Electronic Journal Formats

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Abstract

This paper reviews the main document formats currently being used in electronic journals and provides a pointer to the formats likely to be prominent in the near future.

Keywords

Electronic journals, SGML, HTML, PostScript, PDF, LaTeX, bitmaps, multimedia

1 Introduction

On the heels of the rapid growth of the World-Wide Web have come advances in multimedia document formats and the hardware and software to support them. As a result of this combination of factors, the electronic journal is, at last, economically and aesthetically viable.

This paper begins with a working definition of electronic journals and an explanation of the two main forms of dissemination at present, namely the CD-ROM and the Internet. It then goes on to discuss the major document formats currently being used in electronic journals: ASCII, bitmaps, LaTeX, PostScript, PDF, SGML and HTML. This is followed by a description of some of the formats used in multimedia and an introduction to the latest multimedia advances that may influence the electronic journals of tomorrow. A complete list of the journals and journal projects mentioned in the paper, together with the document formats they employ, are listed in Appendix 1. Appendix 2 compares the features of a typical viewer for each format.

2 What are electronic journals ?

The journal has been defined as

> "any collection of learned articles which has been accepted via the peer review process for publication as part of a series" [1].

An electronic journal could then be defined as a journal in which the end product is available electronically. However, this discounts many of the products currently describing themselves as electronic journals, not least because the majority do not employ the peer review process.

The definition would also be criticised by those who would argue that the electronic journal is essentially a network-based publication. The ELVYN project [2] investigated how publishers and libraries could work together to provide an electronic version of a printed journal. The definition of an electronic journal as given by respondees in this project could be summarised as

> "A searchable printed journal delivered to my desk through the network" [3].

For these sample users, a journal available via storage devices such as the CD-ROM would not constitute an *electronic* journal. In the same vein, Hans Roes comments, "The notion *electronic journal* suggests something new, something synergetic, something which has sprung from the net itself." [4]

How far it is appropriate to extrapolate from the definition of the conventional journal in an attempt to define an electronic alternative is a matter for debate. According to Judy Mayers *et al*, [5][1],

"The term "electronic journal" does as little to describe [the] future as the term "horseless carriage" did to capture the promise of the automobile."

In this article, the following broad definition of the electronic journal will be assumed: a journal in which the end product is made available electronically and whose constituent articles may or may not be peer reviewed.

3 Dissemination

At this stage of electronic journal development, the two main vehicles of dissemination are the CD-ROM and the Internet.

3.1 CD-ROM

One of the first experiments involving the provision of journal articles via CD-ROM was the ADONIS project [6]. The CD-ROM's large and expanding storage capacity and its relative inexpense contribute to its growing popularity. A major advantage from the point of view of publishers, booksellers and librarians is that it can be handled in a similar way to books and journals. As Steve Cunningham comments, the CD-ROM can carry an ISBN and "has the weight of an artifact", so discouraging copyright violations [7].

Despite these advantages, or perhaps because of them, the CD-ROM is regarded by some as a "transient technology" which is "inherently limited" in comparison to network delivery of information [8]. CD-ROM apologists counter with current practicalities: transmission over parts of the Internet can be as low as 10 kilobytes per second. At that rate, it could take sixteen hours to download the contents of a CD-ROM [7].

Because of this large storage capacity, the CD-ROM is sometimes used in an archival capacity. The weekly journal*Applied Physics Letters Online* [9], for example, is distributed via the Internet by the OCLC Electronic Journals Online service. OCLC also provides an annual compilation of articles for institutions who wish to "recycle printed issues" at the end of each year. Despite Hitchcock *et al*'s comment that "the market for CD-ROM collections of "old" papers is unproven" [10], several commercial publishers have plans for such collections, for example, the *World Wide Web Journal of Biology* [11] will be archived quarterly and the *Journal of Quantitative Trait Loci* [12] will be archived annually to CD-ROM.

3.2 The Internet

With the announcement that Microsoft Network, or MSN, is to be merged with the Internet [13], the commercial future of the latter becomes even more secure and its suitability as a vehicle for journal publishing will increase in the eyes of publishers. However, the future feasibility of network dissemination still relies on advances in network capacity and speed at both a national and an international level.

Pullinger [14] proposes three possible models for network publishing. In the first, material is received by, or pulled down to, the end user's machine. The periodical *EJournal* [15], for example, is emailed to subscribers and back copies of *Architronic, The Electronic Journal of Architecture*, may be accessed via the gopher information-retrieval protocol [16].

[1] Referenced in [4].

The second model uses a CWIS (Campus wide information System) into which material is deposited. This is the model employed by the TULIP [17] and ELVYN [2] projects. Here, high speed networks are less crucial and the onus is on the availability of local resources.

It is Pullinger's third model that makes most demands of the network. It comprises a central host which holds the electronic journal and which users must access via the open network and browse remotely. The Red Sage [18] and SuperJournal 1 [3] projects have followed this model. The Red Sage project provides academic pilot sites in the USA with online access to a collection of biomedical and high impact clinical journals such as the *New England Journal of Medicine*. SuperJournal 1 was a UK-based pre-competitive collaboration of a group of publishers to demonstrate access to journal articles in various formats over SuperJANET.

The Internet comprises islands of good connectivity, interconnected by inadequate links. One emerging solution to this varying level of service is, in effect, to merge Pullinger's second and third models by placing mirror sites within each island. This is the model adopted by the IDEAL system [19] described in Section 4.6 and is the likely long term model for the SuperJournal 2 project [20]. Other combinations of the three models are increasingly common. For example, many journals that use email delivery are now making their archives available via a Web site [21].

According to Pullinger, remote browsing of journal contents necessitates a minimum end-to-end network speed of 34 Mbps. The TEN-34 [22, 23] project is an attempt to provide a 34-155 Mbs backbone to European research and university networks. If TEN-34 is successful, Pullinger's third publishing model will become feasible for European-wide journal dissemination. However, remote browsing of journals is economically viable in some countries and less so in others. In France for example, "network access is still too expensive for reading online" [24].

The future organisation of the Internet is unclear but it appears that its anarchy may, for better or worse, be curtailed. Potential and actual changes in telecommunication and network charging mechanisms may affect the future of electronic journals. At a UK level, for example, higher education institutions requiring JANET connectivity of over 4Mbps are now required to pay a direct charge in addition to the current top-sliced fee [25]. Several institutions have already decided not choose the higher speed option. The development of secure charging mechanisms for content delivery [26] may also affect the viability of electronic journals.

3.3 The Future of Dissemination

CD-ROMs and the Internet dominate the electronic journals scene at present. However, as the managing editor of the electronic news magazine, *Newsweek Interactive*, comments,

> "Anyone who wants to be a serious player in new media this century will have to adapt to shifting technology and shifting delivery systems." [27]

If the information deliverers have to adapt to these continual changes, so will the information receivers.

4 Electronic Journal Formats

Paper-based journals offer several advantages over current electronic journals; their conventions are familiar, they make good use of human reading skills, they are easily portable, easily annotated and they can be read in the bath. Thus, if electronic journals are to be accepted by users, they will need to add value to the journal concept beyond that currently offered by the paper-based journal. This means that features already present in paper-based journals, such as colour and high quality graphics, for example, are vital, and that added-value features available only in electronic journals may be highly desirable. The latter would include searching facilities, multimedia, interactive presentations, simulations and direct access to data and references. It would also involve potentially earlier access to articles accepted for publication.

Sections 4.1 to 4.6 describe the main formats currently being used in electronic journals. They are

- ASCII and bitmaps
- TEX and LATEX
- PostScript
- PDF
- SGML
- HTML

Some of the formats used to support multimedia features such as figures, sound, movie clips and interactivity are described in Section 5. A chronological summary of the journals and journal projects mentioned in this paper, along with the formats they employ may be found in Appendix 1. The latter highlights both the accelerating pace of the introduction of electronic journals and the recent increase in the use of PDF, HTML and multimedia. A table comparing the features of a common viewer for each of the formats listed in Appendix 1 is presented in Appendix 2.

4.1 ASCII and Bitmaps

Until recently, most electronic journals and articles had to be restricted to the lowest common denominator formats of ASCII or bitmapped page images. Vehicles for more sophisticated formats were not widely available to users.

ASCII, or American Standard Code for Information Interchange, has the capacity to represent just 128 unique symbols; it covers the English letters and numbers and some of the more common keyboard characters. This restricted character set, leads to the inadequate representation of, for example, chemical and mathematical formulae and languages other than English.

Bitmaps are graphical images stored, not as individual characters, as in ASCII, but as patterns of individual pixels. The limitations of bitmaps include large storage size and poor visual quality. The latter is due to the loss of detail during the transformation of complex images into bitmaps. In the ADONIS project, for example, the quality of bitmapped images was found acceptable for text, tables and line graphs but not for half tone photographs [6]. Despite these disadvantages, both ASCII and bitmaps remain popular formats for widely distributed material.

ASCII is often used for list-server-based journals and articles, in which documents are delivered to subscribers via email. As mentioned in Section 3.2, the peer-reviewed periodical *EJournal* [15], is delivered in this way. Figure 1 illustrates the format of *EJournal*.

Other publications employ a combination of ASCII and bitmaps, the ASCII enabling full text searching and the bitmap images allowing articles to be viewed in the same visual format as in the paper version. An example of this approach is Elsevier's TULIP project [17, 28] which made available over eighty journals in the field of Materials Science including the journals *European Polymer Journal* and *Progress in Materials Science*. The articles were provided in scanned bit-mapped form, along with accompanying ASCII text files. Figure 2 illustrates a sample bit-mapped page presented via the TULIP Journal Browser [28]. The successor program, EES (Elsevier Electronic Subscriptions) [29], announced in February 1995 aims to offer libraries electronic subscription to all Elsevier Science titles. EES too will provide bitmapped images and ASCII.

An alternative approach to the problem of searching is evinced by UMI's Business Periodicals Ondisc (BPO) system [30]. A CD-ROM-based database provides scanned images of journal articles from a collection of up to a thousand business and management journals. Searching is enabled on the contents of a disc holding the ABI/Inform index database. This latter database allows free-text searching of bibliographic details and abstracts, as well as searching of a range of indexed terms.

Even where more sophisticated formats are employed, bitmaps may still have a role in the short-term future. The Elvyn project, for example, used HyperText Markup Language, or HTML, which is described in Section 4.6. HTML was found inadequate for the representation of complex mathematical equations; small bitmaps were therefore inserted in the documents [2].

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June, 1995        _EJournal_  Volume 5  Number 1        ISSN 1054-1055
                  There are 877 lines in this issue.

                 An Electronic Journal concerned with the
              implications of electronic networks and texts.
                    2928 Subscribers in 37 Countries

            University at Albany, State University of New York

                          EJournal@albany.edu

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Information about _EJournal_ -                     [Begins at line 786]

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    About Supplements to Previous Texts
    About _EJournal_
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Figure 1: Title "page" of *EJournal*

TULIP Journals Browser:

International Journal of Plastic, Vol: 10 Issue: 3

Exact results and approximate models for porous viscoplastic solids

View page:

Next First Last

Pergamon

International Journal of Plasticity, Vol. 10, No. 3, pp. 213–235, 1994
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EXACT RESULTS AND APPROXIMATE MODELS
FOR POROUS VISCOPLASTIC SOLIDS

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†Laboratoire de Mécanique des Solides, Ecole Polytechnique, and
‡Laboratoire de Mécanique et d'Acoustique, CNRS

Abstract—The aim of this paper is to present new approximate macroscopic models for porous viscoplastic materials, based on partial but exact results applicable to such media. Available results are first supplemented by providing a new inequality (which, in addition to its intrinsic interest, allows one to rederive in a simpler way some previous bounds of Ponte-Castaneda and Talbot and Willis), and by exhibiting the exact form of the overall potential of a typical porous viscoplastic volume element, namely a hollow cylinder loaded in generalized plane strain. Approximate expressions for the macroscopic viscoplastic potentials of materials containing cavities of cylindrical or spherical shape are then proposed, based on these and other results; these expressions satisfy, in particular, the three following natural requirements: (i) reproduce the exact solution of a hollow cylinder or sphere loaded in hydrostatic tension or compression; (ii) be a quadratic form of the overall stress tensor in the extreme case of a Newtonian (linear) behavior; and (iii) yield the currently accepted Gurson criterion in the other extreme case of an ideal-plastic behavior.

I. INTRODUCTION

Pioneering works on the ductile rupture of metals, both in the case of a plastic behavior (MCCLINTOCK [1968]; RICE & TRACEY [1969]) and in that of a viscoplastic one (BUDIANSKY *et al.* [1982]), put emphasis on the rate of growth of the voids, and especially on its dependence upon the stress triaxiality. It was later recognized (GURSON [1977], in the plastic case, DUVA and HUTCHINSON [1984], in the viscoplastic case) that this rate could be deduced from the overall yield criterion or viscoplastic potential of the voided material; this possibility is interesting in that it reveals easier to derive rigorous bounds or approximations for the latter than for the cavity growth rate itself, because of their remarkable variational properties.

Figure 2: Bit-mapped page presented via the TULIP Journal Browser

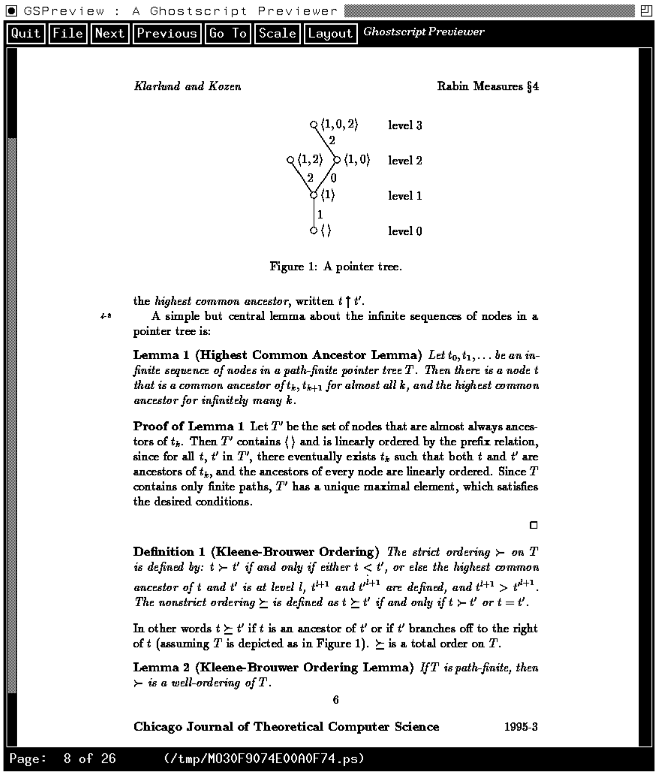
4.2 LaTeX

LaTeX [31] and PostScript [32] are the formats of choice for many electronic journals in the science disciplines. Their use enables the high quality output necessary for the presentation of, for example, mathematical equations.

The peer-reviewed *Chicago Journal of Theoretical Computer Science* (CJTCS) [33], for instance, is available via the Internet in both LaTeX and PostScript form. The "definitive version" of each article is a LaTeX source file, compatible with LaTeX2e, as well as the older version of LaTeX. Diagrams and figures that cannot be conveniently represented in LaTeX are made available in encapsulated PostScript (EPS) form.

LaTeX source files comprise marked-up text. The mark-up is primarily logical, in that, for the most part, it describes the logical structure of a document rather than the visual appearance. Some publishers, for example Springer-Verlag [34] make LaTeX and TeX style files available to their authors and editors to facilitate preparation of journal papers which conform to the style of a particular journal.

The use of LaTeX is generally confined to the scientific community, particularly mathematicians and computer scientists. Authors in these communities are most likely to be computer literate and to use LaTeX. However, even here, the use of LaTeX is not without its problems. There will always be the authors who ignore the required journal style file, invent their own and then omit even to send them to the editor with their submitted articles. In such cases, far from saving the editors time, electronic article submission may add to the editorial workload. The problem is not confined to this format but it can be particularly acute with the use of LaTeX due to the potential sophistication of the documents being produced. The editors of CJTCS aim for maximum portability of the LaTeX source files by using a "disciplined subset of LaTeX". This often involves significant copy editing of the files submitted by the authors to remove "clever" but non-standard markup.



Klarlund and Kozen **Rabin Measures §4**

$\langle 1,0,2\rangle$ level 3
$\langle 1,2\rangle$ $\langle 1,0\rangle$ level 2
$\langle 1\rangle$ level 1
$\langle\rangle$ level 0

Figure 1: A pointer tree.

the *highest common ancestor*, written $t \uparrow t'$.

A simple but central lemma about the infinite sequences of nodes in a pointer tree is:

Lemma 1 (Highest Common Ancestor Lemma) *Let $t_0, t_1, \ldots$ be an infinite sequence of nodes in a path-finite pointer tree T. Then there is a node t that is a common ancestor of t_k, t_{k+1} for almost all k, and the highest common ancestor for infinitely many k.*

Proof of Lemma 1 Let T' be the set of nodes that are almost always ancestors of t_k. Then T' contains $\langle\rangle$ and is linearly ordered by the prefix relation, since for all t, t' in T', there eventually exists t_k such that both t and t' are ancestors of t_k, and the ancestors of every node are linearly ordered. Since T contains only finite paths, T' has a unique maximal element, which satisfies the desired conditions.

□

Definition 1 (Kleene-Brouwer Ordering) *The strict ordering $\succ$ on T is defined by: $t \succ t'$ if and only if either $t < t'$, or else the highest common ancestor of t and t' is at level l, t^{l+1} and t'^{l+1} are defined, and $t^{l+1} > t'^{l+1}$. The nonstrict ordering $\succeq$ is defined as $t \succeq t'$ if and only if $t \succ t'$ or $t = t'$.*

In other words $t \succeq t'$ if t is an ancestor of t' or if t' branches off to the right of t (assuming T is depicted as in Figure 1). $\succeq$ is a total order on T.

Lemma 2 (Kleene-Brouwer Ordering Lemma) *If T is path-finite, then $\succ$ is a well-ordering of T.*

6

Chicago Journal of Theoretical Computer Science 1995-3

Figure 3: Postscript version of CJTCS article viewed using a Ghostscript Previewer

CJTCS uses LaTeX in preference to SGML[2] because of LaTeX's superior facilities for the representation of mathematical formulae and because of the wide-spread availability of the appropriate software for typesetting and displaying in this author and reader community.

For display or printing, LaTeX files must be converted into an appropriate format, usually PostScript. This is a two-stage process. First, the file is passed through a LaTeX formatter to produce a DeVice Independent (DVI) form. It is then converted to PostScript. Software to perform these conversion processes is widely available in the science and engineering community, as are programs for previewing the DVI and PostScript documents. Figure 3 illustrates the use of GSPreview, a Ghostscript previewer for PostScript.

LaTeX is built on top of TeX, a lower level markup language which describes the visual appearance of documents rather than the logical structure. Authors are increasingly using LaTeX in preference to TeX and, similarly, electronic journals are increasingly providing articles in LaTeX rather than in TeX.

4.3 PostScript

Whereas LaTeX provides a logical representation of a document, the PostScript page description language describes the visual appearance of the final page in a device and resolution-independent manner. Whatever formats are chosen for delivery and browsing of electronic journals, the majority of end users will continue to require the option of a paper copy. The majority of laser printers accept PostScript files for printing. Hence, it is a popular format in which to make electronic journal articles available. As well as being coupled with LaTeX, as mentioned in Section 4.2, PostScript is also often coupled with HTML. For example, Project MUSE, described in Section 4.6, uses PostScript and HTML.

[2] SGML, or Standard Generalised Markup Language [35], is described in Section 4.5.

An advantage of PostScript for publishers is that the document files are not easily altered by the end user; hence publishers can be assured of retaining the look and feel of their journal articles and protecting copyright. This advantage is also obtained using the PDF format described in Section 4.4.

A disadvantage of PostScript, and also of other formats such as PDF, is that the files are usually large and hence transmission is potentially slow. A further problem arises if the reader's machine does not have a font which is used in a document. In the case of specialist journals which may use unusual fonts, default fonts may not be an adequate substitute and the original font may be too expensive to licence to readers. One of the main advantages for publishers of the PDF format described in the next section is that it enables the necessary fonts to be embedded in the document files.

4.4 PDF

An increasingly popular format for electronic journal presentation is Adobe's PDF, or Portable Document Format [36]. It is used as the underlying representation for the Acrobat suite of software.

PDF, first announced in late 1992, may be regarded as a version of the PostScript page description language with additional hypertext features for online presentation and browsing of documents. These features include

- hypertext links within and between documents
- annotations and bookmarks
- thumbnail sketches of pages
- fonts embedded in documents
- indexing and searching facilities

Online presentation and browsing of PDF documents is via the Acrobat Exchange or Reader software. Exchange allows links, annotations, and bookmarks to be created and used. The Reader is a limited version of the Exchange software, enabling use, but not creation, of hypertext features. The Reader software is available free of charge from the Adobe World-Wide Web site [37].

The Acrobat suite provides facilities for the creation of PDF files. In addition, an increasing number of desk-top publishing packages, for example Adobe PageMaker 6.0, include facilities to convert their proprietary formats to PDF.

PDF is becoming an increasingly popular choice with publishers for provision of electronic journal articles because, as with PostScript, it is possible to retain the distinctive format of the journal in question. An additional reason for enthusiasm is that certain fonts may be legally embedded in PDF files, thus tackling the problem of local unavailability of fonts.

Apart from any superimposed hypertext features, the screen layout of PDF journal articles may be identical to the PostScript, and hence to the hard copy version. In its initial stages, the CAJUN project reproduced the entire journal format of *EP-odd (Electronic Publishing – Origination, Dissemination and Design)* in PDF [38]. Components such as editorial information, indexes and articles were in the same relative position and in the same format as they appear in hard-copy. Since the initial phase of CAJUN, the World-Wide Web has grown in popularity and there has been increasing integration of Acrobat with Web browsers such as Netscape Navigator 2.0. Acrobat's functionality has also increased to include inter-document links and extended support for multimedia components. As a result of these developments, the more common organisation for PDF-based journals now appears to be individual PDF articles linked by an HTML-based journal structure. An example is the IDEAL system described in Section 4.6.

Adobe Acrobat is just one of a number of "page description" systems currently available. Other examples are Farallon's Replica, WordPerfect's Envoy and Common Ground from No Hands Software. The latter is among the tools which may be evaluated in SuperJournal 2 [39]. However, Adobe PDF appears already to have consolidated its position in the electronic journal field.

4.5 SGML

SGML, or Standard Generalised Markup Language, is a system-independent language for describing the logical structure and meaning of documents [35]. It does not describe the visual appearance of documents and so requires an application to convert it to a suitable viewable format. This may be achieved using an SGML viewer such as Softquad's Panorama [40]. Alternatively, SGML is often converted to HTML, a limited application of the former. Because HTML is the markup language used by World-Wide Web browsers, it is widely available.

An SGML DTD, or Document Type Definition, defines the rules for marking up a class of document. Each document *instance*, that is, an SGML-marked-up document, must contain, or refer to, the relevant DTD. Various DTDs have been developed to define the structure of journal components. The MAJOUR (Modular Application for JOURnals) Header DTD [41], for example, was designed by the European Workgroup for SGML (EWS) primarily as an exchange format for header information of scientific articles. The ISO[3] 12083 Article DTD [42] defines the structure of journal articles. The definition of HTML, described in Section 4.6, may also be regarded as an SGML DTD although, as commented in Section 4.6, it incorporates various non-standard features.

There were some initial hopes that the majority of publishers would use standard DTDs such as MAJOUR and ISO 12083. However, it has become clear that the structure of journal articles is more diverse than originally assumed. As a result, many proprietary DTDs have also been developed by individual publishers, although most draw on the features of standard DTDs such as the two described above. In addition, some journal topics have been found too specialised to be adequately covered by DTDs developed in SGML. In the field of chemistry, for example, there are moves to promote an alternative markup language called Chemistry Markup Language (CML). This is derived from SGML and has been described as "HTML with Molecules" [43].

Since being approved as an ISO standard in 1986, SGML is increasingly being used in various forms of large scale documentation and being supported by growing numbers of desk-top publishing and word-processing products. It is probable that SGML, along with PDF, will be used increasingly by publishers as a format for processing and archiving journal information.

4.5.1 Applications of SGML in Electronic Journal Projects

The eLib-funded SuperJournal 2 project [39] suggests SGML as one among several possible formats for investigation. Similarly, the eLib CLIC Consortium Electronic Journal Project [44] refers to it as one of several possible formats which might be chosen for displaying graphically illustrated contents pages for the journal *Chemical Communications*.

Several major electronic journal projects already employ SGML. Among these, the OCLC Electronic Journals Online (EJO) service provides online access to articles from thirty-six journals [45]. These include

- Electronic-only journals such as *The Online Journal of Current Clinical Trials*,
- Dual paper-electronic publications, for example *IEE Electronic Letters* and
- "Mega-journals" such as *Current Opinions in Biology*, in which six biological review journals are made available in a single package.

Initially, all journals were available only in SGML format for viewing via OCLC's graphical user interface, Guidon [46], illustrated in Figure 4. This interface was designed specifically for electronic journals. It runs in a Microsoft Windows environment on a 386 or higher PC and, since August 1995, on a Macintosh platform. Facilities include

- Hypertext links to figures, tables, equations
- Browsing by issue/date/time period
- Full-text searching using boolean capabilities, wild-card, adjacency and proximity indicators

[3] International Organisation for Standardisation

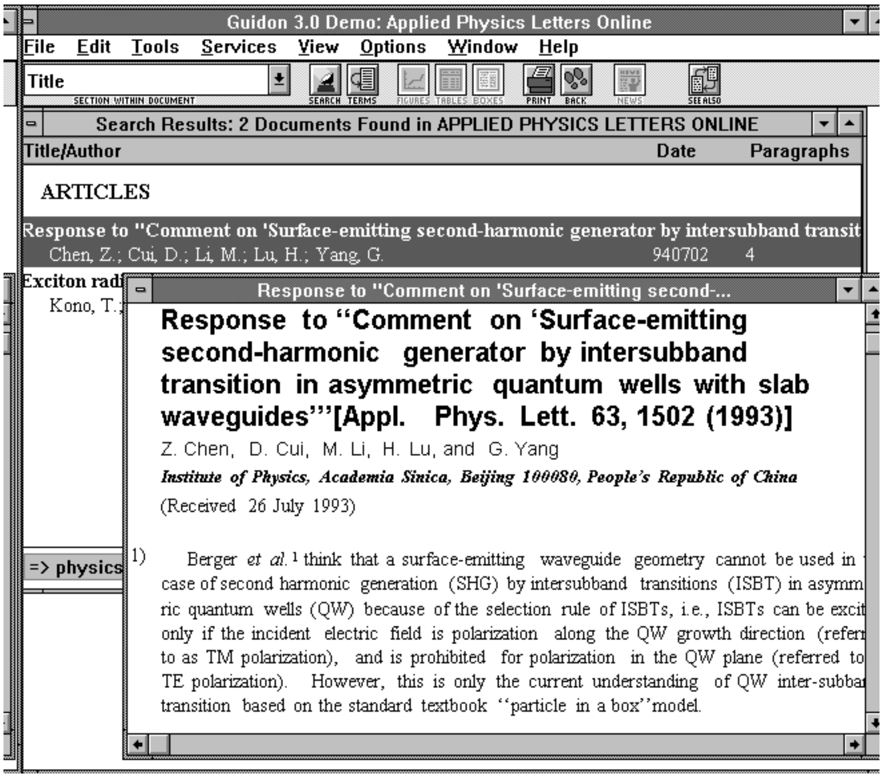


Figure 4: The Guidon interface

- Automatic notification of new articles in fields of interest via e-mail or fax.

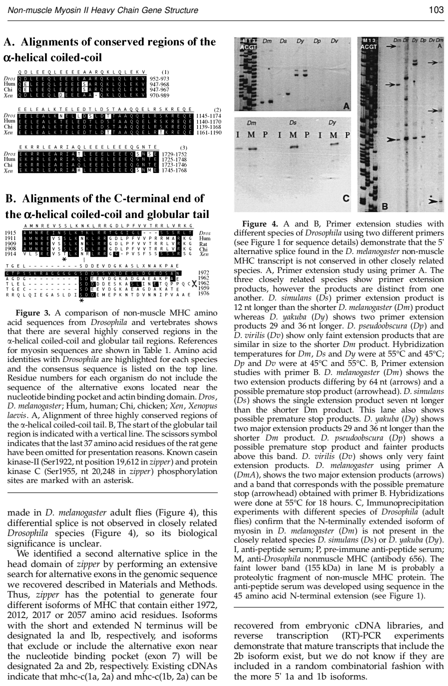
OCLC has extended its EJO service to make journals available in HTML. This widens accessibility to subscribers from more computer platforms but brings with it the disadvantages of an HTML-based system, as described in the next section.

4.6 HTML

With the widening availability of World-Wide Web browsers such as Netscape and Mosaic, electronic journals incorporating components based on HTML, or HyperText Markup Language [47], are proliferating. Several electronic journal projects have recently been announced which involve PDF articles linked by an HTML-based journal structure. An example is Academic Press's IDEAL project (International Digital Electronic Access Library), as mentioned in Section 4.4. This was launched in January 1996 [19]. The tables of contents and article abstracts of 184 journals will be made available in HTML to users with access to standard Web browsers, such as Netscape Navigator. In addition, authorised users may view, download and print journal articles in PDF. Figure 5 illustrates a PDF article viewed using the Acrobat Reader. Figure 6 shows an HTML table of contents. Clicking on the first article title results in the display of the abstract shown in Figure 7.

In a similar vein to the IDEAL system, the Institute of Physics Publishing intend to publish all their journals on the World-Wide Web during 1996 [48]. Again, journal articles will be made available in PDF, as well as PostScript. TEXwill be provided for appropriate journals.

The Infobike project [49] will make journal articles available in PDF via local or remote document servers. The system is designed to allow also for the delivery of full multimedia such as video, sound or even software and datasets. Trials at Staffordshire, Keele, Kent and the CALIM consortium of university libraries will begin in September 1996.



A. Alignments of conserved regions of the α-helical coiled-coil

B. Alignments of the C-terminal end of the α-helical coiled-coil and globular tail

Figure 3. A comparison of non-muscle MHC amino acid sequences from *Drosophila* and vertebrates shows that there are several highly conserved regions in the α-helical coiled-coil and globular tail regions. References for myosin sequences are shown in Table 1. Amino acid identities with *Drosophila* are highlighted for each species and the consensus sequence is listed on the top line. Residue numbers for each organism do not include the sequence of the alternative exons located near the nucleotide binding pocket and actin binding domain. *Dros*, *D. melanogaster*; Hum, human; Chi, chicken; *Xen*, *Xenopus laevis*. A, Alignment of three highly conserved regions of the α-helical coiled-coil tail. B, The start of the globular tail region is indicated with a vertical line. The scissors symbol indicates that the last 37 amino acid residues of the rat gene have been omitted for presentation reasons. Known casein kinase-II (Ser1922, nt position 19,612 in *zipper*) and protein kinase C (Ser1955, nt 20,248 in *zipper*) phosphorylation sites are marked with an asterisk.

made in *D. melanogaster* adult flies (Figure 4), this differential splice is not observed in closely related *Drosophila* species (Figure 4), so its biological significance is unclear.

We identified a second alternative splice in the head domain of *zipper* by performing an extensive search for alternative exons in the genomic sequence we recovered described in Materials and Methods. Thus, *zipper* has the potential to generate four different isoforms of MHC that contain either 1972, 2012, 2017 or 2057 amino acid residues. Isoforms with the short and extended N terminus will be designated la and lb, respectively, and isoforms that exclude or include the alternative exon near the nucleotide binding pocket (exon 7) will be designated 2a and 2b, respectively. Existing cDNAs indicate that mhc-c(1a, 2a) and mhc-c(1b, 2a) can be

Figure 4. A and B, Primer extension studies with different species of *Drosophila* using two different primers (see Figure 1 for sequence details) demonstrate that the 5' alternative splice found in the *D. melanogaster* non-muscle MHC transcript is not conserved in other closely related species. A, Primer extension study using primer A. The three closely related species show primer extension products, however the products are distinct from one another. *D. simulans* (*Ds*) primer extension product is 12 nt longer than the shorter *D. melanogaster* (*Dm*) product whereas *D. yakuba* (*Dy*) shows two primer extension products 29 and 36 nt longer. *D. pseudoobscura* (*Dp*) and *D. virilis* (*Dv*) show only faint extension products that are similar in size to the shorter *Dm* product. Hybridization temperatures for *Dm*, *Ds* and *Dy* were at 55°C and 45°C; *Dp* and *Dv* were at 45°C and 55°C. B, Primer extension studies with primer B. *D. melanogaster* (*Dm*) shows the two extension products differing by 64 nt (arrows) and a possible premature stop product (arrowhead). *D. simulans* (*Ds*) shows the single extension product seven nt longer than the shorter Dm product. This lane also shows possible premature stop products. *D. yakuba* (*Dy*) shows two major extension products 29 and 36 nt longer than the shorter *Dm* product. *D. pseudoobscura* (*Dp*) shows a possible premature stop product and fainter products above this band. *D. virilis* (*Dv*) shows only very faint extension products. *D. melanogaster* using primer A (*DmA*), shows the two major extension products (arrows) and a band that corresponds with the possible premature stop (arrowhead) obtained with primer B. Hybridizations were done at 55°C for 18 hours. C, Immunoprecipitation experiments with different species of *Drosophila* (adult flies) confirm that the N-terminally extended isoform of myosin in *D. melanogaster* (*Dm*) is not present in the closely related species *D. simulans* (*Ds*) or *D. yakuba* (*Dy*). I, anti-peptide serum; P, pre-immune anti-peptide serum; M, anti-*Drosophila* nonmuscle MHC (antibody 656). The faint lower band (155 kDa) in lane M is probably a proteolytic fragment of non-muscle MHC protein. The anti-peptide serum was developed using sequence in the 45 amino acid N-terminal extension (see Figure 1).

recovered from embryonic cDNA libraries, and reverse transcription (RT)-PCR experiments demonstrate that mature transcripts that include the 2b isoform exist, but we do not know if they are included in a random combinatorial fashion with the more 5' 1a and 1b isoforms.

Figure 5: An article page from the *Journal of Molecular Biology* viewed using Acrobat Reader

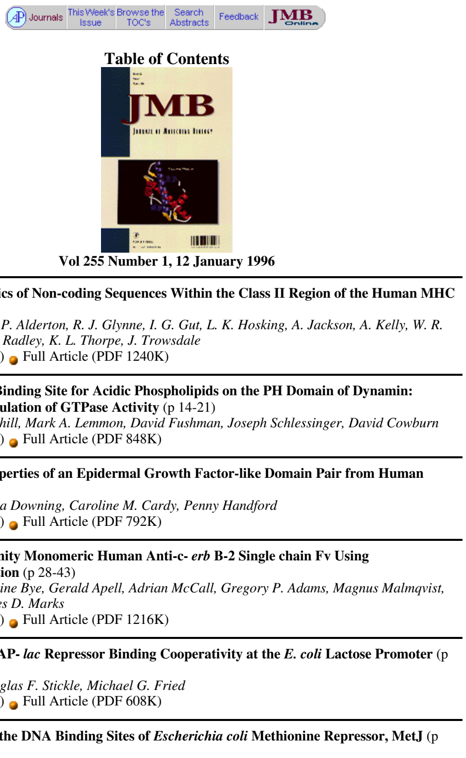


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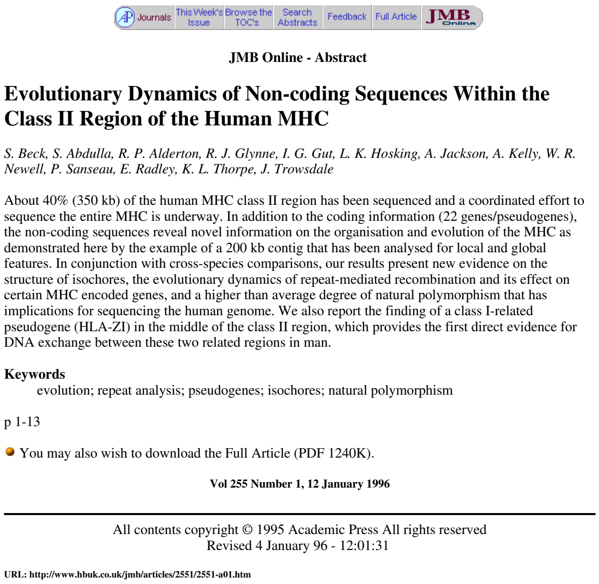
Figure 6: HTML-based table of contents from the IDEAL system



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JMB Online - Abstract

Evolutionary Dynamics of Non-coding Sequences Within the Class II Region of the Human MHC

S. Beck, S. Abdulla, R. P. Alderton, R. J. Glynne, I. G. Gut, L. K. Hosking, A. Jackson, A. Kelly, W. R. Newell, P. Sanseau, E. Radley, K. L. Thorpe, J. Trowsdale

About 40% (350 kb) of the human MHC class II region has been sequenced and a coordinated effort to sequence the entire MHC is underway. In addition to the coding information (22 genes/pseudogenes), the non-coding sequences reveal novel information on the organisation and evolution of the MHC as demonstrated here by the example of a 200 kb contig that has been analysed for local and global features. In conjunction with cross-species comparisons, our results present new evidence on the structure of isochores, the evolutionary dynamics of repeat-mediated recombination and its effect on certain MHC encoded genes, and a higher than average degree of natural polymorphism that has implications for sequencing the human genome. We also report the finding of a class I-related pseudogene (HLA-ZI) in the middle of the class II region, which provides the first direct evidence for DNA exchange between these two related regions in man.

Keywords
evolution; repeat analysis; pseudogenes; isochores; natural polymorphism

p 1-13

- You may also wish to download the Full Article (PDF 1240K).

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Revised 4 January 96 - 12:01:31

URL: http://www.hbuk.co.uk/jmb/articles/2551/2551-a01.htm

Figure 7: HTML-based article abstract from the IDEAL system

As mentioned in Section 4.5, HTML is a simple application of the SGML standard. Figure 8 illustrates a section of HTML markup for the table of contents from the IDEAL system shown in Figure 6. HTML documents may include hypertext links to other documents. "Documents" accessed via WWW browsers may be almost any form of information, from a stand-alone text-file to the result of a database query. Thus, documents don't have to exist as files; they can be "virtual", generated by a server in response to a query or document name [50]. The target of a hypertext link, that is, the document that is displayed when the link is selected, is identified by giving its Universal Resource Locator or URL [51] within the HTML file. In Figure 8, the inclusion of the following line results in the display of the words "Abstract (HTML)" on the screen:

```
<a href="/jmb/articles/2551/2551-a01.htm">Abstract (HTML)</a>
```

When this word is selected by a mouse-click, the file described by the pathname "/jmb/articles/2551/2551-a01.htm" is accessed. This pathname indicates the location of the abstract; hence the abstract is displayed. In this example, the URL is a simple local file name, but URLs may also specify the location of remote documents and the protocol to be used to access them.

Another example of the use of HTML is Project MUSE which enables World-Wide Web access to scholarly journals published by the John Hopkins University Press [52]. Through the use of HTML, MUSE aims to provide journal access with facilities that cannot be provided in print. In addition to access via a variety of indexes, MUSE offers the potential of hypertext searches and links to notes, illustrations and voice and textual annotations. Users can exploit the Web browser's facilities to download text for printing and build up 'hot lists' of frequently accessed documents.

Web browsers have a built-in capability to interpret some file formats. For example, the Netscape browser can read GIF, JPEG, and XBM graphic file formats[4] as well as HTML. In order

[4]XBM is a bitmap format available for X Windows (a Unix environment). GIF and JPEG are discussed in

```
<center>
<STRONG><FONT SIZE=+1>Table of Contents</FONT></STRONG><BR>
<IMG align=middle src="2551.gif"><BR>
<strong>Vol 255 Number 1, 12 January 1996</strong><br>
<HR>
</center>

<b>Evolutionary Dynamics of Non-coding Sequences Within the Class II
Region of the Human MHC</b>
(p 1-13)

<br>

<i> S. Beck, S. Abdulla, R. P. Alderton, R. J. Glynne, I. G. Gut,
L. K. Hosking, A. Jackson, A. Kelly, W. R. Newell, P. Sanseau,
E. Radley, K. L. Thorpe, J. Trowsdale
</i>

<br>

<dd>
  <a href="/jmb/articles/2551/2551-a01.htm">Abstract (HTML)</a>
  <img src="/jmb/icons/orangeba.gif" align=middle>
  <a href="/jmb/articles/2551/2551-a01.pdf">Full Article (PDF 1240K)</a>
</dd>
<BR>
```

Figure 8: HTML markup for part of the table of contents in Figure 6

to read other formats, *helper applications* may be necessary. These software packages perform such tasks as displaying still images, playing sound and video and uncompressing files. Helper applications are often obtainable free of charge or as shareware on the Internet. They are increasingly being embedded in browsers via interfaces such as the Netscape plug-in API (Application Programming Interface). Multimedia formats are described further in Section 5.

The functionality of HTML is slowly advancing but remains fairly basic. The markup is still very primitive, thus allowing only very basic search facilities and requiring some characters and special symbols to be rendered as images, as in the ELVYN project [2]. As the World-Wide Web becomes more commercially-oriented, the needs of esoteric journals may not be top priority for HTML developers, as evinced by the apparent lack of progress in the improvement of support for mathematics, originally to have been implemented in Version 3.0 [53].

Browsers such as Netscape are increasingly introducing non-standard HTML features. With the introduction of its own browser, Internet Explorer [54], there is always the risk that Microsoft will also develop its own brand of HTML. The question as to whether HTML will continue to be a recognisable standard is one reason why some publishers prefer to use PDF. Another reason for this preference is the lack of control over article layout and use of fonts provided by HTML browsers.

5 Supporting Multimedia

The current trends in network publishing, and hence in electronic journals, are towards the provision of multimedia material via enhanced Web browsers, capable of identifying and displaying sophisticated multimedia documents. In the long term, it is likely that multimedia features such as video clips, sound tracks and interactive images and data will become an accepted part of electronic journal articles. Users may be able to run simulation programs, rotate 3D images and apply mathematical formulae to test data. This may be particularly useful in the natural sciences. The CLIC Project, mentioned in Section 4.5, for example, is launching an electronic version of the paper-based journal *Chemical Communications* [44]. The project aims to deliver "semantically full chemical information", including molecular coordinates and spectral information.

5.1 Hardware Implications

The PC is increasing becoming the platform of choice for the latest developments in hardware and software to support access and use of the Web[5]. Very often, the latest developments in document formats are first developed for the PC platform and only then for Macintosh and Unix environments.

For full access to the majority of the current generation of electronic journals, a Windows environment is required, whether this is Microsoft Windows for the PC, X-Windows for Unix or the Apple Macintosh interface. With regard to Microsoft Windows, version 3.1 is currently adequate, although access to Windows 95 or Windows NT will enable access to the very latest electronic journal developments.

To date, very few electronic journals contain multimedia components, although this is likely to change as these journals become better established and authors become used to the new media. The term multimedia PC usually refers to a PC that is equipped with a CD-ROM drive and a sound facility. For most PCs, the latter is enabled via a sound card, although the latest Pentium-based PCs have sound built into the processor.

Most readers will require hard copy output of articles that they are particularly interested in, so access to a high quality printer is essential. Monochrome PostScript-based laser printers are currently the best option; they provide high quality at a reasonable price. As colour laser printers reduce in cost, they may become a feasible alternative.

Section 5.2.

[5] The only exception to this trend, for some specialist multimedia applications, is the continuing predominance of the Silicon Graphics machine [55].

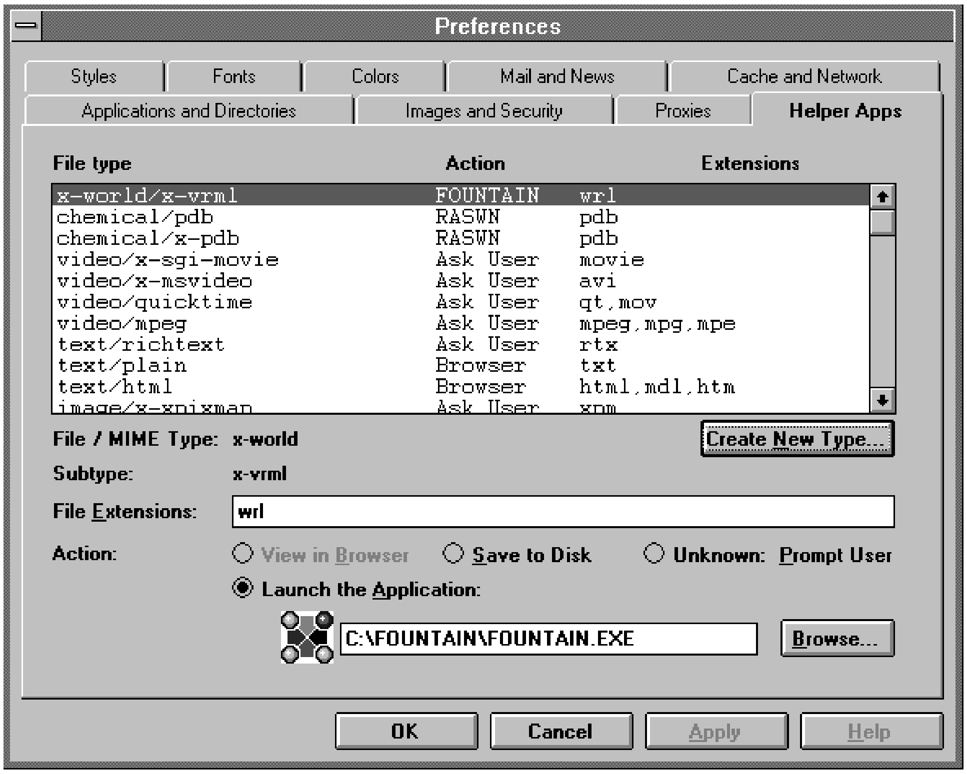

Figure 9: Netscape Dialogue box for listing and editing helper applications

5.2 Still Images

GIF, or Graphics Interchange Format, is the most commonly used, and universally supported, data format for cartoon-like images on the World-Wide Web. When used with Web browsers, GIF images may be *inline*, that is, directly on the Web page in question, or *external*, that is, appearing in a separate window when requested by the user.

JPEG (Joint Photographic Experts Group) is also used, mainly for photographic images [56]. Some more recent browsers, such as Netscape, can display inline JPEG images but others only display JPEGs externally.

There are many other still image formats available including

- TIFF (Tagged Image File Format), used to provide bitmapped page images in the EES project described in Section 4.1 and
- EPS (Encapsulated PostScript) used to represent complex figures in CJTCS, as discussed in Section 4.2.

The list of graphic and other multimedia formats supported by any particular browser may be viewed and added to via the appropriate browser file option, as shown in Figure 9 for the Netscape browser.

Because of the large size of most image formats, many employ compression techniques [57]. Some techniques, such as that employed by the most common versions of JPEG, are described as *lossy* techniques because information is lost during compression and decompression. This may be of little importance if the images are solely for viewing; the losses may not be very significant to the human eye. However, it may be significant in interactive electronic journals in which images such as satellite data and gas chromatography charts might be analysed to extract data.

5.3 Audio and Moving images

The use of video and audio is still very rare in electronic journals. The pioneering journal, *World Wide Web Journal of Biology* [11], aims to provide HTML-based articles with links to movies in MPEG, AVI or Quicktime format, as well to as sound files and interactive molecules.

MPEG, or Motion Pictures Expert Group, is the closest approximation to an international standard video format. Microsoft's AVI (Audio Visual Interleave) and Apple Quicktime are proprietary standards. Viewers for MPEG and Quicktime are freely available for X Windows, Microsoft Windows, and Macintosh platforms [58]. An AVI video player for Windows is also freely available [59].

MacroMedia Director is the dominant application used to generate multimedia titles [60]. The Director player is available free as a Netscape plug-in for Microsoft Windows called ShockWave. The latter may well play a part in future interactive journals. As indicated in Section 4.6, there is some worry about the introduction of such non-standard features to Web browsers; the fear is that each browser will support a different collection of formats.

The only fully platform-independent sound file format is Sun Microsystem's AU format. Higher quality but platform-dependent formats include AIFF for the Macintosh and WAV for Windows. The Netscape browser has built-in facilities for playing both AU and AIFF files. The WAV format is commonly used for sound effects in Microsoft Windows; browser helper applications for playing WAV files are freely available. The audio section of the MPEG standard provides very high quality sound and players are available for a range of platforms. As already mentioned, to date, the inclusion of sound files in electronic journals is very rare, although such a facility might be of potential relevance to journals in fields such as music, linguistics, zoology and so on.

5.4 Interactive Images

Until now, documents accessed via the Web were mainly HTML-based, possibly with simple inline images in GIF format and the occasional MPEG movie or sound sequence. However, browsers are now being developed to support a new wave of formats that will enable, not only movie clips, but interactive 3-D content via formats such as VRML and Java.

VRML, or Virtual Reality Modelling Language [61], enables the creation and display of three dimensional environments and models. Various VRML browsers may be freely down-loaded [62]. Some work in a Microsoft Windows 3.1 or X Windows environments; others require the Windows 95 operating system or a Silicon Graphics machine. The potential of VRML in electronic journals has already been recognised in the field of chemistry, and demonstrations may be viewed [61].

Developments such as Java [63] make full multimedia journals increasingly feasible. Java is a simple but powerful programming language, based on the more complex C++ language, which enables interactive content on the World-Wide Web. When Java arrives on the electronic journals scene, it may prove the most suitable tool for interactive presentations such as user processing of data, rotation of 3-D images and other simulations. A special browser, called HotJava, has been developed to showcase the capabilities of the Java language. Small Java programs, called Applets, may also be included in HTML files and observed using Java-enabled browsers, such as Version 2.0 of Netscape Navigator. It is hoped to incorporate Java Applets into later issues of the eLib newsletter *Ariadne* [64].

There may well be a delay before Java Applets find their way into the electronic journals field on any scale. The programming required to develop Java content is considerably more sophisticated than that required to develop HTML Web pages and would imply a large investment by publishers. However, publishers may regard this as an investment worth making. Unlike HTML, the code of Java Applets is not transparent to either the reader or to the system on which it is running. Publishers may see such Applets as a way of regaining control over the content of their publications.

5.5 Multimedia Problems

The size of image, sound and especially video files is a limiting factor for multimedia journals at present, as it is not possible to guarantee adequate network speed and capacity. This implies that CD-ROM-based multimedia journals may be more feasible in the medium term. Alternatively, Pullinger's second model for network publishing, involving the storage of material at a CWIS rather than at a central host, may be appropriate.

Until high-speed lines and relevant hardware and software are more widespread, a proportion of electronic journal users will have to forego the potential added value of multimedia. Some electronic journals cater for users with slow lines and text-only interfaces, such as Lynx [65], by making all multimedia, including graphics, optional. Most browsers allow the image-loading functions to be delayed or turned off. The main problem with current multimedia electronic journals, however, may not be a technical one but rather the difficulty of persuading authors to submit articles incorporating multimedia features.

6 Conclusions

The future of electronic journals appears to be network-based, and, more particularly, based on World-Wide-Web technology or its successor. However it should be remembered that alternatives to the Web do exist and are vying as platforms for the electronic journals of the future. The Hyper-G hypermedia system [66], for example, offers several advantages over the World-Wide Web, particularly in the area of maintenance of documents and hypermedia links. The *Journal of Universal Computer Science*, or J.UCS [67], has been developed to take advantage of the additional functionality of Hyper-G, although it is also accessible via World-Wide-Web browsers. HTF, the format used by Hyper-G, is very similar to HTML. In fact, HTML may well be used in place of HTF once a more sophisticated version of HTML becomes standard. It is likely that the philosophies of systems such as Hyper-G will have an influence on the future shape of the Internet, although they are unlikely to rival the Web.

The problems of archiving electronic journals relate not only to longevity of the physical storage media but also to the potential for obsolescence of the data format employed. The logical nature of SGML is an attempt to side-step this problem by remaining independent of any particular platform, package or application. However, even SGML is not entirely future-proof, as evinced by the problems in the attempt to develop standard journal DTDs. For librarians, the good news is that archiving may become someone else's problem, for a price. Until now publishers have had no interest in legacy data; there was nothing they could do with it. Now, there is a possibility that academia might be prepared to pay publishers to maintain archives.

A plethora of platforms and accompanying document formats is currently emerging. It remains to be seen which of these will be adopted, in the long term, as standards for electronic journal dissemination and presentation, but some possible contenders are already making their mark. In the short term, ASCII and bitmapped formats will carry on playing a role in electronic journals due to their portability. The more recent trend, illustrated in Appendix 1, of HTML-based interfaces to PDF-based articles is likely to continue. The retention of hard-copy features made possible by PDF may help readers make the transition from paper to electronic format. However, the introduction of electronic journals provides the opportunity to introduce new facilities, such as interactive and multimedia presentations and more flexible methods of searching and browsing. If their full potential functionality is to be realised, electronic journals need to move further away from the conventions introduced by the paper-based journal.

Acknowledgments

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Appendix

Table 1 : Journal projects and the document formats employed

Key: * = Sample articles from nine publishers

Journal/Project	Date Announced	No. of Journals	Formats								Referenced in Section
			ASCII	Bitmaps	TeX/Latex	PostScript	PDF	HTML	SGML	Multimedia	
ADONIS	'87	680+		x							3.1, 4.1
BPO	'89	1,000		x							4.1
EJournal	'91	1	x								3.2, 4.1
TULIP	'92	80+	x	x							3.2, 4.1
ELVYN	'92	1		x (equations)	x	x		x	x		2, 3.2, 4.1, 4.6
OCLC EJO	'92	36						x	via Guidon		3.1, 4.5.1
Red Sage	'92	70+	x	x (graphics)					x	x	3.2
CAJUN	'93	9									4.4
SuperJournal 1	'93	*		x (graphics)	x (equations)			x	x		3.2
ESS	'95	1,100	x	x							4.1
CJTCS	'95	1			x	x					4.2
MUSE	'95	43				x		x		x (potentially)	4.3, 4.6
IDEAL	'95	184					x	x			3.2, 4.4, 4.6
IoPP	'95	31					x	x			4.6
Infobike	'95	300+					x	x		x	4.6
SuperJournal 2	'95	50	x	x (graphics)	x (equations)	x	x	x	x	x	3.2, 4.4, 4.5
CLIC	'95	1						x	x	x	4.5.1, 5
WWW Journal of Biology	'95	1						x		x	3.1, 5.3
Journal of Quantitative Trait Loci	'95	1						x			3.1
Applied Physics Letters Online	'95	1						x	via Guidon		3.1
J.UCS	'95	1				x (and HTF)					6
Ariadne	'95	1						x		x	5.4

Table2: Features of Typical Viewers

Features	Formats and Example viewers						
	ASCII	Bitmaps	TeX/Latex	PostScript	PDF	HTML	SGML
	PC Email[1]	TULIP Journal Browser[2]	xdvi[3]	Ghostscript	Adobe Acrobat Reader	Netscape Navigator	Softquad Panorama
Support for character sets	low	N/A	medium	medium	high	medium	medium
Representation of formulae	poor	good	good	good	good	poor	medium
Document size	low	high	low	high	high	low	low
Browsing & linking facilities	none	none	none	none	moderate	good	good
Flexibility of searching	none	none	none	none	good	good	good
Support for graphics	none	medium	low	medium	good	good	good
Support for multimedia	none	none	none	none	moderate	good	good
Developers control over layout	low	high	moderate	high	high	low	medium

Key

1. A DOS-based electronic mail program
2. The TULIP Journal Browser presents bitmapped pages via an HTML-based interface. The features described above refer to the bitmapped pages only.
3. DVI Previewer for X Windows

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