

The users of e-publishing and their communication behaviour

Jack Meadows

Information Science Department, Loughborough University,
Loughborough, Leics. LE11 3TU, UK

1. Introduction

A major problem with discussing how users interact with electronic publications is that such publications are not only new, they are also evolving rapidly in terms of their characteristics. As a result, studies of users have also changed – from the 1980s and early 1990s, when e-publications were mainly experimental and few in number, to the present-day, when they are numerous and widely available [21]. It was expected in the 1990s that the first decade of the present century would be a crucial period in the transition from print publishing to e-publishing, and such is, indeed, proving to be the case. At the same time, the medium for e-publication is increasingly becoming online and interactive. Such forms as CD-ROM are still useful for specific purposes (for example, including electronic information with printed matter), but the main future for electronic publishing is clearly linked to online developments.

One problem in discussing user interaction with electronic publications is the somewhat restricted scope of the most extensive user studies of e-publishing. These have tended to concentrate on academic or professional groups, frequently in North America, and on their use of e-journals. Fortunately, many of the factors affecting users are common across a range of e-publication types. Because of the rapidity with which change is occurring, most attention will be paid here to user studies that have appeared over the past five years. However, these studies have often confirmed the results of work carried out in the 1990s (especially since usage of the World Wide Web became common).

Users' attitudes to e-publishing, and the way they interact with it, are affected by a range of factors. At a general level, they depend on the value that is attached to electronic resources, with particular emphasis on the perceived advantages and disadvantages of e-publications. Next, they can be affected by the specific sort of user group being studied. Then they can vary according to individual preferences regarding methods of seeking information. These various factors are, in turn, affected by others. One such is the availability and reliability of the electronic facilities that users can access. Another is the extent to which habits and skills acquired in the use of print publications can be applied in an e-publishing

environment. The discussion of users' behaviour below will concentrate on the significance of these different, though often related, factors.

2. Perceived disadvantages and advantages of e-publications

2.1 Disadvantages

To understand why e-publications are, or are not used, it is best to start with their apparent drawbacks. At the most basic level, use of e-publications is affected by factors that relate to the physical characteristics of the facilities available. For example, users need high-resolution, high-contrast screens with appropriate ambient lighting. If the reading is being done from a fixed screen, there is an additional need for the screen/desk/chair combination to be satisfactory for the individual reader in ergonomic terms. Conditions are rarely perfect. Some attempt to optimise conditions may be made in the workplace, but computers at home are often used under conditions that are far from the optimum. These problems may be compared with reading printed materials. Print publications are typically more flexible. They can be read under a range of light conditions, and can be adapted to whatever position the reader finds comfortable. Moreover, reading from a screen is typically slower than reading a page of print, and is more likely to miss points of detail. For readers who wish to annotate the documents they are reading, paper is still the easier way forward. Methods of annotating electronic documents exist, but they are not as straightforward as writing with a pencil on paper. Various surveys have asked users to specify where they see printed text as having an advantage over electronic text. The answers have typically mentioned – ability to browse, convenience, physical comfort and portability [eg. 17].

In view of this, it is hardly surprising that users prefer to read lengthy texts from paper, rather than from screen. This has been apparent from the early days of user studies, when surveys produced the apparently paradoxical result that a prime requirement for electronic information was the ability to produce print copies [23]. Though computer interfaces have improved considerably in recent years, the emphasis on print-outs remains. One survey of the way chemists at a US university use the electronic literature has commented that they appear to employ the system as a kind of networked photocopier, producing print-on-demand copies of articles[7]. This habit can be linked to the common observation that consumption of paper is going up at the same rate as the number of computers in use. It has led to the typical provision of two formats (PDF and HTML) for electronic text to facilitate both printing and reading online. One drawback is that electronic versions of printed material are constrained by the format of the print version, which is often sub-optimal in terms of layout on the computer screen.

The deterrent effects of minor problems are of considerable importance, though not always mentioned in surveys of e-publishing usage [41]. An example is slow access time to an e-publication. This may be due to a variety of causes involving the user (e.g. narrowband access), the system (eg. overloading of the network), or the publisher (eg. poorly designed Web pages). A user who is highly motivated to obtain the information may not be deterred, but more casual readers can be. Access to adequate facilities is still not universal in the developed world. In the developing world, not only is access to the technology a greater problem, but so also are other basic problems, such as access to a reliable source of

electrical power. Another example of a low-level problem is the volatility of information mounted on the Web. Attempts to find material on the Web – for example, a citation from the article that is being read to another – may find it unavailable. Mainline sources (such as journals produced in both electronic and paper versions) can be relied on, but other material (such as electronic reports) may disappear within a time-span of a year or so.

At a different level, there are limitations imposed by users' lack of knowledge of information sources. General search engines, such as Google, are typically used to track down relevant material, especially by students. Such an approach will not necessarily identify the best specialist resources. One problem is the retrieval of much irrelevant material; another is uncertainty concerning the quality and reliability of the information retrieved. The great majority of readers of e-publications are self-taught in their use of the Internet, usually progressing by a process of trial and error. In consequence, institutional aids to help access to e-publications, as typified by the activities of university libraries, are frequently underused [1]. So, too, are a number of the value-added features that are supposed to improve the usability of electronic publications. Many users in institutional settings prefer to rely on their colleagues for assistance, if they encounter problems in accessing and handling e-publications [40]. An introduction to the most useful e-publications for a particular subject now often figures as a part of undergraduate courses at university, but not all the participants pay heed to what they are told [22]. Even academic scientists making specialist searches sometimes feel that may be missing out on relevant material [13], though this is often balanced by a belief that they have acquired enough information to carry out their immediate task. Students who use institutional facilities (usually the library) may encounter additional problems. Examples include: limitations on access to some of the information sources (e.g. due to licence restrictions); difficulties in navigating the institutional interface; costs of printing; lack of expert advice [28]. Passwords can also create difficulty for users, especially when different passwords are required for access to different information sources [30]. A further query relates to the use of e-publications by readers who suffer from some kind of disability. A study of e-journals found that there was a lack of awareness of problems of accessibility for such readers among most e-journal providers [5].

2.2 Advantages

Against this litany of problems must be set the advantages that users perceive in using electronic text. A prime one, in terms of physical characteristics, is access. A physical visit to a library can be time-consuming, and sometimes frustrating. Printed copies of books or journals may allegedly be present, but may actually be missing or borrowed from their normal location. In any case, few libraries are open all the time. By way of contrast, electronic resources are typically on tap continually, and can, moreover, be accessed from the desktop, whether at work or home [41, 27]. The result has been a shift from visiting libraries to obtaining information outside libraries using the Internet. One survey of American college students found that nearly three-quarters used the Internet more than the library to cater for their information needs [18]. Remote access is generally encouraged by librarians, though they hope that as much of it as possible will go via their own services. On the positive side, remote usage helps them counter space limitations, allows much better

monitoring of usage, and may even produce some savings in terms of overall library costs [25]. The position with regard to public libraries is less clear. One survey found that use of the Internet did not seem to interfere with use of the library [9]. One question relates to the need for a ‘critical mass’ of e-publications in any discipline. The argument is that users are deterred from reading online if only a limited amount of the information they need is available that way. So far as e-journals are concerned, it has been suggested that perhaps 60% of the journal needs of readers must be satisfied online in order for e-journals to become their main form of access to the literature [1]. The problem is currently diminishing as an increasing number of institutions break the ‘critical mass’ barrier.

Easy access is only one of the advantages users attribute to e-publications. Another important one is the timeliness of the information. The time lag between acceptance of material for publication in print and its public availability can be measured in months, or years. Electronic material can, in principle, be made available to readers as soon as it has been accepted. In practice, this may not always occur: for example, if it is desired to make the printed and electronic versions available simultaneously. But some compromise can usually be reached. Thus the papers accepted for a particular issue of a journal may be made available individually online as they are accepted for publication. One study found that 88% of the researchers questioned wanted articles to appear online as soon as they had been peer-reviewed [32]. Certainly, the user of new electronic information will usually have an edge over the user of printed material in terms of speed of access. Some readers fear, however, that speed of provision can militate against the reliability of the content. In a traditional printed journal, half of the time between receipt of a paper and its publication may go in production and distribution. The other half is concerned with editing and refereeing – in other words, with quality control. Because electronic material can be produced and distributed so rapidly, the time lag for such material depends primarily on the level of quality control imposed. In topics where speed of access to new information is vitally important, this can lead to a bypassing of quality control mechanisms. One of the earliest examples was the physics electronic preprint archive, set up in the early 1990s, which allowed authors to add papers that had only just been completed. This particular case has worked well, perhaps because the community concerned had been accustomed to circulating preprint versions on paper prior to the advent of electronic communication. From a user viewpoint, electronic preprints have a great advantage over printed preprints, since anyone can access them. Printed preprints, on the contrary, can only be dispatched to colleagues whom the author knows. In other fields, the need for high-quality information may outweigh the value of speedy access. Doctors, for example, may need information rapidly, but it is vital that the information should be vetted for acceptability first.

Another advantage users see in electronic information is the more flexible handling that it offers over printed information. The obvious example is searching [19]. Electronic searching for a specific item within an extended piece of text can obviously save time over using a (probably incomplete) index with a printed work. Moreover, electronic searching can increasingly be done simultaneously across a series of texts (eg. issues of a journal) rather than sequentially, as in searching printed texts. In addition, retrieval can be extended to include access to other electronic material that is cited in the initial texts. It has also been noted that electronic searching highlights material on the borderline of a subject, which may probably not have been found in a print-based environment [15]. The greater range of

facilities offered by electronic publishing (e.g. animated graphics) are currently less important for most users [17], though this may be changing. Nearly half of the respondents in a later survey said that they liked linkages to such graphics [15]. Most readers appreciate the removal of the space limitations often imposed in print publication. For example, most printed journals impose a limit on the number of colour plates they can reproduce. E-publications can include as many of these as seems desirable (though this obviously leads to a download problem with narrow-band access). With e-journals, linkage to cited articles, or to reference works, is popular, but the ability to send comments to the editor (or author) is often less important [38]. However, one survey found that over half the respondents liked the provision of links to authors' email addresses and websites, even if they did not use them [15]. 'Letters to the editor' are frequently a popular part of the journal amongst readers. Parallel publishing in electronic and print form can enhance their value. While a small number can continue to be selected for appearance in the print version, many more can appear in the electronic version – as happens, for example, with the British Medical Journal.

3. User information-seeking behaviour

3.1 Personal factors

Users of e-publications obviously bring their own individual backgrounds, motivations and skills to their use of the material. Consequently, any group, however selected (by subject interest, age, gender, etc) always reflects a spread of characteristics. One project looking at the use of e-journals decided that users could be divided into seven categories: enthused (who used a wide range of journals); journal-focused (who concentrated on a restricted range of journals); topic-focused (who typically searched by subject); article-focused (often mainly concerned with an individual journal); bingers (who went to town on using the resources); explorers (who spent considerable time finding out what was available); window-shoppers

(who looked at what was available, but made little use of it) [29]. Though such categorisation may vary with the type of e-publication involved, significant differences between different categories of user are the norm. In the academic world, where most studies have concentrated, the main motivating factor relates to research interests. The more the personal emphasis on research, the greater the use of e-publications both by faculty staff [26] and by research students [16]. A study of astronomers similarly found a correlation between the number of articles they had read in the preceding month and the likelihood that the reading had been of an electronic version [36]. Students are often more exploratory in their use of e-journals. For example, the last three categories noted above – bingers, explorers and window-shoppers – consisted mainly of students. These observations find parallels in studies made previously on the use of printed journals. There, too, the more research-conscious are typically also the more information-conscious, and students tend to be less interested in journals than are staff and research students. Presumably, the driving force in both print and electronic environments is motivation.

The problem of looking for personal differences in the use of e-publications is increased by the rapidity of change. Reactions to such publications may alter with time, so limiting the

applicability of surveys. For example, one question of interest is whether older readers are less likely to use e-publications than their younger colleagues. In the 1990s, age differences were often significant. Thus one study found that academic staff under the age of forty were four times more likely to know about and read e-journals as staff over forty [37]. However, the results of this survey suggested that older academics were slower to take up such publications, rather than opposed to them. A subsequent study still found differences, with people under the age of 35 using e-journals more frequently than the over-35s [24]. Although age differences continue to show up in surveys (in the sense that older people have a greater preference for print publications), this seems to depend partly on the electronic environment in the speciality concerned. For example, astronomy has been very successful in developing an integrated, globally available system of electronic access to publications. A study of astronomers has found that use of these resources depends very little on the astronomer's age [36].

To the extent that age differences occur, they appear to be due to the lower level of training in the use of computer systems that older people have, along, perhaps, with a lower level of confidence. Thus a study of staff and students at one US university found that under-30s were appreciably more likely than post-30s to assess their computer skills as good [3]. The reality may actually be different. One study found that university staff were more efficient in their handling of e-publications than their students [4]. One complication is that apparently age-related differences may actually reflect seniority differences (as have been found in some user studies relating to print publications), with senior people making less use of the Internet [34]. Yet the interesting observation has been made that the way in which research students handle online resources actually seems to be modelled on the way their seniors operate [6]. Other personal characteristics seem to play only a minor role in terms of the use of e-publications. The study of astronomers mentioned above found no significant differences in usage that could be correlated with a range of characteristics, including gender, level of degree earned, and country of origin. Indeed, most studies of the influence of gender on usage have failed to identify major differences. The main exception is a US study that found female respondents claimed a greater usage of electronic resources, in general, and e-journals, in particular, than their male counterparts [13]. Again, gender effects can be hard to distinguish in large-scale surveys because they may be masked by other differences. For example, the gender ratio often varies with speciality, so subject differences – which are examined next – can have a significant effect on the outcome. Gender differences may be more significant outside the educational framework. One study involving public libraries found that women tended to use both the Internet and the library more than men [9].

3.2 Subject-related factors

Scientists, engineers and medical staff were early users of electronic resources. Although other professionals have since joined in, this initial group continues to be more heavily involved than most. To some extent, there is a snowball effect. The groups that have been particularly keen on using electronic resources have typically improved access and contents more than other disciplines, which has, in turn, encouraged more users. For example, astronomers – as mentioned above – have been successful in setting up interlinked

electronic archives of preprints, abstracts and e-journals. The heavy involvement of researchers and societies in this development means that the archives fit the way the users want to use the system, rather than the users having to fit themselves to the system [36]. Consequently, the astronomical community has become heavily oriented towards electronic resources. Other fields have seen differing levels of acceptance. Physicists and chemists have taken readily to e-publications: to a greater extent than geologists or mathematicians [20]. One survey found that the greatest use of e-journals was made by biological scientists, with law academics making the least use [13]. These differences can be related to the information habits and requirements of the different disciplines. Geologists, for example, often require older maps and reports that are not available online. Different subjects need to access different time-spans of literature. Thus a survey of medical faculty found that only one in twenty of the readings they accessed was older than two years, whereas a similar survey of astronomers found that one in four of the readings was of articles more than two years old [36]. So astronomers, on the one hand, are intensive users of electronic literature, yet, on the other, need to access older literature. Requirements like these vary with subject, with the result that different subjects develop differing information profiles.

Comparable differences can be found in the social sciences, where academics in economics and in business schools were early users of e-journals, and have continued to be heavy users ever since. At a more general level, there appear to be differences in the way scientists and social scientists handle the electronic literature, with the scientists more interested in browsing [29]. Staff in the humanities have taken up e-publications more slowly. Thus a survey of academics and students in the Netherlands found that 82% of the scientists, 78% of the social scientists, and 60% of those in the humanities used the Internet in the course of their work [40]. In the years since this study was carried out, the proportion of humanities users has certainly risen. But a later survey still found that respondents in humanities faculties felt less comfortable with electronic information than those in the sciences or social sciences [13]. Yet e-publishing has attractions for this group. The ability to publish large quantities of textual or pictorial data is appreciated, as is the currency of electronic information. The speed with which publications in the humanities appear is typically appreciably slower than in the sciences. Publishing online therefore offers humanities users the chance of much more rapid access to information. Set against this are doubts – and not only among humanities scholars – concerning the long-term preservation of electronic archives. The question for many people who use older material is whether online content will really be made accessible into the distant future. The extension of the national deposit systems that exist for printed matter to include e-publications may help calm this fear.

4. Usage and finance

The use of electronic journals is growing with time: it is accompanied by a decrease in the use of print journals [31]. One study has found that a quarter of the respondents no longer consider it important to have the print version of a journal available, so long as they can access the electronic version [32]. At the same time, patterns of usage of the new media seem to follow those already established with print journals. For example, e-journal readings tend to concentrate on the most prestigious titles. These are the same ones that

have, in the past, received most attention in print form. Indeed, usage of electronic information seems to follow the same 80/20 rule that applies to information in print (where 20% of the sources receive 80% of the usage by readers). Again, like print usage, usage of electronic information divides between a smaller information-conscious group, who make great use of what is available, and a larger group, who make appreciably less frequent use. Work patterns, too, appear to follow those established in the era of the printed journal. For example, even when access to e-publications is permitted on a round-the-clock basis, most usage continues to occur during the normal working day and week [35].

Most readers of e-publications are attached to institutions with staff who try to facilitate access to material online. In particular, the institution bears the main cost of paying for such access. This background, along with the amount of free information available on the Web, has led to appreciable resistance from readers to the idea of paying for electronic material themselves. This resistance to paying can limit their exploration of the electronic literature. Nevertheless, purchase, usually on an article- by-article basis, is growing. One study noted that nearly two-thirds of a sample of scientists and social scientists were buying 1-5 articles per week [42]. Another found that the acceptability of pay-per-view among researchers had grown from 4% in 2001 to 18% by 2004 [32]. But, even when the need for payment is accepted, users believe that the price should be kept to a low level. The complaint – whether well-founded or not – is that the amounts charged by some e-journal publishers are a definite deterrent to individual purchases. Younger readers may feel this more strongly than older readers [42]. In principle, the current Open Access initiative should help here. Its intention is that all researchers should make their papers available freely – usually on the Web site of the institution to which they belong. Clearly, this would be advantageous to users in terms of finance. The drawback is that searching for relevant titles may become more complicated. Furthermore, there is evidence that the design of institutional repositories does not fully tackle the actual needs of users [10].

5. Different categories of e-publication

As will be clear from the foregoing discussion, the majority of user studies have concentrated on e-journals. However, they are only one of the types of e-publication available. The relative advantages and disadvantages of electronic publishing, as compared with print publishing, vary with the type of publication concerned. Thus a survey of users in Singapore found that access to reports and reference works in electronic form was often preferred to print form. Preferences for electronic journals and newspapers were more evenly balanced, but a great majority of users preferred to read books in print form [2]. A considerable quantity of full-length books (mainly those out of copyright) are now available online, but they present problems to users. The obvious one is dislike of users for reading from a screen, which becomes particularly significant for longer texts. Equally, book-length texts pose obvious problems in term of printing out for detailed reading. This is partly balanced by their advantages – such as quick access and ability to search the text – which are attractive to readers. Consequently, specific types of book in electronic form have achieved some success, particularly in the world of learning, and especially in subjects that have a structured approach to information and where it is important that the information is kept up-to-date (eg. law).

Most electronic accessing of books is currently done online. However, there has been an effort in recent years to replace the printed book by an electronic equivalent: that is, by a free-standing, mobile device. The question is what characteristics must an e-book have to attract users. As with other e-publications, basic factors have to be satisfied first. For example, a portable device must have an acceptable size and weight. It must have a display that can be read under the same range of environmental conditions as a book. Moreover, since it must be accessed whenever needed, it must have batteries that last a reasonable time (eg. the duration of an airline flight). In fact, studies suggest that readers want something that has many of the physical characteristics of a printed book [8]. Some of these characteristics – such as provision of a ‘book-like’ cover – can be provided easily. Others – such as turning pages quickly, or opening the e-book at the point where the last reading session ended – have proved somewhat more difficult to implement. Others again – for example, annotating pages of the book – are still being developed. But, of course, readers expect e-books to offer facilities beyond those offered by a printed book. Examples here, that can be readily implemented, include the ability to look up cross-references quickly, to look up words in a dictionary or thesaurus, and to search the text.

Equally, a satisfactory e-book must be able to contain a range of reading matter – the equivalent of 25 books perhaps – since one of the attractions for users is the ability to travel with a single e-book, rather than a range of printed literature. Texts can be downloaded from the Internet, but, as noted above, such material is somewhat restricted in scope (examples are reference works, textbooks, or classic works not readily accessible in print). This paucity of desirable content for e-books is another reason why e-books are moving ahead more slowly than e-journals. There is also the point that e-books not only use the content, but also the layout of printed books. While material is being made available in both print and electronic versions, this is probably the efficient way of proceeding, since readers currently prefer to be presented with a familiar reading environment. The drawback is that it hinders full exploitation of the potential of e-books. Nevertheless, a study of readers at an American university as long ago as 1999 found that there was already a higher use of the electronic versions of books, where they were available, than of the print versions [33].

Electronic newspapers provide an interesting contrast with e-books and e-journals. Two of the main demands on a newspaper by its readers are for up-to-date information and breadth of coverage. An online version has the virtue that it can be updated more frequently than a printed newspaper, and can include material that was rejected from the print version due to lack of space. From their beginnings in the 1990s, electronic newspapers have been designed to exploit the capabilities of the electronic medium – for example, by the use of multi-media presentation. This has proved to be popular with readers, as have the interactivity and the ability to access rapidly past issues of the newspaper. Radio and television stations also maintain websites. In the case of a large organisation, such as the BBC in the UK, the website now has many of the characteristics of an online newspaper. From an online user’s viewpoint, the different branches of the mass media are clearly converging. At the same time, the broad readership of newspapers (as compared with journals or books) means that reactions to e-newspapers can be more varied than for e-journals or e-books, with variations due to age, gender and culture [14].

6. Formal and informal communications

Traditionally, a line has been drawn between formal means of communication (such as books and journals) and the informal transfer of information (as by letters and laboratory notebooks). This line has obviously become blurred with the growth of information technology: an email now can disseminate as widely as a book. However, it is still possible to draw a distinction between a publication that has been vetted externally (especially for content and style) and another that has been entirely self-produced. In general, it is the former type of publication that is in mind when talking about 'electronic publications'. Just as informal and formal communications can interact in the print world (eg. when a set of lecture notes is published as a book), so informal electronic communications may interact. An example is when the contributions to an electronic discussion group are selected and edited to provide a summary of the discussion. Again, chat rooms – where users can interact with each other informally online – seem a long way from e-publishing. Yet 'chats' about a particular question can act as the equivalent of the refereeing process for more formal publications.

The informal forms of electronic communication typically have a broader range of users than current e-publications. In consequence, users interact with the activity in a greater variety of ways than is found for a more restricted activity (such as reading e-journals). But, just as use of e-journals can affect the habits of their readers, so, too, can the use of informal electronic information interchange. For example, women have traditionally used phones for social contact more than men. Initially, the same was true for mobile phones, but as such phones have become more widespread, so their use by men and women has tended to converge. Most studies of the use of e-publications have concentrated on the explicit interaction of users with the publication. A study of such devices as a mobile phone is a useful reminder that, alongside such conscious interaction, changes in the nature of the interaction may be going on at a more subconscious level.

From the viewpoint of e-publishing, blogs [ie. Weblogs] provide an interesting example of the borderline between formal and informal communication. Blogs typically take the form of personal diaries. They are ordered, like diaries, in a chronological sequence, and are usually written in a conversational style. The difference from written diaries is the possibility of commentary and feedback by others. But there is a growing interest in the use of internal blogs within a corporate environment, perhaps devoted to a specific theme. In such an environment, a blog can play a role similar to, but more controlled than, electronic discussion groups, or emails. From a user viewpoint, blogs are easier to read and navigate than the other two activities, though, if they proliferate, they may run into some of the same problems (such as the difficulty of storing and archiving over extended periods) and so may simply add to the information overload [11]. Blogs at first sight can be classified with discussion groups and emails as 'informal' communications. But this assessment must be considered in terms of the development of RSS capabilities. (RSS is usually said to stand for either 'Really Simple Syndication', or 'Rich Site Summary'. Another interpretation – 'RDF Site Summary' – seems to be used less frequently.). This allows for automatic updating of material from user-specified websites [12]. Both blogs and newspapers are popular items for updating among users. A diary published in a newspaper can seem very similar to a diary in blog form, so far as readers are concerned. The fact that one has been

vetted by an editor while the other has not will not strike the average reader. This reflects a basic problem with the blurring of boundaries: it is increasingly up to the users to assess the quality of the information they are viewing. This is one reason why research journals continue to exist online: researchers can trust that their content has been vetted for quality.

7. Conclusion

Print-on-paper publications have evolved over the years to meet the demands of their readers. At the same time, readers' needs have changed with time, so that the readers and the publications have, in essence, developed together. The same is now happening with e-publications. At present, most users employ a symbiotic mix of print and electronic media in their reading. The obvious example is the habit of printing material from e-journals because it is easier to read in printed form rather than on the screen. E-publications, themselves, are superior to print in some ways, but not necessarily in others. Thus the ability to search an e-publication for a specific item of information is much easier than for a printed publication. But readers often wish to browse, which means looking for information without specifying a particular topic. If anything, e-publications are inferior to print publications for this purpose. More generally, the needs of different groups of readers are reflected both in the nature of the literature they use, and in the way they use it [23]. High-energy physicists developed a tight-knit rapid system of communication involving preprints before the days of e-publications. This system has fitted very well into an electronic framework, to the extent that many members of the community now rarely read a print-based publication. Scholars in the humanities seem to be at the other end of the scale, since much of the material they want is not readily available in electronic form. (Though this depends on the field: the number of texts available for scholars of classical Greek are limited in number, and all are now available online.) But electronic access to bibliographical material has allowed them to find material which was previously unknown to them. Consequently electronic access has also affected their habits. Whereas the physicists have often forsaken printed material, electronic access for those in the humanities has actually expanded their use of print resources.

The development of e-publications can be thought of in ecological terms. An equilibrium existed in the print-on-paper world between what users wanted and what was supplied to them. Within this overall environment, individuals and groups carved out their appropriate niches. The transition to an electronic world represents a change of environment, creating new niches and changing the old ones. For some time to come, users will be exploring this new environment and deciding how best to exploit it. User studies will continue to be necessary in the future in order to explore how this user interaction with the environment is developing.

References

- [1] K.Bonthon, C.Urquhart, R.Thomas, C.Armstrong, D.Ellis, J.Everitt, R.Fenton, R.Lonsdale, E.McDermott, H.Morris, R.Phillips, S.Spink and A.Yeoman, Trends in use of electronic journals in higher education: views of academic staff and students, D-Lib Magazine (2003).
[<http://www.dlib.org/dlib/june03/urquhart/06urquhart.html>]
- [2] H.P.Choo, C.K.Ramaiah and S.Foo, Electronic publishing trends in Singapore, IADIS International Conference WWW/Internet, IADIS Press, Algarve, Portugal (2003), Vol. 1, 270-277.
- [3] D.Cochenour and T.Moothart, E-journal acceptance at Colorado State University: a case study, Serials Review 29 (2003), 16-25.
- [4] B.J.Cockrell and E.A.Jayne, How do I find an article? Insights from a Web usability study, Journal of Academic Librarianship 28 (2002), 122-132.
- [5] B.Coornin, Establishing accessibility for e-journals: a suggested approach, Library Hi Tech 20 (2002), 207-220.
- [6] L.M.Covi, Debunking the myth of the Nintendo generation: how doctoral students introduce new electronic communication practices into university research, Journal of the American Society for Information Science 51 (2000), 1284-1294.
- [7] P.M.Davis and L.R.Solla, An IP-level analysis of usage statistics for electronic journals in chemistry: making inferences about user behavior, Journal of the American Society for Information Science and Technology 54 (2003), 1062-1068.
- [8] J.A.Dearnley and C.McKnight, The revolution starts next week: the findings of two studies considering electronic books, Information Services & Use 21 (2001), 65-78.
- [9] G.D'Elia, C.Jorgensen, J.Woelfel and E.J.Rodger, The impact of the Internet on public library use: an analysis of the current consumer market for library and Internet services, Journal of the American Society for Information Science and Technology 53 (2002), 802-820.
- [10] N.F.Foster and S.Gibbons, Understanding faculty to improve content recruitment for institutional repositories, D-Lib Magazine (2005)
[www.dlib.org/dlib/january05/foster/01foster.html]
- [11] M.Gotta, Social computing: getting a head of the blog, Tech Update (2004)
[http://techupdate.zdnet.com/techupdate/stories/main/Social_Computing.html]
- [12] T.Hammond, T.Hannay and B.Lund, The role of RSS in science publishing, D-Lib Magazine (2004)
[<http://www.dlib.org/dlib/december04/hammond/12hammond.html>]
- [13] L.W.Healy, L.Dagar and K.M.Wilkie, Report prepared for the Digital Library Federation/Council on Library and Information Resources, Outsell, Burlingame, CA (2002).

- [14] B.G.Hope and Z.Li, Online newspapers: the impact of culture, sex, and age on the perceived importance of specified quality factors, *Information Research* (2004) [<http://informationr.net/ir/9-4/paper197.html>]
- [15] Institute for the Future, Final synthesis report of the e-journal user study (2002). [<http://ejust.stanford.edu/SR-786.ejustfinal.html>]
- [16] D.W.King and C.H.Montgomery, After migration to an electronic journal collection, *D-Lib Magazine* (2002). [<http://www.dlib.org/dlib/december02/king/12king.html>]
- [17] D.Lenares, Faculty use of electronic journals at research institutions: racing toward tomorrow, *Proceedings of the 9th National Conference of the Association of College and Research Libraries*, H.A.Thompson, ed., ACRL, Chicago (1999), 329-334.
- [18] D.Levin and S.Arafeh, The digital disconnect: the widening gap between Internet-savvy students and their schools, *Pew Internet & American Life Project* (2002). [<http://www.pewinternet.org/reports/toc.asp?Report=67>]
- [19] C.L.Liew, S.Foo and K.R.Chennupati, A study of graduate student end-users' use and perception of electronic journals, *Online Information Review* 24 (2000), 302-315.
- [20] A.Mahé, C.Andrys and G.Chartron, How French research scientists are making use of electronic journals: a case study conducted at Pierre and Marie Curie University and Denis Diderot University, *Journal of Information Science* 26 (2000), 291-302.
- [21] A.Mahé, Beyond usage: understanding the use of electronic journals on the basis of information activity analysis, *Information Research* 9 (2003). [<http://informationr.net/ir/9-4/paper186.html>]
- [22] S.Majid and A.T.Tan, Usage of information resources by computer engineering students: a case study of Nanyang Technological University, Singapore, *Online Information Review* 26 (2002), 318-325.
- [23] A.J.Meadows, *Communicating research*, Academic Press, San Diego (1998).
- [24] M.Monopoli, D.Nicholas, P.Georgiou and M.Korfiati, A user-oriented evaluation of digital libraries: case study – the ‘electronic journals’ service of the Library and Information Service of the University of Patras, Greece, *Aslib Proceedings* 54 (2002), 103-117.
- [25] C.H.Montgomery and D.W.King, Comparing library and user-related costs of print and electronic journal collections: a first step towards a comprehensive analysis, *D-Lib Magazine* (2002). [<http://www.dlib.org/dlib/october02/montgomery/10montgomery.html>]
- [26] D.Nelson, The uptake of electronic journals by academics in the UK, their attitudes towards them and their potential impact on scholarly communication, *Information Services & Use* 21 (2001), 205-214.
- [27] F.Nicolaides, Decomate-II: developing the European Digital Library for Economics, User Studies – Final Report (2001). [<http://www.bib.uab.es/project/eng/d82.pdf>]

- [28] OCLC, How academic librarians can influence students' web-based information choices, OCLC White Paper on the Information Habits of College Students (2002). [<http://www2.oclc.org/oclc/pdf/printondemand/informationhabits.pdf>]
- [29] D.Pullinger and C.Baldwin, Electronic journals and user behaviour, Deedot Press, Cambridge (2002).
- [30] H.Roes, Promotion of electronic journals to users by libraries: a case study of Tilburg University Library, UK Serials Group Promotion and Management of Electronic Journals (1999). [<http://drctwww.kub.nl/~roes/articles/london99.htm>]
- [31] S.A.Rogers, Electronic journal usage at Ohio State University, College & Research Libraries 62 (2001), 25-34.
- [32] Science Advisory Board, Scientific and medical journals on the Web (2005). [<http://www.scienceboard.net/studies/studies.asp?studyId=31>]
- [33] M.Summerfield and C.A.Mandel, On-line books at Columbia: early findings on use, satisfaction, and effect, Technology and Scholarly Communication, R.Ekman and R.E.Quandt, eds., University of California Press, Berkeley (1999), 282-308.
- [34] E.Tenner and Z.Y.Yang, End-user acceptance of electronic journals: a case study from a major academic research library, Technical Services Quarterly 17 (1999), 1-11.
- [35] C.Tenopir and E.Read, Patterns of database use in academic libraries, Reference & User Services Quarterly 40 (2000), 234-246.
- [36] C.Tenopir, D.W.King, P.Boyce, M.Grayson and K-L.Paulson, Relying on electronic journals: reading patterns of astronomers, Journal of the American Society for Information Science and Technology 56 (2005), 786-802.
- [37] H.Tomney and P.F.Burton, Electronic journals: a study of usage and attitudes among academics, Journal of Information Science 24 (1998), 419-429.
- [38] D.M.Torre, S.M.Wright, R.F.Wilson, M.Diener-West and E.B.Bass, What do academic primary care physicians want in an electronic journal?, Journal of General Internal Medicine 18 (2003), 209.
- [39] N.A.Van House, M.H.Butler, V.Ogle and L.Schiff, User-centered iterative design for digital libraries, D-Lib Magazine (1996). [<http://www.dlib.org/dlib/february96/02vanhouse.html>]
- [40] H.J.Voorbij, Searching scientific information on the Internet: a Dutch academic user survey, Journal of the American Society for Information Science 50 (1999), 598-615.
- [41] H.Woodward, C.McKnight, J.Meadows, C.Pritchett and F.Rowland, Use of electronic journals by academic staff and postgraduate students in an information-literate university, Proceedings of the 5th International BOBCATSSS Symposium, J.Zeeman and R.A.C.Bruyns, eds., Hogeschool van Amsterdam, Amsterdam (1997), 274-281.
- [42] K.Worlock, Electronic journals: user realities – the truth about content usage among the STM community, Learned Publishing 15 (2002), 223-226.

