Electronic Publishing and Electronic Publications in Mathematics

EDITED BY BERND WEGNER

Participants (in order of their contributions to the Round Table): Peter Michor, Arnoud DeKemp, John Ewing, Jean-Paul Allouche, Hans J. Becker, Bernd Wegner (chairman)

ABSTRACT. The increasing development of electronic devices for the publication of papers and books in mathematics has led to a drastic change in the communication facilities between authors and editors, to new ways of distributing mathematical publications to research mathematicians – like electronic journals, and to an extension of the offers of information on mathematical research to the mathematical community. At this Round Table reports were given on different aspects related to methods of electronic publishing, and an overview of the production and distribution of electronic publications in mathematics to their users has been provided.

Most of the contributions given by the invited speakers of the Round Table covered several of these aspects and the corresponding written version of their contributions will be found in this report. The problem of authors’ rights was mainly addressed by Peter Michor (Secretary of the EMS). Two representatives of important mathematical publishers joined the Round Table: Arnoud DeKemp from Springer-Verlag, and John Ewing from the AMS. They gave an overview of the electronic products and the corresponding editorial policies of their publishers. This was complemented by the contribution of Jean-Paul Allouche who reported on a French project dealing with the foundation and installation of some new electronic journals. The most import and classical providers of mathematical literature are the libraries. How they will improve and extend their services by using electronic media and offering access to electronic versions of journals was described in the presentation of Hans J. Becker from the library in Göttingen. Finally, Bernd Wegner (organizer of the European Mathematical Information Service EMIS) described how the system of internet-servers under EMIS is used for the moderated electronic distribution of mathematical literature. This latter service has been developed in 1995 by the EMS as a freely accessible www-tool for information in mathematics and is extended permanently. The written version of this contribution has been combined with the article of Peter Michor.

There was a long discussion during the second part of the Round Table. But no joint conclusions or activities emerged from this discussion. Hence the character of the discussion is represented by two written contributions taken from the many comments made by the audience of the Round Table.
There is an ongoing discussion on the future of Mathematical Publications in the age of electronic communication, and many things are happening: electronic journals appear which are no longer printed, and preprint servers take over the role of providing timely information on new developments in science. Much scientific news is spread via e-mail, as in the heroic days of the enlightenment, when personal letters were the main vehicles of communicating scientific discoveries.

For mathematics a lot is at stake, since it depends very much on the compiled literature, its reliability and accessibility. Mathematics is very vulnerable to any downgrading of the reliability of its literature which could be a companion of the more easy means of publishing today. But mathematics is also happy to have a de facto standard of publication: T\TeX. We think that T\TeX will be stable in the future. In certain respects the invention of T\TeX is like the invention of the alphabet. There is high value in its stability, so it will be stable. Even the development of the T\TeX dialects (LaT\TeX, AMST\TeX) is slowing down considerably, not many users are migrating. Of course the raw T\TeX is not the means to distribute journals. Here, the standard seems to be PostScript now, and might be Adobe PDF later – so one must keep the chance to transform to changed standards later. We do not think that standards will change as rapidly in the future as they have in the past, since here stability is also of high value to the community. We might even have PostScript many decades from now, if not forever.

The main vehicle for the publication of mathematical research are the scientific journals; some of them have a centuries-old tradition. There is an established method of refereeing, deciding, and editing, and some fear that this is in danger. The real opponents of journals are the preprint servers. The hep-tp server is already starting to implement refereeing. The unbundled articles alone seem to be better units of scientific information transmission than issues of journals.

Mathematics is different. The literature is of high value, each paper is unique, results are rarely published several times. Journals with boards of editors and with established refereeing and publishing policies exist, are recognized, and will stay if they adapt. Old traditions almost never die, they just become feeble if they do not serve any purpose. We think that journals could also be the means of scientific publication in the electronic age, at least in mathematics. By adapting, we mean that journals must be easily accessible and quicker in publishing, and they should be printed and distributed at lower cost.

This is possible: have a look at the ‘Electronic Library of Mathematics’ of the ‘European Mathematical Information Service’ (EMIS) at http://www.emis.de and its 19 mirrors (as of October 1996): Berlin, master server at the editorial office of

Zentralblatt für Mathematik (run by FIZ Karlsruhe).
University of Adelaide (AU).
Masaryk University Brno (CZ).
Budapest, Magyar Tudomnyos Akademia (HU).
Staats- und Universitätsbibliothek Göttingen (DE).
University of Helsinki (FI).
Københavnns Universitet (DK).
Krakow, Uniwersytet Jagiellonski (PL).
Lawton, OK, Cameron University, (USA).
Universidade de Lisboa (PT).
Marseille, CIRM (FR).
Universidad Nacional Autónoma de México (MX).
Moskva, Russian Academy of Sciences (RU).
Ottawa, Canadian Mathematical Society (CA).
Rehovot, Weizmann Institute of Science (IL).
University of Southampton (UK).
Torino, CSI-Piemonte (IT).
Universität Wien, Rechenzentrum (AT).
ETH Zürich (CH).

The main content of EMIS is the Electronic Library of Mathematics with the following subsections: Electronic Journals, Electronic Conference Proceedings, Electronic Newsletters and also Electronic Monographs. At present there are two conference proceedings in it and 22 journals:

Acta Mathematica Universitatis Comenianae (Bratislava).
Annales Academiae Scientiarum Fennicae Series A. I. Mathematica.
Archivum Mathematicum (Brno).
Beiträge zur Algebra und Geometrie (Heldermann Verlag).
The Electronic Journal of Combinatorics.
Electronic Journal of Probability and
   Electronic Communications in Probability.
Electronic Research Announcements of the American Mathematical Society.
Electronic Transactions on Numerical Analysis.
Geometry and Topology.
Journal of Convex Analysis (Heldermann Verlag).
Journal of Lie Theory (Heldermann Verlag).
Matematicki Vesnik (Belgrade).
Mathematica Pannonica.
Revista Colombiana de Matemáticas.
Séminaire Lotharingien de Combinatoire.
Theory and Applications of Categories.
Soon some more journals will be included:

- Journal of Graph Algorithms and Applications.
- Commentationes Mathematicae Universitatis Carolinae.
- Webs and Quasigroups.
- Journal de Théorie des Nombres de Bordeaux.

We think that for reasonably priced printed versions of electronically accessible journals there will always be a market: libraries, even individual subscriptions to special journals in one’s own field. The available experience shows that the number of subscriptions to print journals having an electronic copy in EMIS went up in some cases and remained stable for others, while on the average the subscription rates to mathematical journals went down due to budget restrictions for most of the libraries. The additional offer of electronic versions through the system of mirrors of EMIS is used frequently: all servers together report some 200,000 hits per week.

About archiving: The “Electronic Library of Mathematics” is a sort of model for this. Mirror sites have to agree to keep the whole content of the server, they will be spread out over all continents, so even major breakdowns cannot destroy all of them. Hence, if we succeed in extending the distribution of mirrors world-wide, then we will have solved the problem of archiving in the best possible way.

Those who conceived EMIS see it as a self-organizing electronic distribution and archiving system for refereed mathematical literature. To be a little more precise about what we have in mind, we include below as an appendix the guidelines for journals and conference proceedings to be included in EMIS. It gives some hints how EMIS is working and why.

There is always an argument about copyright, and about the interests of the commercial publishers which should be protected. On the other hand practically no one speaks for the interests of the main actors involved: authors and readers. Authors of scientific articles want their work widely distributed, easily accessible, and safely kept in the future. They do not earn money with most of their articles, only scientific reputation, and this is not provided by commercial publishers who severely restrict the circulation of journals by very high prices, it is only provided by the reputation of the editorial board and by the readership of a journal. Readers of scientific articles want quick information and easy access. One has the feeling that today more is written than read, so readers are very valuable: it should be easy for them to get at their reading. Who is speaking on behalf of authors and readers? It should be the learned societies. But the largest of them are indeed like publishing houses and they seem more interested in the well-being of their revenue-generating enterprises than in the interests of their members: the authors and readers of mathematical articles.

The following charter would take care of the interests of authors and readers.

**Draft of a charter for free electronic access to publications**

The mathematical literature and access to it is the single most important asset of the world of mathematics. But it is under pressure: prices of journals are rising higher and higher, whereas the budgets of libraries are increasing somewhat below
the rate of inflation or even decreasing. There are more and more new journals. Even in big libraries one cannot find all serious journals today. The role of a printed copy of a journal nowadays mainly consists in sitting in a library waiting for one of its articles to be photocopied. A conservative estimate is that on the average an article is photocopied 50 times, all over the world, and read 25 times. To typeset, print, and distribute it is a waste of human and natural resources: the same service could be done via computer quicker and with greater reach.

This charter is not meant to formulate the future of all the mathematical communication; its aim is only to pave a way for the transition of traditional journals to freely accessible electronic ones. The result might be cheaper and better accessible mathematical literature in the future.

The rationale behind this charta is the following: the aim is to try to lower the overall cost of mathematical literature. One way could be the following: we should distinguish carefully between the final electronic version of a paper into which, in addition to the work of writing and refereeing, only marginal costs have been invested, and the printed and distributed version, which makes use of a rather industrial process. The costs of the former, since they are small, should be carried locally, by academic institutions or libraries. Important libraries could adopt existing journals and take over their costs up to the electronic product. Free personal access to the electronic product should be ensured. The costs of the latter industrial process should be borne by the consumer (library) who prefers to have at hand a nicely printed version. There will be not so few of them, perhaps.

Draft of the charter

(1) The right of access to the electronic file of a paper which was prepared electronically by the author or his institution lies with the author(s).

(2) If the author submits this paper to a preprint server and/or if the paper has gone through a refereeing process positively, the author automatically acknowledges the right of free electronic access to this paper to the (mathematical) public.

(3) If a journal prints a refereed article, the right to distribute and sell this printed paper lies completely with the publisher of the journal. But the right of free electronic access to the file remains with the public.

(4) Everybody who uses the right of electronic access to a paper is entitled to print freely some copies for personal or restricted (educational) use. He is not entitled to sell copies of this paper for profit.

(5) Libraries are entitled and asked to keep permanently accessible files of electronically accessible journals, in order to ensure their perpetuity, besides or without printed copies.

Status of the discussion on the charter

The draft above received mixed responses. Among them:

A short charter like this has its charm, but if we start making all the sentences really precise it will get as ugly as the declarations of the European Community.
Some say that it is too early to fix any rules, or that it is really dangerous to do so: it might wake sleeping dogs.

The idea of having a charter such as this one did not find enough support from influential people thinking about the future of mathematical publications, especially in Europe. It seemed better to drop the idea. On the other hand, now is still the time when things may be formed and influenced; later, habits are fixed, and the chance of lowering the cost of mathematical literature as a whole may be over. Thus the formulation of the charter is given to the public in the form of this article. The reader should be aware that no assembly of any legitimation voted on it — it is just the personal opinion and guideline of the authors, but it led to the creation of the Electronic Library of the European Mathematical Society.

A question to all publishers

Let us ask here a concrete question to the representatives of commercial and non-commercial publishing houses, which are present in this room: Are you willing to put the files of your mathematical journals on EMIS, with a delay of some years, which you can determine and which should make you feel safe against possible loss of subscriptions? No immediate answer is requested. But in this way you put the labor of archiving into the hands of those really interested in it, and you would insure, finally, the existence of the mathematical literature as a whole.

Another proposal: if a mathematical book is available on the Internet, then it will probably sell better: any interested person can see whether it contains what he wants, and if so he will order it, if the price is not beyond a certain threshold, which we guess is at around 10 cents per page. Why do we believe this? It is not nice to read from the screen. And a printout is just a heap of paper, very awkward to read, and not free either. A nicely bound book is valuable in itself and is a pleasure to keep on a bookshelf.

Which publishing house will be running the first experiment on this?

Appendix

ELibM Guidelines for Journals and Proceedings Volumes. The following are guidelines for mathematical journals and proceedings volumes to be included in the Electronic Library of Mathematics (ELibM). This library is a broadly based electronic distribution and archiving network for mathematics. It is provided by the European Mathematical Information Service (EMIS) under the auspices of the European Mathematical Society (EMS).

1. Scientific standards. An editorial board must ensure that articles accepted for publication are of good scientific quality.

   Every article must be refereed and recommended for publication by one or more experts.

   The choice of articles must involve no discrimination on the basis of politics, nationality, race, sex, or religion.
2. **Editorial and typographic standards.** Articles should appear in a polished form similar to that of printed mathematical journals, to the extent this is practicable. In particular, they should have an approximately uniform typography, and each should have a unique identification that is suitable for use in bibliographies of other articles. It is strongly recommended that an abstract be included for each article. The dates of receipt of articles and the dates of publication of articles, issues, or volumes should be visible.

3. **Logistics.** In case a journal or proceedings volume is being offered for sale (in any form), the release of the electronic version to ELibM may be delayed a specified period so as to favor sales. This delay period will be at the discretion of the editors or publisher.

   The editors of an electronic journal are responsible for delivery of their journal’s articles to ELibM. Appropriate technical facilities for automatic document delivery will be proposed by the manager of the ELibM-Server.

   While standards may change in the future, currently a complete PostScript file containing all the font information should be made available for every article in a journal participating in ELibM.

   Provision of additional file formats (.TEX, .DVI, etc.) will be at the discretion of the editors of the corresponding journal or proceedings. The contents of all versions should essentially agree, although there is no requirement that they all share any particular style.

   The proliferation of file formats has not posed a space problem thus far. However, ELibM reserves the right to limit bulk in case total file size becomes burdensome. They are beginning to impose a burden now.

   To relieve editors of awkward physical responsibilities, ELibM is willing to hold the master posting (including all versions in all provided formats). This offer will be of particular interest for proceedings volumes; on the other hand, many journals are so well equipped that they prefer to retain their master posting, which ELibM then mirrors to all servers of its network.

4. **Costs.** Reader access to the electronic journal and proceedings volumes of ELibM will be free of charge. Likewise, to be included in ELibM, these publications must be provided to ELibM free of charge.

   As a service to the mathematical community, the costs and maintenance of ELibM are covered by the EMS in cooperation with Fachinformationszentrum Karlsruhe / Zentralblatt für Mathematik.

5. **Copyright.** Distribution through ELibM servers is authorized by the original copyright holders. It does not imply transfer of any form of copyright to EMIS or any related agency, nor to any person or agency acquiring the data through ELibM. For a journal with a printed version, a person obtaining an article from EMIS has no greater legal right to reproduce it than if he had borrowed the journal from a library.
6. **Permanence.** Science has important personal and historical dimensions requiring that future generations be quite sure what was published and when. The provisions of the next paragraph help to assure this.

One of the first published versions of each article or volume should be designated as original and archival. (This is a must for journals not also published on paper.) The archival original must be maintained unchanged forever, while alternative versions in other formats may be introduced or deleted. The constancy of the archival version will be continually monitored by ELibM as the library's basic guarantee of document integrity to the mathematical community.

The editors and publishers are free to designate the archival version; failing that, the choice is left to EMIS at the time of posting in ELibM.

7. **Distribution agreement.** The above guidelines are an amalgam of information, offers of assistance, assured freedoms, advice, and obligations. The obligations are clearly signaled by the word "must". EMIS invites editors and publishers to enjoy the freedoms and to request assistance at any time. On the other hand EMIS requests prompt mention of points where the above advice may not be followed. EMIS insists that unaccepted obligations be renegotiated in detail before finalization of a ELibM distribution agreement.

Each ELibM distribution agreement (formal or informal) may be terminated on short notice, either by the copyright holder or by EMIS.

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**The Impact of Information Technology and Networks:**

**New Perspectives for Scientific, Technical and Medical (STM) Publishing**

**ARNOUD DE KEMP**

**ABSTRACT.** This text is a strongly abbreviated version of a much longer presentation at the Round Table on Electronic Literature at the European Congress of Mathematicians (ECM2 – 1996) in Budapest. The process of publishing will undergo dramatic changes due to the influence of information technology and networks. The publishing business as a whole will shift from traditional print and paper based organisations to a fully digital workflow from author to end user. Electronic publishing has moved from pre-print activities to digital content on a variety of servers, but still most scientific documentation is printed and not only for archival purposes. In this Round Table a plea will be made for new rules in scientific communication, that authors, editors, publishers, societies, libraries and users can recognize. In addition, in the electronic age we need more protection for original work, transactions over networks and against misuse in general.

**A Short History**

In 1665 the first journals appeared: "Le Journal des Scavans" in Paris and "Philosophical Transactions" in London. They were the first publications with quality

*) (This is a modified version of the author's article in "Vistas in Astronomy" Vol. 40/3 (1996))
control, introducing “Approbation” and “Imprimatur”. Today we see approximately 70,000 regular primary publications. Catalogues from subscription agencies like Lange&Springer, Swets, Ebsco and Blackwell list well over 300,000 serial titles. Little has been done to improve accessibility and retrievability. Book catalogues, whether printed or electronic as OPACs (Online Public Access Catalogues), are still based on rather simple cataloguing rules. The journal literature was abstracted and indexed by so-called secondary or A&I services. One of the most practical tools for accessing new articles in primary journals is Current Contents. There is no library any more that can acquire all relevant publications, not even the Library of Congress (USA), the British Library (UK) or the National Diet Library (Japan). The number of publications seems to double every 15 years and it would be interesting to correlate the number of active members of learned societies like the AMS and EMS and the number of publications offered and accepted over the years. The only effective answer to this increasing problem seems to be the introduction of electronic publishing and communication over networks.

What publishers do

The publishing process, until very recently, was traditional and reclusive. There are very many smaller publishing organizations. Publishers can be companies, societies like the AMS, universities, cities, departments, institutions, states or individuals on a part-time basis. They are as varied as the aims and scope can vary and many are so small, that the publisher is an all-rounder taking care of editorial work, production, marketing, sales and distribution him- or herself ... Publishing as a whole is big business with several mega-companies that seem to dominate the landscape. The many mergers and acquisitions during the last fifty years have worried many scientists and their societies.

In STM publishing we define the following categories: scholarly publishing, professional publishing and textbook publishing. Not all the works published are unsolicited texts that scientists offer for publication. Instead, we see many publications, that are written at the request of publishers or by editorial staff in their offices. I would like to mention reference works, dictionaries, multi-volume compendia, of which some have a very long publishing tradition. Publishers are not homogeneous, but they share the belief of freedom to publish.

The basic or core activities in publishing are selection, editing (also copy and language editing), design and illustrations, translating and indexing, production, promotion, marketing, sales and distribution. The computer has become a powerful tool and the large reference works, along with the abstracting and indexing sources, were the first to be converted to electronic databases.

Still, it has taken a long time for fulltext to become totally digital. The main reason may be the fact that computer screens were not designed for reading text. Although the acceptance of reading lines on a monitor has increased, most information is printed on the fly and then read. The next generation will certainly be more receptive. Publishing always concentrated on the printing or multiplication of documentation, recorded information, carefully checked and peer reviewed, original, integer and authentic. In the electronic age, it seems that the barriers between
informal communication and formal publications are disappearing. I would like to make a plea for a careful definition of:

- communications, papers offered for publication,
- papers accepted for publication in a specific journal or serial title and
- publications with page numbers, a publication date etc., that can be cited in bibliographies.

Also, in the middle area, before the publishing organisation can announce the fact of a final version, it is recommended that a date and a version be specified.

Last but not least, it should be mentioned that the publishing process in the USA is partly financed out of research grants, and several publications levy page charges, which is rather uncommon in Europe.

New Technologies

Quoting Marshall MacLuhan, who in the fifties, said that automation conferences looked like a gathering of coachmen discussing the re-education of horses in times of more and more horseless carriages, it is difficult to see what the newest technologies will bring and what they will mean. We know that repography first has challenged and then threatened the principle of intellectual property. In times of increasing immaterialization, it is difficult to define what an original is. Do we still need originals? Major developments have been word processing, text and pixel retrieval, storage, local and other networks, the personal computer, the workstation, the laser printer, the network computer, Internet, Intranets, Java, digital broadcasting, etc. The future might look like InterCast, a combination of cable or digital broadcast television with a telephone line for interactive communication. Who knows?

The fact is that in STM publishing we recognize and work with over 120 different text editors and word processors. STM, the International Association of Scientific, Technical and Medical Publishing, has carried out some interesting investigations. We see increased use of SGML, but there are already different standards, interpretations and adaptations. Well-known and commonly used formats are PostScript, PDF, \LaTeX, TIFF, GIFF, JPEG, MPEG, MHEG, Quicktime, etc. Over 500 different search engines are used in CD-ROM production. I expect that SGML (ISO 12083) and \LaTeX will become more important and will be used more and more as the source format for electronic publishing and dissemination.

New Products

New products emerge, based on hypertext and other navigation systems, with click-through facilities. Alerting, based on personal profiles, will come as a service. The information industry is working on meta indexes and intelligent agents. At Springer we are involved in a project called MEDOC, with Ariadne as an intelligent agent for computer scientists. We see the first distributed information systems. Information, thanks to SGML, can be searched and presented in different layers, which makes rich indexing possible. Multimedia opens a whole new world for 3-D, simulation, video- and sound-embedded documents. We already see first living books and documents. Pixels become voxels and bits will be supplemented by trits.
Virtual reality allows for a new vision and can be used extremely well in design, production, education, telelearning and teleteaching.

Publishing will get several new dimensions and turn more and more into media production, which can become very expensive. Creation and production involve new skills and bring in added value. In addition to intellectual property, industrial property will become very important.

Conclusion

There will be changes everywhere and all the time. Old rules and values may disappear or be upgraded. The laws that protect intellectual property need to become global. The legal protection of information, transactions and users on networks needs to be enforced and supported by encryption techniques. First attempts are being made with electronic watermarking, tattooing and fingerprinting.

In addition, we need document or information identifiers. Hopefully we will manage to keep and identify quality, and respect originality, integrity and authenticity against fraud and misuse.

My personal vision is that mathematics will become so media and platform independent, that I can click on a mathematical object, cut and paste it and then use in my personal environment, before I ship my article to somebody in cyberspace. That somebody is in my vision most likely Mr. Springer (or Dr. Heinze, our maths publishing director).

An extensive bibliography will be mailed on request. For discussion please contact the author at dekemp@adkathome.de.

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Publishing at the AMS

JOHN EWING

We publish journals, books, and a database at the American Mathematical Society. And all of them will be affected by changing technology.

Journals and books you likely understand, but the database? That’s Math Reviews, of course, and like Zentralblatt it’s different from a journal in almost every respect. Math Reviews is produced by a staff of over 75, processing over 100,000 items each year, dealing with thousands of reviewers, librarians, and publishers, to produce nearly 50,000 reviews. There is a fanatical demand for accuracy, precision, and completeness. Delivering that database, either in paper or on disk or over the Internet, requires even more people, and of course the Internet version of Math Reviews is a sophisticated application, developed by many people with varied talents. It is not merely a collection of hyperlinked files residing on a server.

Because Math Reviews is a database, rather than a journal, it moves into the electronic age most easily. The great strengths of electronic delivery – searching and linking – are ideally suited for a database. Of course, moving “easily” into the electronic age doesn’t mean moving cheaply; we invested heavily in developing MathSciNet, and we continue to do so.
Books? Books will take advantage of new technology more slowly and more subtly. It is still hard to curl up with a computer to read in bed, and it’s not a lot of fun to pore over a computer screen chapter by chapter. Some books are natural: those that resemble databases are made more valuable by searching and linking. But books in general will move into the electronic age more slowly, over a longer period of time, taking advantage of yet unrealized technology.

That leaves journals, the most difficult. Why are they difficult? Because people have too many expectations, and too little vision. I had better explain those remarks.

**Why aren’t journals cheaper?**

People expect journals to be cheaper and, simultaneously, better. Why cheaper? Because, increasingly, journal articles are author-prepared, and because, potentially, journals can be delivered electronically. At the AMS, we now have lots of experience with author-prepared manuscripts, since slightly over half arrive in electronic form. And we have some experience with electronic journals – all our paper journals are now also in electronic form and we are adding electronic-only journals as well.

Preparation of manuscripts is only a fraction of the cost of producing a journal. Even so, for traditional paper journals, if all material were really author-prepared costs would surely decrease. Alas, along with most publishers, we find that roughly half of author-prepared manuscripts require substantial \TeX work. Because that intervention is by highly skilled people who might have to track down a stray macro, for example, it can cost as much as keyboarding the paper from scratch. The savings are therefore smaller than you might think.

Will electronic journals be cheaper? That depends on what you mean by the term electronic journal. If you mean merely a mechanism for mathematicians to retrieve copies of papers, say a DVI or a PostScript file, then Yes, electronic journals should be cheaper. But this is document delivery, not an electronic journal.

This brings up the other expectation: that electronic journals should be a better way to deliver information, with more function. Links, for example: click on a reference number and see the detail, click again and reach the review or even the reference itself. The author claims this is true by Lemma 5? Click to see what that lemma is. Or click to see a derivation of some stated fact, which the author tosses out as folklore. Adding links creatively makes electronic publication a new and better way to communicate mathematics. And journals, or collections of journals, should be searchable: Just type in the phrase “group action” and you can find all papers in all AMS journals this year with that phrase in them. (There are six, by the way.) Electronic journals – real electronic journals – should substantially improve the way we do mathematics.

Doing all this has costs. Putting in the links, providing search engines, developing the environment, costs large amounts of money.

Worse, author preparation makes electronic delivery more difficult, not less. To add links efficiently, for example, one needs uniformity in manuscript preparation. Mathematicians are especially creative when it comes to using \TeX. And
while what appears on the printed page may look the same from paper to paper, the TeX code that’s inside the paper is certainly not uniform.

We face a dilemma: The more author preparation we promote, the more costs we incur to prepare the papers for true electronic publication.

What about the other costs of electronic publishing? We have a top-of-line computer on which our server and search software runs. Most likely, it will be replaced in 2 or 3 years. The computer is supported by (expensive) technical personnel. We provide customer support, so that bewildered users can phone or e-mail to get help. We provide access control, so that users with the proper IP addresses or passwords can gain access. We must support mirror sites. We make CD-Rom archives, so that libraries have a hard-copy of the journal at the end of the year. And we are engaged in ongoing development in order to keep up with the next wave of browsers and Internet software.

What about the savings in printing and mailing? Well, eventually, we may realize some savings. Right now, while we publish both paper and electronic versions, we save only the marginal cost of printing slightly fewer copies of the journal. It’s not much: we are investing in the future.

**Vision**

Where are we headed in the future? No one knows, not with any certainty. The only “experts” in electronic publication are the self-proclaimed kind, and we ought to be skeptical. At the moment, we are setting forth on a journey, and we don’t have a roadmap.

But even if we don’t know precisely what lies ahead, we can still anticipate the dangers. We can still ask what future consequences are likely to follow from our present actions. We can – we must – have a vision for scholarly literature.

Will everyone be publishing his or her own papers? This isn’t a new phenomenon; preprints have been around for many years as an informal system to exchange information. In the past, finding preprints was complicated, and now electronic dissemination has the potential to make that much easier. But part of the function of journals is to organize the literature – journals are supposed to ensure not just accessibility, but quality and stability as well; it’s part of the reason they cost money. Replacing our present system of journals with a freeform system of self-published preprints leads to academic anarchy.

Could we give structure to that chaos? Could we create a system to assign groups of preprint numbers to anyone running a server, and then provide a service to register them. That costs money too. Who pays that money? Publishers, from the revenues of journals?

Can we be certain that papers will survive after 100 or 50 or even 10 years? I don’t know; no one does. But I do know that hardware and operating systems will be wildly different in 20 years, and we’d better be prepared. I also know that TeX, in its present form, will not be around in 20 years. If we must convert the one million electronic papers that have accumulated, we had better insist that they have some uniform structure, so that we can recognize titles and theorems and references when we do that conversion. We had better be prepared for the future. Being prepared also costs money. At the AMS we are now setting aside 1% of all
subscription revenue each year to create a fund so that we are prepared. But who will take care of all the “free” electronic journals in 20 years?

Journals are more than a mechanism to advertise our recent theorems to our colleagues around the world. They must reach across time as well, to future mathematicians. As we replace our present system of communicating mathematics, we need to take a broad view of the roles and responsibilities of publishers in the past, and we need vision about how those roles will be carried out in the future.

**Our legacy for the future**

Can we control the costs of journals? Absolutely, we must. Can we make electronic journals less expensive than paper? I believe we can – I think we must.

But electronic journals are not free, and we cannot avoid costs by either pretending those costs are not there, or by passing them on to our university or to a government grant or to an enthusiastic junior colleague who maintains a web server. That’s not sustainable. In publishing, as in life, you don’t solve problems by avoiding them.

Can we find ways to create, to organize, and to maintain electronic publications so that articles published today can be found (and read) in the future? We ought to make that our highest priority; we should not – we can not – relinquish our responsibility as caretakers of a 2,500 year-old discipline. We need to leave a scholarly legacy for future generations in the same way that past generations left one for us.

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**Electronic Mathematics Journals in France**

**JEAN-PAUL ALLOUCHE**

**1. The general project**

A World-Wide-Web server for French electronic mathematics journals opened in 1995. This is a joint project directed by the SMAI and the SMF (Société de Mathématiques Appliquées et Industrielles and Société Mathématique de France), and supported by the French government (Direction de l’Information Scientifique et Technique et des Bibliothèques du Ministère en charge de l’Enseignement Supérieur et de la Recherche). Technical support is provided by INRIA (Institut National de Recherche en Informatique et Automatique, Sophia).

This server presently hosts

- two purely electronic journals
  journals from ESAIM, European Series in Applied and Industrial Mathematics, *Contrôle, Optimisation et Calcul des Variations* and *Probabilités et Statistiques*;
- a purely electronic proceedings series
  *ESAIM Proceedings*;
- the electronic version of a paper journal
  Journal de Théorie des Nombres de Bordeaux;
- the abstracts of the articles of a paper journal
  Annales de l'Institut Fourier.

At the moment, the access to this server is free:

http://www.emath.fr

The author of this contribution is a former editor of the paper version of the Journal de Théorie des Nombres de Bordeaux, and now responsible for the electronic version of this journal.

2. Submission and refereeing

All these journals contain only papers that have been accepted after being read by one or more referees. This was, of course, already the case for the paper versions of the Journal de Théorie des Nombres de Bordeaux and the Annales de l'Institut Fourier.

The submission is essentially electronic although, in particular for the journals having a paper version, other submissions are accepted, if not encouraged. Almost all of the correspondence between editors and referees, and between authors and editors is electronic.

3. Overview of problems and questions

Here are but a few questions or guidelines as a first step for discussion. They should be considered only as rather vague starting points.

- **Financial and political aspects**
  Although of relatively low cost, an electronic journal is not free (one cannot bypass the expense of secretaries, buying and maintaining machines, disks, ...). Should it be accessible for free, or with a subscription fee, or with a “pay per view” system? It seems reasonable, if a journal is not free, to charge only sites, and not individual machines on a given site. Note that statistical data on connections are easily available. Note also that it is easy to lock or unlock access for a given machine or site.

- **Scientific aspects**
  Since the papers are submitted through a refereeing system, peer review is exactly the same as for a paper journal. But the evaluation instances have to be aware of the quality of the electronic journals and to admit that electronic journals can have standards as high as paper journals.

The electronic journals are probably the only answer to the huge increase of scientific literature … provided that the “highway syndrome” does not strike. Indeed, each time a highway is constructed to decrease traffic jams, the long term effect is ultimately the attraction of many more vehicles. Nevertheless, the easy access to electronic journals and the possibility of computerized key-word search are unbeatable features. Note in passing the necessity of asking librarians to catalogue electronic journals.
Technical aspects

Although I am not an expert in technical aspects, I would like to point out the following facts. \TeX and its avatars are certainly a very important tool. Clearly, only DVI- or PostScript-files should be available, for security reasons. Note that inserting pictures is not really machine-independent. Note also that unconditional fans of MacIntosh machines might have trouble in reading DVI- or even PostScript-files. A tool translating \LaTeX to HTML is available, but not extremely efficient. The future versions of HTML might contain mathematical features that might even (?) make \TeX obsolete (see http://www.lfw.org/math/). ACROBAT and JAVA are probably becoming new standards. The *Journal de Bordeaux* intends to make it possible for the e-reader to run algorithms while viewing a paper: this can be done by using JAVA.

4. Future developments and conclusion

The French server is ready to host other French journals and to cooperate on international actions (experience sharing, exchange of free access, mirror sites, …). The back issues of the paper versions of the journals that are already on the server might become progressively available.

Since many e-journals already exist and many e-journals are being created, the question is evidently no longer to be for or against electronic publishing. The question is: how to keep the process under control from the political, financial, technical, and, last but not least, scientific point of view. The next question will be: how to take advantage scientifically of the electronic revolution? For example, an important question that only begins to be addressed (see Re-engineering peer review, *The Economist*, June 22nd–28th 1996) is certainly the opportunity of making the peer review process more precise, more efficient, and may be less “consanguine”.

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Electronic Publishing and the Role of Libraries*

HANS J. BECKER

First of all I want to thank Prof. Wegner for the opportunity of giving a short description of some aspects of the role of libraries in the development of electronic publishing using the projects of the Lower Saxony State- and University Library of Göttingen.

In the Library at Göttingen is one of the important collections of mathematical literature in Europe. Since the eighteenth century the mathematics literature has been one of the important subject fields of the collection, supported by some of the most eminent German mathematicians of the last two centuries:

*) e.g. the Lower Saxony State- and University Library of Göttingen
- the famous scientific library of Gauss is a part of the collection; and
- Klein and Hilbert supported the library by demanding extra grants from the Prussian ministry in Berlin to enable the library to collect materials especially from foreign countries, particularly from Great Britain and the United States.

After World War II the library was supported by the “Deutsche Forschungsgemeinschaft”, establishing the so-called “Sondersammelgebiet Mathematik” and after 1975: “Sondersammelgebiet Reine Mathematik” in Göttingen.

You are surely wondering why I’m reporting on the development of the collection during the last two centuries, as you are anxious to hear about the newest developments in electronic publishing ... But in my view as a librarian and as a mathematician, especially interested in the history of mathematics, there should be a very definite connection between the current electronic form of mathematical literature and the printed literature before the electronic revolution. Mathematics as a special form of science is building up on the results of former mathematicians reported in literature which is not as accessible as the newer one. But in order to understand the whole structure of our science we have to make all efforts not to forget the achievements of our predecessors. It is true, as mentioned, that a huge part of mathematical literature was written during the last forty years, but a great part of the works of our great mathematicians was written before these years and we should not forget them simply because they were not written in electronic formats.

Therefore there is a great challenge for librarians and libraries and, I think, for the mathematical associations and publishers, too, to connect the past with the present to get a richer future.

Therefore we wish to ask: How can we define projects to realize this connection and what projects are the most effective ones to start with? I do not think that it will be such an easy task to put our mathematical heritage in electronic form.

This is the starting point for some of our efforts at the library in Göttingen. But before I give a detailed description I have to mention three other components: first, the role of the “Deutsche Forschungsgemeinschaft”, especially of the department responsible for libraries, the “Bibliotheksreferat”. For the last five years this department, together with librarians and scientists from different fields, has tried to initiate the spread of the electronic evolution to German libraries by formulating important plans.

On the other hand, the “Deutsche Mathematiker Vereinigung” (DMV) is looking for a change in publishing especially journals and pre-prints. There has been a project by the BMFT (Ministry of Education, Research and Technology) together with the DMV, resulting in:

- established World Wide Web servers at nearly every German mathematical institute,
- many experienced people in the German mathematical community, and
- an electronic journal, the Documenta mathematica.
The third component is the development of the *Zentralblatt für Mathematik* in different electronic forms, now easily accessible to the mathematical community through the Internet.

The projects in the electronic area of the “Sondersammelgebiet Reine Mathematik” at the Göttingen library are the following:

1. We are trying to establish a World-Wide-Web server especially for the mathematical community in Germany with gateways to the printed literature with delivery/copy function and lending function to the electronic forms in the Internet; we started with a special grant from the “Deutsche Forschungsgemeinschaft” to evaluate the Internet in order to give access not to all addresses but to the important and significant addresses; you are familiar with these efforts under the keywords: subject guides, Clearinghouses, Value-added packages etc.

   We hope that we can open our homepage with these special features in January 1997. We will try to cooperate with other World-Wide-Web-suppliers in the field of mathematical literature.

   Especially in the field of electronic and printed journals we will work together with mathematical associations and with publishers such as Springer, Academic Press and Kluwer.

2. In association with Professor Wegner and the Deutsche Forschungsgemeinschaft and in cooperation with Professor Dennis we intend to start the second project (guided by the European Mathematical Society and the American Mathematical Society): “The Electronic Jahrbuch über die Fortschritte der Mathematik 1868–1942, an enhanced and commented version”

The project will have three stages:

1. The first goal is to produce a searchable database as a digital version of the text of the “Jahrbuch”.

2. After this there will be an intellectual review by a committee of mathematicians, who will formulate digital input in form of:
   - classification of the articles according to the MSC (Mathematics Subject Classification), which is used by both *Mathematical Reviews* and *Zentralblatt f. Mathematik*;
   - free keywords in English;
   - additional English titles;
   - comments and evaluation.

The role of the library in Göttingen will be centred on the bibliographic work. There will be groups of librarians from the Göttingen library and the AMS library to look at the bibliographical aspects:

a) There should be a standardization of the abbreviations of journal titles, like that in modern databases, and in case the title of a journal has changed the various versions of the title should be identified. In some cases the publishers have renamed their journals, and in others, in the course of the many years that *Jahrbuch über die Fortschritte der Mathematik* appeared, the abbreviation of source names took place according to different systems.
A modern user often knows only the current names and abbreviations. Such identification is important if one wishes to consider the source as a reliable search datum.

b) Some of the sources are journals that have continued publication to the present day, but some are series of publications that are now known only from references. In these latter cases getting hold of the literature itself is usually a difficult problem. For this reason the journal sources data which can be derived from the *Jahrbuch* should be complemented in an appropriate way with pointers to obtaining the originals.

c) Author identification should be undertaken as carefully as possible. Over the years there may be changes in orthography and transliteration of an author's name. The identification of the various forms of an individual's name is of great service to someone searching a database.

The third part of the project consists of:

- a) the selection of important journals;
- b) the selection of important collected works; and
- c) the selection of some other important categories of publications, e.g. dissertations, Schulschriften, etc. by a committee of mathematicians and librarians in order to scan these printed works as images in cooperation with authors, publishers and mathematical associations.

When the project is completed the mathematical researcher will be able to search for an author, a title or some classification. If he is interested in the original work after looking through the details in the database, he should have some links to the electronic image, if the work has been selected for scanning, or he should have some links to obtain the work through conventional lending methods or copying from certain libraries. There will be some more problems such as copyrights and charging problems.

To conclude I want to mention another project of the library. We are planning to install an electronic archive as described by Frank Quinn from Virginia Tech in his paper: "A Digital Archive for Mathematics". We think that this will be a “natural” extension of storing handwritten and printed material in our library and that it will be useful for the German mathematical community.

To close my speech I would like to cite James Michael: "It was the best of times. It was the worst of times". Sounds familiar? This is the opening sentence of Dickens' "A Tale of Two Cities" – a story of revolution.

This is what we are facing today as information users, information providers, information seekers, and information creators. We are facing a network information revolution. With revolution comes chaos, uncertainty about the future, and myriad other problems. Carefully planned change is required. Strategic change is required.

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Summary of the Plenary Discussion of the Preceding Contributions

BERND WEGNER

The discussion in the previous reports reflected two controversial positions: that of the authors and readers of mathematical publications who mainly wanted to see some reduction of publication costs and subscription prices resulting from well-prepared electronic files of their work, application of desktop publishing technologies and particular involvement of the authors in the publication process, and that of the mathematical publishers who wanted to point out that costs for the publication of mathematical texts even will increase due to offers of the texts through several media, enhanced facilities for electronic offers, archiving and standardization problems for electronic publications and increasing costs for maintenance of the technical background for electronic offers.

Obviously this discussion could not lead to any joint conclusion or coordinated joint activity involving both parties. The reason is that most of the electronic publication activities are in a preliminary state or just a vision for the near future. The few electronic journals in mathematics which have gained some experience in this part of the publication business are run on an almost voluntary basis, supported by a mathematics department or some consortium of mathematicians. Their economic structure cannot be taken as a model which could serve as the basis of an estimate of the costs of electronic publishing at a commercial publisher. On the contrary, the figures of commercial publishers presented in this context can be considered as a very rough estimate only, because they are pure speculation. The period of commercial electronic offers of mathematical journals is too short to provide more precise figures. Most of these journals are electronic versions of well-established print journals. Pure electronic journals offered on a commercial level can be considered as experimental only.

Two of the longer contributions to the discussion are represented in full text below. They give some impression of the opinions of those who did not attend the Round Table and may roughly be considered as representative of the comments from the audience.

Comments from

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There are real costs involved in producing a quality mathematics research journal, whether paper or electronic.

There are a number of myths around that support the flawed view that journals should be free or priced at minimal cost:

1 All authors write clearly in good grammatical English with proper spelling and punctuation so that even readers new to the field or readers whose native language is not English can read and understand the mathematics without difficulty or ambiguity arising.
⇒ Not true! High quality journals have to return something like 50% of papers to authors for them to improve the exposition and language. Even then many authors cannot achieve a satisfactory standard. A high quality journal thus has to PAY for a Technical Editor to go through every paper to “debug” the exposition.

2 Authors will do the \TeX\ typesetting work for a journal, so the journal typesetting costs will be nil or negligible.

⇒ Not true! Even with \TeX\ there are so many dialects that journals often have to spend large amounts of time modifying formats to standard formats. Too many authors insist on embedding their own personal macros or using special fonts [often proprietary fonts, that cannot be used in an electronically-available version of the journal without a licence]. Quite often authors use \TeX\ badly – for example, their files cannot be read. Many good authors do not use \TeX\ anyway, and many journals do not wish to exclude those authors. Thus a high quality journal has to pay for a Technical Typesetter to go through every paper to \TeX\ it, to debug an existing \TeX\ file, or to re-\TeX\ it if the author’s file is unusable. Such typesetting is an expensive skill, that journals have to PAY for.

3 Individual journals will be available on the Editor’s server or his University server and can be accessed at any time.

⇒ Not true! Editors move from university to university; servers get replaced every few years; universities have financial crises; technology moves on and files can no longer be read or printed easily; networks suffer e-congestion; working mathematicians get baffled as to where to find journals if there are too many possible locations, etc. Also it is unrealistic to imagine that individuals [or perhaps even universities] servers can act as the “archive of record” for mathematical material. Mathematicians are sufficiently vain to imagine that their published work will be of interest to someone in 50-1000 years; and indeed some of what is published at present will be – the problem is that we cannot easily identify which papers these are! Mathematics is a subject that develops like a pyramid (recall that Newton said that he “stood on the shoulders of giants”); therefore it is our duty for posterity to ensure that published work continues to be available indefinitely. This is something that publishers accept responsibility for, and so PAY for.

4 Editors do their work at zero cost, as their universities absorb the cost.

⇒ Not true! Editors run up quite large bills for postage (especially air mail postage), photocopying, and secretarial assistance; especially if they insist on papers being modified to be clearly written. Many Editors proofread, as they believe that their reputations require this guarantee of accuracy. Increasingly universities are unwilling to allow academics to run up real costs (e.g. postage, secretarial time) without recompense; some ask for partial replacement for teaching too. The journal has to PAY for these costs.
Therefore quality costs money:

1. To prepare the electronic files, whether for paper, server, or both;
2. To create accessibility of the material – that is, its distribution in the short term;
3. To maintain its accessibility in the long term.

If publishers have no income, or little income, the necessary consequence is that:

1. Papers will be less well prepared and less easy to understand;
2. In the long term, papers will simply “disappear”. This is not satisfactory; therefore I believe that publishers (whether commercial, learned societies or universities) will continue to have to charge for mathematics journals.

Finally, it is my personal opinion that there will be a market for both paper and electronic versions of journals for years to come, as each format has its own role; and that probably paper will continue to be the principal archiving format.

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Summary of Remarks at the Round Table on
“Electronic Literature in Math”

AVIEZRI S. FRAENKEL

First set of comments

1. Peter Michor said that the author should retain the right to his own paper. I’d support this position strongly. This view has recently been realized by Bill Thurston, Director of MSRI, who signed a contract with CUP (Cambridge University Press) for publishing the MSRI Proceedings, after lengthy negotiations with some of the leading Math publishers. The contract seems to protect the rights of the authors for republishing, etc.

2. Two kinds of electronic journals were mentioned by some of the panel members; those published by commercial publishers or professional societies such as the AMS, and those published by scientist-volunteers. As to the former, it would be useful to hear their projected cost; in fact, I was surprised that no panel member addressed this question so far. The latter were referred to by John Ewing as “unsustainable”. I think it is too early to grieve over them. Some of them, such as the EJC (Electronic J. of Combinatorics) are highly successful, having now over 1,000 subscribers. The “battle” between the commercial publishers and the volunteers is yet to be decided.

Second set of comments

1. John Ewing said that he is afraid some of the volunteer-electronic journals might fold, and Arnoud de Kemp from Springer said that a journal published both electronically and on paper, as many of the Springer journals are now produced, costs 25% more than the paper version only. It might thus be
of interest to note that there exist today electronic journals, produced by volunteers, such as ElJC, which are completely charge-free to the end-user, strictly refereed and archived. I believe that ElJC, whose Editor-in-Chief is Herb Wilf, and of which I am one of the editors, is archived by the AMS. So even if it folds, the archives are there.

2. It was mentioned that at AMS, 50% of \TeX-submitted papers need extensive editing; and that at Springer:
   (i) much money is spent in unifying/standardizing the electronic articles,
   (ii) a paper accepted for electronic publication still has to wait for publication until the entire issue is formatted. Again it is of interest to contrast this to what happens at volunteer-electronic journals. At ElJC, a paper can be submitted in any flavor of \TeX or as a PostScript file. After acceptance, no further unifying/standardizing is performed. The paper is published the next day, in the current volume, as there are no issues, which seem to belong to the pre-electronic era. The same day also all the subscribers are informed automatically of the new paper.

3. Bernd Wegner mentioned that most papers in EMIS appear in .PS or .DVI form. It seems to me worthwhile to encourage submission of the .TEX version as well, even if it cannot be \TeX-ed by the end-user, as it lets one make searches in a simple way.

4. The extra value added by the electronic media is exciting and promising. This includes
   (i) refereed addenda that are added to the papers (errors, further developments, etc), which transform the paper from a static to a dynamic entity.
   (ii) Having the references, or a subset thereof “clickable” (hypertext).
   (iii) Dynamic Surveys of entire subfields. Such surveys used to be static and published only at long time intervals. They can now be updated periodically, at relatively frequent intervals. All of these things have been implemented at ElJC, which currently features four dynamic surveys.