Serials & Information Technology
The Electronic Journal: A User's View

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1. Introduction

As a means of supporting scholarly communication, the electronic journal offers the potential for both increased speed and reduced cost. The increasing costs of paper-based publishing have been matched by a fall in electronic publishing costs. Furthermore, electronic storage and retrieval techniques allow for rapid searching of large volumes of information.

The present paper considers two approaches to the electronic journal, both of which were investigated at the HUSAT Research Institute. The two approaches differ in their assumed method of storage and distribution and focus on different aspects of the research communication process, hence providing different lessons for the scholarly community. The first formed part of the Birmingham and Loughborough Electronic Network Development (BLEND) project, while the second was investigated as part of HUSAT's contribution to Project Quartet.

2. BLEND:
The Computer Human Factors Journal

The BLEND system (Shackel and Pullinger, 1984) was based on the Notepad computer conferencing software package hosted on a mainframe and accessed via a remote terminal, either over the Joint Academic Network (JANet) or the Public Switched Telephone Network (PSTN). The package was adapted by the project teams to support most of the activities associated with the publishing of a journal, from the authoring of a paper, through submission to the editor, transmission to referees, returning to the editor with comments, transmission of comments to the author, editing of the paper and finally electronic "archiving". The project was keen to stress that articles were archived rather than published because the EIES project, a similar project in America, had stumbled over just this point. For most academics, publishing is an important aspect of career development, and the American project had discovered that academics were unwilling to expend the effort required to write a paper if it was only to be published in a low-prestige, experimental journal with restricted access. In contrast, BLEND allowed authors to publish papers in the traditional paper journals subsequently, requesting only that their archiving in the Computer Human Factors journal be acknowledged. Indeed, some journal editors expressed the view that papers which had been archived would have a smoother route through the traditional process since they had already been subjected to the usual standard of refereeing.

Four issues of Computer Human Factors were archived, each containing several articles. Hence, the system demonstrated the feasibility of an electronic journal and even demonstrated its superiority over the paper version in at least one respect. Although each article was "read-only" once archived, each issue of the journal had space allocated for comments to be entered on each article. These comments were available for all subsequent readers of the article. However, because the articles' authors were also part of the "electronic community", they could read the comments and reply to them. The effect of this was to generate much more of a dialogue and a feeling of "live" research than is possible in the paper medium, where the time between submission and publication may be measured in years rather than weeks.

In fact, in many instances the paper journals perform an archiving rather than communication function. Many authors circulate preprints to colleagues in the same field and hence by the time an article appears in print it will be "old news" for the people to whom it is most relevant.

Although successful in some respects, the BLEND project was not without its problems. At the time it was conducted (1980-1985), screen technology was relatively primitive. A typical screen displayed light characters on a dark background (white on black or light green on dark green) and could display only 24 lines of 80-column text as a screenful. Movement through the article was slow, relying on a system whereby each paragraph was numbered and the reader could jump to any particular number. The first screen following the title was equivalent to a contents page, with the starting paragraph numbers of the major sections listed. Not surprisingly, readers

preferred to print paper copies of articles which they wanted to read in their entirety.

Furthermore, the fact that readers could access the system using almost any terminal meant that it was not possible to include graphics in the articles. The content was restricted to the lowest common denominator, plain ASCII text, and hence any figures which were included had to be drawn in "typewriter graphics" — simple lines and boxes created with dashes and so forth.

Perhaps the biggest problems suffered by the system were those relating to access difficulties. At the time of the project, it was the exception rather than the rule for academics to have a terminal in their office. Most had access to terminals in the university's computer centre, but these terminals might be in a different building to the academic's, office, would frequently be in use by other users and hence might not be readily available. The general finding of the project was that extent of system use was inversely related to the distance of a terminal from the academic's desk; high usage was associated with a terminal in the office, while at the other end of the scale the necessity to move to another building meant that usage level was very low.

3. Project Quartet:
The Hypertext Electronic Journal.

Project Quartet aimed to investigate the implications of information technology for the scholarly communication process. As such it was wider than the BLEND project, being concerned with a broad spectrum of communication activities including electronic mail, computer-based conferencing, electronic document delivery, desktop publishing and electronic publishing (see Tuck *et al.*, 1990).

Whereas BLEND had investigated the notion of a journal held on a central host and accessed remotely, the Quartet team based at Loughborough were concerned to investigate the idea of a journal held on the scholar's own desktop microcomputer or workstation. In this sense, the electronic journal is seen as a replacement for the personal subscription to a paper journal which would ordinarily sit on the scholar's bookshelf. Modern storage media such as CD-ROM encourage this view since they are essentially publishing media like paper rather than a shared resource such as a file server.

However, if new technology is to replace existing technology, it must at least support the same tasks as the existing technology. Preferably, there should also be some "added value" for the user to move to the new technology, otherwise there is no incentive to change. For this reason, the

first stage in building an electronic journal was to study how people use the paper version.

The results of such a study have been reported fully elsewhere (see Dillon, Richardson and McKnight, 1988). For present purposes it will suffice to mention the main findings. Firstly, it is clear that people very rarely start reading at the title and continue through, page after page, until they reach the references. The myth that paper documents are linear and that this structure forces a particular pattern of reading is not shared by most readers. Rather, regular users of journals have a mental model of the article and use this in order to move rapidly through the article to the point of interest. What this point is will depend on why the person is reading the article. If the aim is to "keep up to date" then a reading of the abstract may suffice; replicating the experiment reported in the article will require careful reading of the method and procedural details.

When presented with a new issue of a journal, readers frequently like to scan the contents page, looking at titles and authors. If an article appears interesting it is a simple matter to turn to its first page and rapidly scan through. Even when looking for a specific article in a back issue of a journal, readers frequently scan the entire contents, and the serendipitous finding of articles of interest during this process is mentioned regularly. Indeed, an information retrieval specialist might be horrified to learn how much important material is discovered by accident in this manner, although the average scholar would not.

With such findings in mind, we set out to build an electronic journal which would allow readers to do all the things they do with paper journals and hopefully add something new. We have described the design process fully elsewhere (McKnight, Dillon and Richardson, 1991) so only brief details will be given here. The first design decision concerned the structure of each article. Since readers have a mental model of articles, any system which supports this model should be easier to learn to use than one which does not. For this reason, it was decided to maintain the same structural components of the article (abstract, introduction, method, and so forth) while using the Guide hypertext package to allow rapid access to the sections and ease of movement between them. Hence, the top level of a typical article contains section headings corresponding to the paper version, each of which is a "button" or "hot spot". The selection of a button causes the relevant text to be "unfolded".

The design also incorporates other features suggested by behaviour with the paper journal. For example, a typical reader will keep a finger in the references section and turn to it when a reference is

encountered in the body text. In the electronic version, selecting a reference in the text causes a pop-up window to appear containing the bibliographic details. Figures, tables and even equations can also be hidden behind buttons since many readers report that they disrupt the reading process. This has the added advantage that figures can always be embedded in the text which discusses them, whereas in the paper medium the economics of publishing often dictate a layout such that figures will not necessarily be on even the same page as the text which discusses them.

The Guide application contains a "top level" command which allows the reader to return to the top level and close all buttons in one step, and also contains a simple string search facility which allows the reader to search through an entire document.

In order to support the browsing type of activity, a "front end" was written using Apple's HyperCard application. Since the journal is seen as replacing the version which sits on the scholar's bookshelf, it was decided to use such a representation as the basis for the browser. Once again, this has the added advantage that it is recognisable and allows the user to bring existing experience to bear rather than force re-learning. However, it is clear that such a representation is only viable where a small number of journals are involved. If the aim had been to emulate a library, such a representation would be impractical. Furthermore, it may be that, even with a small number of journals, an alternative representation would better support the users tasks. For example, a "concept map" showing the major topics represented in the journals might be an alternative, and clearly more research is needed into such aspects of the design.

The design also includes a search facility which allows a range of different searches to be performed. For example, the user can limit the search to a particular subset of journals, or search the entire database for all articles containing a particular term. Clearly such a search as this latter would be impractical in the paper medium, and it is in such searching and retrieval that the electronic journal offers a potential advantage over the paper version. However, it remains to be seen which particular searches would be useful for readers. It would be relatively easy to build a complete inverted file index to the entire database, but any data suggesting that readers would find such an index useful has yet to be collected.

Selecting a journal from the shelf yields a display of the available volumes and issues. At this level, either an entire volume's contents can be chosen for display or a single issue can be selected. The display produced by the latter looks remarkably like its paper equivalent except for the

absence of page numbers. In the electronic journal, clicking the cursor on a title or author causes the top level of the article to be displayed.

The journal Behaviour and Information Technology (BIT) was chosen for a variety of reasons, not least of which is that it contains a significant proportion of articles concerned with what the BLEND project termed Computer Human Factors. The consequence of this is that articles frequently refer to other articles in BIT, and Guide allows us to turn such references into hypertext links. Hence, selecting a reference to an article leads to that article's top level being displayed. At present the link is always to the top level but in principle it could be to the relevant section of the referenced text. Quitting from Guide returns the reader to the browser at the point from which the first article was chosen.

4. Implications For Usage

In a recent report of an attempt to implement computer teleconferencing within the Research and Development division of Hewlett-Packard, Fanning and Raphael (1986) pointed out that "the true issues have been personal, sociological and political." The same is true of the electronic journal. The enabling technology already exists, but a variety of psychological and social issues have yet to be addressed.

For example, although research has shown that reading from screens can be as efficient as reading from paper (Gould et al., 1987), many users still express a preference for paper, particularly for extended reading. The work of Gould and his associates suggests that for comparable levels of performance between the two media, a high quality screen display is needed. Modern screens increasingly approximate the quality levels suggested by Gould and are certainly better than those which were available to the average BLEND user. Furthermore, the point-and-click nature of modern graphical user interfaces makes document manipulation much easier than it was in BLEND. However, preferences for paper are still expressed and although increasing experience with the electronic medium may lead to their eventual decline, presumably such preferences will continue to be expressed for some time to come.

If Guide has a major failing it is that, despite its name, it does not offer any significant navigational support. Hence, a reader who unfolds several buttons, jumps from article to article and generally moves around the database can easily get lost. In the paper medium such navigation is "hidden" by our experience of standard structures (sections in articles, chapters in books, and so forth) and access mechanisms (tables of contents, indices). Until such experience can be taken for granted in the

electronic medium (which effectively means it must be learned in school or before), it will be necessary to provide navigational support. In this respect, although Guide does not have extensive navigational support, the fact that it readily supports hierarchical structures typical of much technical writing means that existing document models may be transferred from paper to screen.

The access difficulties mentioned earlier in relation to BLEND would not necessarily be encountered in the present day. A small survey reported by Shackel (1990) indicated that the average number of staff in an academic department having a microcomputer in their office was over 90%, with the survey considering five different academic departments. Of course, having the machine is not necessarily enough — the scholar's workstation would need to be connected to the outside world. However, the precise nature of such interconnectedness may be determined by essentially non-technical factors. After all, it was

for legal and political rather than technical reasons that the UK was excluded from the EIES study and which led to the setting up of BLEND.

At present, scholars have a personal store of information and, along with other scholars, make use of a local store (e.g., campus library). Information not available here can be requested from a national library. Scholars can also request information directly from colleagues and can use mail facilities to send information to colleagues and the library, but extensive discussion usually requires physical movement (*see Figure 1*).

In contrast to this, suppose we reduce the system to its essentials by removing anyone who does not make a direct contribution to the end use of the information. This would leave us with a "network of scholars", not unlike the renaissance situation where each scholar had a library containing all known knowledge, although the present-day scholar could only aspire to possessing all known knowledge on a very narrow specialism

Figure 1:   The present situation.
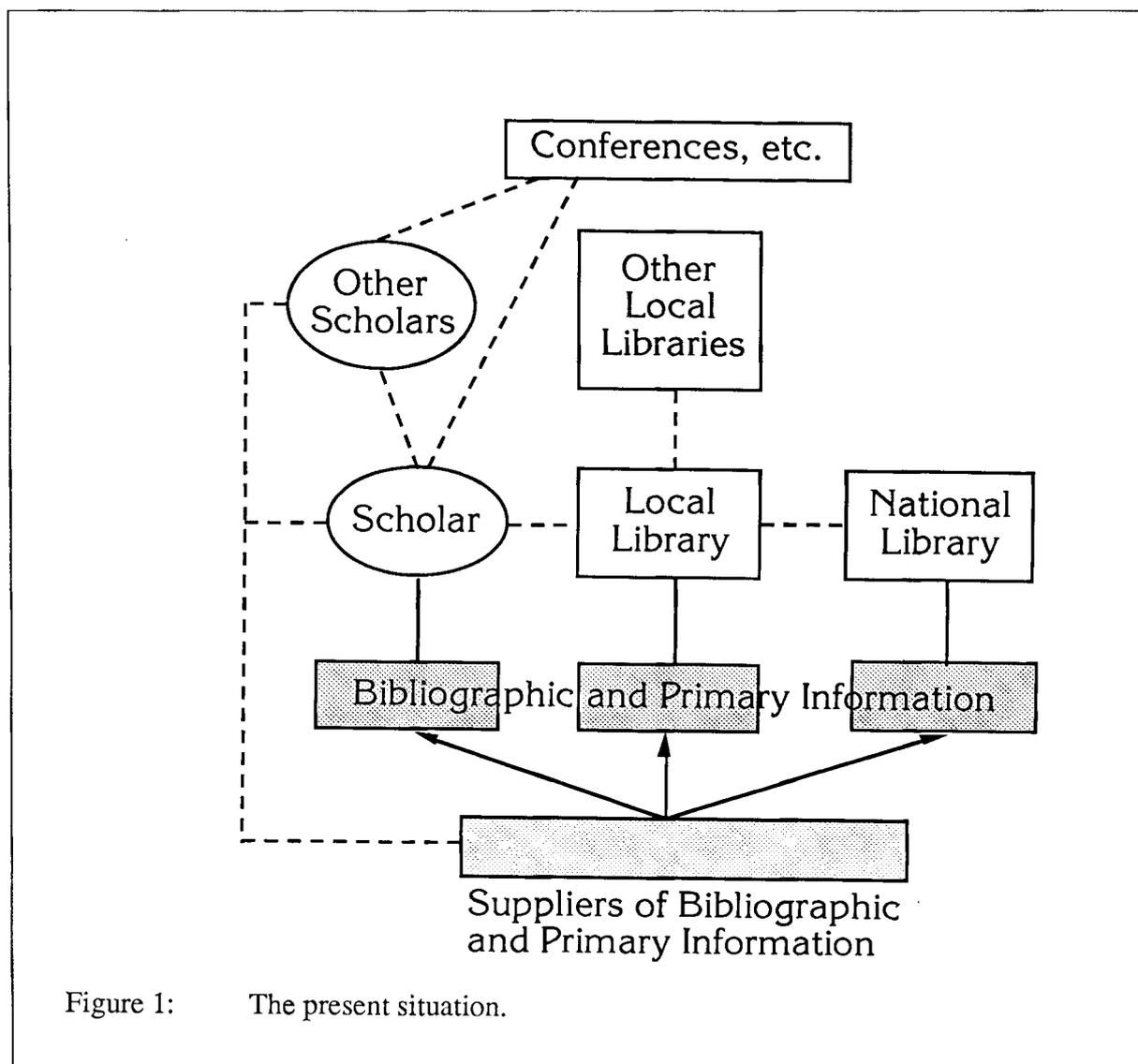
(*see Figure 2*). Such a situation would have the advantage of a high access bandwidth — a lot of information could be accessed extremely quickly — but would be weak in terms of group communication. There would also be much duplication of information.

The duplication of information could be minimised if we consider a centralised system as an alternative. In such a system, all the information would be stored in one national archive (which would also provide mail and conferencing facilities)

and we agreed to keep in touch. The comments were emailed to him from my home in the early hours of Easter Sunday, illustrating another advantage of email — it's generally there when I want it rather than at fixed times. By the time Bill's article appeared in print, both he and I had moved on. Indeed, a discussion letter by David Stodolsky, which appeared in the same issue as Bill's paper, has also had an electronic airing, once again demonstrating the immediacy of the electronic medium.

Figure 2:   The network of scholars.
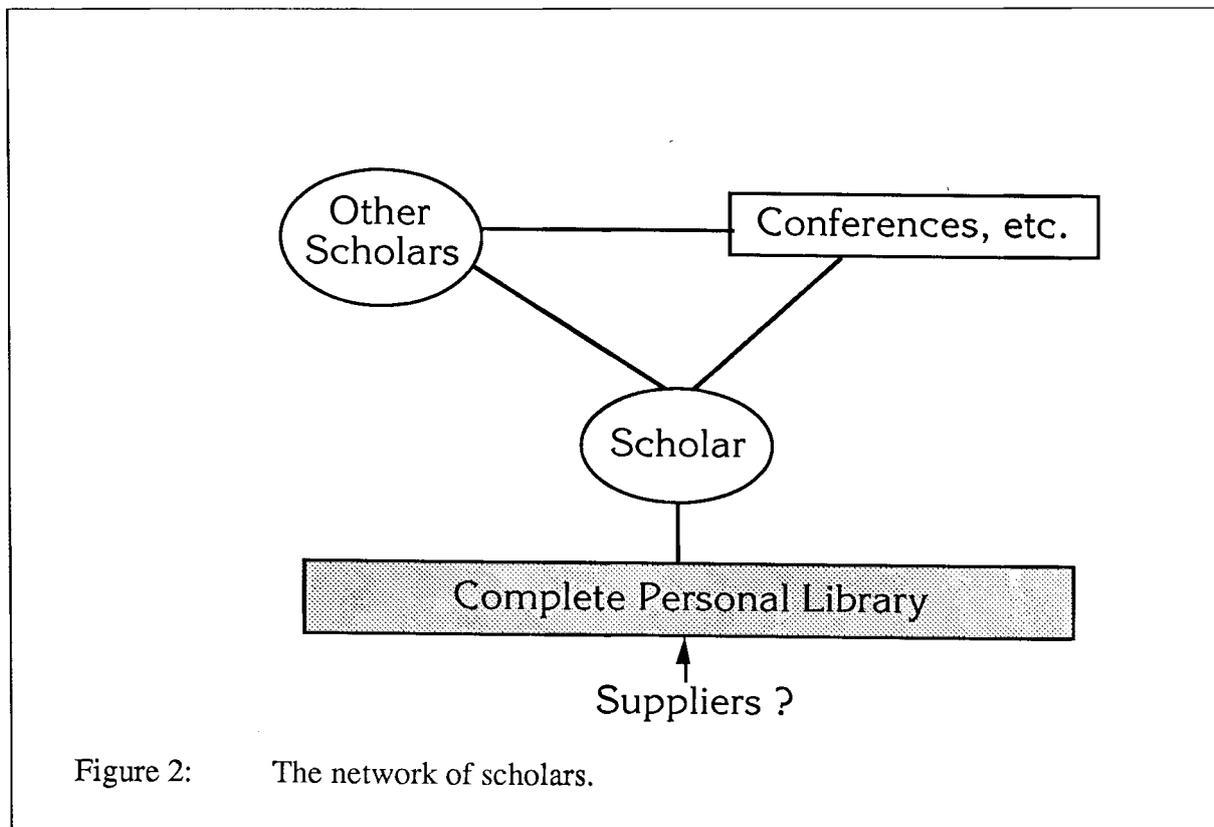
and would only be delivered to the user when required (*see Figure 3*). However, access to such a system might pose problems since it would require either a very large number of high bandwidth lines or be non-interactive. It would also be inefficient if a group of scholars in the same location (e.g., a class of students) were accessing the same information at approximately the same time. However, such a system is not too different from that argued for by Gardner (1990).

In the context of the present discussion, it is also interesting how I encountered and acquired Bill Gardner's paper. I saw an abstract of the paper on an electronic bulletin board, and I therefore emailed Bill in America and requested a copy — by email if convenient, otherwise by "snail-mail". I very soon received a copy of the paper via email and offered Bill some comments, sent him some of my papers

If we were to remove the national archive and distribute the primary and bibliographic material to local area networks (LANs), we might arrive at a compromise position between the centralised system and the network of scholars (*see Figure 4*). Obviously each LAN would not contain all the stored documents since this would approximate to a large number of centralised systems. However, it would allow particular LANs to specialise in material relevant to local needs . The system would also need to support inter-LAN transfers, although these might be infrequent and require relatively low bandwidth.

The network of scholars, the centralised, and the distributed systems are all simplifications which at best represent "polar", limiting cases. In reality, the system which evolves is likely to be a pragmatic compromise, influenced by psychological,

sociological, economic and political considerations. However, electronic journals are already beginning to appear. For example, the journal *Postmodern Culture* is published from North Carolina State University (NCSU) and is distributed free over the academic networks. There is an editorial board, papers are refereed and the journal appears in regular "issues". Subscribers are sent only the contents file but can retrieve any article from a remote file-server simply by sending the appropriate electronic mail message. In this way,

the fact that, even if it wasn't illegal to do so, photocopying an entire book takes so long, gives inferior quality and costs so close to the original as to not be worth the effort. In contrast, a normal floppy disk containing over a megabyte of information can be copied perfectly in seconds. If publishers *are* to become involved in electronic publishing, then new mechanisms of copyright control may need to be developed.

The publishing industry also contains mechanisms not only for printing information but
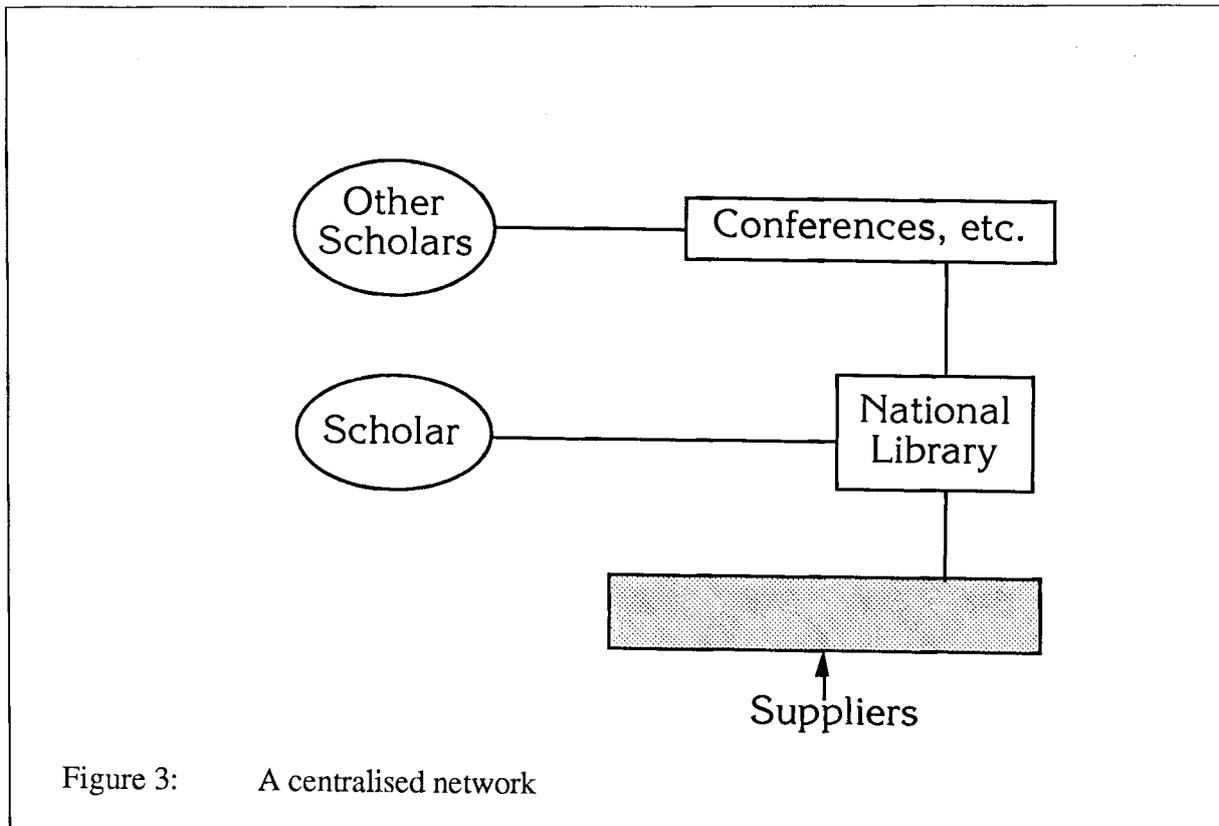

Figure 3:　　A centralised network

the network is not unnecessarily burdened by distributing the entire journal to all subscribers and the issue is effectively "unbundled". Furthermore, the support which *Postmodern Culture* gets from NCSU can be seen as a direction for the future, with universities once again becoming publishers.

To date, the involvement of traditional publishers in electronic publishing has been minimal, and it is not difficult to see why this is so. Publishing houses have a lot of capital invested in the paper medium and are ultimately supposed to be profit-making concerns. Even journals published by professional bodies are usually required to be at least self-supporting. For publishers, therefore, it is important that they are the sole source of the information which they own so that they can ensure proper payment. In general, the paper medium helps in this process and many publishers rely on

also for marketing and distributing it. For this reason, authors have traditionally assigned copyright of their work to the publisher "in exchange" for the service of distributing the work. However, increasingly the circulation of preprints mentioned earlier is being done via the many international electronic networks to which most Western scholars have access. Scholarly communication is a two-way process in which the reader of a journal article is also potentially the author of another article. Scholars occupy the dual rôle of information provider and information consumer, and an electronic network of scholars may have no need for an intermediary like a publisher.

The network of scholars scenario described above is certainly feasible from a technical viewpoint, but brings with it other problems of a

social and psychological nature. For example, at present the academic editors of paper journals act as a method of quality control. Although the refereeing system is open to criticisms on other grounds, it does serve as a filter. Acceptance of a paper in a reputable journal confers a certain public recognition of the "worth" of the paper, and this recognition is important for both the reputation and career advancement of the author and the trust that the reader places in the significance of the results. When all are free to "publish" their own work directly, all publishing becomes potentially "vanity publishing". However, the Postmodern Culture journal mentioned earlier appears to be maintaining the traditional system of submitting papers and appearing at regular intervals, but using the e-mail system for distribution.

5. Conclusions

We might suggest that the so-called paperless society is coming about not because of technical advancements but because of ecological and environmental considerations. Certainly such suggestions could not be made if the technology

was not developing rapidly. However, the danger is that change is technology-driven rather than user-driven.

The present paper has shown that various forms of the electronic journal are possible. If an electronic journal is desirable, the form it takes should be determined by the requirements of the user rather than the dictates of the technology. It must be remembered that the technology is a means rather than an end; it exists to serve the user rather than vice versa. The tasks which can be performed must be those desired to be performed by the user rather than those which the technology permits.
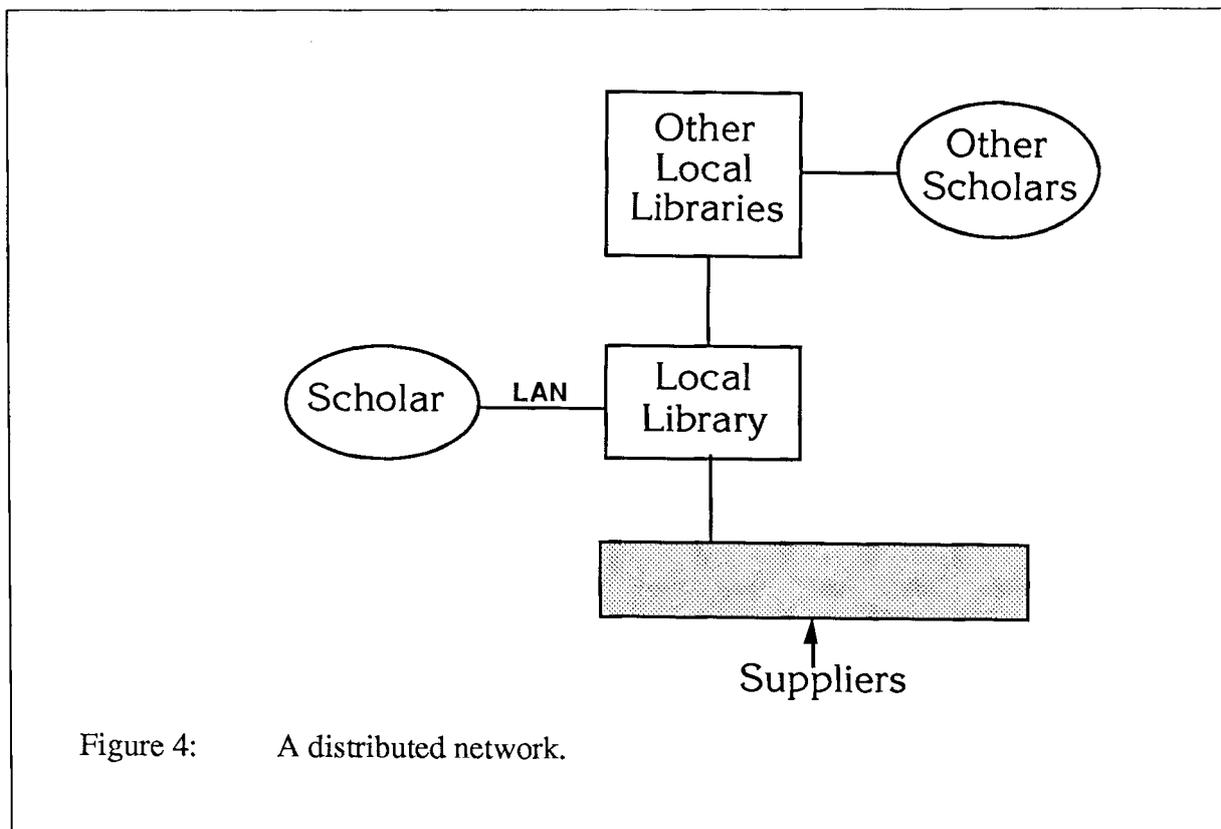
6. Acknowledgements

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Figure 4:   A distributed network.

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