

The Impact of Electronic Publishing on the Academic Community

Session 1: The present situation and the likely future

Electronic publishing in astronomy

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Background

Astronomy is a small, largely self-contained discipline with just a few scholarly publishers. Information is largely transmitted through periodical literature, although conference proceedings (mostly unrefereed) and the exchange of preprints are important for the early distribution of recent results. Bringing the astronomical literature online is somewhat easier than if we had hundreds of journals and dozens of publishers to deal with.

Nearly half of the world's peer-reviewed literature in astronomy is now available in electronic form with a very rich set of features (*Astrophysical Journal*, *Astronomy and Astrophysics Supplements*, *New Astronomy*): extensive links both within the document and to external sources;

- to the references,
- to bibliographic information,
- to works which cite the present article,
- to various data sources.

With such a set of interlinked resources, astronomy is now served by a working digital library. We can begin to get a glimpse of the electronic future by looking at how astronomers are using and adapting to the electronic resources which are now available. We call our interlinked set of distributed resources Urania. The Urania resource stands on three legs: (i) the peer reviewed literature; (ii) the bibliographic database (the NASA-supported Astrophysics Data System), which contains all the abstracts in searchable form as well as page images of the historical literature; and (iii) scientific data, much of the original data as well as published data tables.

What have we learned from our experience in producing electronic astronomical journals?

Based on two years of electronic publishing we can say four things: first, no true electronic journal can exist by itself any more; second, the intrinsic value of the links is nearly as great as the content itself; third, there is a "digital continuum of information" now available to researchers at their desks; and fourth, the electronic environment is changing very rapidly and will continue to do so.

Implications

Individually and together, these statements have major implications for the academic community.

Paper is not a satisfactory archival medium any more. A good archive will have to include links and electronic material. Archiving will become nearly impossible in the traditional sense. Publishers will have a moral responsibility to either maintain archives of their products, or else to produce them in such a way as to enable working archives to be maintained by other institutions.

There is a pressing need for standards in naming electronic items and making links. Care must be taken in the production of electronic scholarly material to ensure ease, reliability and longevity of interconnectivity.

Continually improved tools and Web capabilities impose the need to be able to reconstitute the older material to incorporate new capabilities, such as the better display of tabular data or the incorporation of citations to the work. This can only be done if the original material is designed for updating. Such a design facilitates robust archiving as well.

It is now nearly as cheap to archive electronic material in a form which is publicly available as it is to simply store it on tape. Older material will be much more accessible than was previously the case.

Electronic information knows no boundaries. Effective interconnections can work as well across disciplinary boundaries as they do across national boundaries.

A provocative thought is that intensely scholarly material can, in principle, be as accessible to school children as it is to the advanced researcher. There is some potential for misunderstanding and even mischief. On the Web, scoundrels can dress up pseudoscience to the point where the general public may not be able to differentiate it from well-founded science. Academics will have to consider that they are no longer just writing for their most learned colleagues.

The easy access to everything from the original data, say from NASA missions, to the final peer-reviewed scholarly publication can (and is already starting to) affect the way scholars conduct their work. We are just starting to see this revolution. The effects are subtle, but may be of great importance in the long run.

Finally, from e-mail to online meetings to full 'collaborative' work using special software, scholars around the globe are working together --- at least in the sciences --- in ways never before possible. It is truly an age of instant information; too much information, in fact. Today we can still digest all the online material in our fields. Tomorrow we won't be able to do that. We will need help to find the high-quality, relevant material. Designing effective tools to do this will be one of tomorrow's growth industries.

Discussion following presentation by Boyce

Several discussants referred to the great public interest in astronomy, which meant that astronomical websites were frequently accessed. In this respect, the subject might be atypical. Mastroddi mentioned the ability of amateur astronomers to place their own CCD images on the Web. Boyce commented that without reliable calibration these images were scientifically worthless.

In answer to a question about charging policy, Boyce said that abstracts were accessible free of charge, only complete papers were charged for. Drenth referred to the possibility that a paper might be changed after it was placed on the Web. Celis was concerned about the constant changes in technology, which meant that libraries never knew how to invest for the future. Boyce commented that the American Astronomical Society was committed to using 'standard' Web technologies.

Meadows said that printed paper retained many advantages for the reader, but the great benefit of electronic media was instant access from the desk. Lindquist asked about the size of the archive. Boyce replied that one year of the *Astrophysics Journal* required 60 gigabytes for the complete archive for 25\000 pages, including the PostScript files. Some links between journal articles and original databases had been introduced but this was far from complete. Editions for the last twenty years had been scanned, but as yet, not earlier ones.

Another discussant asked whether indexing schemes used by different electronic publishers were diverging. Boyce confirmed that the general attitude was to solve one's own problems before bringing systems together, thus raising the prospect of widely differing solutions.

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