

ELECTRONIC JOURNALS

Electronic Preprints Point the Way to 'Author Empowerment'

While traditional publishers try to extend their publishing empires onto the Internet, an underground movement of researchers hopes to head them off. Its goal is to turn the electronic medium into a means of "author empowerment," in the words of physicist Paul Ginsparg of the Los Alamos National Laboratory. Led by Ginsparg and Stevan Harnad, director of the Cognitive Sciences Center at the University of Southampton in England, they are trying to prove, as Ginsparg puts it, that not only can scientific articles be published over the Internet "unbelievably efficiently," but they can be offered virtually free to all comers.

Computers and the Internet, they say, open the way to speeding and cutting the cost of most of what traditional journals do: typesetting, printing, and distributing the publication, and coordinating the work of authors, reviewers, and editors. "All the real labor—writing, reviewing, frequently editing—still comes heavily subsidized directly from the research community," says Ginsparg. Existing publishers are betting that traditional copy editing and layout and the array of electronic amenities they are starting to offer online will retain subscribers (see p. 764). But Ginsparg believes "they'll be history ... unless they can play a more cost-efficient role."

Ginsparg has already offered a lesson in the potential for cost-cutting by founding the Los Alamos e-print archives, a free electronic preprint archive that has already become a key resource for physicists. Now Harnad is creating an electronic preprint service for researchers in cognitive science, hoping to prove that the success of the e-print archives can be generalized to scientific disciplines beyond physics. And a group of physicists led by Boston University's Andrew Cohen is laying plans for what could be a proof-of-principle electronic journal: a fully refereed journal, using the archives as a submission mechanism, that costs little or nothing.

For Ginsparg, Harnad, and others, spiraling journal prices are the call to arms. A study conducted by the Association of Research Libraries (ARL) in 1994 showed that the average journal subscription cost had more than doubled since 1986, with the result that while the actual number of journals purchased by libraries had dropped, library expenditures had almost doubled. The ARL study laid the blame on an "imperfect, monopoly-like marketplace" for the publishing of scientific and technical information. Scientists naturally want to publish in the

most prestigious journals in their field; those journals are controlled by a small group of publishers; and university and research libraries have to subscribe to those journals no matter what they cost, said the study. As a result the publishers can and do "charge extraordinarily high prices" for subscriptions.

Ginsparg started the e-print archives in August 1991; since then, he says, they have countered what he calls "this bizarre misconception that the publishers add so much essential 'added-value' that we should all be willing to pay big bucks for it." The electronic preprint distribution system now serves 17 disciplines in physics and last year handled over 13,000 submissions. "The archives have become a very important part of the research community," says Cohen, "one of our most valuable tools" (*Science*, 23 February 1993, p. 1246).

Spreading the word. Now Southampton's Harnad hopes to "generalize the physics e-print archives to the rest of scholarly/scientific inquiry," in particular the biological and social sciences. Harnad has received a \$340,000 grant from the British Joint Information Systems Committee, a government funding agency, to establish the Cognitive Sciences Eprint Archive at Southampton. The cognitive sciences version will include relevant papers from biological and medical sciences, humanities, and social sciences, so if it works, says Harnad, "it will be evident to everybody that this will work in all fields of learned inquiry."

He acknowledges, however, that researchers in biomedical and social science may not

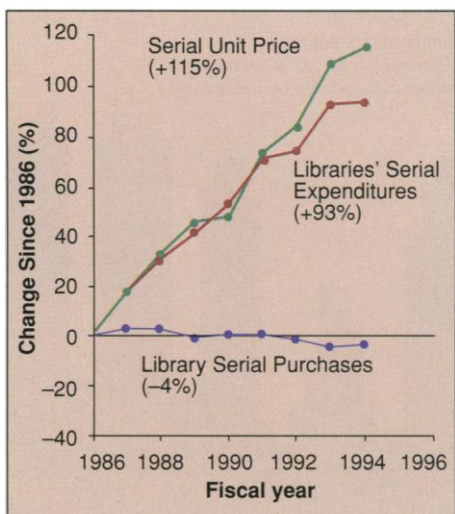
be as receptive as physicists to the idea of circulating their work electronically prior to refereeing. Physics, after all, had a computer-addicted preprint culture well before Ginsparg started his archives. And Harnad knows from personal experience how cautious authors can be about publishing in a new medium.

In 1990, with support from the American Psychological Association and Princeton University, he launched *Psycology*, an electronic version of a successful print journal called *Behavioral and Brain Sciences (BBS)*, published by Cambridge University Press. BBS, which Harnad founded in 1978, publishes controversial "target" articles simultaneously with critical commentary on each article. Although Harnad is still convinced that the electronic medium is the optimal one for commentary, he admits that *Psycology* has been a slow starter. "The best authors are still afraid to submit to *Psycology*," he says. "They submit to BBS, where both the journal and the medium are already well established. ... Getting articles for *Psycology* is still like pulling teeth."

Trying to entice authors into a preprint archive could be even tougher, so Harnad has come up with what he calls a "subversive proposal" to lure authors and readers away from the established print journals. "The proposal is this," he says: "Let the researchers submit their articles to their prestigious paper journal of choice for refereeing and publication, as before, but let them simultaneously take the version they submitted and deposit a draft in the public e-print archive. The rest can be entrusted to human nature. When the paper journal accepts the article for publication, are the researchers on that day going to be crazy enough to remove it from the public archive and say no one can see it electronically anymore? My bet is that, as with the Los Alamos archive, authors will leave their papers in the public eye on the day of publication, and will simply swap the revised, refereed, copy-edited draft for the superseded preprint, tagging it as such. So readers who want to read only refereed articles can do so."

The next step is obvious, says Harnad: "The readers will go to the electronic version to read the article, because it's up first and it's easy, and eventually everybody will realize that the paper version is useless."

Harnad's grant came through late last month, and he figures it will take 2 months to set up the system using software developed by Ginsparg and his colleagues at Los Alamos. Then, he says, he has to become an activist, persuading the best researchers and writers in the cognitive sciences that they lose nothing by submitting their preprints to the archive. "We go after them," he says, "with constant calls to use the archive. As we start getting good stuff, we advertise. We send e-mail and even paper, to all the cognitive disciplines, alerting them to what's already available in the archive. And we hope that gradually it



Paper trail. Spiraling journal costs are driving a search for low-cost electronic alternatives.

will head toward critical mass." Whether it will work, says Harnad, "no one can make an informed prediction. The only real empirical evidence is Ginsparg's archive, which has reached critical mass."

Adding peer review. Even if Harnad can reproduce the Los Alamos archives' success in fields beyond physics, however, traditional journals will still hold an ace: peer review. As Cohen puts it, "Many physicists believe refereeing is a good thing. Bad papers are filtered out, and papers containing errors are sometimes corrected."

Some of Cohen's colleagues even worry that the success of the archives poses a threat to the concept of the refereed paper. Says Harvard University physicist Sidney Coleman, "If we read things right, the traditional journal will die. It's too awkward, too clumsy, too expensive; it's like having physics papers delivered to your door by a uniformed courier each morning ... [but] there is no doubt refereeing improves the literature. If traditional paper journals disappear and we only have Internet circulation of authors' manuscripts, then all those advantages disappear."

In response to such concerns, Ginsparg and a dozen colleagues from the physics community set out over a year ago to create a system of open peer commentary, a form of peer review in which any preprint could be available on the archives—but so would any commentary that any legitimate physicist chose to make. They eventually tabled the project, however, in part, says Cohen, because they didn't "want to taint the archives should the open peer commentary turn out to be a major fiasco." But this past summer, Cohen, Coleman, and a handful of theoretical physicists met at the Aspen Center for Physics to consider more conservative approaches.

The result was a formal proposal to publish a free, fully refereed, almost traditional, albeit completely electronic, journal covering two fields well established on the archives—theoretical high-energy physics and phenomenology. "This would not be a replacement for the electronic preprint system," says Cohen, who has become the journal's

de facto editor-in-chief by virtue of writing most of the software. "When people come in to work in the morning, they will still look at the latest papers in the archives. The journal will serve a different function. It will provide a set of papers that the reader knows have been peer-reviewed."

The archives and the journal will remain distinct, with the archives serving only as the point of submission to the journal, and Ginsparg has agreed to institute mechanisms to make that possible. In particular, he has installed a password system. When an article is sent to the archives, the author will be



Upholding tradition. Physicist Andrew Cohen hopes to bring peer review to Internet publication.

given a password, which must be used to make any changes to the article. To submit the article to the journal, the author would simply inform the journal of the submission and send along the archive reference number of the article and the password. The journal could then freeze the article simply by changing the password. "That way," says Cohen, "you can assure that a paper that has been accepted for publication is indeed the same one readers have been receiving."

Editors would then pass on the archive reference number to the referees so they can access the paper themselves. Articles accepted by the journal would remain in the archives. The still-unnamed journal would have a Web site, and like any other electronic journal would be published in numbered issues and volumes. But readers accessing an article would likely be calling it up from the archives—or one from one of the computers around the world where the archives will be mirrored—and not from any virtual journal headquarters. The result,

says Ginsparg: "one global archiving and distribution system, and no unnecessary duplicated effort."

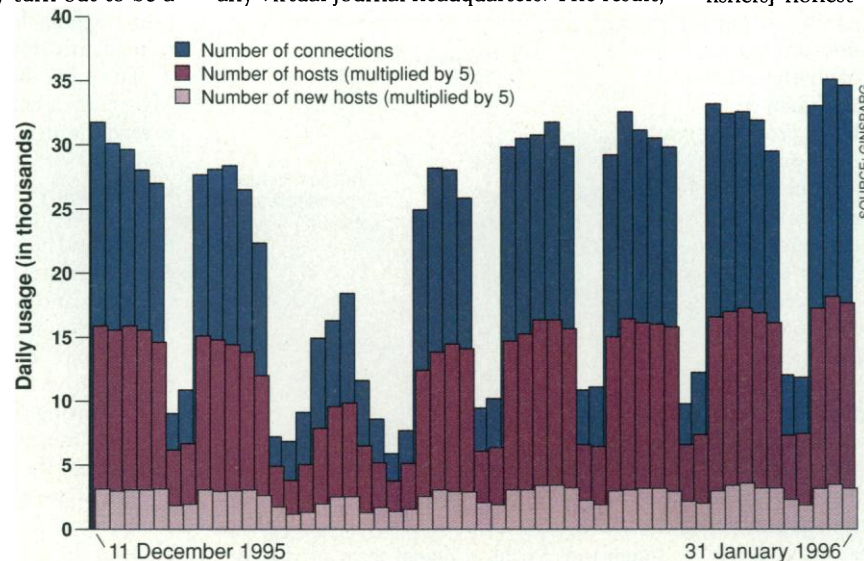
As for the cost of publication, says Cohen, he and his colleagues assume it would be minimal. The e-print archives, for instance, cost the National Science Foundation, which now funds it, 1.5 cents per electronic transaction. The journal will involve more human labor, but "since we're doing it initially for free," says Cohen, "we expect it won't cost very much to do."

Cohen and his colleagues are now talking with professional physics organizations about the possibility of forming an association with the new journal. Many of these organizations publish their own journals. But physicist Martin Einhorn of the University of Michigan, a member of the executive committee of the American Physical Society's Division of Particles and Fields and an editor for the new journal, expects that the new journal will attract support, "in part because it's the wave of the future. ... It just has to happen. It's going to be so much better and cheaper."

Some observers question whether researchers themselves can match the quality that professional publishers deliver. Says Rich Roberts, who is head of New England Biolabs and editor of *Nucleic Acids Research*, "You can't get a really professional job done by people who aren't themselves professionals." Bob Kelley of the American Physical Society raises a different concern. Researchers can handle the technical side of putting out a journal for next to nothing, he says. "But when you're looking at creating an organizational structure that has longevity, that guarantees the stability of the journal, that's when you'll run into some difficulty."

But Ginsparg and Harnad believe the threat of such new journals should "keep [publishers] honest" as they set prices for their own electronic journals, says Ginsparg, by showing how much of what they provide can be done for free. And Harnad conjures a nightmare scenario for the big publishers: "The best people start putting stuff [in a free electronic archive], and readers start saying, 'Why wait for the journal to come out? I have to teach this stuff; I have to know this stuff; I can get it from the archive,' and then the libraries come around and say, 'Should we order this journal?' and the scientist says, 'I don't care, I no longer read it in paper.'"

—Gary Taubes



Not gathering dust. Traffic on the Los Alamos e-print archives.