ELECTRONIC SERIAL PUBLISHING AND ITS EFFECT ON THE TRADITIONAL INFORMATION CHAIN

Gerard A J S van Marle

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Dr Gerard van Marle is the University Librarian, University of Twente, PO Box 217, 7500 AE, Enschede, The Netherlands

Foreword

At the beginning of my conference presentation I informed the delegates that some of my subject matter could be found in more detail in five of the quoted documents and I would also like to give due credit to the authors and organisations responsible for those articles at the beginning of the printed paper. The five documents are numbers 1, 3, 4, 6 and 13 in the list of references.

Introduction
Electronic information transfer: past and present projects

Electronic information transfer is not new. It is not a new idea that computers and networking are transforming libraries and that it is possible to build a complete electronic library. Many of the concepts were published almost half a century ago in the famous paper by Vannevar Bush in 1945.

The first attempt at large scale implementation was performed at MIT. In 1965 a planning conference was held which resulted in the INTREX project (information transfer experiments), directed by Professor Overhage, professor of engineering at MIT. This project was ahead of its time because the aspirations were beyond the capabilities of the existing computers and available computer power, but the ideas behind it, are still valid, despite being formulated more than a quarter of a century ago. The three main streams of progress in the field of information transfer were defined by Overhage (1966) as follows:

♦   the modernisation of current library procedures through the application of technical advances in data processing, textual storage and reproduction
♦   the growth of a national network of libraries and other information centres
♦   the extension of the rapidly developing technology of on-line, interactive computer communities into the domains of the library and other information centres.

How right he was and still is today!

There have been many subsequent pioneering research and development projects involving the concept of the electronic journal. It would take too much space to present a comprehensive overview, so I list just some of them:

◆ "The Electronic Alternative", a study
    performed (in 1978 - 1979) on behalf of the
    US National Science Foundation focusing
    respectively on the role of authors,
    publishers, librarians and readers in the
    journal system.

◆ EIES (the Electronic Information Exchange
    System Project) started in 1976 at the New
    Jersey Institute of Technology. The primary
    goal was to replicate electronically the
    functions of conventional printed journals.

◆ BLEND (the Birmingham and Loughborough
    Electronic Network Development project)
    this project took place in 1980 - 1984. Its aims
    were "to explore and evaluate various forms
    of user communications through an
    electronic journal and information network
    and to assess the cost-efficiency and objective
    impact of such a system".

Some important projects being carried out at
present deserve to be mentioned.

The Mercury Project could be considered a
follow up of the INTREX-project. In a series of
planning meetings during the academic year
1987/1988, a group from Carnegie Mellon and
OCLC, came to the conclusion that the technical
barriers experienced by INTREX were
disappearing and that the declining costs of
computing implied that the cost of electronic
libraries would be comparable to traditional
libraries within a decade. This analysis resulted
in 1988 in the formulation of a plan which was
published in the first "Mercury Technical Report
Series" (1989). The serious work on the Mercury
Electronic Library began early in 1989.

Elsevier's TULIP-project, another well known
project, started in March 1991 and is a co-
operative research project testing systems for
networked delivery and use of journals in the
field of materials science. Eleven US university
libraries are the initial participants, together with
five official observers.

In another recent development, the "Red Sage
Project", an experiment involving Springer
Verlag, AT&T Bell Laboratories and the
University of California, San Francisco, Springer
Verlag will provide "electronic subscriptions" for
30 journals in the field of molecular biology and
radiology to the UCSF Library and the Center for
Knowledge Management. The journal will be

accessed by the "Right Pages" electronic
document browsing and alerting system
developed by AT&T Bell Laboratories. During
the first phase of the trial students and faculty
members, using PC's and workstations, will be
able to search, read and print the full-page images
of articles - including graphics and photographs.

After logging into the Right Pages system,
users see an array of journal covers on their
screen, similar to the display of periodicals in a
library. To read a journal a current or back issue
is selected, using a mouse, and the table of
contents page is displayed. Articles in the issue
are viewed by simply pointing to their entries in
the table of contents. Journal issues can also be
browsed page by page, and articles can be printed
on demand on local laser printers.

To help people keep track of current
publications, the Right Pages system will also
alert them to newly published articles in subject
areas in which they have registered an interest.
Individual users can create personal-interest
profiles that the system will use to search the
contents of all incoming journals automatically.
When articles matching a profile are found, the
users are notified via electronic mail. The next
time the user logs into the Right Pages system,
these articles are highlighted for easy reference.

The first phase of the trial began in January of
1993. Succeeding phases will extend the
availability of the electronic journal subscriptions
to additional campuses in the UC system, and to
other leading colleges and universities in the
United States. UCSF and Bell Labs will also work
together to extend and customise the Right Pages
service to meet the specific needs of the
university.

Yale pre-prints service is based on the idea
that network users place abstracts of their pre-
prints on the Yale computer for searching over
the network, and that , once the required
document has been located, users can access the
host computer of the originator's university and
download the pre-print for local reproduction.
Here the urge is to combine the speed of the
network with the existing organised submission
of pre-prints by academics in order to overcome
the frustrating delays through a 'prior to peer
review' access system, which is in itself a form of
peer review and market research.

The last example is another Springer initiative, the so-called "Springer Journals Preview Service", which started on the 1st March 1993. Thirty selected journals in the life sciences and radiology can be previewed via INTERNET ten days before the shipping of a new issue. Everyone with access to INTERNET can subscribe. Tables of contents are supplied free of charge and bibliographic information plus the author's abstract cost only $20 per calendar year per journal. The files are supplied in ASCII format, structured in accordance with accepted standards. They can be read on any computer without further processing and can easily be integrated into one's local database.

Types of electronic journals

There is a broad variety of electronic information services of which the electronic journal is only one element but it might well become the most important one in the future. Consequently, the first question to consider is: What are we talking about?, and, do we all have the same idea about an electronic journal? I am afraid not. So, in order to understand each other, we have to agree about the definition of an electronic journal. This is more difficult than one would expect at first sight.

A lot of possibilities need to be considered and frequently it is remarked in the literature that, there is, as yet, no tight definition simply because the electronic journal is still developing and is not yet a finished, well established product. One approach is to divide electronic journals on the basis of the transfer medium. Therefore we can currently identify the following types of electronic journals:

♦ CD-ROM journals
♦ floppy disc journals
♦ on-line journals/networked journals

CD-ROM journals

CD-ROM journals have been well known for many years now, for example "ADONIS", and they are, for the most part, journals which are also published in printed form. There is however also an example of a journal which began publication as a desk top publishing venture in the 80's and is now being published on CD-ROM. This quarterly journal, *Verbum Interactive,* subtitled *The Journal of Personal Computer Aesthetics,* features colour, sound, animations and music. It is available at a price of $49.95.

Another new CD-ROM "journal", if one regards this as a journal, is Elsevier's *Active Library on Corrosion*: a joint effort between Elsevier Science Publishers and the National Association of Corrosion Engineers (NACE). This CD-ROM product contains several "library sections", offering the user a typical hypermedia environment in which to create links from one section of ALC to another. The product has recently been described and tested from a user's point of view by Primich (1993).

Floppy disc journals

A few journals, mainly in the area of computing, are being published on floppy disc. They are mentioned in the literature.

On-line journals and networked journals

I personally consider these to be the "real electronic journals", if certain criteria have been met. These criteria are dealt with when I try to define such a journal.

Examples and definition of the "real" electronic journal

Most readers will probably have heard of the first electronic, full text with graphics, peer-reviewed journal, *The Online Journal of Current Clinical Trials,* the product of a joint venture between the American Association for the Advancement of Science which developed the content and focus and OCLC which distributes the journal on its network. The journal publishes medical findings within 48 hours after acceptance.

Another, very recent example, is Elsevier's new product called *Nuclear Physics Electronic.* This initiative is still in the experimental stage with an initial test period of one year. It provides the subscriber with advance information about the contents of the printed journals *Nuclear Physics A* and *Nuclear Physics B.* However, it should be noted, that at present, access to abstracts and full text papers is available exclusively to readers at organisations which have a subscription to *Nuclear Physics.*

Science publishing over networks is represented by: *Journal of Fluids Engineering; Modal Analysis; SOLSTICE*; the *Journal of Geography and Mathematics; ULAM Quarterly*, and *Hep-th (High Energy Particle Theory)*.

In attempting to formulate a definition, despite all the uncertainties and pitfalls in the development of the electronic journal, the underlying idea is that the electronic journal be defined in such a way as to be accepted by the academic community as a viable alternative to the printed journal. Therefore my definition would be:

A primary scientific electronic journal is
+ an on-line information system   ,
+ owned by a legally and technically responsible body ("the publisher")
+ controlled by an identified quality control committee ("editorial board"/peers)
+ containing articles by identified authors
+ reporting original results of research which have not yet been published before (regardless the medium)
+ available to subscribers via an open network
+ providing its subscribers with an irregular but continuous flow of new articles
+ which are individually date and time stamped
+ reflecting the moment on which the article became available to its subscribers on the network.

Unlike the printed journal there is no need for a planned schedule since the publication process is dependent only on the availability of refereed articles. There is obviously also no need for volume and issue numbers. Instead it is recommended that all articles be numbered chronologically. These numbers, combined with the ISSN, make it possible to create a world-wide system of unique electronic article numbers. For the sake of providing the user with an indication of the currency of the article, the date could be included in the number.

You will have noticed that I disregard the technology used throughout the production process of the electronic journal. This was, in fact, the subject of a discussion at the IATUL Conference in Hamburg-Harburg. One of the questions was: "Is it essential that an electronic journal be produced fully electronically and that

the printed edition should have disappeared?". In my opinion it is not relevant to the issue. Of prime importance is the impact of the new technology on its users not on its producers and it is similarly important that one can only speak of an electronic journal if it is the first form in which the information is made available. Whether or not the publisher wishes to produce a printed journal and/or CD-ROM, or whatever other medium, at a later stage has no relevance when considering whether or not one can still speak about an electronic journal!

Electronic journal publishing

What is the current state of electronic journal publishing over networks? For the answer consult Strangelove and Kovac's major and ongoing creation the *Directory of journals, newsletters and academic journal lists* on the networks. The third edition of the *Directory* was put up for comment on INTERNET in March this year and contained 41 journals and 182 newsletters. Great care is taken in separating the two categories. Journals fall into three categories: humanities - 26 (63%); science - 11 (27%), and 10% were difficult to categorise by subject. Among the "newsletters" subject categorisation is even more difficult but non-scientific newsletters were certainly in the majority. In addition to journals and newsletters there are the news groups of bulletin boards and very active computer conferences ("lists") on INTERNET are devoted to supporting the development of electronic scholarly publishing.

It is still true that electronic publishing has not yet been fully developed. Although the necessary technology has been available for some years there are many reasons for the slow start to electronic publishing.

Why such a slow start?

The two main reasons are:
+ a conservative attitude of the publishers
+ the personal motivations of the researchers

The publishing industry

Academic publishing world-wide is a very fragmented industry in which 12,000 to 15,000 publishers are responsible for the creation of

50,000 - 100,000 titles. Most of the publishers are involved in one or two journals, few exceed ten titles in the academic field. The bigger ones are well known, of course: Elsevier, Springer Verlag, Academic Press, Wiley, Blackwell Scientific and some of the bigger university presses. However, these publishers are a small proportion of the total. The academic publishing world is characterised as a classic "cottage industry" by David Brown and David Worlock in their study on network publishing: "most academic publishers have benefited from the low entrance costs to journal publishing and economies of scale are minimal. It is only in areas of access to finance and in international marketing where there are benefits from being large. In editorial and acquisition terms, where the quality of contacts is the important feature, small publishers can be as profitable in relative terms as their larger competitors". This explains the fact that it is a kind of industry which is cautious and does not, or hardly ever, invests in risky new information systems.

To some extent this approach is caused by the fact that the revenue available to invest in new electronic and telecommunications systems is less than is required. It was also shown in a study of the attitude of scholarly publishers to the adoption of new media that few publishers invested in the necessary planning activities (R&D, strategic planning, market research or new product development. This is why there were (are) only a few publishing houses working on new services such as electronic and network publishing and assessing the impact of them on traditional printer-on-paper services.

There are, however, as indicated in my introduction, some exceptions to this general picture of a conservative industry. Elsevier & Springer Verlag, as the two leading European publishers, and a dozen other commercial European publishers represent the basis of the European industry. A similar number of society journal publishers represents the equivalent in the USA. Although these companies have experimented, and still do, this is only done on a small scale because of the fear that investment in new technology will not be cost-effective. There is even a fear that it will have an adverse effect on the financial situation of the printed journal.

Under these circumstances a proactive strategy towards electronic publishing systems is not popular with publishers. It is more attractive to monitor the developments in libraries and in the field of subscription agents and to be reactive.

So it is obvious that the publishers have their own concerns, as they worry that the new possibilities of electronic networking will eventually erode their market. There is no doubt, however, that to overcome this threat they will have to react decisively in the very near future.

The researchers

The second main reason for the slow start of electronic serial publishing is the personal motivations of the authors/researchers.

Since the authors are both the producers and the consumers of the information, their attitude to electronic publishing is the most important factor in the process of moving from the printed journal to the electronic one. Therefore it is very important to understand the motivation that causes them to publish in the first place. There appear to be four main reasons:

+ personal ambition: career development and recognition amongst colleagues
+ scientific recognition: validation and verification of research findings amongst one's peers
+ economic reasons: obtaining and or securing funds for further research
+ "moral obligation": results obtained with public money should be made public!

If we bear these reasons in mind, why or when will a researcher become enthusiastic about electronic publishing? The answer is simple: electronic publishing should continue to provide academics with all the advantages of the printed journal plus some additional advantages without any significant new disadvantages.

The advantages of electronic publishing for the researcher are:

+ timely
+ repackaging possibilities (formatting, adding, stripping)
+ retrieval possibilities
+ storage possibilities
+ usage recording
+ on desk delivery

◆   rapid and easy article conferencing (links can
    be easily provided for a two way
    communication by e-mail or even electronic
    conferencing).

The negative aspects for the researcher are:
◆   psychological barriers of networked
    information
◆   knowledge of (different) retrieval systems
    and available journals
◆   unpredictable time schedule for new
    information
◆   restricted reading possibilities (PC-based!)
◆   fear of selective publishing (only "profitable"
    articles)

This means, in my opinion, that the acceptance of
the real electronic journal will be quite different
amongst the different disciplines. Those
disciplines which are used to working with PCs
will move to the use of electronic journals much
earlier than researchers from disciplines that
hardly use PCs.

Why will it accelerate?

Having explained why electronic journals have
had such a slow start, I will now describe the

trends on which I base my expectations that this
slow start will change into a rapid growth in the
number of electronic journals.
    The main reasons are:
◆   improved networking (capacity and usage)
◆   library budget constraints
◆   electronic document delivery/current
    awareness service

Improved networking

A couple of hundred years ago, subscriptions to
the printed journal grew in number only as the
postal service of those days became more reliable
and regular. Consequently networking is one of
the most important developments in electronic
information transfer. We should realise also that
networking, and more generally, the information
industry that will stimulate the electronic journal,
are dependent on the development of many other
technologies, as shown in figure 1.

*Figure 1. Technologies that have an impact on
electronic information in the 1990s*
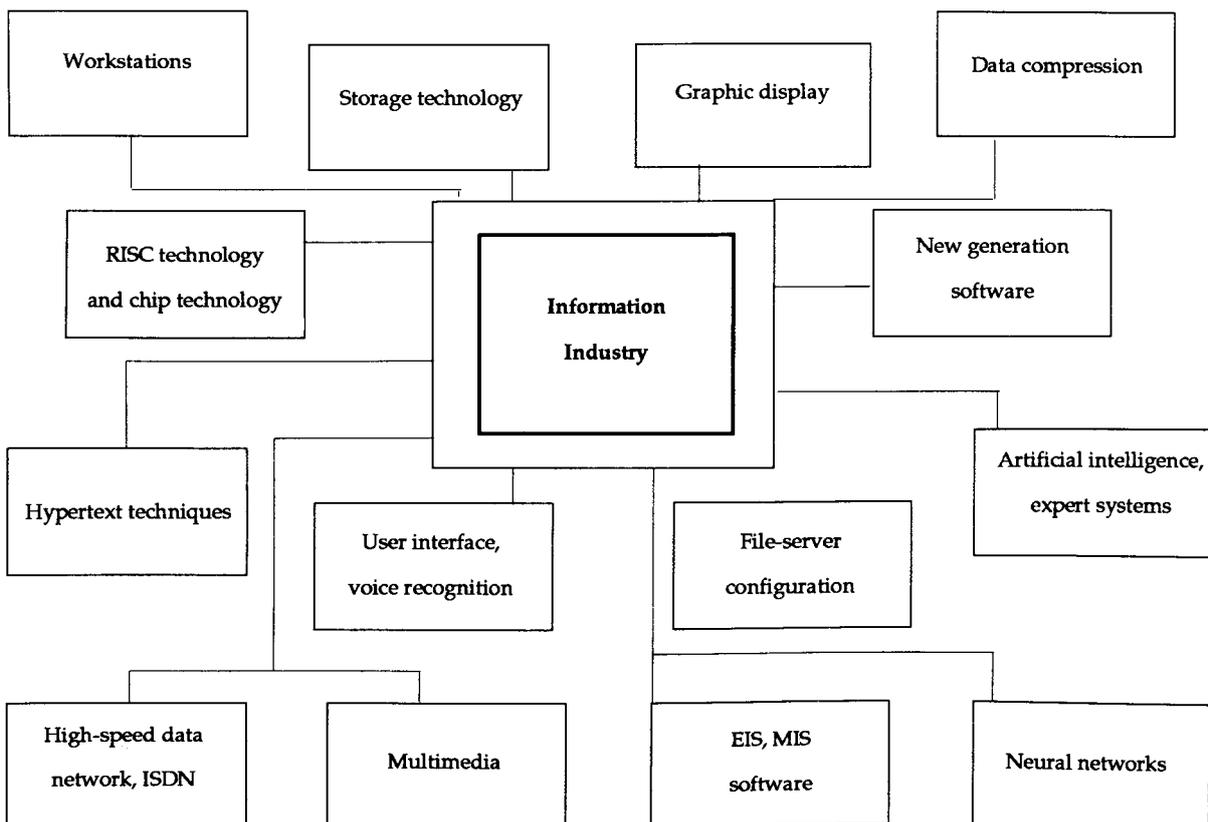
In all parts of the world one can see the rapid development of (inter)national (research)-networks of which the following are some striking examples.

In the USA the vice-president has a proven record of interest in the information infrastructure and technology. It started after the approval of the High-Performance Computing Act of 1991. As a part of this legislation INTERNET forms the basis for a National Research and Education Network. In fact it is not so much a network as a network program to expand and improve INTERNET. After this Act Senator Al Gore introduced his "Information Infrastructure and Technology Act" in July 1992. The bill was approved at the end of 1992 and authorises a total of $1.15 billion over the next five years to ensure that the technology developed by the High-Performance Computing Act of 1991 is applied widely in education, health care, industry and libraries!

The promises of electronic publishing are also beginning to be realised on BITNET, a non-commercial computer network that links over 3,000 computers in 35 countries. BITNET has gateways that connect it with other large, non-commercial networks, like INTERNET. There is a growing number of electronic newsletters and journals on the network, most of the journals being founded in 1990-91.

In the UK JANET, a packet switched Joint Academic Network established in 1984, now connects over 100,000 academic users in the UK. Much of the network has been upgraded to operate at 2 Mbps, and work is in progress to develop SUPER JANET, a fibre optic broadband network operating at up to 100 Mbps with the ultimate goal of transmission at 1,000 Mbps.

SURFnet in The Netherlands is developing from originally a purely academic network into a more open network, with its next upgrade already being planned.

Australia has AARNET: the Australian Research Network, and the list could continue with networks in other countries.

From this overview we can conclude that networks are developed or developing all over the world and that the performance of those networks will drastically improve in the richer countries during the years to come. So the "postal service" that was needed some hundred years ago for the growth of the paper journals can now be replaced by the "network service" for the growth of the electronic journals.

Library budgetary constraints

The second reason why publishers are under pressure to speed up electronic journals are the constraints on library budgets .

Further detail on this is hardly necessary because these constraints have been a general experience in recent years. In ARL libraries over the years 1986 - 1991 fewer monograph volumes were purchased (- 15%) by these libraries and also slightly fewer serial titles (-2%). This figure for serials is even worse since the number of serial titles is still growing from year to year (figure 2).
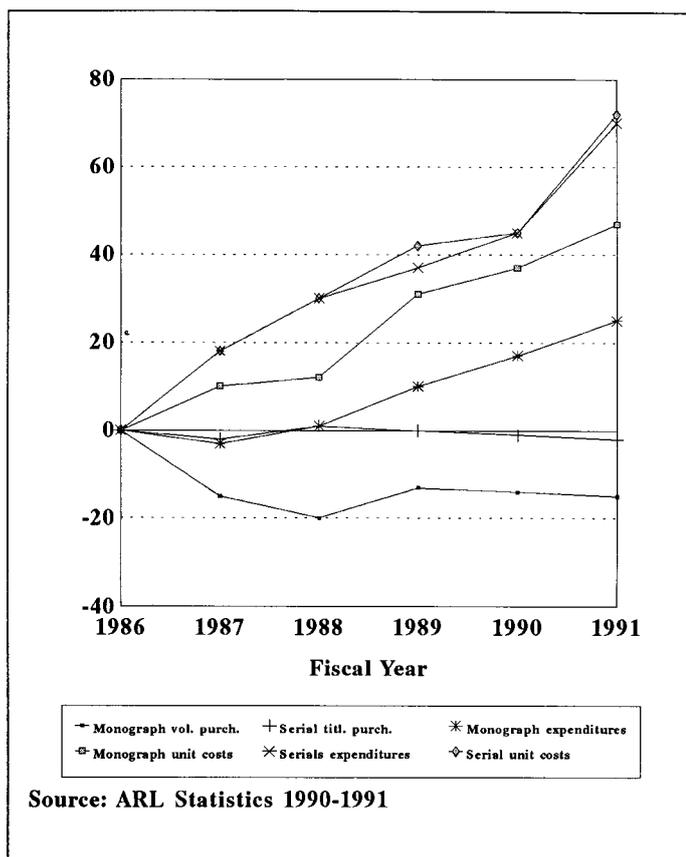

Source: ARL Statistics 1990-1991

Figure 2: Monograph and serial costs in ARL libraries 1985-1991

Figure 3 shows the effect of the constraints on the number of subscriptions to Elsevier's journals. There is a steady decrease in what the company identifies as their "core journals". It also illustrates that the newly launched journals are the ones which are growing but only at a very low level and after about 5-10 years these numbers start dropping as well. These findings clearly indicate that Elsevier has to diversify its products in the near future.

Figure 3: Trends in subscriptions to Elsevier journals
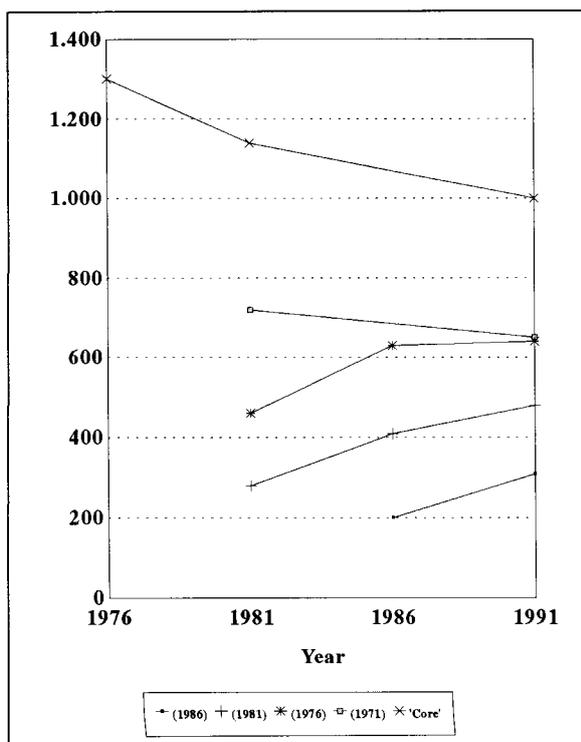
Electronic document delivery

The third and last of the main reasons for the speeding-up in the growth of electronic journals is the dramatic developments in the area of electronic document delivery. Electronic document delivery and current awareness services are, without any doubt, the most exciting, dynamic and perhaps controversial aspects of the STM information business in the early 1990's. They represent the solution for those libraries suffering under increasingly difficult financial circumstances but at the same time pose a real threat to the commercial viability of the very journal of which this new service depends on.

To give you an idea of the key recent developments which reflect the extent and nature

of activities in the field of electronic document delivery, I have reproduced data prepared and made available to me by David Brown of DJB Associates. The information shows the situation in summer 1993, so it can be considered reasonably up to date.

Figure 4 shows the timing of the new services from which it is apparent that there was an explosion of activities in this field at the beginning of this year.

Date of launch

ISI current contents online	1960/70s
UMI	1970/80s
Engineering Index	1980s
Adonis	January 1991
BIDS ISI	April 1991
RLG Citadel	April 1992
PICA-RAPDOC, The Netherlands	Photocopies: Oct 1992 Elect. docs: Jan 1994
OCLC dispatch	January 1993 (article/content first since October 1992)
Swets & Zeitlinger	January 1993
Faxon Research Serv.	January 1993
Springer Previews	March 1993
The Uncover Co	March 1993 (Uncover itself available from CARL since 1988)
Kluwer Ftp	April 1993
Ebsco Subs. Serv.	July 1993

Figure 4: Date of the launch of new services

As a measure of the coverage offered by each service, figure 5 shows the number of serial titles included in the service.

All these new services will undoubtedly result in an increase in individual article supply. It is also to be expected that there will be a further drop in the total number of serial subscriptions. The resulting trend is a shift from expenditure on serials to expenditure on IAS and the medium term effect of this trend in document delivery world-wide is enormous if we assume a growth rate in document supply from 15% in 1993 to 20 percent in 1998. By 1998 the document supply business will represent half of the subscription business!

New/enhanced CAS-IAS services			
	Currently included	Target number	Backlist to
The Uncover Company	13,700	20,000	1989
Faxon Research Services	9,144	11,000	1/1990
Swets & Zeitlinger	7,000	n.k.	-
Ebsco Subscription Services	10,400	n.k.	10/1992
OCLC Inc	9,400	11,000+	1990
FILG	10 bibl. databases	n.k.	-
PICA (The Netherlands)	7,000	7,000	-
BLDSC (UK)	10,400	10,400	10/1992
BIDS - ISI (UK)	7,000	7,000	1988
BIDS II (UK)	10,400	10,400	10/1992
ISI	7,000	n.k.	1988
UMI			
Proquest	1,000	8,000	8/1987
Article Clearinghouse	14,000	n.k.	-
Engineering Index	4,000	4,000	-
Chemical Abstracts	12,000	12,000	-
Adonis	450	5-600	1991

Figure 5: New/enhanced CAS-IAS services

Effects on the traditional information chain

The last part of my article deals with the impact of the new electronic information services, and especially the electronic journal, on the traditional information chain which in its most simple form still consists of authors→publishers→subscription agents→libraries→readers (who in many cases are authors as well).

Authors

As already stated, authors have their own personal reasons for publishing. The creation of the electronic journal, as such, does not need to have an impact on the authors apart from the fact that they will be asked (forced) more and more to deliver the draft article in a very specific way prescribed by the publisher. So there will be less freedom of text delivery.

A further point to note is the widely held view that the new technology offers an opportunity for universities to assume greater control over the publishing process and to diminish the role of commercial publishers. In this situation authors will have to re-think their present "give away" attitude to copyright.

Publishers

Much has been said about the future changes that will take place in the field of publishing. I share the views as presented in a recent article by Karen Hunter, Elsevier's Vice President, in which she predicts some general trends that both publishers and librarians will experience in the next decade:

♦ it will get worse before it gets better;
♦ there will be new electronic entrants who take significant new roles as intermediaries in scientific communication;
♦ libraries and publishers will be squeezed further
♦ scientist will not go much out of their way to assist us if we fail to deliver needed services but they will emerge to be net winners in the next decade.

She concludes her article by suggesting four imperatives for scientific journal publishers "who want to service this next decade".

♦ Get your material in standardised, distributable (SGML) electronic form. The successful publisher will start with standardised electronic files, from which both the paper and electronic versions can be created.

♦ Speed up the publication process.

♦ Pay more attention to how scientists learn about your articles and their abilities to get copies.

♦ Learn to be flexible in product offerings and pricing.

These views are confirmed in a confidential internal strategic planning report for the Academic Publishing Division Elsevier for the years 1993-1997. In this report the conclusion is drawn that they are dependent on one product, the journal, and on one client group, libraries.

Markets: main shifts

From	To
standard product	customised product
multi-stop shopping	one-stop shopping
traditonal competitors	new competitors
(inter)national market	world market

Prices: main shifts

From	To
source pricing	package pricing
single rate pricing	service-level pricing
format pricing	content pricing
cost-based pricing	value-based pricing
variable fee	flat fee/up-front pricing
single-user pricing	multi-user, site licensing

Figure 6: Main shifts in products and pricing

For these reasons Elsevier will speed up implementation of digital dissemination of scientific information making available the shifts in the market shown in figure 6, which should be the basis for the fourth point of Karen Hunter's imperatives, "learn to be flexible in products and prices",

It is clear that, if the publisher moves towards electronic journals, the role of the subscription agent will disappear in the information chain. Probably the publishers will try to reach the reader directly by bypassing the library. This means that the role of the library could diminish as well.

Subscription agents

"The changing role of a subscription agent" was the title of a paper presented last year by David Sidebottom, Managing Director Faxon Europe, during the Second European Serials Conference. After describing the role of the subscription agent and discussing changes and new opportunities, he concluded that "the way the agent is fulfilling its role is definitely changing but so are those of the publisher and librarian. The services I have mentioned to date, including document delivery, are by no means the end of the line as agents continue to explore new ground, be it information gateways or perhaps providing navigating tools through the maze of electronic media".

I can only agree that the agents have really explored new ground and I tend to believe that they form the part of the information chain that has most markedly crossed their traditional boundary within that chain. It is inevitable that this will cause tension between agents and the publishers on the one hand and the librarians on the other. The key issue of course is the question of copyright and the different purpose for which they deliver articles compared with libraries, i.e. for-profit versus not-for-profit! I expect that their new business will be monitored closely by the publishers. If they provide this service cheaper and better than the libraries can, I do not expect much conflict with librarians.

Libraries

I will not go into detail about the position of the library because this was the topic of a paper by Hazel Woodward reproduced in this issue of

Serials. I merely wish to reiterate that, as with the publishers, there is a real threat that the electronic journal will eliminate the role of the library or will at least change it.

Readers

As Karen Hunter expects, readers will probably be the part of the chain that can profit most from the possibilities of the electronic journal. Their situation will only change with regard to the payment for electronic services, if they want to bypass the library from personal preference. Readers will of course be forced, if they want to benefit at large from the electronic journal, to create their own personal electronic library on their PCs, replacing the existing paper based personal documentation systems. This implies a further need for personal retrieval and storage software.

Another effect will be a reduction in the number of visits to the library and the potential danger of loosing the advantages and results of browsing. Finally, as mentioned before, reading will be restricted to PC-based workplaces. However, I expect a growth in the use of portable PCs which will reduce this potential disadvantage.

As a summary of the possible changes in the traditional information chain figure 7 is a combination of data from Merriman (1992) and Schauder (1993).

Figure 7: Changes in the traditional information chain

Changes in the traditional information chain

In the print environment there were essentially three dependency patterns:

1. Author→publisher→vendor→librarian→reader
2. Author→publisher→vendor
3. Author→publisher→reader

All of the following dependency patterns exist already or are possible in the electronic environment:

4. Author→database→reader
5. Author→publisher database→reader
6. Author→vendor database→reader
7. Author→librarian database→reader
8. Author→publisher→vendor database→reader
9. Author→publisher→librarian database→reader
10. Author→publisher/vendor database consortium→reader
11. Author→publisher/vendor database consortium→librarian→reader
12. Author→publisher/vendor database/librarian
13. Author→publisher/librarian database consortium→reader
14. Author→publisher→vendor/librarian database consortium→reader

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Conclusions

We will all experience dramatic long term changes in scholarly publishing. These changes will have an impact on all the parties involved in the traditional information chain. The impact will not merely be on the individual parties but on the chain itself. I am sure that new information agencies will emerge and will try to get a piece of the information-cake in order to take their place in a new electronic information chain. There is an urgent need for solutions to be found in the legal, technical and organisational spheres and I hope that this will be done in the spirit or co-operation instead of confrontation.

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