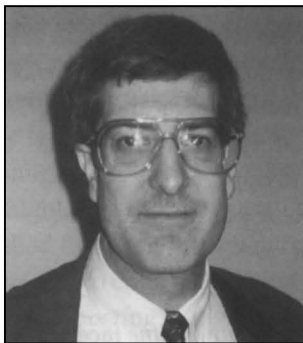


DEVELOPING VIABLE ELECTRONIC JOURNALS

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When developing Science Online the AAAS had to be aware of its readership for the printed version, not only to produce a suitable product but also to assess the impact on the size and diversity of the subscribers, its revenue base. A survey provided a profile of usage of the initial product and this information is used in developing new business and pricing models.



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Introduction

Solid, respectable scholarly publishing has, for the last several years, been undergoing a transition of no small import, as publishers, authors, libraries, their institutions, and readers the world over have struggled to define the parameters and to explore the possibilities of transmitting scholarly information via the Internet. Some of the advantages are clear: Internet publication presents the possibility of cost savings on print, paper and postage charges. It allows for articles to be put before a wide audience at a faster pace than ever before; and unique features such as hyperlinking and cross-platform searching open new and faster research capabilities for scholars.

At the same time, the presumed strengths of traditional print publishing have come under scrutiny from many quarters, including the authors who supply much of the content for scholarly journals, and the libraries that provide much of the economic support. Besides the usual complaints about annual price increases in excess of inflation, there are sharp questions being asked about the need for publishers to hold copyright, and in some cases even the traditional methodology for peer review has come under fire. Though, to be sure, no serious challenges have emerged to the fundamental idea that scientific works need to achieve peer acceptance in order to be considered authoritative, there have been challenges to the notion that peer review need be conducted anonymously and by only a modest number of peers. If two reviews are good, the promoter of Internet-based 'community' peer review might ask, why are not dozens—or even hundreds—of peer reviews better? The presumed low cost of placing and maintaining items on a Web site is seen as the full and sufficient remedy to any cries of excessive cost or impracticality.

Through this hazardous environment, many scholarly publishers are trying to navigate in a way that both delivers the vision of

significant reader benefits inspired by the new technology, and nevertheless safeguards their operating revenues. *Science*, one of the world's premier scientific journals, is also facing these issues, but from a somewhat unique perspective. This paper will discuss the strategic and business challenges that *Science* has encountered in bringing its unique contents online to current readers and in attempting to broaden that readership. To some extent, every publication faces unique challenges in reaching its own audience, but it is hoped that this discussion will at least reveal some issues that are commonly faced by other scholarly publications seeking to take advantage of electronic capabilities. It is also hoped that librarians, who are among the principal buyers of online products, will gain a deeper understanding of the financial and strategic challenges faced by scholarly publishers.

***Science's* unique niche**

Science is much like any other scholarly journal in that it seeks to publish top quality research by managing a formal peer review process. Also, like many journals, there is a degree of selectivity involved even beyond what peer review might authenticate as competent work, because only a limited number of pages can be printed in any given issue. *Science* is somewhat more selective than the average journal because it receives a remarkably wide range of high quality submissions, but the basic principle of selectivity applies to many scholarly journals.

Here, however, *Science's* similarity with most other scholarly journals ends. Many aspects of the content presented each week in the magazine are unusual, if not entirely unique, in scientific publishing. By accepting papers from all fields of scientific inquiry, *Science* presents a broadly multi-disciplinary and global overview of the cutting edge developments in many areas. *Science* also provides broad and deep news coverage of findings and other events affecting scientists around the world, as well as commentary, opinion, and reviews from top scientists observing the latest events in their own field, or in the worlds of law or policymaking as they affect scientists.

Because of its unique content offering, *Science* also attracts an unusually large and diverse

readership. *Science* reaches one of the largest and broadest audiences of any scientific journal, with a total circulation over 150,000 subscriptions worldwide, including readers from 60 scientific disciplines, and about 30,000 of those subscribers from outside the US. Hundreds of thousands more readers are served each week through some 18,000 library subscriptions.

Since many of the strategic issues *Science* faces relate to how library and institutional access to *Science Online* might affect the print subscription base, it is worth noting that the library market for *Science* is, again, much larger and more diverse than for the typical scientific journal. *Science* reaches thousands of universities and colleges, as one would expect, but is also carried in corporations, government agencies, medical centers, high schools, and public libraries. Indeed, collectively these sectors represent about half of the library subscriptions to *Science* in print. The fact that an overwhelming majority of individual subscribers to *Science* work in the academic, government or corporate sectors encourages AAAS to believe it can maintain both a large individual member base and a sizeable institutional subscriber base into the future. The relatively low pricing enjoyed by *Science* subscribers is dependent partly on the ability to maintain such a large and diverse paying audience.

Besides spreading the costs of the publication very broadly, *Science's* large subscription base reduces everyone's cost in another important way: it enables the journal to earn a substantial portion of its operating revenue from advertisers (who are attracted by the broad access to a scientific audience). The diversity of the audience for *Science* creates a wide variety of reader needs and expectations for the journal. These diverse needs present both challenge and opportunity as the journal moves into electronic publishing.

The Online challenge

Like any new publication, *Science Online* faced normal product development questions as it was prepared for launch: Who are the intended subscribers for this product? How can they best be reached and solicited for subscriptions? Which features will attract the most readers? How can we reach a critical mass of readers quickly in order to attract advertising support?

But in addition to these conventional publication launch questions, there was a cascade of far murkier business issues related to launching a product in a new and untested medium. Which subscription model among the many being tested will generate optimum sales and create a financially stable product? How can we establish the viability of an experimental medium to advertisers who normally follow only proven products? Given that we anticipate fewer buyers than the print product enjoys, what impact will a higher cost per buying unit have on our market penetration? Which pricing strategies will best counter the presumed resistance to the new product in the market place? And finally, the most complicated issue to address has been assessing what impact the new product might have on current operating revenue, and how should we manage this transition to a seemingly more risky revenue stream?

Early strategic discussions at *Science* were vigorous and sometimes chaotic, but there was general agreement that, in order for the journal to remain relevant and for AAAS to fulfil its broad mission of communicating science and serving scientists, *Science* must engage the new medium. Much of the early site development was premised on two somewhat unsatisfyingly general ideas articulated in the management group.

One was referred to internally as the "Fire...aim" strategy. This was shorthand for the notion that the Web site would need to experiment with many different features and functions, before settling on the ones most useful to the readership. Market surveys at this early stage were rejected on the theory that conducting them would take too long, and that in any case, the technology – and users' familiarity with it – is changing too rapidly for surveys to provide much insight. The second overall strategy articulated called for using the unique properties of the Internet to enhance existing content, rather than merely posting a 'digital copy' of the print journal.

These overarching themes may seem simplistic or obvious—and indeed may not seem to provide much guidance—but they have remained more or less intact throughout the development of the site, even while various theories for managing content and establishing a business model have been tried and rejected.

The initial tactics used to introduce *Science Online* were similar to those followed by most scientific publishers bringing their content online. The site launch was promoted within the pages of the print journal. During a six-month trial period, everyone was allowed to use the site for free in order to build traffic and generate user feedback.

The chief strategic difficulties presented by the electronic publication are associated with the potential substitution of institutional online access for paid personal subscriptions. There were three types of threat perceived in the introduction of *Science Online* site-wide subscriptions. First, it was recognized that if the availability of *Science* content through a library online subscription were to lead to mass departures of individual print subscribers, the negative effect on operating revenue for *Science* could be devastating, because individual subscription revenue is so important to *Science's* operating budget, and also, because the number of subscribers is important to our ability to sell ads., a substantial loss of individual subscriptions would represent a double hit to our revenue (as well as a very significant mission and culture problem). Furthermore, *Science's* large print run enables it to obtain significant economies of scale in its printing costs. A rapid and substantial lowering of the print volume could lead to higher costs, forcing us to raise print prices, which in turn might lead to more subscription losses. Thus, cautious movement forward was in order.

Fortunately, however, it became clear early that many subscribers value both print and online. Most indicated that they would not readily accept the online product as an adequate substitute for their own print subscription. Therefore, this risk was felt to be relatively remote.

A second risk lies in what we refer to as 'segment erosion'. This means that even if there are not large departures of members, we could experience significant economic damage if there were more modest losses in some key portions of the subscriber base. Among the segments we considered most vulnerable were multiple library subscriptions, international members, and students or other young member categories. All the vulnerable groups are either in price-sensitive categories, or represent strategically important segments to *Science*, or both. Even minor losses in these areas are deemed to be moderately

damaging. The risk of losses in some of these segments is clearly higher than the risk of a general abandonment of membership. If substantial segment erosion were to occur, *Science* might have to withdraw or restructure its online offering.

Finally, it was clear as we introduced site-wide subscriptions that there might be a loss of personal subscriptions to *Science Online* in those institutions that purchased site-wide subscriptions. This outcome was seen as a high probability, but not as a particularly damaging loss financially, since very little revenue is associated with personal subscriptions to *Science Online*. Interestingly, even this most probable downside of site-wide subscriptions has not yet happened: individual members continue to purchase personal access to *Science Online* in increasing numbers.

Given the many uncertainties, there is reason to question why a non-profit association should plunge into providing internet-based content. For AAAS, several reasons have emerged as dominant. In part, there is a sense that electronic publishing is a desirable, and inevitable, development in the history of publishing, and *Science* must remain relevant in communicating important scientific findings and news. Closely related to that motivation is a sense of mission: *Science* sees this as an opportunity to contribute to improving the communication of science among scientists and to the public. Since this is the long-standing mission of the AAAS, it is an opportunity not to be missed. Furthermore, there has been substantial interest and market demand from our usual audience of scientists and from librarians who see *Science Online* as a necessary addition to their collections.

Though there was ample justification for producing the journal online, it was clear by mid-1998 that we needed more information about how readers use *Science Online*, and how they value it in relation to the print. In the fourth quarter of 1998, a survey was commissioned to explore these questions, even as the first site-wide institutional subscriptions to *Science Online* were introduced. No one survey can answer definitively all the business, strategic, and product development questions that will arise in this new and unfamiliar publishing environment. The findings, however, provided some insight into how readers use *Science* and *Science Online*, which we hope to

use to better manage the transition from an 'all-print' to a 'print-plus-online' financial structure for the journal.

Key research findings

A fundamental question the survey explored was whether readers view *Science Online* as a supplement to, or as a substitute for, the print journal. This is a difficult question to get at, because, if put directly to the subjects in the stark terms used above, many people will naturally respond that the products are substitutes, on the superficial basis that the content of each product is the same. Instead, the survey focused on identifying the usage patterns for each version. Presumably, if the online were used in the same circumstances as the print, or if usage of print declined, there would be reason to suspect that the online product does act as a substitute for print.

Respondents readily identified many advantages of online publications. Though there were many different kinds of advantages cited, those most frequently noted can be grouped into four categories: Immediacy, 'Searchability', 'Decluttering', and Productivity. Over 35% of respondents cited one or more advantages related to the ability to gain access to important scientific information faster than ever before. Nearly 30% also mentioned the many advantages associated with being better able to locate relevant material through online searching, including the ability to conduct the search over a much larger base of archived articles. And around 15% of readers cited either productivity gains from gathering information online, or space savings and personal organizational benefits (which I have labeled 'decluttering') from online journals.

As positive as these findings were, however, it is interesting to note that about 20% of respondents could cite no benefits to reading online journals. This is one indication that there remains a core of readers who continue to rely on print and are not ready to accept online journals, even as supplements to the print. Even so, this group appears to be a shrinking minority of readers, and clearly are not a good barometer of how the journal should be organized for the future. In contrast, a significant portion of members indicated that they might, in the future, accept online access as an adequate substitute for their subscription to *Science*. Clearly, the pricing

models would need to account for the existence of both viewpoints: those who do not want online added to their print subscription, and those who may be willing eventually to forego print altogether.

Of more interest are the findings about how print and online are valued among those who use both. Readers were asked to rate the relative usefulness of print versus online for a number of aspects of the information-gathering and knowledge-management process. Among the values that were rated were archive access, timeliness, ease of use, portability, and readability. Online was viewed as having a clear and substantial advantage over print in the area of timeliness, and a more modest advantage in the areas of archive access and ease of use. However, print was cited as having an overwhelming advantage over online in the values of portability and readability.

These differences in valuation of print versus online were more or less consistent across key demographic segments of the readership, including, most interestingly, different age groups. A preliminary conclusion from these data is that the practice of gathering information from print sources may not be a generational phenomenon that is on the verge of yielding to an online method of information gathering. If anything, it appears that online products are being used as productivity enhancements to print journals, and as a strategy for navigating through the information overload that many scientists and indeed other professionals perceive. Substantial minorities of readers report using *Science Online* principally for browsing, searching, previewing print or selectively printing out articles they need to read immediately, reading quick summaries, or gaining faster access to especially 'hot' articles prior to receiving the print. In short, *Science Online* users are avid about its benefits, but few read lengthy, technical articles online. For thorough review of information, readers mainly wait for the print journal.

To summarize the key conclusions of our research:

1. Many readers want both print and online access to the contents in *Science*, a shrinking minority want only print, but very few (at present) indicate much interest in receiving ONLY online access.
2. The usage patterns for online resources are significantly different from those for print.
3. While the acceptance and valuation of online resources is greater among younger scientists who have been educated on computers, there is no evidence of an age difference in the valuation of print.
4. Readers want to capture the new functions and features made available through online publishing that cannot be delivered in print, most notably: immediacy, searchability, and decluttering.

Librarians, of course, have needs and priorities that encompass both the readers' needs and the organization's. First, librarians are interested in obtaining the values and features of electronic publications that readers have highlighted. They expect to be able to deliver these online benefits at every desktop within their institution, with no passwords slowing down and complicating their users' access. Further, librarians are rightly concerned about other issues such as archiving, and what kinds of long-term commitments they must make to retain print in order to get online access. Finally, price is a major issue for librarians, given that acquisition budgets are limited (or shrinking!) even while new online and print products are being introduced at an unimaginably rapid pace.

The business models for *Science Online* have been developed, and continue to evolve, in light of readers' and buyers' changing needs. On the content side, the editors have developed a site rich with hyperlinks, including links to supplemental data and citations, as well as new added-value special features such as 'Enhanced Perspectives'. These features launch from the popular print articles in *Science* surveying the findings in a 'hot' specialty field. Online, the Perspective article is enriched with links to many other sites for readers who either need more basic information in order to become familiar with the jargon in the specialty, or who are specialists and would like more technical information about the field being surveyed.

The editors have also focused on delivering time-valued content. Thus, the full text of each weekly issue is posted online on the same day it is mailed to print subscribers. Moreover, in the

section of *Science Online* known as *ScienceNOW*, readers are presented with three or four briefings each weekday on a very recent finding or policy development of interest to scientists. The stories are kept succinct and written in non-technical language to increase accessibility and to facilitate online reading. *ScienceNOW* is edited for suitability to the Web environment, and is never put into print.

Finally, *Science Online* and its partners at Highwire Press continue to develop productivity tools to optimize reader benefits from using the online service. A variety of alert services are available, from simple content alerts to more customized alerting capabilities. There are also Subject Collections, allowing readers to review all the content published in *Science* related to a given topic or discipline.

Business models

Just as *Science Online* has been developed with readers' needs in mind, so we have tried to develop business models to accommodate the needs and expectations of a very diverse market, while considering the sustainability of the Association's publishing operation. As a result, an unusual number of access models have been built for *Science Online*, at a remarkable range of prices. Access to the weekly Table of Contents and the search engine for the site, as well as some samples of full text content, are free for all to use. Individuals registering with the site—again at no charge—may also obtain access to abstracts and short summaries of news articles. For these services one need not even be a member of AAAS. A pay-per-view system is now in place for public access. Single articles can be obtained for \$5 each, while personal access to the full site can be obtained for only \$10 per 24-hour period. Full-text personal subscriptions to *Science Online* is reserved for members of the Association only, and may be obtained for a modest \$12 surcharge to the annual dues.

Because of the very broad range of institutions served by the print journal, we have also developed a multi-layered access model for institutions. Many of the libraries receiving print *Science*—for example, secondary schools, public libraries and small liberal arts colleges—have no need for site-wide subscriptions. Therefore, an

inexpensive 'Workstation' model was developed for them. The access in this model is restricted to specific workstations physically located in the library, and generally requires an institutional print subscription, but the cost is only \$25 per workstation per year. Because of the usage restrictions and the technological requirements of this model, it is not suitable for most university libraries.

Library rates for site-wide access are higher than the cost of print library subscriptions, but allow much broader access and flexibility:

- online site-wide access can be obtained without agreeing to retain any print subscriptions;
- walk-in users to the physical library are accepted;
- access is available on any desktop computer within the institution's network;
- affiliated users may access remotely, where the institution's technological infrastructure permits authentication;
- the institution is not held responsible for user behavior;
- the maximum remedy against abuses is termination of the institution's access;
- access is seamless to users, with no passwords required;
- the Subscription Administrator for the institution (usually a librarian) has substantial independent control over access, including the ability to correct or update IP addresses online, with no processing delays.

In addition to the workstation and site-wide access models for institutions, we work with library consortia to develop pricing schemes that will give some relief to smaller entities when they can act as part of a larger group of buyers. Still other access models continue to be developed and considered. In some instances *Science* has also agreed to license its content to third-party aggregators who can offer yet a broader range of content and pricing choices to librarians.

Conclusion

Because of the unique position of *Science* in scholarly publishing, it may be perilous to generalize from the experience of developing the subscription pricing model for *Science Online*. But

changes to traditional methods of scientific communication appear to be inevitable, and managing the transition effectively for all parties—readers, librarians, and publishers—is critically important in order to preserve the functionality of the system. Thus, some tentative generalizations may be in order, if only to establish a base on which to improve.

Direct costs are not the only drivers of online subscription pricing. Other elements of pricing include assessments of market size, the prospects of developing alternative revenue streams such as advertising, and the business risk involved. During a period of considerable uncertainty for scholarly publishing enterprises, it is critical for publishers to bring information online in forms that are responsive to the needs of readers and buyers.

As more journals introduce online versions, and as new electronic-only journals begin to develop, the pressures on library budgets will, at least for a time, increase. The roles of both publishers and librarians during this period of transition will no doubt change, but the ultimate goal of transforming scientific communication will be best served by a period of experimentation and open

debate. Publishers may positively influence the debate by demonstrating the added value of their products—in print and online—and by developing price models that provide flexibility and choice to institutions.

In pricing online products, transparent pricing schedules enable buyers to gain confidence that the prices they find—for example, in agency catalogs—are the same for other institutions of similar size and composition. By cutting down on negotiation, transparent pricing allows for all prices to be relatively lower. Nevertheless, pricing flexibility may be required to accommodate the very different needs and capabilities of the many organizations that support information products through subscriptions. Besides practising transparency, fairness and flexibility, publishers should establish price models that are media neutral, to the extent possible, and not biased toward either the establishment of online journals or the preservation of print. Rather, it will be best to allow the market of users to determine which media should be retained into the future, by the functionality that those different media bring to the work of science.