◆Keynote Address: Author/Institution Self-Archiving and the Future of Peer-Reviewed Journals

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Stevan Harnad is intensely focused. For 12 years, he has honed his "author self-archiving" argument, presented it in countless articles and speeches, and vigorously defended it in the September 1998 American Scientist Forum (*www.ecs.soton.ac.uk/~harnad/Hypermail/Amsci/subject.html*) and other discussion lists. The argument goes like this: Journal subscription fees or "toll charges" limit the number of potential readers who can gain access to research articles. By giving away their articles only to publishers who collect tolls from subscribers and licensees, scientist-authors forgo much of the impact their papers would have if they were also available to readers whose institutions cannot afford the tolls. In a sense, the loss of impact subsidizes the profits of publishers. If authors would post their peer-reviewed articles in freely available archives, they could greatly increase the impact of their research on the progress of science.

Unlike authors of books or other materials written at least partly for direct financial gain, researchers have no interest in profit—only in advancing the progress of science. Authors give away their research articles because they want them to be read. Their primary goals are to create knowledge and to have their research results and conclusions used, built on, and applied by other researchers.

Researchers mostly read and use the articles they have access to in the journals that their institutions can afford to subscribe to. Many of the articles they read show up as citations in the articles they write. The sparse data available on the number of citations to "open-access" and "toll-access" papers support the argument that open access increases an article's impact as measured by the number of citations to it.

In the Gutenberg era, the expense of publishing on paper required publishers to charge access tolls. But are tolls still necessary in the post-Gutenberg era, when print on paper is no longer a requirement? Some costs remain when paper is eliminated. Harnad's argument is limited to peer-reviewed articles, and the costs of peer review continue to exist in the world of open-access online publishing. Similarly, the costs of correcting errors and improving readability remain, although Harnad does not include copyediting when he calculates the costs that must still somehow be recovered when access to research is toll-free.

About 20,000 peer-reviewed journals are published on paper. Some are published at cost, and a fair profit has been added to the price of others. Even the richest institutions, however, cannot afford subscriptions to as many as half these journals. Thus, the researchers-authors of the 2,000,000 articles per year published in these journals will reach only a small fraction of their potential users. Harnad argues that in the post-Gutenberg era there is no longer a reason to lose that impact. Research impact is an important part of what inspired researchers to become researchers and of what motivates them to wear their peer-reviewer hats. Impact is also the rationale for the "publish or perish" system used by universities.

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Stevan Harnad

In physics and some other fields, it has become common to post unrefereed preprints of research articles electronically for readers to use at their own risk. After peer review and acceptance by a journal, authors can self-archive the final refereed draft, making it freely available; this can lead to more impact, more citations, and the usual cumulative benefits, such as the advancement of science, prestige, tenure, and promotion.

As evidence in support of his argument, Harnad showed data from Steve Lawrence's 2001 paper in *Nature* (411[683]:521). Computer-science articles published toll-free online were cited 336% more often than articles from the same conference proceedings that were published offline. (In this field, articles in conference proceedings are often more prestigious than those in journal articles.) An article by Kurtz and others (submitted to the *Journal of the American Society for*

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Information Science and Technology) shows that the number of citations of articles in astrophysics depends heavily on the number of times the article has been read, and citation impact is a predictor of the use of an article.

Open access to peer-reviewed research articles has been aided by the application of the Open Archives Initiative (OAI). OAI is a protocol for tagging the minimal metadata required for identifying research articles to make them easily harvested, searched, and retrieved. Authors can make their papers openly accessible by depositing them in university e-print archives created with free OAI-compliant software designed by Harnad's research group in Southampton. OAI harvesters, such as OAIster, then allow researchers to search the growing number of OAI-compliant university archives, which already contain over a million records. The process of developing this system has been supported by the Budapest Open Access Initiative (BOAI), which also supports the creation of new open-access journals.

During the question-and-answer session after his presentation, Harnad noted that objections to open access are often misdirected. The objectives of open access are to maximize research impact by maximizing access to research. The objectives are *not* (1) to replace journals, *not* (2) to reduce the budgetary problems of libraries, and *not* (3) to provide access to research literature for teachers, students, the general public, or developing countries, although (2) and

(3) may follow from it.

Because Harnad has frequently encountered objections to self-archiving by authors, he has developed a FAQ list with his answers to the objections (see *www.eprints.org/self-faq/*). When he projected the list on the screen, a questioner stepped up to the microphone and asked, simply, "17?" In answer (to "17. Publishers'

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future"), Harnad acknowledged that many readers whose institutions can afford the tolls may continue to prefer to read peer-reviewed research results on paper and use the electronic version as a supplement. If the shift to exclusive use of open access happens gradually, journals will downsize and cut unnecessary costs, but retain features that are essential to the remaining users of toll access.

According to Harnad, toll access to research articles costs $2000 per article, on the average. A high-end estimate of the cost of peer review is $500 per article. Hence, if the demand for toll access were to shrink or disappear because of user preference for the open-access versions, the peer-review costs for their own outgoing research could be paid directly by universities (the primary subscribers to journals) out of the substantial windfall savings on their former subscription budgets for incoming research. Some of the savings could also be used to support copyediting if researchers believe that it is essential. Harnad suggested that much of the reference-checking and manuscript markup done by copyeditors could be handled by software, but it is unlikely that software can do much to catch errors or improve writing.

Science editors are used to thinking of journals as profit centers, not as toll barriers that prevent authors from achieving the full impact of their papers. Nevertheless, the numbers of paid subscriptions to many journals are decreasing while the archiving of open-access peer-reviewed papers is on the increase. The rate of increase is too low to satisfy Stevan Harnad, but he is certain that the outcome is both optimal for research and inevitable. After 12 years of relentlessly supporting the open-access concept, he remains intensely focused on his goal.