to the potential user. Moreover the evidence of Figure 3.1 for the increase in number of accesses indicates that the removal of some barriers did result in greater use of the system.

Although not reflected in the percentages of those who spent most time talking about a subject, there were many more views expressed on the utility of the system in the thirty-five month survey. Some of those who discussed access difficulties did so in the context of its interaction with the lack of DEC availabilityand/or its interaction with the difficulty of handling little or too much information. The interaction between accessiblity and usability or utility operates like a feed-back where the resistance in the accessiblity barrier, say, is effectively increased by negative experiences at barriers later than it. For example, a non-shared terminal in another office may be accessible at all times and this is found satisfactory. However, if the host computer is not working when tried, then the response maybe not to try again until the next normal attempt, whereas if the terminal was in the office, an attempt may be made only a short time later. One member described a change in this type of behaviour after getting a terminal in his office. Another example is when one successfully logged in to find no message, then perhaps the attempt to log-in will grow sufficiently less frequent so as to guarantee receiving a message and encouragement "someone was out there", as described by another member. These situations interact so as to form positive feedback

on the strength of the barrier, i.e. a negative feedback on
transmission, that could easily lead to a stable state of non-use if
any one of the barriers is too strong (see Figure 10.4).

Barrier 1   Barrier 2   Barrier 3   Barrier 4

→ | availability | → | accessibility | → | usability | → | utility | →
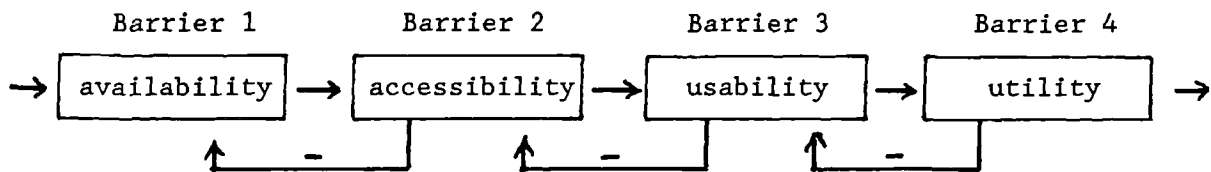
Figure 10.4:   Negative feedback on successfully overcoming the
                barrier and failing at the next.

To review the barrier framework:

1. It was developed in response to observed irregularity of log-ins
    for understanding what prevented use.

2. It was used as a way of identifying areas for improvement.

3. Some areas can be improved, because there are actions which can
    be done, appropriate knowledge with which to do so, or technical
    advances expected.

4. It is clear that a perfect technical system would not meet many
    of the difficulties experienced.

5. Some barriers are real, but are ones for which there are no
    immediate answers.

6. Other barriers are potential, for example cost, or only vaguely
    identified, for example, organisational image and the resistance
    to change in work habits.

7. The barriers relate to, and interact with, one another, so that
    it is important that they are studied as a group and not treated
    independently.

Aspects of the barrier framework are now discussed in turn. The
technological advances since 1980 are expected to change some of the
barriers in accessibility, but there are no immediate prospects for
some questions of usability. These two aspects are discussed in the
following two sections. The organisational images adopted by
different groups associated with the CBCS are then briefly

discussed. There are two more aspects of the barrier framework that should be considered. The different access patterns discovered suggest different barriers encountered or different responses to them. Attention has already been drawn to the fact that the Accessibility barrier was effectively removed for many of the high access rate groups 3 and 4 by the choice of local terminal equipment and telecommunications routes. In order to gain benefits from the use of a CBCS for scholarly communication, do all the barriers have to be removed, or does the removal of some lead to some benefit as is suggested by groups 3 and 4? This question is discussed in Section 10.6 in a study of the tasks that might wish to be accomplished in the CBCS.

To review these two aspects of the barrier framework we ask the following questions:

8. To what can the differential access rate of the users be attributed. Is it the different barriers encountered or a differential response to them?

9. To receive the benefit of use of a CBCS, do all the barriers have to be effectively removed, or does an increasing removal of barriers lead to commensurate return of benefit?

10.3 Future technological developments

In the period 1980-1985, during the study programme, many developments were initiated that would affect the barriers to use though not the conclusions associated with them.

The prospect for greater accessibility to computer-based systems improves annually in the UK. The introduction of the Joint Academic Network (JANET) in 1984, which allows researchers to transfer messages and files, has already facilitated access to many services hitherto inaccessible. In particular, the BLEND system became available to many more academic researchers through that telecommunications route. The telecommunications infrastructure in the U.K. is being developed from the Packet Switch Stream (PSS) to other higher speed systems and the planned 64K bit Integrated Services Digital Network (ISDN).

In 1980, there were few pieces of local terminal equipment that contained any intelligence while in on-line use. During the study programme, in 1983, the first communicating microcomputer became available with built-in autodialler and autolog-in and software to support communications. In 1987, almost all microcomputers have to a greater or lesser degree of sophistication, the option of a package which includes handling communications by a variety of technical protocols and by file transfer facilities. These still tend to be limited to on-line use and file transfer itself, but integrated use of local word-processing on files transferred to and from the CBCS are increasingly becoming available. The prospect for developments at this point may be considered good. The change in attitude of organisations to computer equipment has also been of considerable magnitude. In 1980 there were few networks and most universities had computer centres with equipment that was not designed to access the Public Service Telephone Network (PSTN). For example, one university had terminals in all the offices of the computer centre, but to access a PSTN line a participant had to walk to another building, fetch a key and unlock the telephone. However in 1986, many universities now have Local Area Networks with links to PSS and JANET and it is no longer considered a special privilege to have access to those services as LINC members reported in 1981. Thus many of the barriers to use caused by inaccessibility are changing.

Local Area Networks (LAN), however, bring their own difficulties, especially in the equivalent to the log-in, and the accessing, of or transfer to, services outside the LAN itself. The principles of easy access, availability at any time and simple log-in remain the same so as not to present the prospective user with a barrier. Accessing a host computer over PSTN with the kind of log-in analysed has been made easier with the use of microcomputers with auto-log-in. Putting increased intelligence at the local terminal equipment is just one option in reducing the effort involved in the access stage. Two other options are also possible, putting increased intelligence into the telecommunications links and into the CBCS. In the former, the user accesses a telecommunications service, rather than use it to access a host computer, and then is able to use a variety of services on different computers with the access to those handled by memory and intelligence in the

telecommunications service. Some of the features of the U.S. links, e.g. Telenet, already partially provide such services. In the latter some of the storage of the CBCS may, for example, be distributed to local terminal equipment rather than centralised and so the log-in will not be relevant. The CBCS might do the work of accessing the local terminal equipment to update its store of communications. This is planned with the electronic mail services subscribing to the CCITT X400 standard. If either option is adopted, the key requirement is the lack of a demand on the user to take any sequence of steps in the course of accessing the CBCS that is not meaningful and does not have an easy command structure to it.

There are developments, too, associated with some of the other usability issues. We have already referred to the experiments in handling the structure of discussions by Palme, 1980, and Johnson-Lorenz, 1981. Our development of a document structure that can be predicted and used at every point of the system makes use of one particular structure in which paragraph separators are used. This development must be considered an interim measure to demonstrate its possibility. The prospect of future developments looks reasonably hopeful in that there is considerable work in examining how documents can be interchanged between systems and handled within one particular system. The developments divide the content and format of the document so allowing a format-free copy of the content to be transferred. The logical structure of the content is marked so as to permit many different uses and presentations of the same content and logical structure. The work is being pursued in standards bodies (CCITT, 1984; ISO, 1986).

In summary, there are many concurrent developments in the electronic medium for its widespread availability and in its use to pass documents and messages around in a standardised structure. There are also one or two smaller experiments in structuring discussion, (e.g. the U.K. Alvey-funded COSMOS project, see Wilbur et al, 1986.) The main result of these developments will be to alter some of the barriers found in accessibility and usability. More specifically, the developments outlined here address the accessibility of the host and the links with it and provide much more flexibility in the use of LTQ. From the results of the thirty-five month phone survey, this would suggest an increased access rate if LTQ is available and

communication is desired. Secondly the development of intelligent
terminals and standards address the difficulties of the log-in and
the structures of documents and, with the X400 standard, may obviate
the need to access a host entirely. Also, a restructuring of the
software for use with the X400 standard may permit the update on
information in the system to be transferred to a local point
avoiding many accessibility problems as they were experienced in
this experimental programme. The developments seem to suggest
an ease in access and are such as to make the possibility of
unnecessary host computer access.

Will this result in more use of the CBCS with great benefits to the
users? This depends on the utility of the system. As the example
in the previous section illustrated, the judged benefit or otherwise
of overcoming the cost in logging in is related to the experience of
the utility. It is possible that a general lowering of the barriers
in accessing and using the system actually decreases use if the
experts more readily discover that there is little benefit for them.
This is not such a strange phenomenon, for if one takes effort to
visit a place, then often more is accomplished there, whether work
or sightseeing, than if the place is on one's doorstep. The effort
of accessing the host computer system may lead to a greater
exploration. This is not to suggest that this is the case, rather
the evidence seems pointed the other way. It is mentioned so that
it is clear that there need not be a correlation between removal of
some of the barriers and use of the system.

The difficulties in access and certain kinds of usability did mean
that some of the problems in using a CBCS for the transmission and
storage of articles were not able to be directly studied. We turn
to several of these now.

10.4   Theoretical issues in the development of the usability of a CBCS to
        support electronic journals

Although the preceding section presents reasons for optimism as
regards technical developments and the resulting lessening of
barriers in accessibility and parts of the usability of a CBCS to
support scholarly communication, other parts of the barriers present
the need for further research at a much more theoretical level. The
parts of the usability barrier which are neither addressed by the

technical developments nor by the enhancements include the structure of the software, reading on-screen and up-date of all information on the system. These are part of leading the user to what is wanted with the right level of information and of operation. This barrier appears for three reasons: first, the attempt to put full text onto a database raises particular questions and possibilities of barriers which have not yet been addressed; secondly, the use of a particular system which some users would have liked to have re-structured in its level of operation; and, thirdly, the structure was required to be changed because of the need to handle both formal and informal communications within the same operating space.

The suggestion was made in the telephone survey that the barrier introduced by attempting to integrate the formal and informal communications was an unnecessary one, and that the structure required to accommodate the integration prespecifies too much of the operation. If some wish only to read the papers, without discussion, others to debate issues preparatory to writing articles, why not, it can be argued, provide the system which best handles each part separately? In other words, why not create a system which consists of an integrated set of software, each designed specifically for one type of communication, for example, computer conferencing for debates, electronic mail for personal messages, bulletin boards for newsletters, stores with information retrieval facilities for articles. This suggestion was made by two members in the second telephone survey.

A corollary question is whether the integration of such a suite of different communication programs would best be handled by the CBCS itself, or left to be handled by software independently developed for local terminal equipment. This would be similar to the system presently in operation in primary communication in which everything is handled separately and the user of the information is responsible for collecting and correlating the information.

Thus the first theoretical issue raised is to examine how much and at what point any integration between the informal and formal communication is accomplished. The information provided by this research suggests that certainly some users like such an integration and find it stimulating. A few found the integration confusing and the software not optimised for any single type of communication.

One aspect of the integration is the way in which information as to
the contents of the system can be given, with subsequent access to
it aided by locational procedures, although these were not fully
developed in the BLEND system itself. The question can then be
raised as to whether or not there is a method for notification of
every new item, of whatever kind of information, prior to its actual
reception. It is possible that this is an interim requirement for
users in the initial development period of electronic journals of
this type in order to create confidence in usage by maintaining a
currently updated view of the contents of the system and one which
will therefore pass. Closely related to this is the theoretical
issue of how the locational information is tied to the locational
aids and procedures for accessing the information.

Do users require information on all new items in the system in order
to enable them to handle the system, or do they see this requirement
as part of keeping an up-to-date overview of the subject area
itself, in which up-to-date views are maintained over several
sources of information? If the latter was the case, would it be
helpful to note all new items of information in the field, rather
than just those on the system itself? This was the idea behind the
annotated abstract journals and the use of messaging by users to
draw attention to publications and conferences of interest outside
those connected directly with the system.

On the other hand, the information about the new information may act
in a more direct way for the researchers. Rather than being merely
information about the existence of new items, they may act as a
mechanism for preprocessing the value of accessing that information
relative to other demands upon time and effort. If this were to be
the case, the argument would be made for an integrated communication
system with information on new items and easy inspection via access
from the locational information.

The necessity for locational aids and access to communications
present another theoretical issue to be studied; how is the user to
gain access to the material which is potentially of interest? If
there is to be a relatively unintegrated system, then it may be
acceptable to provide different types of aids for retrieval for
different types of communication, with the proviso that the dialogue
design is compatible in concept and operation. Even in that

situation, the information retrieval is not completely worked out, despite the large amount of work done in keyword research and relevant research in On-line Public Access Catalogue Systems (see for example Kinsella, 1986). This is because the relation between accessing the document and accessing the information within the document has not yet become an issue of importance owing to the limited availability of full text systems.

This aspect for accessing the information within a document appears more pertinent when a system that contains an integrated store of different types of communication is considered. There may be, for example, a discussion on a topic that cites papers, both stored on and off the system, a private correspondence on the work of a particular group of authors, discussion on the relevant articles stored on the system, as well as the articles themselves. Readers may wish to be able to move between this information and want to give a command that says 'Give me everything that mentions "paper writing habits"', say. Alternatively, it may not be a search task that is being done, but a following through of thinking that requires reference to a cited work while in a discussion on a related topic, or to a paragraph of text referred to by a discussant of the article.

The third issue is therefore how to retrieve and move among a store of communications in such a way as to support the users in the tasks in which they are engaged. After an electronic journal has run for a number of decades, a substantial amount of information will have accumulated and the problem of access to that which is required is a pertinent one. This is particularly so if the store contains many levels of information, and has become some sort of 'knowledge base' as envisaged by some LINC members.

Having found a way to access that information, there is still the problem of presenting it on the screen or number of screens, such that the users know where they are locationally within the store of information and where they are in relation to the task in which they are currently engaged. The work on reading, already described in chapter 7, is one special case of the problems presented by the new medium in accessing and locating oneself with respect to that information within a single article. Here we are concerned not with the access to information, which has already been listed as an issue

above, but with the presentation and manipulation of the information in such a way as to enable the user to know what is being seen and what to do. Various windowing techniques have already been developed (see for example, Card et al, 1985) and these might be used both within documents and between documents, but it may still be important to consider how to display the difference between refereed and unrefereed work, in order to distinguish between 'on the line' response to messages and that work which has undergone peer review. The distinction is made in the present primary communication and general communication system by a number of attributes of the communication, including the appearance, location and packaging. Even within a particular journal, the Letters to the Editor are usually distinguished typographically.

These four main issues remain largely unstudied and have implications for the future design of CBCS to support scholarly communication. Each has been experienced in a small and partial way as part of a barrier to use of the system by some participants. The question is what kind of development of these areas will lead to increased use and avoid more complex barriers in usability. The issues discussed have been the following:

1. To what extent should the CBCS support integrated levels of communication? Could that integration best be accomplished in a host computer system (whether distributed or not), by distributed but separate series or in the local terminal equipment?

2. To what extent is an up-to-date overview of the content of the system necessary for the users in relation to their overall need for up-to-date information for research?

3. What kind of search aids are appropriate to provide for the user of an integrated store of information which includes many kinds of communication?

4. What kind of aids are appropriate to moving around the store of information and displaying it on the screen in such a way that the users are confident in what is being displayed and their location relative to the store and the current task?

It will be noted that these usability issues relate strongly to those of utility and accessibility, and the amelioration of these barriers may help those associated with them, for example in the handling of informal messaging which is an aspect of the utility barrier.

10.5 Organisational aspects of the 'barrier' framework

Several references have been made throughout the thesis on various aspects of the organisation associated with the running of the system, both those directly concerned with it and those concerned with the institutions of which the potential users were a part. The latter played a large part in the obtaining of local terminal equipment and its accessibility and visibility. In the six-month phone survey, the organisational and bureaucratic influences formed a substantial part of the barrier in accessibility. The unfulfilled expectation of leadership to facilitate communication also led to a mismatch which resulted in contributing to the barrier found in utility. These organisational aspects are therefore briefly reviewed.

Organisational support to access and use the system

The difference in the level of support provided for the use of this kind of system to that of other communication systems may be illustrated by the telephone service and postal services. Users can assume a working service and, within normal usage, a degree of support and maintenance that has been developed to be largely invisible, by the regular and frequent monitoring of the system. This is essential in systems where the operation is in isolated circumstances, nearly always the case for communication systems. In the BLEND system the first hint that there might be problems largely came from the users themselves and so they were fulfilling part of the service operations of the more established mail and postal services. The users of the BLEND system expected a service equivalent to that of the established services and said in the thirty-five month survey that this was required for longterm use.

As well as the support required for using the system, users expressed a perceived lack of support in running the LTQ. Users felt particularly under-supported for the TORCH microcomputer. Most felt that the operational use of the system was supported in its

HELP facilities and by personal response to telephone calls and letters (Pullinger, 1985). The need for support in use of the system went further than this, however, users also required a certain amount of leadership and stimulus to communicate. The users' image of the organisation associated with the system was therefore one of a service with stimulus and support for communication.

The image initially assumed was quite different from this (Shackel, 1982a). The image assumed was that of a set of individually motivated and mutually supporting groups of researchers making what they would out of the opportunity provided by the availability of the system for experimental purposes. This contrast is presented rather more starkly than the assumption originally presented and apparent, but is intended to indicate the very much larger degree of seeing the system as a service than had been expected.

Organisational support in the institutions

The place where communication is not an isolated activity is in an institution. Internal systems are developed for handling telephone and postal services, the provision of which are seen as normal for researchers in academia or in industry. It was precisely in that comparison too that the participants in the experimental programme felt under-supported. Indeed as was seen in the six-month survey, there was for some a deliberate antagonism by the institution towards having to adapt existing services to accommodate new communication methods, for example the installation of telephone lines that did not go through manual switchboards. The image of the users by the institution in the early 1980's was one of the institutional members doing something out of the ordinary and out of the monitoring and/or control of the units set up for that purpose. This can be seen, for example, in the written undertakings to pay all the invoices for a line not going through the manual switchboard, which were required by one university and one defence funded research organisation.

On the other hand, the users' image of the organisation was that this was a type of communication similar to others provided and yet not supported by the institution. The exception to this were the users who worked from home, perceiving the communication to be separated from the institutional organisation to which they belonged

during the daytime, or even using the telecommunications to contact the institution and thereby feel semi-independent, as one user described the liberation of his changed life-style.

In the later Eighties, we are seeing the growth of communication systems that are supported and provided by the institutions in the way described in section 10.1.3, and which go some way towards the users' expectations.

Organisational support and work habits

A third organisational aspect lies in the interaction between the work habits of the individuals, the organisation of the CBCS and the support of the institution of which they were members. The six-month survey showed that the bureaucratic and organisational processes of the institutions frequently presented a barrier to use of the system as did the organisation of the BLEND system in its availability and support of local terminal equipment, as well the position and role of the person within the institution and subject area. Use was therefore modified by these barriers which interacted with set work habits to create some aspects of the access patterns observed.

Several users' organisations saw participation in the experimental programme of direct benefit to the institution. Accessing the system was therefore supported as occurring during work time and provision of telephone lines and equipment was facilitated. The limitations were then mostly in the availability of the CBCS which forced these users to access patterns that tended to be early in the day, when they first came into work and/or the last thing to be done before leaving work. Since they were usually in the office, this resulted in regular access patterns. Others who had institutional support but for whom this was not seen as an important part of the job often had many other demands of a higher priority and thus while local terminal equipment was not a barrier, their lack of time proved to be so. This was typical of some professors in the universities. Another group of researchers lacked any form of technical support and were frequently away from the office engaged in action research or consultancy. For them, both the lack of time, the lack of institutional support and the lack of perceived organisational support from the CBCS 'service' each proved to be a barrier and for many these were insurmountable with low to zero use.

Organisational apsects contribute to all four barriers which were identified clearly earlier in the chapter. Availability, was affected according to whether or not using the system was seen as part of the job; accessibility was affected by getting and running LTQ and an operational CBCS and telecommunication routes; usability was affected by the CBCS organisation in support and help to use the system; and utility was affected by the organisational support or otherwise for message-making. These are reviewed in Figure 10.5.

Availability: - Local organisation's support or otherwise of time and
                        effort spent in using CBCS.

Accessibility: - CBCS organisation's support or otherwise in
                        maintaining a fully operational system.
                     - Telecommunication's infrastructure for maintaining a
                        fully operational telecommunications system.
                     - Local organisations support in obtaining and running
                        LTQ.
                     - CBCS support in running LTQ.

Usability: - CBCS support in use of the system.

Utility: - CBCS support for facilitating message-making.

Figure 10.5: Organisational aspects perceived as contributing to the
              barrier framework.

10.6   The task-space for CBCS-supported scholarly communication

The hope of Shackel was that by forming the Computer Human Factors experts together in a group and giving them a communications medium they would become a 'community' (Section 4.1). However, the greatest amount of general satisfaction was gained from largely individual use and individual benefit. The benefit was tied directly to neither the group facilities nor the electronic journal aspects. The surveys showed three fairly distinct areas in the individual benefits gained from largely informal communication:

- stimulus for paper-writing with ideas generated from individual
  participation in the study programme;

- stimulus for work gained from discussion with others on or off the
  system;

- access to information through the abstracts journals, paper,
  journals or contact with other researchers.

These match the expectations expressed in the interviews fairly well (see Figure 6.6), where users wanted to build up contacts, which they reported as doing; to have a closer touch with Computer Human Factors, including access to previously published work, which was reported in the reduction in the difficulty in locating such information; to encourage the production of papers which would otherwise not have been done, which was reported by at least three; and to learn more about electronic journals by participating in the programme; and to have some positive return for the investment of time put into learning and using the system, which for some there was, or to like using the system, which one third did. For these, the reasons for participation were rewarded.

Only one other expectation was named, and that was the corporate activity of a group in developing a pool of knowledge and in which new ideas could be stimulated corporately - the Closed User Group aspect. Several groups did indeed develop this, as previously described, but the community as a whole did not, neither did it spawn more than a few such groups using the system in that particular way. Why was this? Was it because of the experience of the barriers which prevented full use of the utility supported by the CBCS? or was it because CBCS are not able to facilitate the kind of group communication envisaged and expected by some potential users? What can be said about the utility of the CBCS for scholarly communication and its future development in the light of the use made of the BLEND system? This section discusses this area of questioning.

Two barriers, the availability of researchers time and requirement and the lack of facilitating leadership directly affect the question of individual-oriented use of the CBCS. The changing national context meant the expansion of networks of researchers and increased participation by potential CBCS users in several of these networks. Potential users thus had less time and less requirement to use the CBCS for certain types of communication. Secondly, the given suggestion for more leadership to facilitate group dynamics is strongly supported by the work of Hiltz, 1984. She showed the amount of use of the system was directly related to the amount of time spent on-line by a facilitator or leader.

As mentioned in the methodological critique, this must not be considered the only aspect of the group dynamics. There might not have been a sufficient number accessing the system to create the feel of a community; that is, in order to attain the perception of a community, a certain proportion of members might have to be seen to participate with a minimum frequency, so-called 'critical mass'. The results of the statistical analysis of message-passing support the idea that the 'critical mass' was never reached corporately, except on certain occasions when the discussion 'took off'. As analysed in Chapter 4, this meant that those from different access rate groups had very different perceptions of the rate of increase of messages on the system which led to the perceived barrier to using the system because of the quantity or lack of messages.

Why then did the users express such a strong desire to see the experimental programme continue (section 5.2.8)? For those who were a member of a small regularly communicating group, it may reasonably be surmised that this was to maintain the on-going work and relationships formed that would not so easily be transferred to other media. Indeed it was members of such groups that reported a reduction in the use of telephone and postal services (section 5.2.5). Other reasons may only be speculated and they include the perceived potential of CBCS when fully developed as a system; access to a communication system for contacting others in the subject field, even if this was not regularly made use of; a network with more informality in style than other networks (e.g. the professional societies or recently formed national network associated with the Alvey programme and the British Computer Society).

The second speculation, viz. that researchers used it occasionally as an access medium to other researchers as an academic stimulus in a way not available elsewhere, reflects Group 2's behaviour. They accessed the system infrequently, once every 8 weeks, but many times during that week when they did so. This illustrates a highly individual oriented use.

Groups 3 and 4 all formed members of groups with the exception of two users, whom tended to respond to, but not initiate, messages and participated in every level of communication and most subject areas of discussion. For all members of group 3 and 4, contact with

others in the field had previously been limited. The behaviour of groups 2, 3, and 4 suggests a rather obvious behavioural response to the availability of the CBCS to support communication with others. Provided that some of the initial barriers in accessibility and usability are overcome successfully, those individuals who had experienced limited communication with others and wanted more, responded to the system by either treating it as a route to other researchers, participating in small groups or in many levels of communication. Those with some generally satisfactory participation in research networks, nevertheless found it of benefit to access other researchers in the field on an occasional basis at their need and initiation, and discuss research ideas in the preparatory phase to writing or experimental design. Observation showed that those with very good networks in the subject area itself did not use the system so much. This need or otherwise for contact with others, explored previously in Chapter 4 and 5 in a different perspective, suggests one reason for the observed difference in the access patterns of the five groups.

Participant observation and analysis of questionnaire results, as far as this was permitted with the methodological limitations, shows a differentiation in experience of barriers (see Figure 10.6).

Access Rate Groups BARRIERS	Low Access Group 1	Medium Access Group 2	High Access Group 3 & 4
Availability	Lack of time (Strong) Lack of requirement (Strong)	Lack of time Lack of requirement (Weak)	-
Accessibility	LTQ etc. (Strong)	LTQ etc. (Weak)	-
Usability	Log-in Inconsistent Command Structure	Log-in Inconsistent Document Handling Reading On-screen	Structure Reading On-screen Update on all information on system needed
Utility	Too Little Archived Material Too Many Messages (Strong)	Refereed Articles not Appropriate Too Little Archived Material Too Many Messages	Lack of Leadership (Strong) Refereed Articles not Appropriate Too Few Messages (Strong)

The Strong/Weak description refers to the strength of the barrier.

Figure 10.6:   Participant observation of the correlation of perceived
barriers with access rate groups

The fact that different sets of expectations are presented and that
there are differing patterns of use and different barriers to
potential use experienced, suggests that the question of appropriate
group dynamics must be more closely tied to different groupings
rather than a general 'community'. 'Critical mass' may only be
achieved by sufficiently high numbers in a general group by allowing
smaller groupings to develop, whereas a tightly cohesive group,
found among the members of Group 3 and 4, could create critical mass
by group work with very few members. Message-making analyses of
such group work would deny or confirm such a hypothesis.

There were three barriers to use related to the information store.
The first was a component of handling the informal communications;

the structure was found unsupportive of later searching of
conference entries (messages), as identified in the Thirty-five
month phone survey. The next had to do with the desire to have much
more information stored on the system, whether formal or structured
informal. The third was in the difficulty experienced in the
editorial procedure for refereed papers.

Once again there seem to be different desires among the different
access rate groups which suggest that people are focusing upon
different parts of the available task-space. Consequently we
explore the idea of task-space briefly before examining the
potential effect of barriers on the tasks accomplished.

The availability of storage and faster transmission speeds in
telecommunication enabled the combination of information retrieval
facilities: not only the selectivity of articles, but also to the
text of the article itself, and from there to engage with the
author's ideas. From the genesis of computer conferencing, the CBCS
offered access to other researchers and a medium for communication
with them, in group discussions (or 'conferences'), i.e. access and
engagement with their ideas. But as we have seen, the system was
also used as a medium for selection of others in the research
community that were previously unknown as working in a particular
field. Thus there are three areas for development, one in the
selectivity of and access to, relevant articles and engagement with
the ideas therein, the second in the access to on-going discussion
and participation in group work and the other in selection of, and
access to, others working in the same field and then engagement with
them (see Figure 10.7).

	Articles	'Conference' Discussions	Researchers
Selectivity	Selection of Relevant Research	Selection of Relevant Discussion	Selection of Relevant Researchers
Access	Access to Relevant Research	Access to Relevant Discussion	Access to Relevant Researchers
Engagement	Engagement with Relevant Research	Engagement in Relevant Discussion	Engagement with Relevant Research

Figure 10.7: Selectivity, access and engagement on a CBCS

It is clear that this task-space contains functions that can all be accomplished without an electronic system, but one in which the functions can progressively be implemented electronically. At present, the main routes for selectivity are, respectively, the information retrieval databases used largely by libraries, newsletters and government-funded university databases of researchers. Access is still largely done in person and using mail; use of library facilities or the request for inter-library loans; postal reports of meetings or attendance; and writing and visiting researchers, respectively. Finally, engagement is still largely accomplished using paper, face-to-face meetings or with individual researchers by the use of mail, telephone and face-to-face meetings.

The BLEND system aimed to provide electronic equivalents for all of the task-space illustrated and, in addition, the preparation required for each function, for example, the editorial procedure for refereed papers and identification of relevant researchers in the U.K. to participate in the experimental programme. Some areas were more successful than others, for example there was no general way to select a journal article except by searching the journal contents lists. Reading articles on-screen was a real barrier so engagement with articles in that way was difficult. On the other hand, many commented on the use of the system to identify (select) relevant researchers, even if the access and engagement with them was not on the system.

But were the satisfied expectations what the users had intended to do, or did the barriers modify the tasks according to the utility of the system to support them? In management tasks that were much more clearly defined, Eason et al, 1974, found that tasks might be

modified if the system did not match the needs of the task. (See
Figure 10.8). In this case, two responses were found likely, either
a non-use or a modification of the task so that the system was used
but not in the same way ('partial use'), or alternatively an
intermediary was asked to do the task ('distant use') (Eason,
1981a). There were certainly participants in the BLEND experimental
programme who used an intermediary to investigate and print off
relevant material and those who used it only a few times and then
did not use it again. It is possible that these are examples of two
of the response categories discovered by Eason. Partial use may be
the response to some tasks that were expected and desired but
considered not able to be accomplished. For example, if the desire
to engage in large group discussion was considered supported by the
system's usability or utility, then it is possible that the task
might be modified a) to being fulfilled elsewhere, b) to being
accomplished in small motivated groups to discuss specific ideas or
c) to involve oneself in every level of communication everywhere on
the system. In consequence it should not be <u>assumed</u> that a
successful use of the CBCS is one for which it is best suited and
towards which are pointed the only directions for the future. The
potential modification of the barriers on the task can be placed
into Damodaran et al's framework by adapting their interaction
diagram to include the organisational influence and the
communication infrastructure (see Figure 10.9)
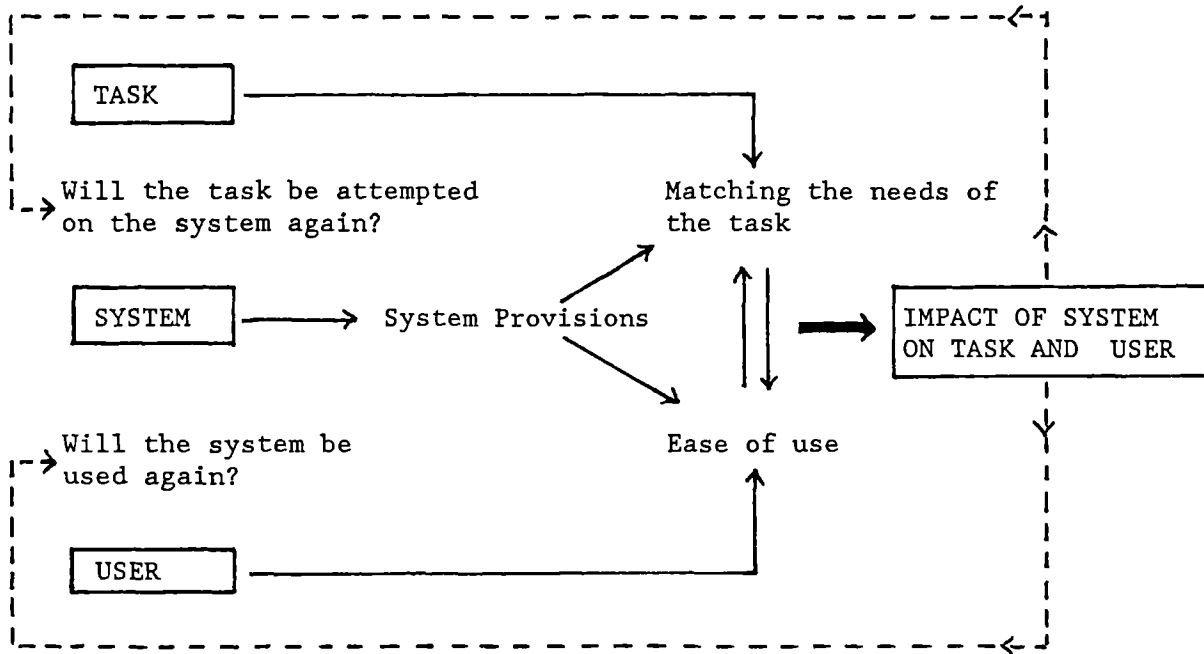
(Modification of a diagram by Damodaran, 1985, after Eason et al, 1974)

Figure 10.8: Impact of system on task
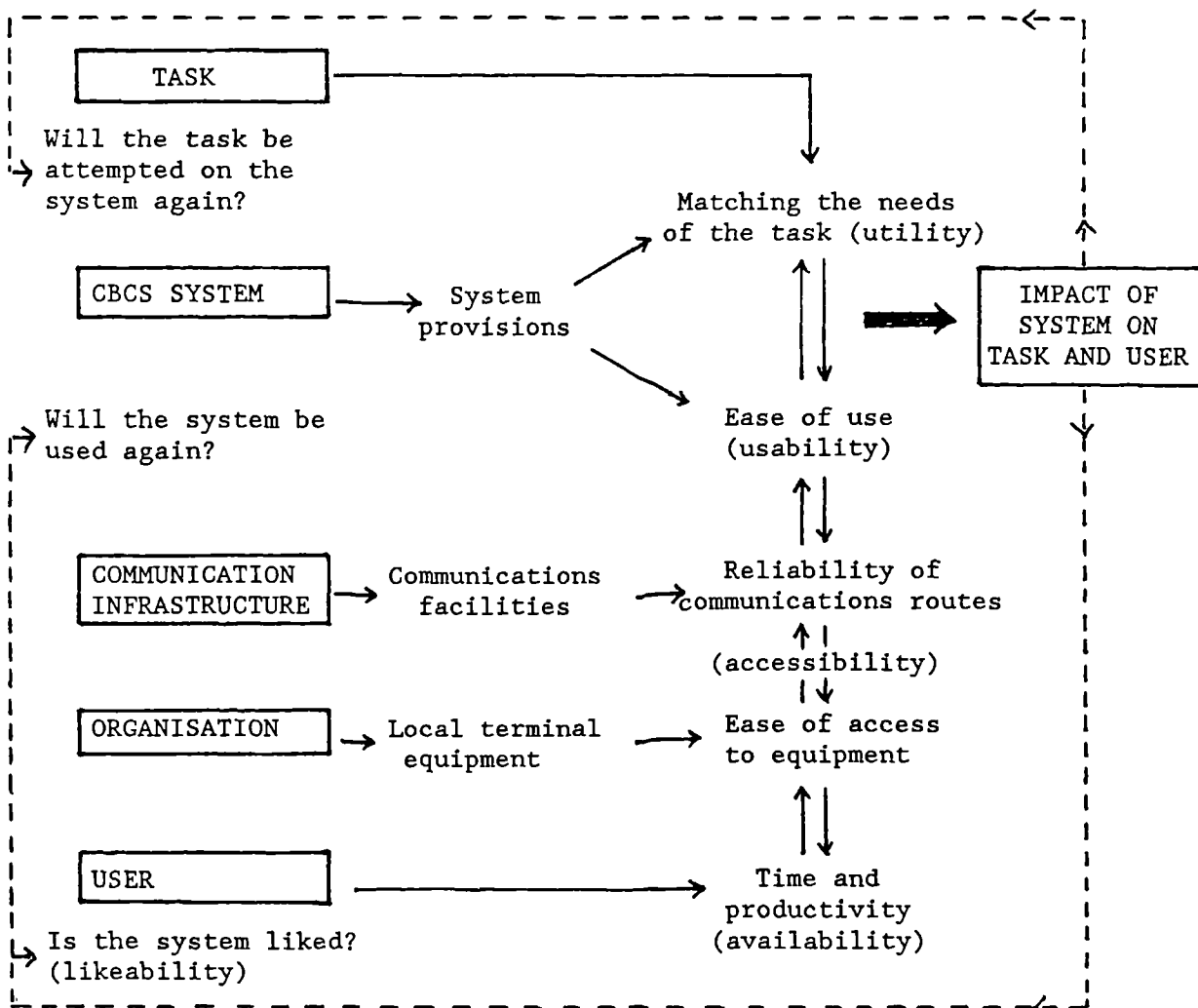
Figure 10.9: Impact of system on task including the barriers to use

If the barriers to use have modified the task required to be done, then modification of the barriers would lead to modification of the tasks observed and desired. This implies that amelioration of the barriers would lead to a change in the way that tasks are accomplished on the system and a movement of the focus of activity within the task-space. In other words, removing the barriers to use could change the use.

10.7 Advice for future experiment designs

By 1987, there have been two experiments in running an electronic journal, in the sense of originating, editing, refereeing and being able to access and read the articles electronically. There will, as Licklider 1966 hoped, be others, a series of experiments perhaps funded in part by Government, perhaps launched commercially.

Hiltz and Turoff, 1978, also emphasise the need for experimentation:

"What is needed is a more general approach to the whole question of information-communications systems and a period of innovation, proliferation, experimentation, development, evaluation and assessment, during which maximum incentives operate to create a diversity of these systems."

(p. 461)

Based on the experiments' research findings, what advice should guide and help design future CBCS so that they have the potential for successful support of scholarly communication?

In using Shackel's method of studying feasibility and examining barriers to use, we have distinguished six main areas:

- availability of time and effort by the potential users.
- utility of the CBCS to support the task required in scholarly communication.
- accessibility of local terminal equipment.
- usability of CBCS which includes the telecommunications infrastructure.
- cost-effectiveness of the system for individual use and for overall use.
- likeability of CBCS-supported scholarly communication.

The first requirement is for user availability, primarily in potential users' productivity. As was seen in the U.S. NSF-funded experiment, the time period there was too short to allow development of ideas and experimentation to a point where the papers could be written and submitted into the CBCS. Although the time period was long enough in the UK BLEND experimental programme, the requirement for papers submitted was, on average, the totality of the productivity, during a period when products were being called for elsewhere. By dropping a demand as high as originally requested from LINC participants in the BLEND programme, there is the potential danger, also discovered, that there will not be enough material available to sustain system use. There needs to be sufficient material on the system, relative to frequency of access, to sustain use at a level acceptable to the user but without the high demand on a limited number of potential users. This would seem to suggest that for different types of material, there is a critical mass of users some of whom contribute substantially and others who do not, but who do so sufficiently to sustain the level of new material required for acceptability without high demand. Exactly what that critical mass is will depend on the particular material. At present, decision making of this kind for formal material is made by journal publishers as they discover how many journals are economically sustainable in each subject field. However, from the findings and discussion, it is strongly suggested that the equivalent of a printed refereed paper journal on an electronic medium would not be an appropriate development to pursue. Established practices, for determining a sustainable supply of material, such as the rules of thumb used by publishers, will not be directly applicable. Nevertheless, in as far as it is possible by hypothesis, the time period and supply of material should be considered beforehand, according to the working habits of the potential users.

So, the first advice that can be offered towards future experiments is that the CBCS should be running long enough to allow potential users to contribute scholarly contribution and that there are a sufficient number of potential users to sustain an acceptable flow of information whilst not requiring high demands on potential contributors.

But what kind of information might be expected by the users, and what contribution from them? The task-space suggests that researchers engage in a wide range of activities associated with their scholarly communication (see Figure 10.7). The functions in the task space have immediate consequences for the utility of the system and the usability of the software to support these tasks, which we will address shortly. In discussing the users and their tasks, the research shows that some researchers have established networks for accomplishing the same goals and seem not to require this kind of support. Moreover, if these networks are developed they take time, which, with the intention of altering them, will mean little time is available for learning to use and using a CBCS for equivalently perceived goals. Thus before an experimental system is developed, the need of the users for this kind of communication system must be established, and it is more likely to be found among the middle to junior researchers than established figures. Another way in which networks are established is in the groups described by Crane and already discussed. There researchers engage with other researchers and research in small authoring groups and so the demand for the selection, access and engagement with other research and researchers would seem already largely met. In the U.S. funded experiment, this was perceived in part and there appeared little reason for communication.

The second piece of advice would be that the selection of the users should be those who have not yet developed full networks of access to research and researchers, probably not the most senior researchers, and those who have the need to do so. The information stored in the CBCS should include that about the communications, whether articles, abstracts or structured discussions, and about researchers who work in the subject area. People work in a great variety of ways and no assumption should necessarily be made on which is to be primarily accessed, nor that all the steps would be undertaken using the CBCS.

In particular, since many of the barriers to use discovered in this research will have been removed, or at least ameliorated, the tasks that the users try to accomplish are likely to change. Turning from the potential users to the utility of the CBCS to support scholarly communication, we repeat our advice for the need to investigate ways

of using the communications in engagement with the research and of supporting discussions and debates. In the former area arethose issues to do with browsing and reading text on screen and the activities associated with so doing; annotating the text, note-making, archiving, peer review, etc. In the latter are the matters of a discussion stimulant, probably by a communications facilitator and software structures for long-term storage of the content of the discussions, which themselves form part of the store of communications. These areas, in particular, need more research and thus should be a priority for experimentation.

The issue of usability cannot be over emphasised. Shackel, 1982b, indicated that a major research finding from the first year of experience was that this kind of system, with its occasional use, cannot be made too simple. However, with a changing understanding of the utility required to meet users' needs the questions of usability will not remain static. Thus, the system should be flexible enough to allow experimentation to be incorporated to reflect the interaction between matching the needs of the users with the ease of use of doing so.

Timescales in any experimental programmes to be planned are also important in accessibility. Both U.S. and U.K. experiments found that a large proportion of the programme timescale had passed before potential users had managed to obtain suitable local terminal equipment. Thus it is recommended that potential users are well-equipped prior to the start of the programme and that they have sufficient support for local terminal equipment operation from the local organisation, the national services and any needed from the CBCS.

The analysis of any cost-effectiveness has so far been theoretical. It is difficult to anticipate large experimental programmes that do not in some way rely on some governmental aid, even if only in the development of the telecommunications infrastructure to assist in accessibility. On the way to fully commercial systems, there are areas about which we are particularly ignorant, for example, the number of staff required to maintain and run the CBCS for a group of journals. This might be explored in future programmes if there is prospect of development into commercial systems. Other aspects could be derived from running software programs to record usage.

Finally, there is offered encouragement for a more detailed study of likeability, of being able to analyse its constituent components and distinguish more distinctly the different attitudes than were possible here. In particular, the effect of established working patterns and habits on the attempt to introduce new communications systems and, conversely, the effect of use of those systems on working patterns could be further explored.

There are other areas about which there is even less knowledge, for which any advice and encouragement would be based more on belief than on experience in research. These include the questions about the effect of international systems, to which Sheridan et al, 1981, attributed much importance, and accessibility to a large store of full-text information, which proponents for the electronic journal have likewise believed valuable, either more complete in coverage of the topics in a particular field or more complete in terms of history, where all past and present items would be available. Such moves, to seek greater geographical, subject or time coverage would lead to a number of problems about which we know little, but for which nevertheless proponents for the electronic journal should seek exploration and experimentation.

These general pieces of advice amount to addressing those barriers and areas discovered in the research using the feasibility framework and also those potential areas of difficulty which have not been addressed. It will be clear, however, from Figure 10.9, that these interact in a complex way and that not only will each barrier have to be considered but so will their cumulative effect. Different barriers were hypothesised by different researchers in the U.S. experiment, and these were considered in the development of the U.K. CBCS. Thereupon different barriers and interactions were discovered. What the research has shown is that the effect of these is not independent and that there are many to be discovered in the course of developing a CBCS to support scholarly communication. It is hoped that this barrier framework will allow sufficient development so that the main study in the next experiment will be upon the utility of the system to support a range of functions in the task-space and to address the users' response to the availability of such utilities.

10.8   Conclusions

In this chapter the different aspects of the system have been
brought together in a framework of barriers to use. It is proposed
that the development of this framework is a useful way of looking at
the use of a CBCS in order to aid the development of such
communication systems. Much of the work can be considered
speculative, but there have been suggestions made on tightening both
the framework and exploring some issues in more detail. In
particular mapping individuals' experiences of the barrier together
with their expectations and their subsequent use of the system with
their subsequent attitudes would provide a much stronger framework
and could lead to definite predictions of the result of the
implementation of a CBCS having certain characteristics.

The development of the task-space and inclusion of the barriers into
a task-modification context would suggest that the barrier framework
could be applicable in other contexts where there is optional use of
a system that is designed with a number of tasks in prospect and
where the equipment and its organisation are not all completely
provided and maintained within one institutional system.

The advice for future experiments leads us to the question of the
feasibility of electronic journals, a question not hitherto
addressed directly in this chapter. Future experiments should be
enabled to study the use of CBCS and its utility. The next chapter
therefore addresses the main starting themes of the research work.

11. THE FEASIBILITY OF ELECTRONIC JOURNALS

The electronic journal is in the process of 'becoming'. There are
many attempts at electronic publication in short pieces of
information, for example those run by the Institute of Electrical
Engineers under INSPEC and the daily newsletter published on Prestel
by VNU publications. There is widespread use of communication
systems for academic research support, for example the EIES system
in the US and the JANET computer network infrastructure for
universities in the UK. The use of CD-ROM (Compact Disc - Read Only
Memory) to store large amounts of full-text data in digital form
looks promising in 1987. There are many possibilities for putting
these types of initiative together to form a system to support
scholarly publishing. Which one(s) will be chosen? In our journey
of discovery on electronic journals, the research has identified a
number of factors which will affect the form of an electronic
journal, ranging from the telecommunications infrastructure and
support for local terminal equipment to the usability of the CBCS
and the state of the professional area at the time. These involve
many different organisations and we might expect that the growth
that will depend on the response of relevant organisations.

Our journey of discovery has had the form of orienteering. There
are directions in which to go, but because the electronic journal is
still in the process of development, there are no obvious end
points. Also one experiences many barriers en route. By
formulating a framework for those barriers, the movement across our
orienteering terrain becomes more predictable and help is provided
in travelling in the desired direction thereby. Although one has
not yet arrived at the electronic journal form, nevertheless there
is increased knowledge in each of the research directions. These
are reviewed at the start of this concluding chapter. Moreover, we
are able to prepare a plan for the next journey, better equipped to
deal with the barriers and hoping to travel further. That hope is
examined and then expressed in the second section with a fictional
reflection on what it may feel like to be part of that journey.
Finally, we review the major area of our focus, human-computer
interaction, and suggest that we seemed not to have travelled as far
as the guides have suggested because system development did not
sufficiently examine people and their organisations.

11.1 Orienteering with the research directions

In Chapter 2, we raised three research directions which would guide
the development of our thinking. How far has the research
contributed answers to those questions?

1. Can the electronic medium, in the form of a CBCS, be developed
    to support the researchers in their scholarly communication?

2. What will the effect of the CBCS be upon the scholarly
    communications?

3. Will the use of a CBCS in scholarly communication help in any
    way the problem of handling the information explosion?

First, can a system be developed to support scholarly communication?
Despite the limitations caused by the barriers to use, there are
signs that it is possible to develop a system that will support
several kinds of communication within the research community.
Future development will aid the removal of some of those barriers
especially in accessibility and certain aspects of usability
associated with the handling of documents. Cost-effectiveness in
financial terms would seem to remain a difficulty, but without a
study in the UK on the scale of King and Roderer, 1978, the relative
contribution from government to the present primary and secondary
communications structure cannot be fully appreciated. For example,
library subscriptions at the higher rate help pay for personal
subscriptions, and many of the former are paid for by government
departments by the provision of services to higher education. It
would seem that government funding to at least the present amount
would have to be provided to support an electronic alternative to
the whole communications system. It need not be substantially
greater, for as we have seen in King and Roderer's study, the
loading moves slightly from the cost of library and inter-library
loan services to the individual subscriber and other individual
users of articles. It is, however, difficult to affirm Lancaster's,
1978, assertion that "In a realistic cost-benefit organisation, the
electronic system may already outperform present operations." This
remains an area for further research.

One specific question raised under the possibility of developing a
CBCS was whether or not the support of both information-seeking and

producing behaviours would increase the usability of a system, as argued by Mick et al, 1980. Turning this around, would users have used the system less if there had been but one of these behaviours supported? For reasons of the possibility of modification of the task owing to the barriers experienced, this question cannot be answered directly. There are, however, pointers to be found in what was used and what was expressed as being wanted.

Let us suppose first that the only behaviour supported was an information-seeking one. In the task-space this meant that there might be only the top left triangle of functions (see Figure 10.7), the article to select, access and read; any listed and archived conference discussions and lists of researchers. The way that these were placed within the structure of the CBCS means that we cannot extricate the figures of access proportional to information-producing behaviour. However 76% of the overall time spent on the system was in informal communication, and there were a number of different activities observed, which included origination of material, i.e. not all of the time was spent in searching the list of researchers (in fact not everyone even accessed this particular facility) and reading past discussion, although there was trend towards this rather than originating material. Conversely 20% of the overall time was spent in journals, so that not all behaviour on the system was information-producing. Moreover, since one quarter of all accesses started by an investigation of the journal areas, it is suggested that there is a mixture of priority and total time spent in the two activities.

A second piece of evidence comes from the fact that tasks cross the task-space. For example, a reader of an electronic journal articles noted the author's name, investigated him in the researcher's list and then made contact on the system. There the information-seeking behaviour led to an exchange with a researcher. Another example came when two researchers met at one of the face-to-face meetings engaged with each other on the system and then went on to formulate a joint research programme in a conference discussion. Two other researchers in reading one refereed article, went away and tried out some suggestions and fed back the results in the discussion associated with the articles. These three examples illustrate the movement around the task-space incorporating both information-

seeking and -producing behaviour.

Thirdly, the participants identified both the lack of support for information-producing (lack of leadership, too few informal communications, difficult editorial procedures) and for information-seeking (too small a store of information). For these three reasons Mick et al's 1980 assertion seems to be justified.

The second question about the effect of the CBCS on scholarly communications we have considered in some detail. There was little effect on refereed articles, the same length and style being adopted, but there was a considerable expression for change in that length and style. Interestingly, although the Poster Papers Journal was available for such experimentation, little was done. This suggests that the researchers themselves may not have the resources to be able to 'switch' to something more appropriate. Just as in the reading research programme one area identified as requiring research was the development of reader's strategies appropriate to the medium, so also will writers need to learn to prepare material appropriate to the medium (see also Wright, in preparation). The entire time-scale for learning to do so is in the order of two decades. We learn to read and handle pages at around five years of age and then go on to learn how to handle scholarly articles in our professional area at university. It is not until writing up a doctorate, or thereafter, that it is usual to find practice in writing scholarly articles and to enter into full scholarly communication. Although many aspects of reading and writing are shared between the media, there have been sufficient changes noted that it seems likely that there will be at least a decade before writers prepare text easily for the electronic medium and that it is structured in the way expected by readers.

The third question raised is whether or not CBCS-supported scholarly communication will aid researchers in handling the information explosion. The collection of the bibliographic references to the dispersed literature in Computer Human Factors might be expected to help. It did so for some, but by no means was it well used. Certainly the development of support systems for selectivity have helped, but such services are generally little used. Back, 1972, suggests that such services are best used to assist in retrospective comprehensive searches and that the very low use he discovered of

their use was because informal sources and citations in relevant documents were likely to be used first. The informal sources to which he refers include other researchers, current journals, and citations found in them, as well as newsletters. So the first response of the researcher in handling too much information is non-comprehensivity. This suggests that increasing the number of contacts through whom, or by which, to achieve the non-comprehensive search would be of benefit. The function of selectivity on the BLEND system, with its access to researchers as well as bibliographic references, suggests that a broader approach to information-seeking behaviour could be supported and focused through a single system.

The second response to an overload of information also uses other researchers and forms part of the information-producing behaviour as well as information-seeking. The tendency seems to be towards collections of experts in groups so that each individual can narrow their range of expertise and receive pre-processed views on peripheral topics from colleagues. Group discussion further facilitates the processing of ideas, saving time in that background, resources and a greater number of ideas are aired and debated during consideration of the content. This is what appears to lie behind the development of the author-writing groups described by Crane, 1965. The aid to processing is a collection of other people who are engaged in similar, though not necessarily identical, research who can mutually help each other in processing the content of the research field. Although applied behavioural sciences do not appear to form themselves in such well-defined groups, probably because of the need to respond to a wide range of situations, nevertheless the same behavioural patterns for accessing information are apparent. Pullinger and Howey, 1984, in a small study on how researchers accessed relevant bibliographic references in Computer Human Factors, discovered that informal sources were the first and main rate. This suggests that the second response is using the pre-processing done by colleagues or by authors in papers is valid in this research community as in others.

Can the development of computer aids to the comprehensivity of coverage be tried with the pre-processing done by colleagues or by authors in papers? In Pullinger and Howey's survey, the researchers

said that if they were going to use a computerised information retrieval system for getting information, then both factual background and evaluative comments should be attached to the bibliographic reference. This was the genesis of the annotated abstracts journal on the BLEND system. There were not many comments offered to help readers in that way. One hypothesis for the lack of annotation is that the procedure was formal rather than discussive and may have been seen as too big a public statement about someone's work when compared with an informal comment to a colleague. The author would not know the context of the reader and that uncertainty was perhaps sufficient to put off the additional work required in making a 'fair' statement with respect to all the other work in the area. In such a situation a person making a factual and evaluating comment would not only have to do all the processing, but also have to be prepared to back the result of it to the whole research community. The suggestions made by the system users for discussion on specified topics or papers with leadership to encourage and facilitate that discussion would seem to suggest a safer and more informal route is desired in making value judgements about the work of others and in debating the issues. Such a route would also demand mutual exchange rather than a one-way public annotation of abstracts which could prove costly in effort without much reward from others. Group discussion in this way could provide pre-processing of information in the manner desired without necessarily demanding synchronicity or the same place. Furthermore the suggestions for better facilities to search and select items from the discussion re-inforce the use that may be made of it after the topicality of the discussion had ended. A development in this direction may be one way to further the computer-assisted aid for processing the content of articles as desired by Licklider. So a third response that may be developed is <u>specialist group discussion on specified papers or topics</u>, where that group is geographically dispersed.

These three responses to the information explosion suggest that the use of CBCS would lead to greater benefits from equal effort in terms of both selecting and accessing the information and in contributing to it.

A result of our orienteering is not only the provisionof a structure
for the barriers experienced, but also a set of signs that the
original directions for the development of a CBCS to support
scholarly communication were correct but need modification. A
combination of information-seeking and -producing behaviour should
be developed with an exploration of the form of the formal
production of communications and also of the group support
facilities to enable an increased transfer of knowledge among
researchers.

11.2   Next steps for the electronic journal

11.2.1 Comparing the situation with the seventeenth century

Part of the literature from which the research directions emerged
made an analogy between the new availability of the electronic
medium with the postal service as a communications channel.
Houghton, 1975, listed seven reasons for the success of scientific
journals (p 19):

1. Made available news of work only previously published in foreign
    languages.

2. Made available a channel to allow discussion on research without
    having to read complete original account.

3. Brought together and conserved material which would have been
    dispersed as individual tracts or pamphlets.

4. Facilitated research by providing a relatively inexpensive means
    of communication.

5. Encouraged scientists to publish their work.

6. Created a forum for continuous, critical examination of
    research.

He noted that these facilitated the establishment of priority
claims, and created the archival function of journals.

Those retrospective reasons for the successful development of
scientific journals in the seventeenth to nineteenth centuries
reflect the emerging rationale for electronic journals and that

utility which the research has suggested appropriate for further exploration. The list is used to suggest exploration and development and to comment upon the utility found in the BLEND experimental programme.

First, news and access to work only previously published within some geographical boundaries can be seen to be potentially facilitated. The use of international computer networks provides a link across physical boundaries. Asynchronous communication transcends the limitations of time shifts around the earth. Finally, language as a barrier to news and access of research work, is being penetrated by the increasing adoption of a single language, English, for such communication and by the development of automatic translation in computer systems.

Secondly, the possibility of engagement with research without having to select and access the whole complete original account was discovered as contributory to the development of journals. This follows closely the aim of Mick et al, 1980, for computers aiding the processing of research content as well as its selection and access. Electronic journals can facilitate the growth in this area as discussed above and also in the context of the task-space (Section 10.6). Specifically, computer-aided access to sections of documents enables rapid viewing of parts of interest. The suggestions made by participants in the experimental programme for shorter reports and reviews of other work also lead to a more rapid engagement with content without reading long accounts. Finally, the discussion environment of a computer conferencing system provides a means for discoursing on the research accessed.

Thirdly, the journal brought together work which would have been dispersed as individual papers. The use of computer systems to collect gray literature is the modern equivalent and work funded by the European Community DGX III's DOCDEL project is experimenting with this (Van Dijk, 1987). In the BLEND research programme, it was seen how the discussion paper submitted to <u>Computer Human Factors</u> generated the majority of the on-line discussion. This would probably have been circulated as an individual paper for discussion, and not submitted to a formal archiving journal. Thus the use of the system suggests that there could be potential for access to the

gray literature .

The next three points, the increase in scholarship because of
communication, the encouragement for scientists to publicise their
work and a forum for continuous critical examination of research,
are all potentially facilitated by electronic communication and
discussion on-line. Computer conferencing communications are
cheaper than travel and some other forms of communication (Johansen
et al, 1976). It is easier to comment upon and publicise work being
undertaken and enables the sense of continuity in critical
reflection to be changed from quarterly to weekly or daily.

Finally, the establishment of priority claims, which led to the use
of journals for archiving articles, could be facilitated by the
international dimension of news of work. This archival dimension of
work completed was the least desired for an electronic journal but,
as we have discussed, this utility may depend on the completeness of
coverage of the field and of the usability of the system for
accessing information of interest.

Comparison with the seventeenth century development would point to
the following areas for exploration and development:

1. Discussion environment

     - with an international dimension

     - and facilitation for continuous critical reflection.

and

2. Access and engagement with content of research, suggesting

     - information shorter than complete archival accounts

     - access to parts of documents

     - short review articles

     - discussion papers

     - news of progress of research.

The development of an archival function to establish priority claims
might also be considered within the same environment, but if
appropriate might come to arrive naturally as it did in the
eighteenth to nineteenth centuries.

The selectivity and access to information in the task-space whether
of the kind described above or the discussion itself, require new
ways for indexing information. How is the content of a research
article, for example, to be indexed so that users can extract a
shorter section from the document? How do you index discussions for
later retrieval? These have been raised previously as research
questions (Section 10.4), but the need to do so in order to meet the
goals suggested by the analogous historical development and research
both point to Thompson's, 1972, test of a change for being part of a
communications revolution. His first characteristic for easing the
access to stored human experience is tested by whether or not there
are changes in the way people index information for retrieval.
Whereas Hiltz and Turoff, 1978, cite information retrieval systems
as being such a change, moving away from a published document
approach appears more radical and potentially further rewarding in
its effects.

Thompson's other two characteristics, the 'size of the shared
information space' and 'ease of discovery and development of nascent
consensus' are tested, respectively, by the ability to modify or
contribute to the communication taking place (in both content and
process) and whether or not the communication "increases the
probability of transmitting or receiving an interesting but
unexpected message". The former is illumined by the research on
message-passing. Although computer conferencing looks as if it
provides a "completely shareable writing space" (Hiltz and Turoff,
1978, p 470), the frequency patterns of access mitigated against the
ability to contribute, especially for those accessing less
frequently. Thus the size of the information space will increase as
the human-computer interaction is considered in a more detailed
manner and people facilitated in their participation. The second
was to be tested by how easily new ideas are transmitted through
society, how ideas emerge which trigger off others in different
disciplines. At the individual research level, this serendipitous
activity is always thought important: (Houghton, 1975, p.44)

"The serendipity factor of the usage of journals is also vital and can never be measured. The value of casual browsing through a journal can never be compensated if the form were to be completely replaced by other channels of communication."

There is no overt reason why serendipitous 'flicking through' of articles should not take place on an electronic system. It is true that we have argued that the best reading aid for access content within an article reflects the selectivity and retrieval function of computer systems (Pullinger, 1987), based on the research in Chapter 7, but that suggests a different mechanism for accomplishing serendipitous activity is needed rather than denying its possibility. Moving from full articles physically contiguous within a specified sub-field to sections of articles, physically un-related except by indexing and part of a larger store in the field, suggests that use of indexing rather than physical proximity should be sought. If current serendipitous activity is associated with the obtaining of useful insights from the content of a text not directly in ones application or focus of interest, then an extension may be to use the new indexing suggested by Thompson's first characteristic to generate files for browsing which have content but not applicational proximity. This will then reflect and contribute towards penetration of similar ideas through society and create the nascent consensus proposed by Thompson.

Interestingly, the field of Human-Computer Interaction is being encouraged to consider itself cross-disciplinary in this way (Rasmussen, 1987). Dealing with people-computer problems, it has been claimed, is too large an area to be dealt with by the creation of a new inter-discipline. Rather one should create an arena, or market, in which those who have related interests can offer their ideas, even though the participants in so doing may not share a common specialist language nor then go on and be part of the development of that application. Indeed, what is suggested in such a cross disciplinary approach is not dissimilar to a structured serendipitous activity. The idea is that a people-computer problem should be tackled by encouraging experts to participate in such a way that they can contribute their own expertise into an application area that they may not have considered to be their speciality. Development of a 'serendipitous' aid using the electronic medium may

thus be a way of contributing to the amelioration of the many human-computer problems which constantly emerge.

In summary of the discussion, consideration of whether or not the new communications medium constitutes a revolution led to a consideration of the human-computer interaction research for electronic journals, used in its broadest sense. The consideration generated by Thompson's ideas point to the following areas for further development in the electronic communication:

1. indexing of content and discussion
2. facilitation of communication, especially in group discussion
3. exploration of a 'serendipitous aid', especially across disciplines.

These pointers and suggestions are combined with our learning about the barriers to give an indication of what an electronic journal system of five years time may feel like to use. Naturally, since our focus has been on the users' interaction with the system rather than on societal impact, this will be the focus of a short fictional piece of writing. Equally naturally, this will bear little resemblance to the reality of 1992 except by chance. This is for two reasons. First, certain aspects have to be chosen and decisions made of the most likely scenario for developments. Secondly, in common with all science fiction writers, projections tend to look at only two to three parameters. In this case it means that the utility of the system, about which the research has learned little, is treated as supporting the kind of communications which we have today, i.e. articles and discussion. The transcendence of many of the barriers discovered in this research, and the maintenance of some unnecessarily, are therefore its main focus. Rarely is the primary communication system consciously viewed as a 'tool' for communication between researchers. It has been incorporated into the working life of the researchers, just as have conferences, seminars and post for more informal communications. The question of feasibility of the electronic journal has been explored in such a way to indicate that the goal of a CBCS-supported scholarly communication should be perceived likewise, i.e. that the tool becomes part of the working life of a researcher.

11.2.2 A fictional reflection

Dr. Frank Gibson had been wondering about his next piece of
consultancy for sometime, aiding in the design of an interface for
one of the new government computer systems for welfare offices. It
had made him pleased that they still came to university departments
with good research records for this kind of advice, but he knew he
would have to sift through much related material, nothing, he
suspected, being directly applicable. He hoped that the new
'Contentualise' aids would help him. He walked down the corridor to
where the department library was stored. Most of the books had gone
sometime previously. Here the department kept a store of CD-ROMS of
archived primary and secondary communications that were relevant.
CD-ROMS! They could have thought of a better name than Compact
Discs Read Only Memory. Pity that the only cost-effective way at
present seemed to be to separate the electronic published articles
and abstracts journals from the discussion and full information
retrieval facilities on his own terminal. At least the department
had promised to install the CD-ROM player (player or reader?) onto
the department Local Area Network. It had been typical of them to
install it into a separate room, also used for coffee, rather than
multi-tasked onto the University LAN. As usual, it had all to do
with finances and from whose budget they were deducted. He couldn't
grumble, though. Since the universities and research establishments
had actually started using the same computer and telecommunications
networks, access to other researchers and research material had been
considerably improved. Funny, he hadn't thought about that before,
but despite the initial grumbling and learning to use the system,
things were better in that he did not feel as isolated as when first
starting the job. Access to researchers and research material.
When would they get those together. It must be theoretically
possible for everyone with all those networks, but instead of which
only a few universities and services had fully integrated them. Now
which disc do I need? Ah yes, the complete set of articles for the
major seven journals in the field for the last five years. Good
thing that the professional society had brought them together to
strike a deal. Seven discs would have been a disaster. The other
disc had been named the 'Also-Ran' - well it was a compilation of a
lot of journals that had occasional articles of interest in them.

Never took too long to study that one, but the odd article was so
applicable. Bother, Graham's seen me. Tell him I can't stop what
I'm doing now. It's always the way with these bright students, you
want to spend time with them and they call just at the wrong moment.
Now if I was in my room it wouldn't matter. The software for the
micro there had all sorts of aids for just this eventuality, it
could pick up any screen and enable a restart, even on these big
databases. Ah, that's good, he's only wanting to use the other
player himself. He thought of how he had once expressed to
industrial research colleagues his envy that they were not
interrupted, they told him they envied his flexible hours and the
interest shown by the students. His frown darkened as he remembered
Graham. That interest had its drawbacks with these new systems
available in the library and the department. Why some of the
students had even organised fly-on-the-wall status to observe some
of the discussions going on between researchers in new areas of
application. The students had begun to point out work that he had
not had the opportunity to see. Hmph. Usually he was grateful, but
it sometimes made him feel a bit of a fool. Still he remembered
when he had started and all the students had taken his lectures as
the gospel-truth and they had been based on one quarter of the
material that this system now helped him to find. That's
interesting. That's the paper I had notification of last week when
I turned the computer on. Must be a new disc. It _is_ interesting.
I must discuss that first point on the communication network. Prof.
will be interested in this too. Not that she has ever used this
much. Too busy. I always send her a synopses of the discussion
that old Teldon does. Once she got so excited that she came and sat
for hours typing. Why couldn't she use her own equipment? Funny
how people feel they need their hand holding even when they are
entirely competent. That fellow, Teldon was most stimulating. He
always had some perceptive or provocative remark to make on every
article or discussion entry. Just the chap needed, a real
communications facilitator. He wondered what sort of job he would
have had, if not that. It might have been as a technology
journalist. He had become a journalist for the researchers
themselves, helping keep them up-to-date and pre-process the
information. There were several discussions he hadn't had time to
join recently, coming up to exam time, but he must just pop in and
read the _summaries_. Now there's an archaic expression 'pop in', pop

in where? How? He didn't know where the information was stored.
The micro collected all the items of interest from all points of the
computer network and he had lost sense of where they all were.
Didn't matter. Read it at home tonight. He'd have a word with
Prof. She couldn't understand his requirements for home reading.
It was alright for her, somehow she had the knack of getting
equipment for which he had to make a strong case. He found it hard
to explain how the majority of his thinking was done at home. Just
as well that last year he had done sufficient consultancy to buy a
lap top with 100MB hard disc. So he transferred all the information
he thought he'd need to read at home. This helped, though why they
wouldn't pay telecommunications costs for those bits for which he
had had to plug into the university system, he didn't know. His
wife still thought it was funny when he said he was reading. Mind
you there were good times too. At a recent research meeting he had
finger tip information while the civil servants still used paper and
had to hunt through hundreds of papers only to find that the
information they required was not there. He had lots of extra 'just
in case' and had it available. They were really impressed, though
one wanted to know if he had just typed it in. It would have been
easy enough to do. Flick up a menu. Choose the article style, and
start typing. The automatic indexing and reference prompt was
helpful and he found the reminder to create more headings useful to
formulate his thinking instead of just typing. Amazing how he had
not minded the standardisation of article structure. Of course the
professional society had debated it at length, but basically if they
wanted to have a communications system that would bring everything
together it was necessary wasn't it? So much better than not having
access to it at all. He guessed that the technological development
had still been substantive to support the whole thing. Just think
how awful it would have been if the old system of databases which we
had to access was still in operation - each with its idiosyncracies.
Now they were available together to him on the micro. Except for
the CD-ROM store which would be shortly. Then he would really be
satisfied. Must speak to Prof. about a home system. Didn't she
know he still did most of his writing at home? Maybe I'll meet her
at coffee-time. Oh, its that time now. He went.

* * * * *

Meanwhile, Anna at the professional society headquarters in London was feeling pleased as she made her first report to the council on the communication between them and their members. There had been a big upsurge of interest in the work of the society since people had been able to contact them so easily through the electronic network. It was presumably because of the considerable effort they had made in presenting a case to the publishers for a concerted effort towards electronic publication. Members were getting fed up with all the different proposals and systems intending to be provided on the networks. Most important though was the linking of seminar leaders and the social facilitators needed on the system to promote discussion. The argument for a full-time communications facilitator had been purely economic, with the intention of making the number of accesses to the publishers' databases sufficiently high to make the deal they had negotiated between them worthwhile. The spin-off had been that more now came to seminars, because they looked forward to seeing the other members with whom they discussed issues using the computer conferencing facilities. She laid the overhead down on the projector carefully and demonstrated how the rate of penetration of membership had increased enormously since the introduction of the system. It all makes so much sense, she declared, the access by researchers to the research material and to other researchers leads naturally to joint concern for the subject area and its growth, which is where we come in. Before we had problems getting anyone to do anything, now Dr Teldon stimulates their interest and encourages them to volunteer to lead seminars, which they are usually willing to do since they know exactly the kind of people that will be there and that it will be interesting.

Anna paused, looking around at the effect of her words. Not all had been in favour, the Council tended to reflect old work patterns - letters, articles and committed attendance at meetings and conferences. Some had been particularly antipathetic to the shorter articles and to the ease with which the software had provided access to research material. They remembered the hours in the library, the carefully nurtured friendships to create a network that would pick up articles, books and seminars of interest. Now all a fellow had to do was turn on the micro, and in the middle of the night it had up-dated itself with information on all new articles, discussion summaries by this man Teldon and whatever else they had on it.

Research? On the other hand they couldn't deny that they hadn't
become a lot better known since the Whole Thing started. Why people
wrote to them and asked them their view (it was usually a printout
of a request made several months ago on the System - but you know
what's it like always being at meetings). And then the membership
had increased. Well if that's the way the world is going why stay
behind?

Anna saw their approval and went on. We hope to use the new
telecommunication standards to extend the integration of discussions
and refereed type material even further. We intend to propose to
editors of journals that a proper quality can be maintained without
going to referees, but by submitting the article to the relevant
discussion and see what they think of it. Yes, of course it's
awkward when one of the group is a member, indeed that is the most
likely case. As you say the group is also likely to be the more
junior members rather than the senior members because of the
latter's busyness. What do you suggest? Unrefereed articles? Last
year you were set against them. Ah, you see how honest the
discussions are and how irrelevant papers are ignored, well if you
think our own journal should give a lead in this. Yes, that will
mean accepting all papers sent, but we shall naturally recommend the
maintenance of a strong editorial policy on type of content and
length. Agreed? Good. Then we will not store everything
permanently, but only those that seem to emerge out of the gray
background. That's really rather good. We allow 'publication' of
both gray and white literature and that which shines will be taken
special note of. The council groaned, they still hadn't got used to
Anna's particular sense of humour.

* * * * *

One of the publishers, Quickword Ltd, was also groaning. His
computer system had broken down early the previous evening. He knew
what that meant, all those who had organised automatic updating of
anything on each topic had not had the stuff. That wasn't the worst
aspect however. Here it was midday and the computer still not
operational. He knew that they should have used a service
organisation to store it all, but somehow he hadn't got used to the
idea of not 'stocking' what he had to sell. This meant that all
those researchers following up citations, references etc. would have

failed to find those recently published by Quickword. That was no good either. Many of them wouldn't look for another six months, after all they had lots of others. More lost revenue. Maybe he shouldn't have been persuaded by their society. Still Quickword had received a lot of press publicity, far more advertisement than he would have got otherwise, and then the journal, if one could still call it that, was doing well. It would have been changed soon if not. Yes, he should not be dissatisfied. Even the regular meetings with other publishers had not been as aggressive as he had feared - they were all in this together and there had been much nervous laughter at the start which had turned to a good humour as they could monitor so exactly the call on each publication and journal type. Times were changing, and on the whole for the better.

He went to switch the printers on, a job he could still do. The computer back-up store allowed him to print off all those written requests from abroad. He wondered how soon the government would agree joint programmes that would allow a full co-operation for research from different nations. The majority of his income still came from abroad and this continued with both selective printing of articles and the usual journals. The latter was really just a quarterly dump of all the articles. Not many had this now, there were so many pages. But the deposit libraries still demanded a copy, although they also stored the CD-ROMS. He couldn't imagine that technology departing for a while. Ah, here's the computer maintenance woman now. Don't need to show her where everything is, she's the usual one. I expect she'll try to persuade me to have a pair operating in parallel again. What do people think we're made of? Gold?

* * * * *

Thola glanced at the screen. My little gold-mine, she murmured. One corner showed a list of twenty new communications that week on her own research subject that she filled her spare moments with. She looked at her company tasks and then weakened and looked again at her own research area. Only one new name among the usual mixture of research reports, floaters and formal debate contributions. She flicked up the name on the list of researchers. He had been working in other areas and had obviously been recently moved by his university in China to study future developments in organisational

technology. These modern aids to help locate material in related areas had obviously brought the reference here. Ah well, back to the company tasks, briefing papers on two different research areas. No, those could wait! His contribution was in English, which she had deliberately learnt when the participating nations had agreed upon it as the international language. She glanced over his work and decided it was not directly relevant to her interest in industrial archaeology, subsection office technology, but saw his research techniques could be applied with the same methodology to give some interesting results. Moving into communication mode she spoke to the machine. It would store her suggestions in English for her, she chose to do everything in English, and then translate automatically into his language, whichever of the two Chineses he spoke. The database was still so unspecific in places. Now back to the job.

Thola was one of three information researchers in the company, whose job it was to provide briefing papers for experimenters and management. Her two colleagues viewed her with some suspicion because she found time to develop her own interests as well as producing the most desirable briefs. The fact is, she mused, only I use this new international network properly. Most of the others had only recently got used to working from home and still used their teleworkstations with unease, even though it facilitated taking a siesta - officially abolished by the Mediterranean countries in turn as they moved to Protestanism in their work habits.

She sat at home with her family and yet had contacts all over the world, several from Northern Europe who found excuses to visit her, and she had succeeded in research by writing, distributing and analysing surveys and questionnaires by computer. Now so many people were using teleworkstations, organisational transactions could be analysed and compared with what few reports there were of such work when different technologies were used in the. She laughed. A real find had been that person from Britain who gave her a lead to the recently released material of the police logging of all calls within and without organisational boundaries of one large company. The case did not interest her, but the transactional analysis was a gold-mine. All mine - the gold, she murmured.

She started preparing the selection procedure for her company
briefs. This was the most difficult part. Now that so many
articles had been stored, well whereever they were stored, together
with papers, invited comment, syntheses and the overall reports from
the communications facilities, the problem of selectivity had never
quite been solved. The jargon in each area changed all the time in
such a subtle way that one could never be quite sure what was being
covered. The data maps of the synonym mappings of the area which
were now displayed on the left were a help and in this case the
translation into Greek helped. The brief was usually specified
entirely in Greek. It had needed international lobbying and finding
to get the translation service operated in the synonym matching and
general keyword tree searches, mostly lead by the European community
who had forced it on the Japanese and North Americans. The European
Community had a long history of honouring languages, led by the
French who were worried about the maintenance of their language and
the Germans who had built up their databases. This had benefited
the poorer countries in the Community who had their language
supported and generous aid given them to join in.

The lists came up for the first brief. This is the part which she
enjoyed. Browsing, reading the text, and using dynamic statistics
and diagrams on several parts of this large screen enabled her to
correlate and compare information without having to memorise it.
Her two older colleagues thought this some form of cheat and still
agonisingly learnt much of the material by heart for future
reference, seeming to live to her for the day when all electronic
noise would be silenced. Yet they could not deny the quality of the
brief and her evident joy in her work. She did not want to be owned
by the company and have only company ideas and specifications in her
head. The office technology archaeology had interested her from the
start, moving away from pure sociological and organisational
analyses to the effects of technologies on organisations. This was
under-researched and it was exciting to be able to use the
back-dated keyword maps and explore writings from round the globe so
long ago. Britain was particularly interesting in its attitudes to
technology, but it had not joined in participating in this venture.
It was rumoured that the financial contribution was perceived as too
high and that they were developing their own system. The sooner
they joined the better, but she had good friends who did much for

her and set up an unofficial link in one of the computers in
Britain. Next week was the Special Conference and Britain opened
her barriers to allow researchers there to join in the week's
discussions on potential ways forward in organisational design based
on the latest archaeology. Pure treasure trove, she thought. Life
had been so dull before and now friends around the world. Her
semi-independent state from the company seemed worth all the
insecurity despite her disablement. Probably the only old,
black-dressed, disabled Greek woman known throughout the world. She
laughed again.

* * * * *

11.3 Conclusions: Whence and whither?

The research has been based on the second large experiment directly
addressing the feasibility of using a CBCS to support full-text
article communication and other forms of communication between
researchers. The first pointed to the need to develop the
experimental process itself and to study further the human-computer
interaction, before the CBCS-supported communication could be
examined. The work described here developed the experimental
structure which led to a detailed examination of the human-computer
interaction. The focus of the work has therefore been slightly
different from previous major studies of CBCS, for example Johansen
et al, 1987, Hiltz and Turoff, 1978, which have concentrated on the
use of the system and its potentiality, rather than the barriers to
use and the human-computer interaction. Both those named studies
predicted a much bigger use of CBCS than in fact have occurred. Our
work suggests the reason why. 'System' development has not
sufficiently included people and organisations into the work of
development. The identification of this is the major research
finding which should enable those exploring electronic journals to
progress further in future experiments.

During the last decade, the image and status of the study of
human-computer interaction has risen sharply. The subjects in this
study, i.e. members of the LINC community, and the researcher have
both been part of the increasing amount of research required for the
improved design of computer systems to accomplish the tasks
required. In addition an increasing number of applications are

being sought for new technological developments, particularly in the interconnection between telecommunications and computers. In this subject alone, this has lead to an 'explosion' of information, one that is also apparent in many other areas of scientific and technological development where there appears to be the necessity for, or possibility of, major advances.

There are many attempts to inform researchers of this explosion of interest; professional liaison bodies, government databases of researchers, newsletters, new journals, seminars and conferences. Yet these seem to increase the amount of information without providing a real facility for handling it. Underneath all the work described herein, as we indicated at the start, is the question of how we can help researchers handle the quantity of information being produced, how best it may be communicated and synthesised so that researchers can explore the ideas and concepts contained within it. The facilities offered by aids in electronic systems suggest that electronic communication seems to be one such way. The integration of databases of research and appropriate aids for engaging with researchers suggest that electronic systems may help with the information explosion when further research and development is accomplished.

Involvement in 'action research' has meant for me a developing understanding of the problem areas and of the issues in them. There have emerged three main areas of findings: methodology, human-computer interaction and electronic journals. This is, to our knowledge, the first time that a large system has been systematically explored by using Shackel's feasibility model. Its use has thrown up suggestions for its further refinement and a range of issues that have been explored in the two other areas. The main finding in human-computer interaction has been the systematic development of the barrier framework when hitherto the problems in the use of such systems have been anecdotal or identified separately. Finally, the reason why people should pursue their way through difficulties in use is the prospect of enhanced communication and in particular the prospect of electronic journals. Our findings in the third area concern the appropriateness or otherwise of the full-length journal article and of how to develop more discussion via the system.

In each of these areas there have been issues not identified because of the particularity of the experimental programme, or left alone because of prioritisation within the programme, or left only partially studied for the same reason. Moreover the study of the areas has thrown up more questions and research to be accomplished, which have been noted and itemised in the respective areas.

The findings are far from being fully tried and tested theories: rather they mainly reflect the pre-paradigmatic stage of thinking characteristic of action research which consists of description and an ergonomically informed deduction. Those deductions led to hypotheses, a few of which have been tested through development work and experimentation. In so far as we are able to state them and with the caveats presented above in the methodological critique, our findings are the following:

<u>Methodology</u>
- the use of Shackel's feasibility framework is useful for establishing a comprehensive view of the usability of a system.

- in studying telecommunications systems the framework should be enlarged by the introduction of 'accessibility' and a refinement of 'likeability'.

- the action research approach revealed the necessity of the modification of the framework. Its primary strength was that the use of a more formal approach would have eliminated the opportunity for investigating the areas which emerged, because they would not have been identified.

<u>Human-Computer Interaction</u>
- human-computer interaction should be studied in detail and developed to a point of acceptability for the users.

- the interaction between the system's facilities and the communication habits of the users should be studied; and the system modified if necessary.

- facilitation of group work should be further developed in all levels of communication.

- the computer system's facility in selection of items and a
manipulation aid for jumping offer the reader the best aid to
reading text when it is divided into chunks, rather than
scrolling or paging. Some development of the text may also be
advantageous.

- the 'barrier' framework provides a useful comprehensive view
of those things which got in the way of use. It should be
further tested with individual data in future experimentation.
Its appliction is potentially quite broad as new services
('value added') are introduced onto the open market.

Electronic Journals

- the use of the computer-based communication system increased
the connectivity of the research community and the number of
communications among them, though not necessarily on the system.

- it is possible to operate an electronic journal, in the sense
of originating, editing, authenticating and making the paper
available to readers via an electronic medium.

- at the present cost of telecommunications, an electronic
journal of the BLEND type requiring the use of
telecommunications would not be cost competitive. The
feasibility is sensitive to both telecommunications policy and
the number of personnel required to support the communications
structure.

- further explorations should be made on all levels of
communication, particularly formal journals and group work.

- there are no over-riding reasons why the future of electronic
journals should not be pursued in further experimentation. In
particular, experience with use of a CBCS substantially
increases the acceptability of not having hard-copy.

- the expectation of graphics in journals is now firmly
established and future experiments should incorporate this need.

Is an electronic journal feasible? No reasons have been established
that indicate a categorical negative. A necessity for studying
human-computer interaction has meant the potential utility of an

electronic system for supporting electronic scholarly communication has not been fully explored. It is our hope that there will be further experiments. What has been shown is that it is necessary to get the human-computer interaction correct before the concept can be fully tried and tested. However, every analysis of the promise and the potential nature of a communications revolution is confirmed by what was achieved by the subjects in the study, if the typical users of future systems are enabled to become like the successful users of this study.

On a personal note, I have been ambivalent about the future of electronic journals throughout the research. It is afterwards as I write, I find my mind turning to the many friends whom I have made through the BLEND system with whom I would not otherwise have conversed except in surveys, nor met in normal working life. I thank them for allowing me to accomplish this research and would like to think of meeting them again via some CBCS, this time in a greater amount of professional communication. Thus, finally, my heart warms to the idea of an electronic 'journal' - provided that the human-computer interaction has been fully researched and developed.

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POSTSCRIPT : STARTING A NEW USABILITY-UTILITY CYCLE

Recent technological developments and their implications for the feasibility of electronic journals

Introduction

During the end years of the experimental programme and those immediately following it, there have been technological developments that may prove major components in the feasibility of information systems and, in particular, electronic journals. Some, for example, the development of distribution networks and storage devices, have already been discussed briefly, although there are relevent recent developments affecting the organisation of the scholarly communication system. Others, for example the developments in screen displays and the human computer interface, promise major enhancements for the usability of computer systems for communication. As indicated at the end of Chapter 7, action research was used as a methodology for both formulative and summative evaluation in one cycle of maximisation of the opportunity presented by the utility by systematically increasing the usability. The new technological developments present the opportunity of changing work habits by breaking through some of the barriers to use and, therefore, of developing and evaluating the utility of the next development of CBCS for scholarly communication. We will consider briefly both areas of development; the distribution and storage of communications and the developments in the human-computer interface. The latter is considered first.

New technological developments in screen display and manipulation

One major development over the three years at the end of the experimental programme has been that associated with high resolution screens, bitmapping, window and multi-screen displays, and efficient tools for interaction. The way in which these relate to text has facilitated new ways of handling structures

for text and new ways of accessing parts of a text and other texts. This is often known as hyper-text, with descriptions reflecting these two aspects, such as 'a document as a set of nodes and directed links between these nodes' (Trigg & Weiser, 1986) and 'hypertext is the generalised footnote' (Neilson 1987).
Conklin 1986, emphasises that the concepts of hyper-text are not new, but the technology to make it effective is so. For this reason, recent technological developments may prove to have major formative influences on the direction of the 'becoming into being' electronic journal.

What are these new developments? First, screens are becoming larger with higher resolution , which enables increasingly more material to be placed on-screen, both textual and graphical. Secondly, colour is now possible, both for foreground and background up to a range of over 1000 shades and hues. Thirdly, bit-mapping and screen control enables the development of windowing and multi-screens. Fourthly, interactive devices such as mice, turtles and touchscreens have been interfaced with the above developments resulting in an operating principle that may be described 'what-you-can-see-you-can-handle' (Smith 1982 : now often nicknamed WIMP environment for operation: Window, Icon, Mouse, Pointer). Fifthly, these developments facilitate storing links between many textual elements so that both links and textual elements can be displayed on high-resolution screens with multi-windows and screens and accessed by the interactive devices. This is what is usually called hyper-text. Finally, sometimes distinguished from hyper-text, is 'hyper-media' or 'multi-media', where the different elements which are linked may be textual, graphical, audio or video. Such is the case, for example, of text describing and referring to a reprographic representation of a painting, as investigated by Brown University's Intermedia (see, for example, Yankelovich et al, 1985) or of office environments as investigated, for example, by Horak et al, 1984, and Forsdick et al, 1984.

Some of these developments are directly applicable in themselves to the current state of the electronic journal, for example the use of larger screens with higher resolution which can make text more legible and may make it easier to read. Others, such as those depending on bit-mapped displays, require different storage and display processes for journal communications. The development necessary before using the technology for electronic journals is the first reason why these developments contribute to a new usability-utility cycle and are not evolutionary aspects from the current state of electronic journals. The second reason why the developments contribute to a new cycle is because the usability is perceived by users as very high, as evidenced not by the sometimes ambiguous summative evaluation in controlled laboratory conditions, but by the formulative evaluation in market conditions, whereby more interfaces are being developed that use 'what-you-can-see- you-can-do' interaction (for example, Microsoft Windows and DEC's Gem which follows the Macintosh interface). The usability in stand-alone interfaces is of such a nature that many of the specific difficulties encountered in the research herein may be circumvented.

How will these developments affect reading and the handling of text stored in an electronic journal? After a brief survey of several of the developments listed above, we will look more generally at the electronic journal in the light of the survey.

New screen displays

Bigger windows enable more text to be seen. Is this advantageous? We have argued (in Chapter 7) that the smaller visual scope of VDUs as compared with print on paper reduces orientation for the reader as a result of less opportunity to grasp the structure of the text. Reisel and Schneiderman, 1987, examined the task of inspecting and reading software programs using bigger windows onto them. In a comparison of four window sizes onto the program, 10, 22, 60 and 120 lines, the largest window was found significantly better in the reading tests they applied and was preferred. They attributed this to the subjects being able to see

the structure of the program and the use of readers' strategies
to jump around that structure rather than read serially. This
might reasonably be expected to be a result transferable to the
sort of text found in scholarly articles by evidence they cite
from Haas and Hayes, 1985. The latter discovered that text re-
ordering was done significantly faster on screens containing
50 lines than those of 24 and that comprehension scores were
higher. On the other hand there was no difference when the task
was proof-reading. This suggests that visual scope enhances use
of text on screen. The statement is not to be made without
qualification, as Norman et al, 1986, suggest increased visual
scope might be expected to lead to difficulty in locating
information on the screen. Hartley's (1987) survey of help that
can be given in this respect clearly articulates the need for
good design in a number of areas, to aid location of information.

Colour has not been substantially researched for the use of long
texts of the kind found in scholarly publishing, except for a
few studies including a recent one by Wright and Lickorish, 1988.
They found that the advantage of coloured paper to aid remembering
whereabouts subjects had read something previously in a section of
an article was not replicated on a C.R.T. screen and stress
caution for transferring information design solutions from one
medium to another. They suggest that the advantage of colour may
be found in interfaces incorporating the use of windows or multi-
screens and interactive devices that operate in the WIMP
environment. This remains an area where more research is
required to establish if colour can contribute to the usability
of reading text on-screen. It·is suggested later that it may
find its best application in handling hyper-text.

Windowing

The next area of development is the use of several windows on a
single screen or of several screens. The advantages have been
seen in a variety of ways from an enlargement of visual scope to

stacking what was accessed in backwards time order or displaying
movement through a heirarchic database. Norman et al, 1986, list
seven different layouts that can be derived from cognitive
representations of information that may be displayed in the
windows or screens. We can readily think of examples in
information held in scholarly articles which would fit these
different cognitive layouts:

1. Linear array   : Enlarging the visual scope (as in enlarging
                       screen)

2. Information
    integration   : Display of three documents which the reader
                        is reviewing for the purpose of synthesising
                        ideas.

3. Selective
    attention   : Display of several documents or pages, but
                        only one of which is being read and used at
                        the time. This is similar to the leaving
                        of books open on a desk, even when not
                        directly referring to them for a considerable
                        period.

4. Levels of
    processing   : Display on a graph, with its associated
                        statistics and textual comments.

5. Memory storage: Making general marks next to a document while
                     refereeing prior to interpreting them on a
                     third screen or window into a sequential text
                     from other locations in the document.

6. Zoom in,
    Zoom out   : Selection of a piece of document with its
                        contents list and bibliographic reference
                        displayed.

7. Perspective   : 3-D graph in a document, location in a
                        diagrammatic representation of a database.

While screen control will allow many different displays to be made
possible to the reader, Norman's hypothesis is that if the
relationship between the windows or screens and the information
they contain does not match the cognitive representation derived

from them by the user, then some drastic effects in the events of the interface will occur. He calls for research into the use of such multi-windows or screens.

One relevant piece of work on short article length texts in one of these cognitive layouts has been done by Tombaugh et al, 1987. They investigated the third cognitive layout, selective attention, with a stack of windows, each containing the text of a section of the document. When reading a section, it was the only text visible, although windows in the stack were visible. They compared the use of this cognitive layout as an aid to remembering where the reader had read something with the use of a single window on the text. When the readers were thoroughly familiar with manipulation of the inter-face, the multi-window display should prove to be of help. It was clear that the relationship between the representation and the information contained in the representation was accurately obtained by at least one group of subjects, although others did indeed spend time not fully formulating the correct model. The research suggests that use of multi-screens or windows can help users in some reading tasks on structured documents.

Hypertext

The developments in enlarged screens with higher resolution, colour displays and multi-screens and windows, find their largest textual application in the new ways that text can be handled. In the BLEND system, we illustrated how a reference or a diagram might be called up without search routines and then the reader return to the text. This small enhancement is one illustration of the type of linking of one piece of text, in this case a bibliographic reference, with another, the main body of text. Two other links made between texts which have generally considered separate documents, occurred when the discussion about an article was placed into the same area to be accessed (Chapter 4) and evaluative comments were tied

to abstracts (See Chapter 7 and Pullinger and Howey, 1984).
These developments of the usability of the scholarly communication
system are exactly those described by hyper-text.   In
the BLEND system, articles consisted of a set of paragraphs,
each a node linked backwards and forwards to the other and
in addition a node might have a link to evaluative comments and
links to other nodes such as a reference or figure (Pullinger,
1984).   This serial linking of nodes is not the only possibility
for the structure of an article.   Other characterising examples
with homogenous features are the heirarchy,matrix and 'blob'
structure.   (See Figure 13.1)   .

Those examples are designed to facilitate the exploration of
a single document or a small collection of textual nodes.
The results of the reading experiment in Chapter 7 indicate
that moving from serial pages to other structures would seem
acceptable, because the aids able to be provided currently
reflect a sense of 'retrieval and display', rather than direct
page analogies.   The main development of hypertext as a concept
was a means of linking nodes from different documents, for
example a paragraph linking to a bibliographic reference, linking
to the referred document start, linking to the relevant section
of that document.   Its genesis was often in a very large number
of small sections of text which belonged in one large document,
for example GUIDE (Brown, 1984) and application made possible
when the instruction to the computer to follow a link was accomplished
easily, for example, by the use of pop-down menus or by placing
a mouse on a reference or highlighted word in the text, so-called
'embedded menus'.   The WIMP environment facilitated the use
of links across large documents or between documents as developed
in Brown University in Intermedia (for an overview see Smith,
1988).   There have always been such links in scholarly publishing,
by means of reference, citation and annotation, but it becomes
feasible to do something new by changing the usability of
an interface (cf. Conklin quote above, 1986).

Linear structure as in printed paper

Title of Section:

Section text:

etc.

Title

|

Abstract

|

Introduction Title

|

Introduction Text

|

Methods Title

|

Methods Text

|

Results Title

|

Results Text

|

Discussion Title

|

Discussion Text

|

Reference Title

|

Ref 1 (pointer)

Ref 1 text

Ref 2 (pointer)

Ref 2 text

etc
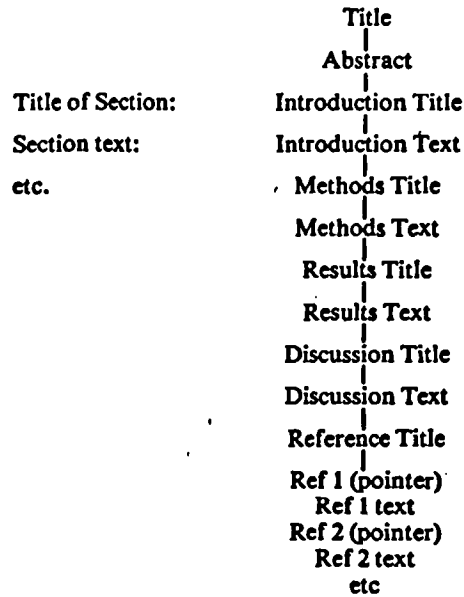
Figure (a). Examples of different text structures: linear.

Tree Structured Text

Title

|

Abstract

|

Titles of sections:	Introduction	Methods	Results	Discussion
Summaries of sections:	Summary	Summary	Summary	Summary
Full text of sections:	Section text	Section text	Section text	Section text

Title   References

Reference pointer:	Ref 1	Ref 2	Ref 3	Ref 4	Ref 5
Text of reference:	text	text	text	text	text
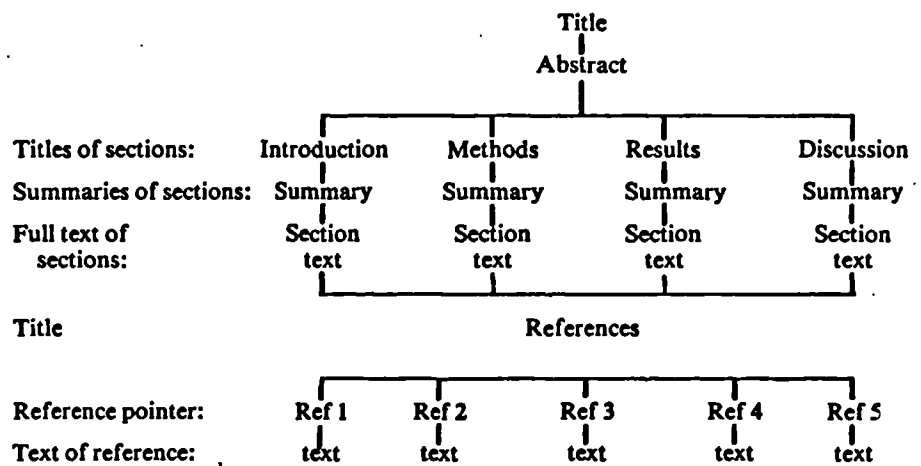
Figure (b). Examples of different text structures: Tree structured text.

Matrix Structure:

Title
|
Abstract
|
Introduction

Choice of whether reader goes vertically or horizontally	Method 1 — Method 2 — Method 3 — Method 4
	Result 1 —— Result 2 —— Result 3 —— Result 4
	Discussion 1 — Discussion 2 — Discussion 3 — Discussion 4

References
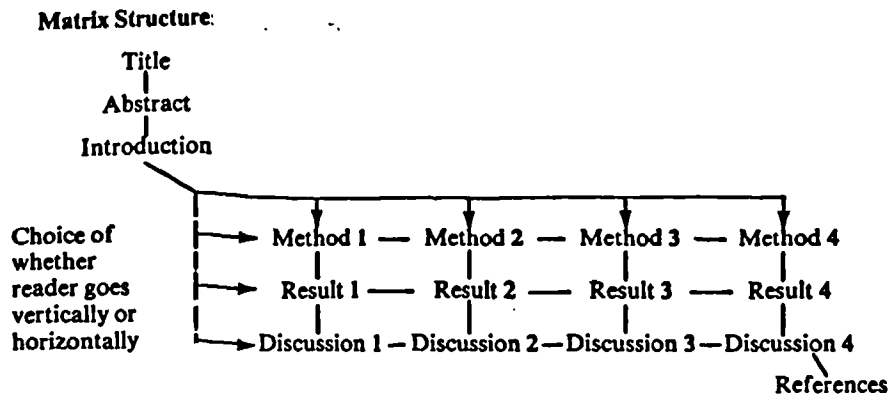
Figure (c): Examples of different text structures: Matrix.

Free Browsing Structure

```
Title Text
Pointers to: Contents,
introduction, refer-
ences, etc.
```

```
Contents
List......
   ......
   ......
```

```
Introduction
Text
Pointers to.....
```

```
Results
Text
Pointers to.....
```

```
References
Text
Pointers to.....
```

```
Discussion
Text
Pointers to.....
```

```
Methods
Text
Pointers to.....
```
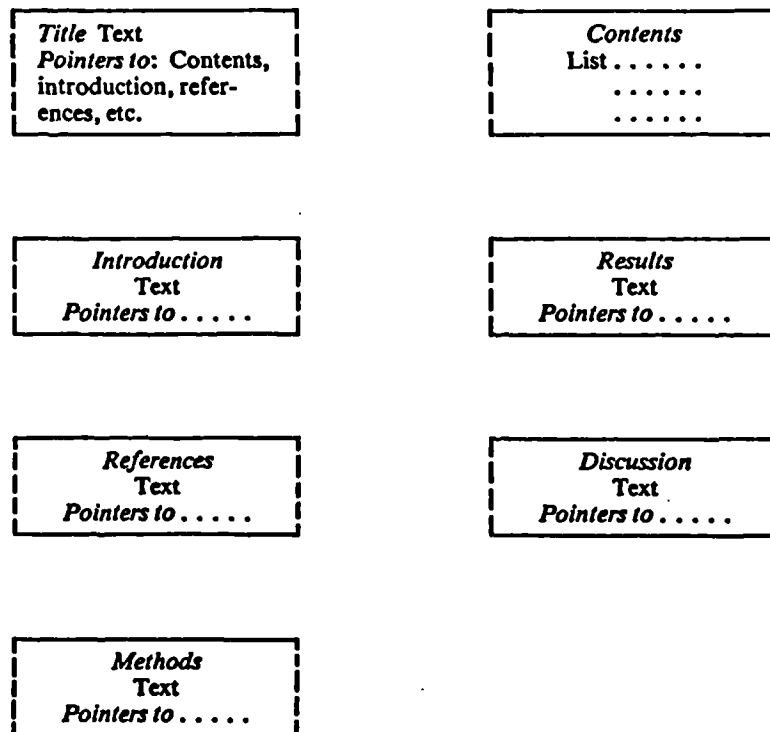
The software will record which sections have been visited and may prompt the reader by a list or other display.

Figure (d): Examples of different text structures: Free browsing.

(Taken from Pullinger, 1984)

Figure 13.1 Examples of different text structures.

There are major research projects into hyper-text, especially
those with nodes containing different media, for example,Inter-
media from Brown University, NoteCards from Xerox, PARC and
Neptune from Tektronix, following such earlier studies as that
on NLS. Brown has developed his early interactive documentation
system into a hypertext one marketed by Owl International,
and Apple has developed Hyper Card from NoteCards. The main
research programmes are essentially multi-user in design and
nature and the commercial products single-user, but planning
multi-user versions for 1988. The many research projects and
emerging commercial products have tended to concentrate on
particular applications, which Conklin, 1986, has divided into
the following four categories:

- macro literary systems
- problem exploration systems
- structured browsing systems
- systems designed to explore hypertext technology

Brown, 1984, suggests that documentation falls into the middle
two categories, as users want different kinds of perusal:

- to gain an overview
- To know everything in full detail
}(structured browing)

- to obtain full details about one particular aspect
  (problem exploration)

The potential use of hypertext systems for journals, and their
accumulation, will cover all the first three categories and
hence may need more substantial development than other applications
We will explore some of the aspects of hypertext insofar as
they directly relate to their potential use with electronic
journals, and the need for development.

Connectivity of hypertext

One key aspect is in the nature of connectivity. In Bush's
original description of 1945 of associative indexing of text,
he proposed links that connect both within and without documents.
(Bush, 1945). This early division in connectivity has been
carried forward by Yankelovich et al, 1985, by distinguishing
them as tags and jumps, respectively. Our examples above of
matrical structures illustrating within-document jumps indicate
that it is more important to stress their function, i.e. whether
or not selection of the link leads to a movement away from
the current position or not. The request to see a bibliographic
reference, or figure does not necessitate so doing, they can
be displayed on another window or screen, whereas the indication
to create an annotation linked to the node being addressed
would do so. This distinction is made readily in the WIMP
interface, for example, with pop-down menus and may prove important
in helping users orient themselves.

Other distinctions may also be made in the nature of connectivity.
Workers in Brown University describe some areas of scholarly
work as learning about old connections established by others
and making new ones oneself. There are therefore both links
already made when the reader comes to the hypertext and ones
which he or she may make in the course of 'reading'. This
view of both writer and reader having equal rights to make,
alter and delete links and also nodes, was a guiding principle
for Brown, 1984, and seen as important by Yankelovich et al
in 1985. However, it can lead to a passive image of the computer's
work in hypertext, in which a rich network of associations
is made, butthe processes to interpret the network are not
provided (Jones, 1987). The computer can be more active in
establishing general links. In the creation of an encyclopaedia,
for example, every occurrence of a match string to an entry
can be end point of a link. This relies on a structure in which
there are terms or phrases which people want information about
or form headings for such information and through which the
information required is accessed. Although the structure need
not be forced upon one, it is still not hidden, as expressed
by Brown, 1984. Indeed, without the concept of an encyclopaedia,

expressed as above, such systems as The Interactive Encyclopaedia
System (TIES) would be difficult to use. Clearly, in a structured
browsing system, some of the disorientation, experienced in
nearly all hypertext systems described in the literature, is
thereby likely to be lessened. The reader has confidence in
expectation of the type and nature of the links.

What structure is there in journals that can be used to give
readers confidence in the nature of the links? Articles
have a title, authorship and some identification for their
access. These form a bibliographic reference. There is main
body of text which may contain tags to footnotes, figures and
references and the collection of the latter. In a straight
transfer of structure, citations, whether in main text or footnote,
could be automatically tagged to the relevant bibliographic
reference and the reference to the abstract or summary, if
one exists, and that to the main body of the text. This is
the computer-generated generalized footnote. The addition
of keywords to the links with, and content addressability to,
those links would then create a series of virtual databases,
with hypertext multi-media articles, information retrieval
and structured browsing in a WIMP environment (see Figure 13.2).
Many other features would work particularly well in such a
hypertext system. A diagrammatic overview of the information
web might be handleable because of the additional information
about structure, as would both predetermined teaching paths
through the database and system paths acting as a record of
the session. Thus to the information retrieval context, connectivity
and browsing will have been added, and to the article reading
context, search and browsing (see Pullinger, 1986 for a discussion
on the former for on-line catalogues). Colour may have a more
natural place distinguishing between elements from the different
virtual databases, rather than sections within an item of a
virtual database; or in indicating how 'far' one is in the
pursuit of links from a marked point, giving an additional
visual cue to where one is. The latter may be useful when
working through a series of links attached to a particular
item, whether the item is an article or conference discussion.
There is, however, another important aspect; the 'intercommunicatibility'
of groups of scholars, and the new developments that are possible

Virtual Document d/b
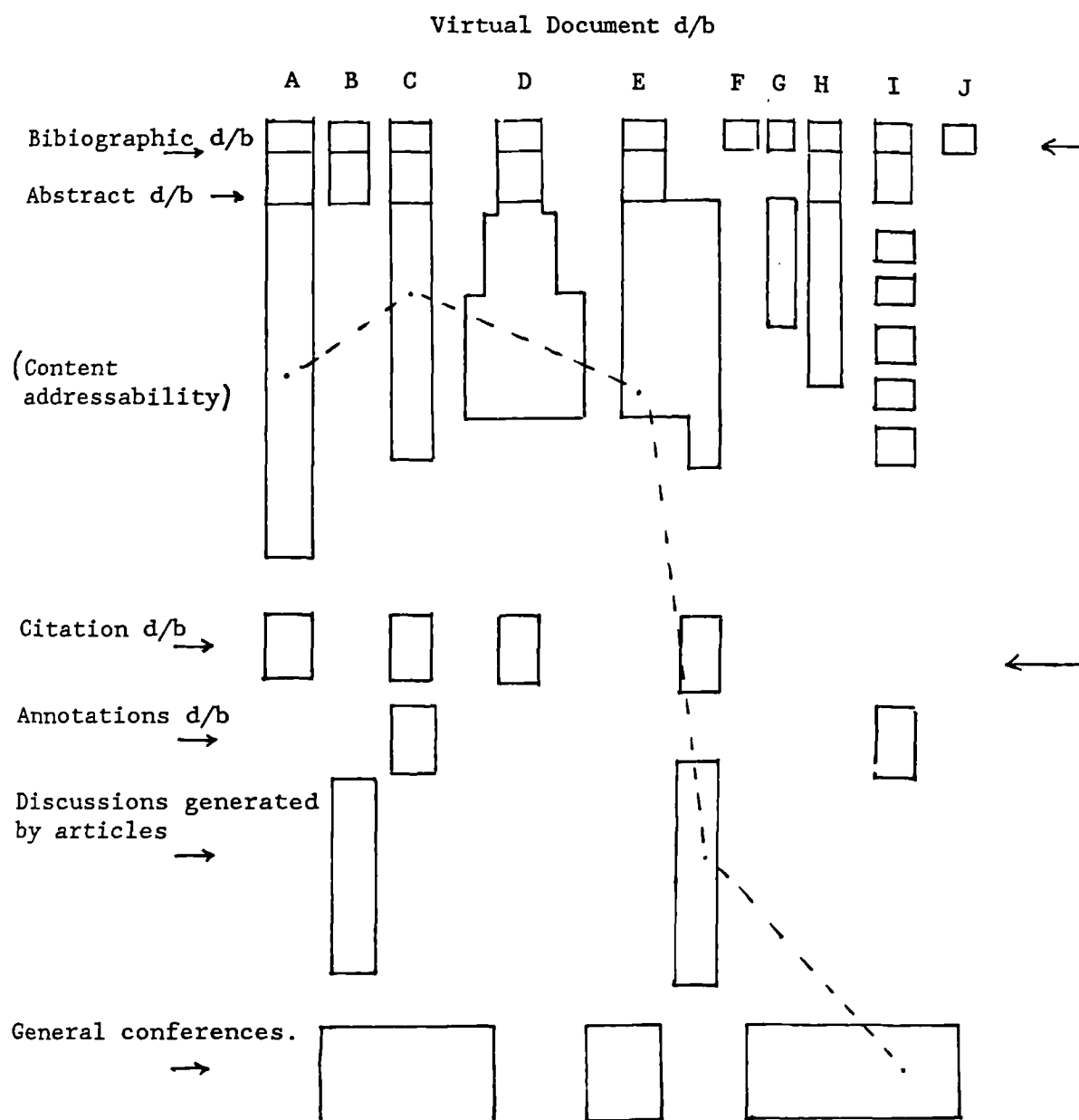
Figure 13.2 Links between textual items creating a series of virtual
databases, which can be separately accessed and searched.

with such utility. It is not only reference to articles that
scholars wish to share, but the addition of material either
as   single annotations or in discussion. Moreover in their
general discussion on an on-line system, citation is made of
published work (note that we are for the moment assuming the
traditional separations of published and authorised work).
These can also be linked in (see Figure 13.2). Palme has argued
that intercommunicatibility leads to another kind of electronic
'journal' by stating that the main use of computer networks
of scholars is not in electronic publishing of articles, but
of mailing lists which lead to conferences (Parnell, 1987,
p.58). This, like the other developments in a hypertext falls
within the task-space of scholarly communication described
in Figure 10.7. The use of connectivity within the database
and intercommunicability among the users enables the task-space
to be addressed as whole, rather than as discrete and separate
databases. In particular, the usability promised by hypertext
(multi-media) systems addresses the areas most weak in on-line
systems at present, the access to relevant research, discussion
and researchers, having identified them, and engagement in
research.

The problem of selectivity

The question of selectivity remains the major problem, particularly
in systems which number millions of nodes   (Woods 1987). While
selectivity seems good in small systems, which is why, in general,
it is the first to be implemented in the three task-space areas
for scholarly communication, things change in large systems
developed over a long period. Blair and Maron, 1985 , looked at
the success of a content addressable system (STAIRS from IBM)
containing 40,000 documents. On average less than 20% of the
relevant text was retrieved per search. While previous studies
had shown the benefit of content addressability in I.R. for full-
text systems, they had been based on small systems. If this is
true of a fairly controlled situation, it is also likely to be
true of a relatively uncontrolled one where all the users can add
links, keywords and text to what is already there. Although these

may be filtered out, at the user's discretion, the rate of
increase in the number of ncdes and links resulting from the
increase of the number of textual elements, could present
the user with some difficulty in choosing or selecting paths
that will guarantee a minimum level of coverage or access to information.
This is the background for the four theoretical issues described
in Section 10.4. In particular, LINC members were keen on
complete coverage of a field and of rapid information. Studies
in selectivity show the former is difficult to achieve on a
large system without a very high cost factor to the user (time)
and the latter has not been explicitly researched, although
some formulative work is addressing it embryonically for computer
conferencing (Wilber et al, 1986). It is, however, precisely
in the area of selectivity that Bush had hoped to improve the
handling of information and communication and was disappointed
at the lack of progress (cited in Woods, 1987). It is also
an area in which handling information in a hypertext system
threatens to get worse and not better for an individual trying
to keep up-to-date with a subject area.

Distribution of information

Technological developments in storage of information and communication
offer prospects of increasing the size of hypertext in which
readily accessible links may be made. Optical means of storage,
optical discs and CD-ROM, are, as the latter suffix suggests,
'write-only'. New magneto-optical devices, using the Kerr
effect, suggest very large storage capacity which can be both
read and written upon. This would make the technology more
appropriate for development of hypertexts and reaching them
locally.

Although technological innovation is continuing, the
organisational considerations for scholarly communication do not
appear to match the same rate of development. If the scholarly
intercommunicability is to operate through hypertext forms as
described above, how are the organisations to be developed?

In particular, the question is raised about integration of
formal (e.g. that which is distributed or collected on an issue
basis) and informal communication (e.g. that which is on-going
day by day) being the first issue of the questions in 10.4.
The structural organisation may take several different forms
(Dodd et al, 1987):

1. a network of scholars each with a personal store of
   information communicating via Local and Wide Area
   Networks;
2. a centralised system, such as BLEND;
3. a heirarchical system working from local organisation to
   national;

and

4. a distributed system, whereby the accummulated collection
   of hypertext would be distributed among Local Area Networks.

In consequence, both in the use of hypertext, with its WIMP
environment and in storage, and in new distribution possibilities,
several forms of development for scholarly communication and
publishing are in prospect. Hypertext, in embryonic form,
appears to accomplish several of the aspects identified as necessary
in the research described above, but other technologies such
as storage and distribution have not so far been developed
sufficiently to try the technological developments out on a
system, although this is the aim of the QUARTET programme (Dodd
et al, 1987). Yankelovich, 1985, for example, raises the question
of concurrent distributed file access over a network and asks
how this will be accomplished, while Kahn, 1987, emphasises
the difference between single-purpose and multi-user, multi-
purpose networks: "Although great progress in the development
of such systems has been made in the last decade, the field
is still in its infancy". Indeed there are still no standards
for exchanging and distributing conference entries as have
been agreed for electronic mail in the CCITT X400 standard
following from ARPA's development of the X25 for early Wide
Area Networks.

This is another reason for titling the postscript as "Starting a new usability-utility cycle." Many of the technological components of a new system are coming together, but they have not yet been developed into a system that can be evaluated either formulatively or summatively. Many of the problems being experienced in so doing are those already identified by the systematic study of feasibility. For example,in an application of CONFER in Hewlett-Packard, Fanning and Raphael, 1986, report that the biggest problem was accessibility to terminal and modem, a major barrier discovered both by Culman, 1984, and in the research herein. Yankelovich's 1985 list of major areas for hypertext reflects a subsection of barriers found herein. The development of software methods to allow a consistent user environment, the sense of familiarity in the user interface and confidence in using systems (integrability) were all recorded in evaluation of use. Graphic design was considered for the Computer Human Factors Journal by Pullinger, 1984, and more generally by Norrish 1987 and Hartley, 1985. This suggests that unless the question of feasibility is examined as a whole, the technological development of small areas may promise much but not be able to be implemented successfully. The Postscript is also so titled for this reason. The same barriers may be experienced, masking potential utility of CBCS for scholarly communication in another cycle of development, unless a systematic approach is taken, learning from previous cycles.

A shared information space

The question of the utility to be provided has still to be discussed in the light of the recent developments. What should be provided for scholarly communication? Hypertext offers a shared information space across people, across types of communication taking in the past history of a subject and across subjects. It therefore has prospects for being the 'market-place of ideas' appropriate for Computer Human Factors (Section 11.2.1). Sharing information space in this way has

consequences for two areas which have not yet been mentioned
in discussing new technological developments; Writing for communication
and group-work. Writing might well alter, as we have described
in Section 11.2.1, with articles, i.e. single communications
which are in some way authorised, becoming shorter and more
frequent, being able to be linked historically with previous
work and encouraging discussion while the issue is 'live'.
Moreover, the difficulty of selection of material by the author
for the average reader is circumvented by tagging and linking,
just as Brown, 1984, proposed for interactive documentation.
Thus the LIN C members demands for a system to provide them
with communications that are available sooner than refereed
papers, have overviews and more detail if required, are all
met. This writing requires consideration even in traditional
form without the added complication of developing appropriate
areas for hypertext articles as in Figure 13.1 (Hartley, 1985;
Wright, 1987).

Secondly, hypertext can support the idea of group processing
of communications and contributions to them. That is the way
in which the small co-authoring groups on BLEND and the conferences
on ARPANET mailing lists operated. This means that some of
the synthesis activities currently undertaken by single authors
in review articles and books might be accomplished by group
activity. This will not be easy. Just as editor and author
expected different procedures in submission of referred articles
to the Computer Human Factors Journal, so Trigg and Weiser,
1986, described the difficulty of transferring procedures for
collaborative work onto NoteCards. They discovered that a
lot of new conventions and agreed procedures were necessary.
We might expect further developments along the line of the
'roles' in group-work described by Maude et al, 1985, including
that of 'leader' (Hiltz, 1984).

Work habits

Will the next cycle change work habits and use of such an
information system? Many users of WIMP interfaces speak of 'at
last a computer I can use'. This development seems to break

through certain usability barriers in the human-computer interaction. In our research on the use of information systems, we found that utility and access rates were not in direct relation, even taking into account accessibility and the purposes for using a CBCS. Two main factors were discovered to be the very slow change in working habits, which did not in general accommodate the utility into a working life, and the masking affect of usability. The use of hypertext systems promise to break through some of the barriers and although the utility may not be changed (as in personal computers), access rates will be higher. However, we are also suggesting that the utility might be changed and would indeed expect it to be so (Section 10.6). A change in usability and utility could lead to change in work habit that would lead to access rates increasing and this we would predict on the evidence of the barrier model.

The information explosion controlled?

Hypertext, taken as a general concept, is often argued as providing a means of handling the information explosion by connectivity. In Chapter 11, it was argued that three present responses of researchers to an overload of information are non-comprehensivity, pre-processing done by colleague or authors in review papers and group work on narrowly defined topics. Connectivity promises to supply increased comprehensivity, some pre-processing done by colleagues and intercommunicability via group work. On the other hand, the problems with selectivity suggest that too many links and too much material can become available to be handled by a single researcher. How will the connectivity balance with the selectivity?

As described by the access patterns in use of BLEND, there are those with strong regular ties and others with weak occasional ones. Both appear to contain participants who are satisfied. Research in office systems echoes Hiltz' 1984 findings that previous pre-use communication between users was a strong predictor of system use. Strong ties appear to be strengthened and weak

ties created where before there was no communication. The
set of scholars to be engaged in communication did not, on
BLEND nor on office systems, appear to fall into an amorphous
group. The increased connectivity and intercommunicability
with developing selectivity suggest that group work will be
one major way of handling the extra information potentially
available in large systems. Cranes' (1965) sets of co-authoring
groups may thus be applicable to electronic communication,
for short periods, in a context of an analysis of scholarly
communication changed from formal to the task-space proposed.

The questions of control of the rate of increase of information
still have to be addressed, and the nature of authorisation,
which forms part of this control. These have been discussed
previously. With the emphasis on textual connectivity, rather
than other aspects, the prospect of information overload would
appear to increase. However, with the lack of any organisational
development to maintain the connectivity over a multi-purpose
communication system (and electronic network is not directly
implied), a control may exist for a considerable period.

Concluding remarks

These ideas remain speculative until implemented in the next
stage of research and development. The increased usability
promises access to new utility for scholarly publication.
Before that is released, however, questions of availability
and accessibility need to be addressed both organisationally
and individually. Questions about the status of the work accomplished
and its spread cover many aspects relevant to these two areas.
After that, there are many questions on selection and access to
information, major questions raised in Section 10.4, and finally,
to do with them all is the question of utility. What will an
electronic journal of the future look like? Just as the current
academic journal would be a surprise to the 16th century
philosophical societies, so too, will whatever is developed in
the future to current professional societies and scholarly
publishers, although we have given indications of the form we

believe it would be helpful to take. The many technological developments promise an exciting entry into the 21st century, provided that the areas identified in the thesis are systematically addressed. Early experiments with the technology constantly indicate similar availability, accessibility, usability and utility problems, even without further investigation of the cost-effectiveness. There is no way of getting ahead of the technology. What is required is a series of major experiments, including one using the technologies becoming available. A new usability-utility cycle will show how to make increased use and new uses of a CBCS for scholarly communication.

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APPENDIX A: A detailed analysis of the pattern of access of the 49 LINC
              users studied to the BLEND system

The initiative and hypotheses for this analysis came from the author and
was carried out by a team, I. Harris, Maude T.I, and the author. The
author bears responsibility for the final conclusion. To study the
different patterns of access to the system an initial study was made of two
measures. The average number of accesses per week was calculated by
dividing the total number of accesses made by an individual by the total
number of weeks from the time of first accessing the system to the end of
the data collection, June 30th 1984. The proportion of weeks in which
there was at least one access was calculated by dividing the number of
weeks in which there was there was at least one access by the total number
of weeks from the time of first accessing the system to the end of the data
collection (see Figure A.1).

Plotting the two measures gives us the graph in Figure 3.2. It is seen
from Figure 3.2 that those who access the system more frequently also enter
on average, in more weeks (see Figure A.2). This is not unexpected,but it
demonstrates that this group do not make the same number of accesses per
week, regardless of the proportion of weeks. This would have resulted in a
straight line (see Figure A.3a), with which it is significantly different,
i.e. they do not 'catch-up' on all the messages and content of the system
by making lots of accesses when they manage to create time to do so.
Conversely, another suggestion made was that people would have the same
average number of accesses per week in the weeks the they entered but that
different people would have widely varying numbers of weeks in which they
could enter. This would provide a graph as illustrated in Figure A.3b.

A third suggestion might be that individuals have in their mind a sense of
the appropriate time between accesses of the system, i.e. a sense of "it's
about time that I logged onto BLEND again". This would produce a model in
which each individual has a different access rate (say, of 1 access per x
weeks) and that the interval between accesses in relatively constant. This
would produce a graph as shown in Figure A.3c. Neither fit the observed
data well. A quick inspection shows that A.3b and A.3c in combination
might look appropriately close to the observed values, but a reasonable
explanation of such a combination is not possible.

An alternative might be that each individual enters in a Poisson type
manner just as calls are received at the telephone exchange. To do so one
must assume that the accesses are independent from each other, the time
periods between accesses are randomly distributed and that the rate of
access is constant (see Figure A.4).

Despite the apparent fit, these assumptions seem not to be valid. For
example, the consistency of the rate of access is violated if people go on
holiday or to conferences and the following week leads to a burst of
activity. The independence of accesses is violated if one access leads to
another, e.g. a request for information. Both these situations would
suggest weeks with a relatively high number of accesses in them.

An examination of the histograms of the number of accesses per week for
each individual suggests that there is indeed a relatively high number of

weeks with a large number of accesses in them and thus individuals are not following a Poisson-type model. A statistical test, using the dispersion index test on the variance divided by the mean against the expected value of 1.0 for each individual, shows that there is a significant difference and we must reject the Poisson rate of access model. The large size of the variance to mean ratio for these histograms suggests another model using the Negative Binomial Distribution (Johnson & Kotz, 1969). This does show a good fit with the data (Figure A.5). A comparison of the regression analysis of the Poisson and Negative Binomial Distribution is given in Figures A.6 and A.7.

Let N be the number of weeks from when an individual first accessed BLEND to the end of the data collection, June 30th 1984.

Average number of accesses per week = Total number of acesses / N

Proportion of weeks in which at least one access is made
                  = Total number of weeks containing at least one access / N

Example:

A person who logged in once a fortnight for a year except for 6 weeks holiday per year, starting July 1st 1982:

    N = 104

    Number of weeks system accessed = 46

    Average number of accesses per week = 46/104 = 0.44

    Proportion of weeks with at least one access = 46/104 = 0.44

A person who logged on once every six weeks and made four accesses in the week entered and who also accessed the sytem for the first time on the same date:

    N = 104

    Number of weeks system accessed = integral value of (104/6) = 17

    Average number of accesses per week = 17 * 4 /104 = 0.65

    Proportion of weeks with at least one access = 17/104 = 0.16

Figure A.1: The two measures used for studying the different user patterns

Average
number of
accesses
per week

0   1
Proportion of weeks in which at least one access was made
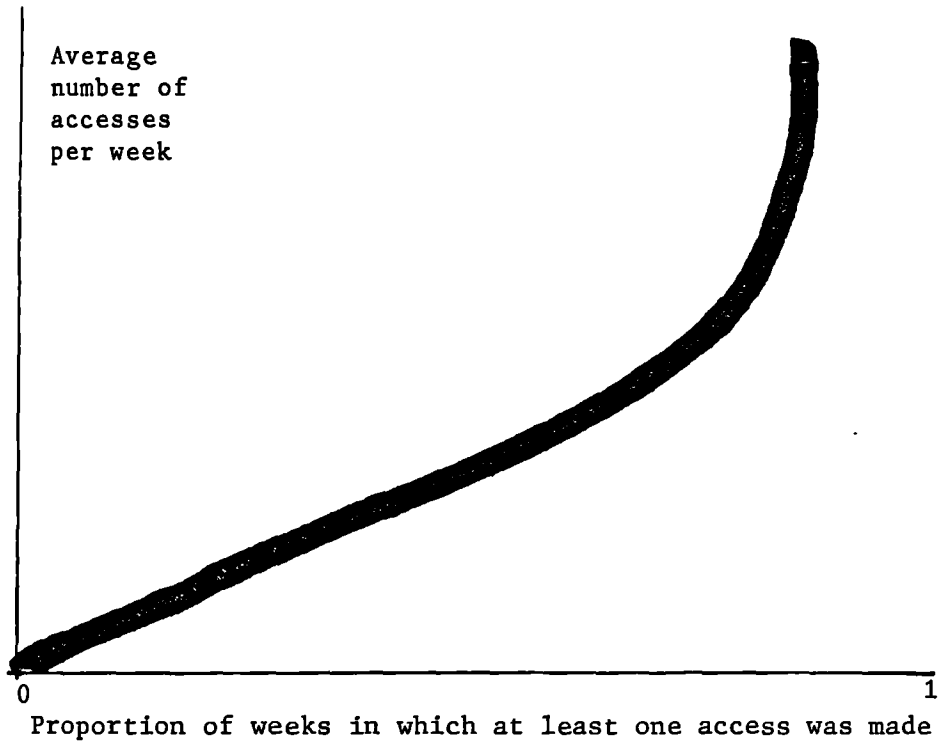
Figure A.2: General Shape of the Graph

Figure A.3 : How Some Hypotheses would Look Using the Two Measures

THE POISSON MODEL FOR ACCESSING THE BLEND SYSTEM

Assume each person enters in a Poisson type manner at a rate λ, then λ is the average number of accesses per week.

$$Pr \left\{ number \ of \ accesses \ in \ a \ week \right\} = e^{-\lambda}$$

∴ The expected proportion of weeks with at least one access = $1 - e^{-\lambda}$

This would lead to the following model:

```
4.0+  Average number
   -  of sessions                                                   *
   -  per week
   -                                                              *
   -
3.0+                                                             *
   -
   -
   -                                                        *
2.0+                                                       *
  --                                                      **
   -                                                     *
   -                                                     2
   -
1.0+                                    *    *
  --                                 *
   -                             2**
   -                    4  *  2*
   -            **4**3*2
0.0+   2232*
    +---------+----------+---------+---------+---------+---------+
   0.00      0.20       0.40      0.50      0.30       1.00
```
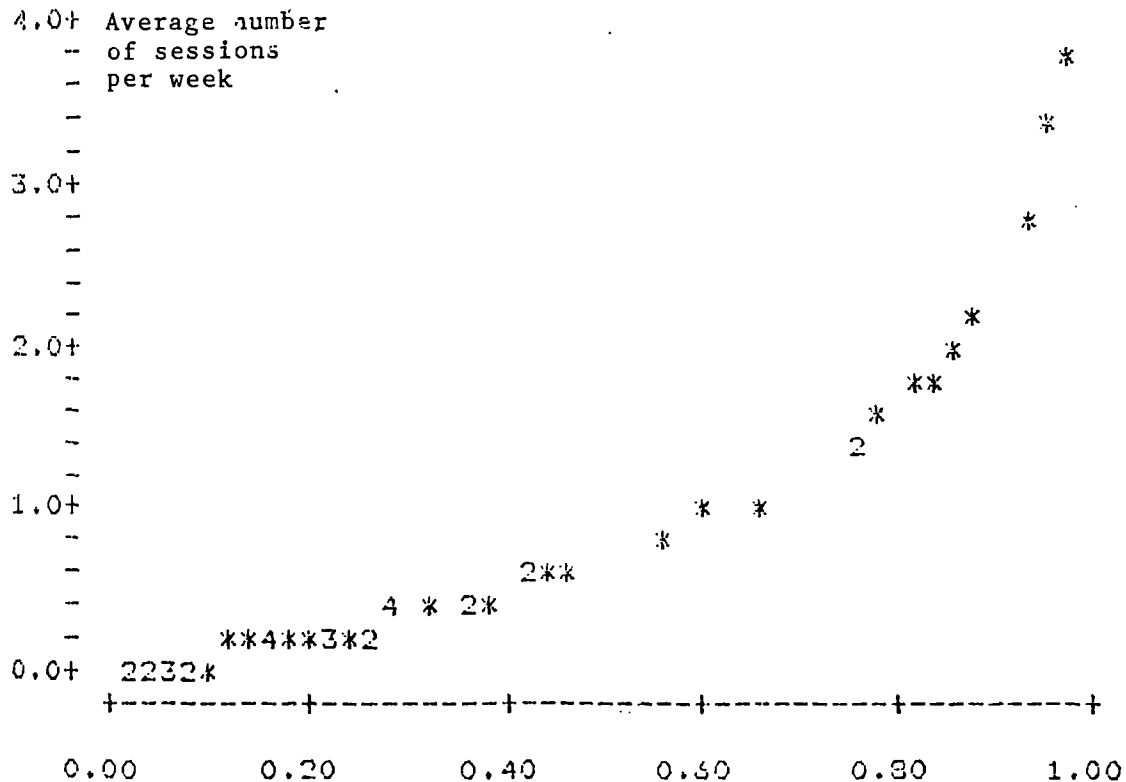
Theoretical proportion of weeks in which at least one access is made
There is a fairly good agreement between the data and this model with a
correlation of 0.96 and a regression of the values leading to observed
values ≃ 0.8 expected values. Thus, assuming the Poisson model leads to
a lower proportion of weeks in which access is made then might be
expected given the average number of accesses per week.

Figure A.4: The Poisson Model for accessing the system

THE NEGATIVE BINOMIAL MODEL

Let X be the number of accesses in a week.
Let $\overline{X}$ be the average number of accesses per week for each individual.
Let S^2 be the variance in the number of accesses per week for each individual.
Let N be the number of weeks
Then we can calculate N and p from

$$N p = \overline{X}$$
$$N p (1+p) = S^2$$

In the Negative Binomial Distribution

$$Pr\{X = k\} = \binom{N + k - 1}{N - 1}\left(\frac{P}{Q}\right)^k \left(1 - \frac{P}{Q}\right)^N$$

$$\text{for } P + Q = 1 \quad \text{and} \quad k = 0, 1, 2, \ldots\ldots$$

Then $Pr\{X = o\} = (1 + p)^{-N}$

Expected
  Proportion of weeks with at least one access $= 1 + (1 + p)^{-N}$

The graph of the plotted values of the expected proportions against the average number of sessions per week are very similar to that observed:

```
   .:+   Average number                                            *
     _    of sessions                                    *
     _    per week                                  *
     _
     _
  3.0+                                                        *
     _
     _
     _
     _                                                   *
  2.0+                                             *
     _                                       *    *
     _                                 *
     _                                 *  *
     _
  1.0+                        *   *
     _                      *
     _          *    2      *
     _       *2    ****  *        Theoretical proportion
     _    ***33*3**                of weeks in which at least
  0.0+  432*                       one access is made
     +---------+---------+---------+---------+---------+
     0.00     0.20      0.40      0.60      0.80      1.00
```
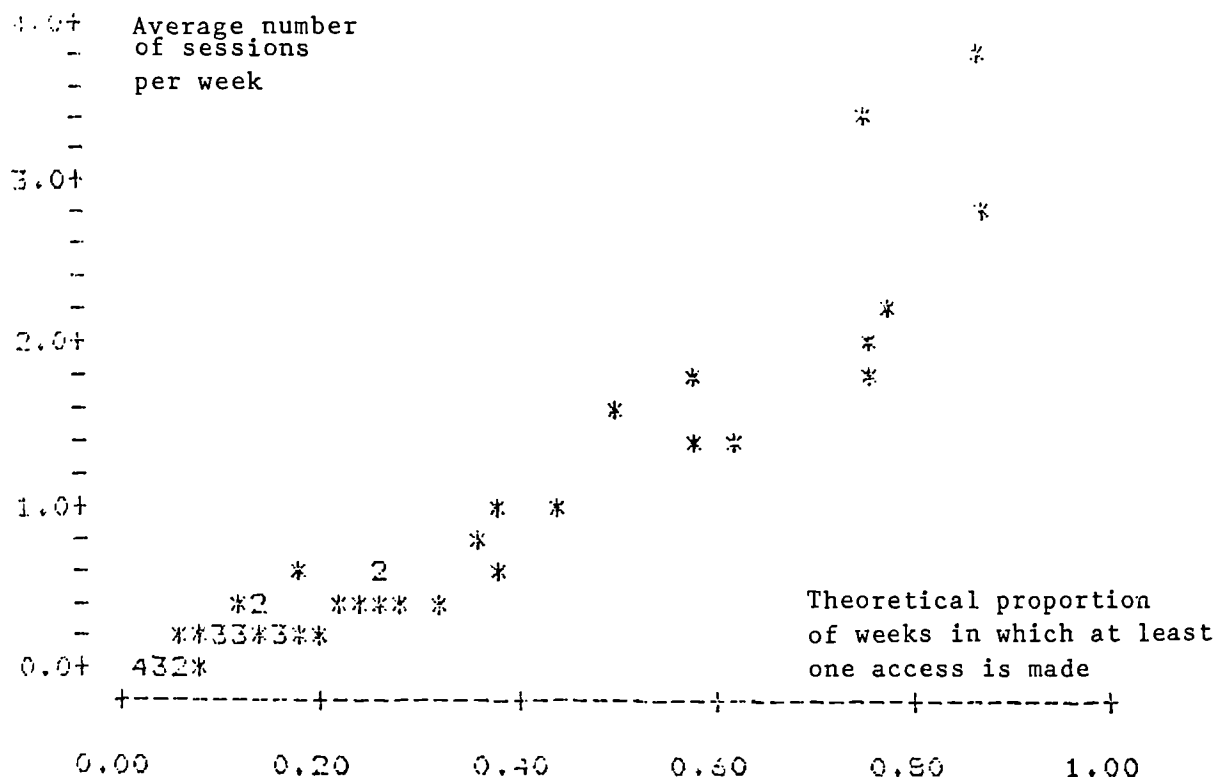
Plotting the observed values against the expected values, a good fit is obtained in which the correlation coefficient is 0.995 and regressing the observed values on the expected values, we discover that observed values $\simeq 0.96$ expected values. Individual distributions are also close to negative binomial as checked by a χ^2-test.

Figure A 5: The Negative Binomial Model for accessing the system

Figure A.6: The Poisson Model for accesses made to the BLEND system

Figure A.7: The Negative Binomial Model for accesses made to the system
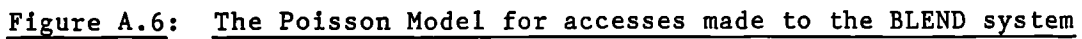
APPENDIX B: The pro-forma used for the Six-month and Thirty-five month
telephone surveys

Use of system:	T S/W F/A	Name Categories and Prompts	S Comments
How much have you used BLEND system?		0 demo only a few 1 p.w regularly	
Do you envisage this level increasing?		Y - N -	
Hardware: Have you got all the equipment that you hoped for by now? Access to equipment		 Y - what? - how five behind? N - can communicate? - how long before can?	
Design of system: 1. What changes to the TECHNICAL functioning of BLEND system would you make? 2. ....SOFTWARE................ 3. ....PROCEDURAL, LINC Structure..			
User support: Documentation sufficient? What other forms of user support would you like?			

Scientific Communication:
 	
Have you had communication through this participation with those you did not previously communicate with?
 	
Have you stinted a paper or short note for the project yet?
		N -
		Y -
		   - casual
		   - continuous 1/2
		   - several
		
		N -
		Y - when can be expected?	

APPENDIX C: Statistical Classification of groupings of system users
by their patterns of access of the system

Group:	1a	1b	2	3	4
Number in Group:	27	4	8	8	2
Total number of accesses	2-100 30.8 (19.5, 42.1)	14-30 25 (17.6, 32.5)	3-86 36.25 (17.3, 55.2)	125-380 230.6 (177, 284)	204-457 - - -
Average number of accesses per week	0.02-0.94 0.276 (0.19, 0.36)	0.14-0.55 0.31 (0.135, 0.475	0.05-1.08 0.394 (0.17, 0.62	1.4-2.8 1.87 (1.57, 2.17	3.4-3.7 3.55 - -
Proportion of weeks in which system is accessed	0.02-0.4 0.153 (0.109, 0.194)	0.11-0.255 0.18 (0.122, 0.238)	0.02-0.3 0.106 (0.05, 0.17)	0.48-0.83 0.663 (0.57, 0.75)	0.74-0.8 0.77 (0.71 0.8)
Average number of access given at least one in the week	1.0-2.6 1.66 (1.49, 1.83)	1.27-2.14 1.6 (1.22, 1.98)	3.0-4.45 3.645 (3.27, 4.01)	2.4-3.42 2.82 (2.56, 3.08)	4.57-4.64 4.61 (4.57, 4.63)
Average time per week in minutes	0.15-18.8 5.1 (3.2, 7.0)	6.5-23.3 15.9 (8.7, 23.0	0.4-16.9 4.1 (missing data)	18.4-90.4 40.3 (25.0, 55.6)	90-148 119 - -
Time per access in minutes	1.7-32.4 17.4 (14.3, 20.5)	42.8-65.5 53.7 (43.0, 64.4)	4.6-15.7 8.24 (5.0, 11.4)	5.9-31.9 20.8 (16.2, 25.4)	26.6-39.8 33.2 (20.3, 46.1)

Each cell contains

> Range
> Mean
> 95% Confidence Interval for the Mean

APPENDIX D: The 1980 Pre-use Questionnaire sent out in October 1980

Questionnaire on Attitudes to the Proposed INFONET System on °Computer Human, Factors° with Regard to The Refereed Paper Journal

Please answer all the questions although some attitudes reflect factors that may, for example, depend on whether you get the equipment you want or not.

The completed questionnaire should be posted to David Pullinger by Monday November 10th 1980.

The questions with rating scales should be answered by marking the line in a place to indicate your attitude and by placing a bracket either side to indicate how certain you are of your judgement. (Brackets close together, eg. ( ), mean more certain and brackets wider apart, eg. (   ), mean less certain).

1.   Do you like the present system of publishing in refereed paper journals?

No_____Yes

2.   What do you most like and dislike (or find most annoying) about the present publishing procedure in refereed paper journals?

3.   Do you expect to find the absence of a bound journal acceptable?

No_____Yes

4.   Do you feel that hard copies of refereed papers are essential?

No_____Yes

5.   Do you expect to find the limited graphic facilities a handicap?

No_____Yes

6.   What do you consider to be the maximum acceptable delay between submission and "publication" in the Electronic Journal?

7. Do you expect your rate of production of papers to increase?

    No_____Yes

8. Do you expect that the exchange of ideas and views on refereed papers between members of the INFONET Community will increase?

    No_____._____Yes

9. ...If so, at what level and for what purpose?

10. Do you expect to find the procedure for publication of papers on INFONET easy to use?

    No_____Yes

11. Do you expect to find the INFONET system convenient to use?

    No_____Yes

12. Do you expect that the INFONET system will change your work habits that are related to journal use?

    No_____Yes

13. ...If so, how?

14. Do you expect to be able to use the journal as much as you would like?

    No_____Yes

15. ...If not, please give reasons.

16. Do you expect colleagues to express an interest in trying the INFONET system?

    No_____Yes

17. Do you expect to wish the refereed paper journal to continue beyond the 3 year British Library project?

    No_____Yes

18. Do you expect to like the INFONET system for a refereed paper journal?

    No_____Yes

In this space you are invited to make a brief outline of your attitude to the proposed Electronic refereed paper Journal "Computer Human Factors", including what you expect the virtues and vices of such a system to be

Questionnaire on the Writing of Papers for Refereed Paper Journals

A suggestion for answering this questionnaire is for you to use files where necessary and to bear in mind the last two papers that you wrote for submission to a refereed paper journal, assuming that these are fairly typical of the sort of paper generally written by you.

Many of the questions have answers that are themselves ranges or answers for which you may find it possible only to give ranges.

1. How many papers for refereed paper journals did you write last year?
    .... _____

2. How many of these were on the subject °Computer Human Factors°?
    .... _____

3. How many words on average did a paper contain?
    .... _____

4. Would you have liked to write more papers?
    .... _____

5. If so – what prevented this? ....
    ....

6. At what time of day do you usually write?
    .... _____

7. Why at this time? ....
    ....

8. Do you like this time for writing?
    .... _____

9. Where do you usually do your writing?

10. Is this by choice? ....
    ....

11. What is the approximate number of hours that a first draft takes?
    .... _____

12. Do you think that this is a longer or a shorter time than most others?
    .... _____

13. How many drafts does a paper usually go through before submission?
    .... _____

14. For what reason? – for example, essential restructuring or small editting?
    ....

15. How many hours do you spend on drafts? (Please list in no. of hours)
....

16. Who does the typing?

.... _____

17. If a secretary, how many other people does she service?

.... _____

18. Does this sometimes cause her a time problem?

.... _____

19. What priority is typing a paper given by the typist in the face of other demands as, for example, dictation, telephone answering, letter typing, query answering?...
....

Questionnaire in Reading Refereed Paper Journals
and Retrieval of Useful Information

1. How many refereed paper journals do you yourself take?

       ...._____

2. How many of these are directly related to the subject of "Computer Human Factors"?

       ...._____

3. How many journals do you regularly access for example in the department, library or by circulation to you?

   ....

4. How many of these are directly related to (ie. might certain articles on) Computer Human Factors?

       ...._____

5. Do you generally read the entire article in a journal if it interests you?

       ...._____

6. Do you generally read just abstracts in a journal?

       ...._____

7. Do you send to the authors for offprints of papers in which you are interested?

       ...._____

8. ...If so, who does the sending? ....

9. ...If not are Xerox (or equivalent) copies made?

       ...._____

10. If so, who makes the copies? ....

11. How are offprints/copies stored? ....

    ....

12. What sort of accessing system do you have for them?

    ....

13. At what time of day do you usually browse/read journals?

       ...._____

14. At what time of day do you usually read whole papers (journals/Xerox copies/offprints)

       ...._____

15. Do you find it difficult to access information on work done in Computer Human Factors?

       ...._____

If you are handed a journal over coffee for a moment by a colleague who refers an interesting article to you, whose reference you take and ask your research assistant to check over, who asks the secretary "if she is not too busy", to send for an offprint, who puts it in your in-tray when it arrives, and which you skim over lunch and, if interested, read at home late at night....

....and you could not explain this schedule in our questionnaire, then this is the space to describe what we did not ask,

There are other types of electronic journal, apart from the refereed paper one proposed, examples of which include Newsletters and Abstracts. Please suggest types and rank them in the order that you would expect them to be of most value to you adding reasons and attitudes.

05-01

People working in human factors, or associated with it, often have very different titles and positions within their respective organisations. Although the members of the INFONET Community are all Government-supported researchers they have a wide range of backgrounds and yet are aiming at contributing to a common area. This area of Computer Human Factors has had little common ground for dissemination of information and the INFONET researcher is interested in previous communication between those who are members of the INC. He would like to know when, how and for what reason you have communicated with others with interests ir Computer Human Factors and hence you are asked to look down the list of INC members (principals and associates), as given to you in on Oct 31st, and give a profile of communication with other members via this questionnaire. (We are using the INC as a representative cross-section of workers in this area). Please exclude those who are in the same location as yourself from the counts. Communication is considered to be meetings/seminar discussions/phone conversation/letters.

Note: Although you are answering this after the first INC meeting -
        please answer as if it was before you knew about this Project.

                                                      No. of INC Members

1.   With how many have you had no communication at all?

                                                       ...._____

2.   Of how many had you heard by name (e.g. by reference or read their papers?)

                                                       ...._____

3.   How many do you know by name to greet?

                                                       ...._____

4.   With how many have you had one and one only communication?

                                                       ...._____

5.   With how many have you had occasional communication (2 times a year)?

                                                       ...._____

6.   From how many have you made professional enquiries about a particular work
      topic of common interest?

                                                       ...._____

7.   With how many do you keep contact so as to keep up to date with their
      research?

                                                       ...._____

8.   To how many would you pass a paper abstract or a reference.knowing that
      they would find it interesting?

                                                       ...._____

9.   With how many do you have regular contact e.g. in organising seminars,
      meetings?

                                                       ...._____

10.   With how many do you have constant contact as in e.g. joint research?

                                                       ...._____

Questionnaire on Attitudes to the proposed INFONET System
on °Computer Human Factors°
· with Regard to General Interaction in INC and Reading Abstracts, Newsletters etc

Please note that, although some of the questions are the same as in page 1 and 2, the previous context was that if a refereed paper journal, here it is of communication between members of INC and use of Newsletters, Abstracts etc. and there are likely to be different attitudes between these two areas.

1. What do you most like/dislike (or find most annoying) about present interaction and communication with other members of the INC?

2. If you use a VDU, do you expect to find absence of hard copy acceptable?

    No_____Yes

3. Do you think that hard copies are essential for some communications and interactions although they are permanently stored in NOTEPAD?

    No_____Yes

.4. ...If so, which and for what reason?

5. Do you expect the INFONET system to change your work habits?

    No_____Yes

6. ...If so, how?

7. Do you expect that your communication with other members of the INC will increase?

    No_____Yes

8. Will you expect to solve problems quicker?

    No_____Yes

9. Do you expect to find the system easy to use?

    No_____Yes

10. Do you expect to find the INFONET system convenient to use?

    No_____ Yes

11. Do you expect to be able to use the INFONET system as much as you would like?

    No_____ Yes

12. Do you expect to like the INFONET system?

    No_____ Yes

APPENDIX D: The 1984 Post-use Questionnaire sent out in June 1984

Questionnaire on attitudes to the BLEND System
on "Computer Human Factors"
with regard to Refereed Paper Journals.

Please answer all the questions.

The completed questionnaire should be posted to
David Pullinger by Friday, 3rd., August, 1984.

The questions with rating scales should be answered by marking the line in a place
to indicate your attitude and by placing a *bracket either side*
to indicate how certain you are of your judgement.

For example: *more certain*   *NO* _____(|)_____ *YES*

   less certain   *NO* (|) *YES*

---

1. Do you like the present system of publishing in refereed paper journals?

   NO _____ YES

2. Do you find the absence of a bound journal acceptable?

   NO _____ YES

3. Do you feel that hard copies of refereed papers are essential?

   NO _____ YES

5. Do you find the limited graphic facilities a handicap?

   NO _____ YES

5. What do you consider to be the maximum acceptable delay between submission
   and "publication" in the electronic Journal? ....

   ....

6. Has your rate of production of papers increased from the start of the Electronic Journal?

   NO _____ YES

7. Has the exchange of ideas and views on refereed papers between members
   of the BLEND community increased?

   NO _____ YES

8. ...if so, at what level and for what purpose? ....

   ....

9. Have you found the procedure for publication of papers on BLEND easy to use?

NO _____ YES

10. Have you found the BLEND system easy to use?

NO _____ YES

11. Has the BLEND system changed those work habits that are related to work use?

NO _____ YES

12. ...if so, how? ....
....
....

13. Are you able to use the electronic journal as much as you would like?

NO _____ YES

14. ...if not, please give reasons. ....
....
....

15. Have your colleagues expressed any interest in trying the BLEND system?

NO _____ YES

16. Would you like the refereed paper journal to continue after the 3 year British Library project?

NO _____ YES

17. Do you like the BLEND system for a refereed paper journal?

NO _____ YES

In the space on the other side of the page you are invited to make a
brief outline of your attitude to the electronic journal 'Computer Human Factors',
including your opinions on the virtues and vices of the system.

> Questionnaire on the Writing of Papers for Refereed Paper Journals.

> A suggestion for answering this questionnaire is for you to use files where necessary and to bear in mind the last two papers that you wrote for submission to a refereed paper journal, assuming that these are fairly typical of the sort of paper generally written by you.
>
> *Many of the questions have answers that are themselves ranges or answers for which you may find it possible only to give ranges.*

1. How many papers for refereed paper journals did you write last year? [ ]

2. How many of these were on the subject "Computer Human Factors"? [ ]

3. How many words on average did a paper contain? [ ]

4. Would you have liked to write more papers? [ ]

5. If so, what prevented this? ....

6. At what time of day do you usually write? [ ]

7. Why at this time? ....

8. Do you like this time for writing? [ ]

9. Where do you usually do your writing? ....

10. Is this by choice? ....

11. Who does the typing? ....

12. If 'a secretary' how many other people does she service? [ ]

13. Does this sometimes cause her a time problem? [ ]

14. What priority is typing a paper given by the typist in the face of other demands such as, dictation, telephone answering, letter typing, query answering? ....

Questionnaire in reading refereed paper journals and retrieval of useful information.	

1. How many refereed paper journals do you buy regularly?

2. How many of these are directly related to the subject of "Computer Human Factors"?

3. How many refereed journals do you regularly access for example, in the department, library or by circulation to you?

4. How many of these are directly related to (ie. contain articles on) Computer Human Factors?

5. Do you generally read the entire article in a journal if it interests you?

6. Do you generally read just abstracts in a journal?

7. Do you send to the authors for reprints of papers in which you are interested?

8. ...if so, who does the sending? ....

9. ...if not, are Xerox (or equivalent) copies made?

10. ...if so, who makes the copies? ....

11. How are reprints/copies stored? ....

12. What sort of accessing system do you have for them? ....
....

13. At what time of day do you usually browse/read journals? ....

14. At what time of day do you usually read whole papers? ....

15. Do you find it difficult to access information on work done in computer human factors?

If you are handed a journal over coffee for a moment by a colleague who refers an
interesting article to you, whose reference you note and ask your research
assistant to check over, who asks the secretary "if she is not too busy", to send
for an offprint, who puts it in your in-tray when it arrives, and which you skim
over lunch and, if interested, read at home late at night....

..and you could not explain your schedule in our questionnaire,
then this is the space to describe what we did not ask.

There are other types of electronic journal, apart from "Computer
Human Factors", examples of which include Newsletters and Abstracts.
Please suggest types and rank them in the order that you found them to be
of most value adding reasons and attitudes.

Questionnaire on attitudes to the BLEND system on
'Computer Human Factors' with regard to
general interaction in LINC and
reading Abstracts, News, etc.

Please note that, although some of the questions are the *same as in previous pages*,
the context then was that of a refereed paper journal, here it is of communication
between members of LINC and use of News, Abstracts, etc. and there are likely
to be different attitudes between these two areas.

1. What do you most like/dislike (or find most annoying) about present interaction
and communication with other members of LINC? ....

....

2. Have you found the absence of a hard copy acceptable?

   NO _____ YES

3. Do you think that hard copies are essential for some communications and interactions
although they are permanently stored in NOTEPAD?

   NO _____ YES

4. ...if so, which and for what reason? ....

5. Has the BLEND system changed your work habits?

   NO _____ YES

6. ...if so, how? ....

7. Has your communication with other members of LINC increased?

   NO _____ YES

8. Have you been able to solve problems quicker?

   NO _____ YES

9. Have you found the system easy to use?

   NO _____ YES

10. Have you found the BLEND system convenient to use?

    NO _____ YES

11. Have you been able to use BLEND as much as you would like?

    NO _____ YES

12. Do you like the BLEND system?

    NO _____ YES

APPENDIX E: <u>Pilot Trial of Different Log-in Presentations</u>

APPENDIX E: <u>Log-in presentation A - descriptive sequence of steps</u>

<u>LOG-IN PROCEDURE</u>

System
Response: | Action undertaken by user.

1) Dial 021-471-2101

2) When connection is made

<u>press carriage return key</u> (denoted henceforth as *(J)*)

*

3) key either <u>20 *(J)*</u>

or <u>21 *(J)*</u>

There are two entry services available to the INC, numbers

20 and 21, you may choose which one to use.

SERVICE 20 START (or SERVICE 21 START as is appropriate)

4) If you obtain other messages, see the following page for what to do.

<u>Hold down control key, key C, release control key.</u>

THE UNIVERSITY OF BIRMINGHAM, TOPS-20 MONITOR 4(3247)-B01

@

5) If this response was not obtained within approximately
one minute at high usage times, then disconnect the line
and dial again.

After the @ prompt, you need to choose into which area
of NOTEPAD (see page ....) you wish to log in. There
are 3 areas (="projects") BL. NEWS, BL.SURVEY, BL.AUTHOR
each with a different password given on the Members Card.

Keying example :

<u>LOG space BL.NEWS space password *(J)*</u>

JOB 52 on TTY43 26-NOV-80 12:53:24 (for example)

Notepad is ready :

Name :

6) Give surname followed by a carriage return *(J)*

Password :

7) Give your own password (it is not echoed back).
The first time you enter into each project you will be
asked to set a password.

Good. Are you using a terminal that prints on paper?

8) If so, key <u>Y *(J)*</u>

but if you are using a VDU, type N*(J)* , it will then ask
you if you are using one of the types of terminal that
it recognises or an "other".

The question is for 2 purposes

a) so that system knows how many lines are on your screen

b) so that NOTEPAD knows whether it will be able to send
more sophisticated delete messages to the terminal.

Thank you.

The following activities are available to you :

9) See page .... for continuation.

APPENDIX E: Log-in presentation B - flow-chart

LOG-IN PROCEDURE

Actions taken by the User are Underlined

Dial 021-471-2101 ←

connection made

key CR

*

key 20 CR   key 21 CR

as for 20 CR

SERVICE 20 START   SERVICE 2 ?→
                                    SERVICE 20?→
key CONTROL C   SERVICE 20 UNAVAILABLE ——————→

THE UNIVERSITY OF BIRMINGHAM, TOPS-20 MONITOR 4(3247)-B01

@   NO RESPONSE ——→

Choice of work area

key LOG␣BL.NEWS␣password CR   (see Members Card
     LOG␣BL.SURVEY␣password CR   for passwords)
     LOG␣BL.AUTHOR␣password CR   ␣ denotes space.

numerous default messages ——————————————————→

JOB 52 on TTY43 26-NOV-80 12:53:24   (example)

Notepad is ready

DISCONNECT LINE   DISCONNECT LINE
                     AND TRY OTHER
                     SERVICE NUMBER

system did
not recognise
your name

Name :

key your surname with a CR

                    ——————→There are no other activities available — —————————→
Password :   at this time.

key your password with a CR

Good. Are you using a terminal that prints on paper?

see page ____ for continuation

APPENDIX E: Log-in presentation C - 'Play'-form

Log-IN Procedure

Dial 021-471-2101

when connection made

User   :   ↙ (where ↙ denotes carriage return)

Response :   *

User   :   20 ↙   or   21 ↙

Response :   SYSTEM 20 START or SYSTEM 21 START

User   :   CONTROL C

Response :   THE UNIVERSITY OF BIRMINGHAM, TOPS-20 MONITOR 4(3247)-BO1

                @

User   :   Choose project, check password and key as in following example.

                LOG ⊔ BL.NEWS ⊔ password ↙   where ⊔ denotes a space.

Response :   JOB 52 on TTY43 26-NOV-80 12:53:24   (example)

                Notepad is ready

                Name :

User   :   key your surname followed by ↙

Response :   Password :

User   :   key your password followed by ↙

Response :   Good. Are you using a terminal that prints on paper?

User   :   Y ↙   for yes
                     N ↙   for no, as appropriate

Response :

A

```
┌ SERVICE 2 ?                  )
│ SERVICE 20?                  ) ──→ Redial and try again
│ SERVICE 20 UNAVAILABLE       )
│ SERVICE 20 UNAVAILABLE       ──→ Redial and try service 21
└ SERVICE 21 UNAVAILABLE       ──→    "    "    "    "    20
```

B

```
┌ ? DOES NOT MATCH DIRECTORY OR USER NAME
│ ? UNRECOGNISED COMMAND - DOES NOT MATCH SWITCH OR KEY WORD
│ ? UNRECOGNISED COMMAND - AMBIGUOUS
└ ? INCORRECT PASSWORD
```

──→ all these give the prompt @ on the next line
    retype all of the log-in code, e.g. LOG space BL.NEWS space password
    followed by a carriage return.

C

```
┌ No response after a short time (1 min at high usage time)
```
──→ redial but if there is still no success after a few times, it is
    probable that the Birmingham computer is down.

D

```
┌ THERE ARE NO OTHER ACTIVITIES AVAILABLE AT THIS TIME
```

──→ Your surname was either entered wrongly or NOTEPAD registered
    noise on the line. Restart log-in by redialling 021-471-2101.

E

```
┌ *** YOUR PASSWORD IS NOT CORRECT
```

──→ You have one more chance at getting password registered correctly
    after a prompt PASSWORD :
    before system will automatically log you off.

APPENDIX E: Log-in documentation provided at the time to LINC members,
log-in presentation D

NOTEPAD LOGGING IN PROCEDURE

Please read right across both pages

Actions taken by the User	What is seen by the User
	Shaded Boxes mark location of action, the computer types everything else.
Switch on all equipment Dial 021-471-2101 when the connection is made, Press Carriage Return (denoted ⏎)	[◌]
	*
Key 20 or 21 ⏎	[◌]
	Service 20 Start
Hold down Control key, press C, release Control key	The University of Birmingham, TOPS-20 Monitor 4(3247)-B01
Key Log␣BL.NEWS␣xxx⏎	@ [Log BL.NEWS]
(␣ indicates a space)	Job 20 on TTY27 23-OCT-80 11:25:06 Notepad is ready
Key your name (e.g. Pullinger)⏎	Name : [Pullinger]
Key your 3 character password ⏎	Password : [_____]
	Good. Are you using a terminal that prints on paper?
Key Y ⏎ for Yes	-Y
	Thank you.
	23-OCT-80 Notepad Page 1
	The following activities are available to you 1. 2. 3.
Key N ⏎ for No	-N
	Please type the number corresponding to your make of terminal.
	1. Hazeltine 2000 4. Beehive 7. DEC V752 (ANSI) 2. Tektronix 4023 5. Superbee 8. Other 3. Datapoint 3300 6. Soroc 1Q 120
	[◌]
Key number ⏎	Please enter the number of lines on your CRT terminal
	[◌]
Key number ⏎	Thank you The following activities are available to you.
	1. 2. 3.

- There are 8/9 dial-up ports on the Birmingham computer which are searched by a hunting procedure.

  If "Service 20 Unavailable" or "Service 2?" is obtained, disconnect the line (ie. hang up) and dial again, trying the other number.

- If there is no response to "Control C" after a short time, disconnect the line and dial again.

  xxx is not echoed back for security reasons because it is the password - see your INC Members Card for the actual log in code and password.
- You have 2 chances at inputting Participant's name.

- You have 2 chances at inputting password correctly - it will ask you to try again
  Note that it is not echoed back for security reasons.

FIRST ENTRY : TO SET A PASSWORD :

Key 3 characters starting
with a letter ✓

Name : [Pullinger]
Please set a three character password
[xxx]
Good. Are you using ....

If you tell Notepad that you are printing on paper it will automatically supply page headings to American A4 size. If you do not wish to have these headings, key N ✓ and pretend that you are a VDU.

- Even though you may have VT52 mode, it may have DEC escape sequences and not ANSI, if you get problems on screen length because of this key 8 ✓ and then choose no. of lines that you have on the screen (often 24).

APPENDIX E: Results of the pilot trial

Results of the pilot trial of the log-in presentations

Subject Number		Recommended log-in to use:		
1		B +	C	
2			C	
3			C	(D)
4	A			
5			C	
6		(B+)	C	
7			C	(D)
8			-	
9		(B+)	C	(D)

First choice marked with letter
Second choice marked in parentheses
+ means the user would like it as well as first choice.

APPENDIX E: <u>Log-in presentation developed for the manual as a result</u>

<u>LOG-IN PROCEDURE</u>

<u>Shading denotes User Action</u>

For error messages A-E
and notes see following
pages

Dial 021-471-2101

when connection made

User	:	↵ (where ↵ denotes carriage return)
Response	:	*
User	:	There are two entry services available on BLEND, you may choose either 20 or 21.
		20 ↵ or 21 ↵
Response	:	SERVICE 20 START or SERVICE 21 START (A)
User	:	CONTROL C (Hold down Control key, press C, release Control key)
Response	:	THE UNIVERSITY OF BIRMINGHAM, TOPS-20 MONITOR 4(3247)-B01 (B)
		@
User	:	Choose project, check password on your Members Card and key as in following example.
		LOG˄BL.NEWS˄Project Password ↵ (where ˄ denotes a space.)
Response	:	JOB 52 on TTY43 26-NOV-80 16:53:24 (example) (C)
		Notepad is ready
		Last Name :

User	:	Key your surname followed by ↵ .	SHORT CUT NOTE 1 PAGE 6
Response	:	Password :	(D)
User	:	key your personal password followed by ↵	FIRST TIME LOG IN NOTE 2 PAGE 6
Response	:	Good. Are you using a terminal that prints on paper?	(E)
User	:	Either Y↵ for yes	
		or N↵ for no, as appropriate	

If answer was N ↵ then

Response :   Please type the number corresponding to your make of terminal.

1   HAZELTINE 2000   4   BEEHIVE   7   DEC VT100 (ANSI)
2   TEKTRONIX 4023   5   SUPERBEE   8   OTHER
3   DATAPOINT 3300   6   DEC VT52

User   :   If you have one of the named terminals or an emulator of
one, key the appropriate number.

If not,

8 ↵

Response :   Please enter the number of lines on your CRT terminal.

User   24 ↵

Response :   Thank you
The following activities are available to you:...(continued as
below)

If answer was Y ↵ then

Response :   Thank you.

The following activities are available to you :
1   Advice and Help
2   Network Query Corner
3   Messages
etc.

Please type the number of the activity you wish to join.

User   :   3 ↵   (for example)

Response :   The title of activity 2003 is :
Messages
You are up to date.
ACTION:

User   :   You may now choose one of the nine basic NOTEPAD actions
by keying a digit (1-9) as listed on p. 16. Keying ? at
this point will also give you a list of these nine basic
actions.

SHORT CUT
NOTE 1

At this point it is possible to bypass the interactive dialogue in the remainder of the log in procedure, by typing spaces between each user entry.

For example, if you are using a teletype, at prompt LAST NAME type each answer followed by a space (denoted by ʌ), where FRIEND is PULLINGER's personal password.

Example: Last Name: PULLINGERʌFRIENDʌY ↵

             Thank you.

or if you are using a VT 52 emulator

Example: Last Name: PULLINGERʌFRIENDʌ6 ↵

             Thank you.

or a Lynwood with 24 lines on the screen.

Example: Last Name: PULLINGERʌFRIENDʌ8ʌ24 ↵

             Thank you.

FIRST TIME LOG IN

NOTE 2

The only difference is that your first name is checked and you are asked to set a password in place of the allotted temporary one, for example, if your name is Rachel Noakes with temporary password FIRST

            NOTEPAD is ready.

            LAST NAME: Noakes ↵

            PASSWORD: FIRST ↵

                    WELCOME TO NOTEPAD

            You are currently registered under a temporary name and password.

            Please set the first name by which NOTEPAD will recognise you.

            - RACHEL ↵

            Please set a six character password, use no spaces or punctuation.

            - JACOB ↵

            Good. Are you using a terminal that prints on paper?

            etc.
*

Although NOTEPAD asks you for a 6 character password you may in fact set a personal password between 3 and 9 characters.

APPENDIX E: Flow-chart log-in developed for experienced users

DIAGRAMMATIC LOG-IN PROCEDURE

Dial 021-471-2101

Connection made

Key ↵ (symbol for Carriage Return)

*
|
(Note: Choice of entry service)
|

20 ↵   or   21 ↵   Error Messages:
                           (SERVICE 20 UNAVAILABLE)
                           (SERVICE 21 UNAVAILABLE)
SERVICE 20 START   SERVICE 21 START   (SERVICE 2?)
                                          (SERVICE 20?)
                                          (SERVICE 21?)
CONTROL C   NO RESPONSE

Disconnect
and redial

THE UNIVERSITY OF BIRMINGHAM TOPS - 20 MONITOR 4(3247)-B01
@

(Choose project you wish to enter, check project password in members card)

Log∧BL∧NEWS∧project password ↵   ←── Retype all log code
                                    ──→ NUMEROUS ERROR MESSAGES

JOB 52 on TTY 43 26-MAR-81 - 16:53:24
Notepad is ready
Last Name:

(Short cut log in: see page 7 of manual)

(for teletype)   SMITH∧personal∧password∧Y↵
(for named terminal)   SMITH∧personal∧password∧7↵
(for unnamed VDU   SMITH∧personal∧password∧8∧24↵

Thank you

The following activities are available to you:
1 Advice and Help
2 Network Query Corner

────→ To log-out key ↵ ────────────→ To change to
(Choose activity, for example number 1)   another project
1 ↵   redial

The title of activity 2000 is:
Advice and Help
You are up to date
ACTION:
────→ To log-out key ?

(Choose what you would like to do...press ? for a list of the 9 possible actions)
(for example to select another activity)

ACTION: 3 Select Activity

(If you want to see activity list again, now key ?)

ACTION: 3 Select Activity ?

APPENDIX E: Aide memoire produced for log-in

Dial   *021-471-2101 for 300 baud*
           021-471-3251 for 1200 baud

When data tone is received

Key | Return |

Response: *

Key |2|0| Return |

Response: SERVICE 20 START

Key | Control C |

Response: The University of Birmingham, TOPS 20 . . .
           @

Key |L|O|G|space|B|L|.|B|L|E|N|D|space|L|I|N|C|Return|

Response: What project do you want to enter:

Possibilities of Projects are:

NEWS	PROGRESS	AUTHOR	BULLETIN	POSTER	CHF1	CHF2	ETC
Messages	Development	Advice & Help	LINC Meeting	Editor — Messages	Papers	Papers	
Chit chat	Progress	Editor — Messages	Oct 1980	Log & Index			
Who's who	Members List	Author Writing	LINC Meeting	Papers			
Projects	Readers List	Activities	Dec 1981				
Advice		+	+				
LINC News	+						
Q & A							

APPENDIX F: <u>Pilot experiment on re-structured text</u>; <u>Sections of a</u>
         <u>Re-structured article</u>

Next entry :

1   QUALIFYING VERBAL QUANTIFIERS
                     =================================

              James Hartley, Alan Rodgers and Mark Trueman
              Department of Psychology, University of Keele
Next entry :

2   Contents   Entry Nos.
==================   =========
      Summary   Precis: 3   Full Text:
      Introduction   Precis: 4   Full Text:12-:
      Method   Precis: 5   Full Text:19-:
      Results (including tables 1 & 2)   Precis:6-9   Full Text: 2:
      Discussion   Precis: 10   Full Text: 2:
      References
      Full Address   39
      End

Next entry :

3   Precis of Summary.
      ===========================
Words expressing frequency, such as 'often' and 'sometimes' are called
verbal quantifiers. Whether such words are used consistently between
individuals, and if it is possible to scale specific sets of quantifiers
have been investigated. We investigated the responses of students to
three sets of verbal quantifiers, finding different results from previous
studies, possibly because we had fewer words in each set. The results impl
that sets of verbal quantifiers must be tested in context.
Next entry :

4   Precis of Introduction.
      =================================
Questionnaires commonly use a five-point scale of quantifiers. Research
has focussed on the quantities conveyed by the words and how such
quantifiers are intervally scaled. Hammerton suggesteset of verbal
quantifiers which were challenged by Goodwin et al. Claxton showed that
the quantities suggested by Goodwin's phrases were understood consistently
by adults and children. Reserchers have shown that the quantifiers
'always', 'often', 'occaisionally', 'seldom', and 'never' are not
intervally scaled. Since questionnaire responses are only ordinally scaled
it is not statistically correct to add scores from different questions.
Schreischeim and Schreischeim advocated 'always', 'very often', 'about as
often as not', 'seldom', and 'never' as an intervally scaled set. Bass eet
al suggested using 'fairly many times' and 'occasionally' in place of
'about as often as not' and 'seldom', which Screisheim and Schreischeim
agreed were better.(1978).

In 1981 Pohl confirmed that Schreischeim and Schreischeim's original set
were not intervally scaled. Pohl suggested 'always', 'quite often',
'sometimes', 'very infrequently' and 'none of the time'. We investigated
Schreischeim and Schreischeim's original set,(A), Bass et al's adjustment t
this, (Set B), and Pohl's set, (C).
Next entry :

11   Full text of Summary
==============================

Words such as always, often, sometimes, never, which express
       ====== ===== ========= =====
degrees of frequency are called verbal quantifiers. Research on such
quantifiers has focussed on whether given words·are used with consistent
meanings by different individuals, and whether it is possible to scale
intervally specific sets of quantifiers. In this paper the responses of
undergraduate students to three sets of verbal quantifiers are compared,
and differences are found contrary to those predicted from previous
studies. The likely explanation of these differences lies in the fact
that far fewer words were used in each set compared with previous
research. The results imply that sets of quantifiers need to be testednd
in content and not chosen ad hoc.
Next entry :

12   Full text of Introduction
===

It is quite common in questionnaires to find each item followed by a
five-point scale : for example, respondents indicate appropriately their
position as :

```
  ----
!     !  always
  ----
  ----
!     !  often
  ----
  ----
!     !  occasionally
  ----
  ----
!     !  seldom
  ----
  ----
!     !  never
  ----
```

Such labels are verbal expressions of frequency and technically they are
called verbal quantifiers.
        =====================

Research on verbal quantifiers has focussed on two issues : (i) what
frequencies or quantities are conveyed by these (and similar) words, and
(ii) how far are such frequencies or quantities intervally scaled.
Next entry :

14 In terms of the first issue, Hammerton (1976) suggested that the
following words or phrases conveyed the following percentages:

Almost all of	....	> 75%
More than half of	....	60-70%
Rather more than half of	....	50-60%
Nearly half of	....	40-50%
Part of	....	20-40%
A very small part of	....	< 25%

Next entry :

14   These findings were challenged by Goodwin et al (1977) who
replicated and extended Hammerton's work. Goodwin e al suggested the
following phrases and percentages :

Almost all of	....	> 85%
More than half of	....	60-70%
Rather more than half of	....	50-60%
A part of	....	15-35%
A very small part of	....	< 10%

In an experiment where respondents were asked to pick a number of matches
from a pile, Claxton (1980) showed that the phrases and percentages
suggested by Goodwin et al were understood with the same high degree of
consistency by adults and children down to the age of 5.
Next entry :

15   A number of researchers have shown (with different methodologies)
that the quantifiers always, often, occasionally, seldom and never
                           ====== ===== ============= ======   =====
are not intervally scaled (e.g. see Bass et al, 1974; Schreischeim and
Schreischeim, 1974, 1978; Pohl, 1981). This is an important issue because
if the responses to questionnaires using such quantifiers are only
ordinally scaled then, strictly speaking, it is not statistically correct
add together the scores from different questions.
Next entry :

16   So researchers have attempted to produce sets of quantifiers which
are intervally scaled. Schreischeim and Schreischeim (1974), for
instance, advocated the use of :

```
 ----
|    |  always
 ----
 ----
|    |  very often
 ----
 ----
|    |  about as often as not
 ----
 ----
|    |  never
 ----
```

but Bass et al (1974) suggested :

(1)
Greetings,   .
Thank you for reading these papers and articles and acting as an
experimental subject on the way that you interact with the computer
to do so. We would be grateful if you would first thoughtfully
answer a few questions, whose content will remain confidential. When
you finish each answer type a Control Y (hold down the Control key,
press Y, release Control key).

Name:

Institute or place of work:

Given that you have selected this paper by its title and author, what
do you expect to find of interest in it?

Do you expect to find this paper of direct interest to your study or
work?

To help you read the paper, the following commands are available.
After the prompt 'next entry:' you may abbreviate any of these commands
to one letter.   Abort   - stop reading the paper
(Forward
(<Return>   - read the next paragraph or section of text
 Repeat   - repeat the section of text displayed
(Back
(Previous   - redisplay the section of text accessed
                                 previously
<Number>   - jump to a section labelled with a number,
                                 eg. 12.

If you want to see this list of commands again, type a ?

All papers start with the following structure:

1. Full title and author
2. Contents
3. Introduction ...
Please type a <Control Y> to continue ...

---

(2)
What, if anything, did you find of interest to you in this paper?

Did you find this paper of direct interest to your study or work?

Did you find the structure of the paper easy to understand and helpful
relative to the content? Please give a rate from 0-10 followed by a
comment.

Did you find the commands available to help display the text easy to
use? Please give a rate from 0-10 followed by a comment.

What changes would you make to aid viewing papers on-line?

The on-line questionnaire and information

APPENDIX G: <u>Reading experiment</u>; <u>Manipulation Instructions</u>

SCROLL

This text manipulation program allows you to move through the text with the following commands - just type:

, 1 press   - forwards 1 line of text

, held   - forwards repeatedly until released

                   - backwards, either 1 line or several

A <Return>   - aborts, takes you out of the program when you have
                     finished reading.

PAGE

This text manipulation program allows you to move through the text with the following commands - just type:

or <Return> (once) - forwards 1 entry or 'page'

or <Return> (once) - forwards repeatedly until released

                    - backwards either 1 entry or several

A <Return>   - abort, takes you out of the program when you
                      have finished reading.

READ

This text manipulation program allows you to move through the text with the following commands - just type:

F <Return> or <Return> - forwards 1 entry or 'page'

B <Return>   - jumps to last entry or 'page' viewed

19 <Return>   - jumps to entry no. 19

"Refer" <Return>   - searches for string or part-string "refer" within
                          text, presents entry containing it - in this case
                          probably References.

A <Return>   - abort, takes you out of the program when you have
                          finished reading.

RPAGE

This text manipulation program allows you to move through the text with the
following commands - just type:F <Return> or   ‐ forwards 1 entry or
'page', holding key down

                         repeats the operation.

B <Return>   ‐ jumps to last entry or 'page' viewed.

                                 ‐ backwards 1 entry or 'page', holding key down
                                    repeats the operation.

19 <Return>   ‐ searches for string or part-string "refer" within
                                    text, presents entry containing it, in this case,
                                    probably References.

A <Return>   ‐ abort, takes you out of the program when you have
                                    finished reading.

Appendix G: Comments from the experimenter

The experiment was generally found to be slightly boring, depending on
subject reading speed it could take up to one and a half hours to complete.
This was tempered by the fact that some subjects were very enthusiastic
about reading and using the new medium. One subject even suggested that
Dickens should be available to be read in the same way.

Boredom may have been associated with the lack of task realism. Subjects
were not allowed to make notes or highlight certain paragraphs when they
might normally wish or expect to do this. They were asked whether there
were any program facilities that they would request (over and above those
they already had), their answers did tend to show that this lack of
annotation facilities was felt.

The content of the text by Perry may have had some effect on the subjects;
it suggested tht readers should read the final chapter or summary in order
to gain a faster working understanding of the paper. Subjects expected
there to be a summary at the end of subsequent experimental papers or
suspected that the aim of the experiment was different to that stated. The
effect of this is not known but reading times were probably unchanged
except for the SCROLL program (in which moving to the end of the text took
a long time in itself). The other programs were much quicker and are less
likely to cause an increase in times. However, the strategies (or 'paths'
through the text) adopted may be expected to change - this can be analysed,
from records kept, at a later date. When subjects went to the end of the
text and found no summary, they often reported disappointment.

Summaried texts had fairly extensive precis at the start, although in
questionnaire answers this was seen as an advantage, when verbally reported
it was inevitably in a negative fashion.

APPENDIX G: <u>Questionnaires in the reading experiment</u>

<u>Questionnaire 1 administered</u>

REF NO.:   TEXT NO.:

NAME: PROGRAM:

1 What did you think of the article you have just read?

2 Give a short precis of the articles main points.
   (No more than 1/2 page).

3. How readable was the article?

        DIFFICULT   -2   -1   0   1   2   EASY
                     └────────┴───────┴──────┴──────┘

   any other comments?

Questionnaire 2

After 3 texts using 1 program

Program:

1   Were you able to read satisfactorily?   Yes/No
     if not, what caused most problems and why?

2   Which manipulation feature did you find most helpful?
     Why?

3   Are there any extra features that you would have liked to
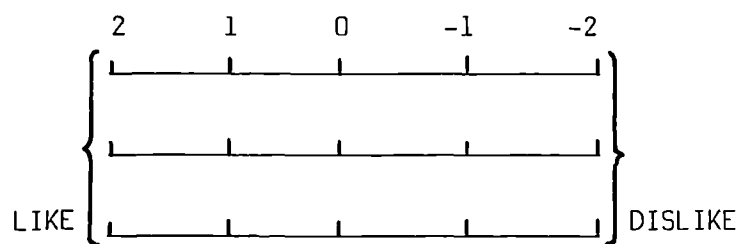   have had?

     Which?

4   Any other comments about the program?

Text type: ie LAYOUT not CONTENT.

1   Place a cross on each of the scales corresponding to your
     opinion on which text type you preferred.

No.

```
        2      1      0     -1     -2
       ┌  L____I____I____I____I____I  ┐
       │                              │
       ┤  L____I____I____I____I____I  ├
  LIKE │                              │ DISLIKE
       └  L____I____I____I____I__I    ┘
```

2   Are there any features of the text layout that you
     particularly liked or disliked?

Questionnaire 3

After 4 manipulation programs

1   Rank the programs in order of preference, ie which would
     you most like to use?

     PAGE

     SCROLL

     READ

     SKIPPING

2   Why did you choose ....as the most preferred?

3   Why did you choose ....as the least preferred?

4   Do particular text formats combine well with certain
     text programs and work together nicely?
     if so which?

APPENDIX G: Example of text for reading experiment;
              General interest in normal paragraphed text display

(Note that the '£' sign indicates the end of the display on the screen)

STUDENT'S USE AND MISUSE OF READING SKILLS

W.G. PERRY

£

CONTENTS   Entry Nos.

£

INTRODUCTION

Mr.President, twenty years ago this Faculty undertook an
experiment to see if some of its students could be taught to
read better. Since the Faculty was then something of a
pioneer in such an enterprise, it would seem approriate
that it should receive, after two decades, at least a report
of progress - the more so because the work now concerns not
the correction of the disabilities of a few students but the
direction of the abilities of a large proportion of the
freshman class.

£

The students of this college are reputed to spend a good
deal of time reading. In fact, a student sits with his
books for nearly a thousand hours each year. The Faculty
has a deep concern that these hours be fruitful. This
concern is evident in the wording of assignments, in the
layout of instruction in each course, and in the
conversations of teachers with their students. It was this
same concern that started the original experiment in reading
improvement in 1938. The experiment began with a rather
mechanical emphasis. It consisted of an instructor whose
main job was to run a projector for the first Harvard
Reading Films, and of some thirty student volunteers,
hopefully the worst readers in the freshman class (and at
that time there apparently were some freshmen who for
Harvard's intents and purposes found it hard to read at
all). The class met for about 18 to 20 sessions and
engendered enough enthusiasm to become, like many an
experiment, a kind of annual fixture, this one known as the
Remedial Reading Course. Each year freshmen as they arrived
in the fall would take a reading test and those who scored

lowest would be informed of their plight and allowed to
volunteer for the continued experiment.
£
NATURE OF THE PROBLEM

   When the Bureau of Study Counsel took over the actual
instruction in this course in 1946, we met with thirty
depressed-looking volunteers one evening in a basement
classroom somewhere. Not knowing really what we were
up against, we gave still another reading test of a standard
sort and discovered that every single one of them could
score better on this test than 85% of the college freshmen
in the country. We felt that to be useful to these people
in their genuine dissatisfaction we were going to have to
take a new look at the reading improvement game. We .
therefore abandoned the word 'Remedial' for the course and
upgraded the material until it could jar the teeth of the
average graduate student. Then we threw the doors open.
£
 The amount of enthusiasm that exists in this community to
read better - or if not better, then at least faster - is
evidenced by the fact that we soon found ourselves with
nearly 800 people enrolled in the course. When we examined
the roll, we found that we had some 400 freshmen from
Harvard and Radcliffe, 150 upperclassmen, 230 graduate
students from the various schools, especially that of
Business Administration, and 2 professors - from the Law
School.
£
   Although the fees paid by these multitudes looked very
attractive on the budget of a small office, we came to feel
this was stretching our energies too far. We have
subsequently cut the class in half and have b een trying to
make some sensible system of priorities whereby we might
offer first chance on seats to roughly that third of the
freshmen class that might be most likely to benefit from
this kind of instruction. In trying to find out who these
people might be, we have turned up some observations about
freshmen, which may be of interest to the Faculty.
£
 One wonders first of all why students who read, on tests,
as well as these do, should want to attend a reading course
at all, much less one that meets daily at 8 o'clock in the
morning. Of course a number come in hope of magic - some
machine they've heard of that will stretch their eyes until
they can see a whole page at a glance. This is
understandable. Freshmen are deprived rather abruptly of
the luxury of thinking that reading is something they can
finish, and are confronted instead with an infinite world of
books in which they sense that they may forever feel behind,
or even illiterate.
£
 But year by year it has become more apparent that what the
students lack is not mechanical skills but flexibility and
purpose in the use of them - the capacity to adjust
themselves to the variety of reading materials and purposes
that exist on a college level.
£
 What they seem to do with almost any kind of reading is to

APPENDIX G: Example of text for reading experiment;
              Abstract with summaries preceding full-text

A prototyping language for text processing applications
_____
_____
                            by

W.P. Dodd, P. Ramsay, T.H. Axford, D.C. Parkyn
         Centre for Computing & Computer Science
              University of Birmingham
         Edgbaston, Birmingham B15 2TT UK

£
    CONTENTS   Entry Nos.
    _____
    _____

a) Abstracted Text

£
b) Original Text   Entry Nos.

£
    Precis of Summary.
    _____
    _____
This paper describes briefly the facilities required of
prototyping languages,with particular reference to text
processing.
A comparison is made between these requirements and the
facilities provided by the language "ATOL".

£
    Precis of Introduction.
    _____
    _____

One of the most difficult phases in a software project is
the requirements specification stage.
Errors are difficult and costly to eradicate.
Normally the user checks the written specification to ensure
that essential requirements have been met.
Some authors recommend using a prototype as these may reduce
costs in the long term.

£

   Precis of Requirements.

  (a) Of Prototyping Languages In General.
The purpose of prototypes is to test-out design theories.
As such, they are aids to communication between designers
and end-users.The users evaluation of the prototype assists
the designer. Evenso, the prototype has limitations. Its
constraints are not necessarily reflected in the end-
product. Research has shown that in certain industries, it
is possible to keep prototype costs down to under ten per
cent of total cost. This may be a result of concentrating
expenditure on the development of the user interface.
Different aspects of the system might require the use of
alternative prototypes. A variety of prototyping languages
is therefore essential.
(Continued in next entry)
£
(continuation)
    A prototype needs to be operational quickly and be easily
modified. This suggests the use of an interpretive language
with good diagnostic facilities. APL is a good example.   ,
Another use of prototyping is to clarify the users concepts
of the requirements, (especially if they are unfamiliar with
computing techniques.)
Trying out different prototypes and learning the appropriate
language may be necessary.
ATOL has been designed specifically for use by non-experts
in the field of text-processing.
£
    (b) Of Languages For Text Processing .
These must have the following attributes:
1.The ability to treat a character string as elementary
data.
2.Conatenation, extraction and comparison operators.
3.Numerical facilities.
4.Integer arithmetic.
5.A powerful set of appropriate data-handling facilities
6.Direct-access files.
7.Sequencing and repetition instructions to be used on basic
data-types.

£

   Precis of Summary of ATOL's Facilities.

   ----
a) For Text Manipulation.
ATOL's syntax is similar to that of BASIC. It does not use
hierarchical control structures. ATOL provides both full
procedures and data structures. It uses 'english' words as
language symbols, which is preferable to special characters,
etc.

APPENDIX G: Example of text for reading experiment; Concrete imaged in
                    24-line screenfuls of text

(Note: the '£' signs indicate the end of the screen).

Was "John Smith" a Farmer"?
by
C.F. Reynolds
Department of Computer Science
Brunel University

Contents   Entry Nos
(1) Summary   2
(2) Introduction   3
(3) Problems to answer this with computers   4-11
(4) Conclusions   12
(5) Author's Address   13

£

(1) Summary

   Historians and genealogists often ask such questions of
their data; indeed this is the simplest type of question
asked. However, in attempting to use computers to assist
their work, many problems have been found. Eleven problems
are briefly described, which are typical of the difficulties
when attempting to use computers to handle amorphous or
ambiguous information.

£
(2) Introduction

   The above question was used at a recent seminar on
"Computers and Genealogy", sponsored by the society of
Genealogists, to highlight the problems of mapping amorphous
historical data onto a computer using generally available
software. The arguments apply to many other applications
and it is important that systems designers are aware of the
conflicts that can arise between conventional technology and
the problem as seen by the users who have to cope with real
world information.
   It is assumed that the question is being asked of a
historical database which has been constructed using
information on people from a wide variety of historical
source documents. The problems that emerge are first of all
discussed in terms of the occupation, with brief comments on
the problems of identifying "John Smith".
A historian asking the above question, which is one of the

simplest he might consider asking, would want to type in no more than:
          IF NAME = "JOHN SMITH" AND OCCUPATION = "FARMER" ...
£
(3) Eleven Problems to Answer this with Computers
_____
_____

Problem 1
    Many database systems require fields to be of fixed
lengths.While this is unlikely to interfere with describing
someone as a farmer there could well be difficulties in
allowing them to be described as an "antidisestablishment-
arianist" or an "agent for South Sea arrow root". Because
the length of a character string needed to represent an
occupation is extremely variable ,a fixed format would
either involve space characters being stored in abundance or
arbitrary truncation for many of the more "unconventional"
occupations.

Problem 2
    It is quite possible for a particular individual to have
more than one occupation at a time. This is very common
among the self employed.
In documents like trade directories you often find entries
which will describe someone as being a farmer, a miller and
a publican at the same time.
£
   On the other hand you may well find someone's name entered
but no occupation given at all. In virtually all systems,
multiple occurring fields have to be explicitly defined at
the time of describing a data structure, and usually the
user has to be aware of this repetition when phrasing his
questions. In fact missing information (i.e. items whose
occurrence is zero) is very common in historical studies.
In addition multiple information on things that one would
normally think only occur once, such as baptism and
burial, are far from unknown. The important things is that
however many times a field is repeated the user should not
need to be aware of the fact that it can be repeated in
phrasing his questions.

Problem 3
    Not only may John Smith have several occupations at one
time, but in addition his occupations may well change with
time. This means that, thinking in conventional terms,
occupation can be thought of as a kind of array using date
as one of the controllable variables.

£
However, if data was explicitly stored in this way the
question would become even more complex, as the user has
simply asked a question about John Smith being a farmer
without in fact qualifying it by date.(Of course some dates
will be precise to the day while others may be very vague).

Problem 4
    A particular problem with historical information is that

APPENDIX H: Statistical analysis of a pattern of message-making in the
BLEND system

Table H.1: The value of the dispersion index for the number of messages
made per week for each Project and Activity, to show the rejection of the
Null Hypothesis that the data came from a Poisson population.

PROJECT	NEWS 81 n = 58	NEWS 82 n = 62	NEWS 83 n = 61
ACTIVITY			
Messages	3.0 ***	2.5 ***	5.8 ***
Advice + Queries Corn	4.7 ***	5.2 ***	7.7 ***
Chit-Chat	1.4 *	2.2 ***	5.9 ***
CHF Q+A	1.6 ***		8.5 ***
Teleconference + Mail			19.0 ***

n is the number of weeks   *** = significance at 0.1 %
                               ** = significance at 1%
                                * = significance at 5%

Table H.2: The value of the dispersion index for the number of
message-makers per week for each Project and Activity, to show the rejection
of the Null Hypothesis for the data coming from a Poisson Distribution.

PROJECT	NEWS 81 n = 58	NEWS 82 n = 62	NEWS 83 n = 61
ACTIVITY			
Messages	1.8 ***	1.4 *	1.7 ***
Advice + Queries Corn	1.6 ***	2.5 ***	4.8 ***
Chit-Chat	1.25	2.0 ***	3.8 ***
CHF Q+A	1.34 *		3.9 ***
Teleconference + Mail			2.3 ***

Table H.3: Statistical significance table for the acceptance of the Modified Geometric Distribution as a description of the data using a X^2 Goodness of Fit Test.

PROJECT	NEWS 81	NEWS 82	NEWS 83	TOTAL
ACTIVITY				
Messages	0.40	0.71	0.85	0.66
	0.61	0.70	0.78	0.73
	(1.0,2)	(2.8,4)	(1.2,5)	(2.1,8)
Advice +	0.19	0.23	0.20	0.20
Queries Corn	0.59	0.74	0.86	0.78
	(2.66,1)+	(0.16,1)	(2.3,1)	(4.7,4)
Chit-Chat	0.21	0.16	0.30	0.22
	0.37	0.48	0.73	0.63
	(8.8,1)**	(0.32,1)	(1.7,2)	(3.0,3)
CHF Q+A	0.07		0.18	0.13
Questions	0.33	-	0.84	0.80
+ Answers	(2,1)		(0.14,1)	(5.5,1)*

Each Cell contains Estimate of a
Estimate of b
(X^2 value for test, degrees of freedom)

+   is significant at 20%
*   is significant at 5%
** is significant at 1%

N.B. One problem of the Chi-Square tests was the need to combine classes in several cases to get expected frequencies greater than or equal to 5. This leads to a loss of power of the test, particularly in the tail of the distribution, where there are few messages but differences might be expected.