Learned Publishing (2000)**13**, 37–42

'Full and open access' to scientific information: an academic's view

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ABSTRACT: Stimulated by the potential of electronic distribution of information, discussions, sometimes rather tense, about the ownership and proprietary rights to scientific publications have generated something of a polarization of the communities that have stakes in this issue. There are some 'middle-grounders', but the intensity of the discourse has made them less visible than the spokesmen for the extremes. In this forum, we examine these positions and then present a case for a specific policy, in light of the views of the parties.

Introduction

The issue of access to scientific work can be expressed succinctly in the words of the title of a recent discussion in *Science*, 'Who should own scientific papers?'[1] Traditionally, in the sciences and in most academic publishing, publishers expect authors to assign them copyright of papers accepted for their journals. So long as print was the principal vehicle for disseminating the results of academic research, this arrangement provided a healthy symbiosis. Authors were rarely able by themselves to reach the audiences that publishers had, and publishers, often the professional societies of the authors, supplied various forms of added value such as critical reviewing prior to acceptance for publication (refereeing, usually anonymously done), and editing, which, when well done, can do wonders for the intelligibility of an academic paper. Publishers, as the copyright owners, also took the responsibility for granting permissions for reproduction of articles in other works. It is sometimes said that publishers pursue violations of copyright such as plagiarism, but this writer's impression, based on asking several publishers about the matter, is that, while they may chase plagiarists of books, they in fact never do the same for people who steal articles from academic journals.

The advent of electronic communication has changed this relationship. We are now in a transition, probably still in the early stages of that transition, as we learn to use electronic mail, the world wide web, and other means to communicate on the internet and its successors. This medium has made it possible for anyone to post information, and as we could all predict, people are trying as many ways of doing this as they can invent. In the context of this discussion, and from the perspective of this writer, the most important issue is how the internet can best serve the needs of science. There is another

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set of perspectives – not a single, unified one – that we must recognize, however we choose to deal with it: that of the publishers who have been the traditional disseminators of scientific results. Commercial publishers and professional societies that publish journals have at most only partly overlapping goals, sometimes even contrary. A question facing both the scientific and publishing communities is whether, or how much, the new medium creates a divergence of what was, for many years, a common interest. Or, put more positively, whether electronic communication could be used in some new way that produces a win–win situation for all.

Products of research as public goods

We concern ourselves here with scientific work supported by funds from government agencies and not-for-profit institutions. The primary rationale, far more important than any other, for such support by public institutions is this: the results of the research supported by such funds become *public goods*. These are goods whose value does not diminish by use. In fact, because science is cumulative, building on previous knowledge, the more the results are used, the greater is their value. It is unlikely that a society produces any other goods whose value to that society has a stronger positive feedback from its use.

The public goods ensuing from such research can only be realized if and when the information about the results of the research reaches the community of scientists and engineers. Dissemination of the results is as integral to the process of 'public research' as the experimental and theoretical work that we traditionally consider scientific research. This perspective was institutionalized in the context of research on global change in the 'Bromley doctrine' which recognized thepractice of 'full and open access' to scientific information as the norm.[2] The principle offull and open access – provision to researchers, at 'the lowest possible cost' of all the (valid) results of (publicly funded and other publicly distributed) research – was adopted there with respect to research and researchers working in the global change effort. It was soon recognized as a practice appropriate to all research supported by public funds when the National Academy of Sciences/National Research Council published its report on global exchange of scientific data.[3]

'Full and open access' is not to be taken to mean free access; this doctrine establishes the principle that the information should be distributed at the marginal cost of distribution, at least to the community within which the information and whatever it stimulates remains in the domain of public goods. This means, principally, the world of academic and government scientists. 'Full and open' does not preclude differential pricing, so that commercial users who convert the information to private goods would face higher charges than academic and government scientists. There are strong economic justifications for different pricing for different markets. The principle also does not, of itself, determine which participants in the enterprise should actually pay the marginal costs to the information distributor. This is a secondary question, probably best answered by determining where that responsibility would minimize transaction costs. It might be direct payment from the funding agencies to the publishers, in whatever general sense that should be taken; it might be the authors, via a sort of generalization of page charges, in which case the funds for those charges would necessarily be included in the grants supporting the research; or it might be the users of the data, who pay the equivalent of subscription or downloading charges, which again would put the burden on the users' grants or institutional funds. (There are experiments starting with new all-electronic journals supported by charges to authors.) At present, subscribers, especially libraries, pay the largest part, but there is some of each of the other modes. Because the libraries are the prime supporters, it is their institutions that now pay the greatest share of the costs of distributing scientific information. How much of those costs come from overhead on government grants is a matter of how overhead is treated in internal accounting systems.

Now we return to the central question: what principles and practices should govern the way we distribute the results of scientific

research? Two important but usually tacit principles must dominate the way we think about scientific information generated because it will become a public good. The first: if the results of government-supported research must be disseminated to realize the public goods for which the support was given, and should be maximally distributed to maximize those public goods, then anything that thwarts that distribution acts against the interests of the government that provided the support. This is indeed fundamental, but it does not in any way inhibit the attainment of benefits that might accrue to private enterprises from that research. The use of public goods, particularly of the results of scientific research, is by no means restricted only to the sectors who return other public goods. A very important secondary product of publicly supported research is obviously the value of goods derived from private investment in applying and developing results of such research in profit-making ventures. But they must be had without inhibiting the achievement of the public good. The manner in which those goods transfer to and are used by the private sector must remain consistent with the purposes of the original investors, i.e. the government agencies. They must not diminish the distribution that maximizes the public-good value of the research. The 'full and open' doctrine is a way to institutionalize that principle.

The second principle is perhaps entirely obvious: if an institution takes on the responsibility to support research on the basis of its results becoming public goods, then that institution assumes the responsibility to see that, by some means, those results reach the public that can use them. We shall return to this point.

In response to the position presented by the first principle, some critics from the publishing world have said that charging only marginal costs of distribution to academic researchers for scientific information would make it very difficult, perhaps unprofitable, for commercial publishers to sell some of that information. This may well be the case. When a commercial publisher considers a potential new market, it is the publisher who must decide whether that market is likely to produce profits. There is no reason for every potential new journal in every field of science to be profitable. Fiscally responsible publishers must be willing to say 'no' to some possible ventures. During the 1970s and 1980s, many new commercial journals appeared. Libraries andeven individuals were willing to buy subscriptions at the prices charged by publishers, and it may be that many of those journals were worth the price. Now, libraries and individuals are dropping subscriptions, for a variety of reasons, including rising costs, limited budgets, and diminishing space. We may well be entering a new era, in which commercial publication of many scientific journals is simply not economically efficient, and perhaps not even feasible at all for small-market, highly specialized journals. It may be that some of those specialized journals, with small readerships and only libraries as subscribers, will disappear from the commercial market as fewer libraries subscribe, subscription costs increase, and still more libraries cancel.

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How will scientists distribute and acquire the information if those specialized journals disappear, or if no commercial publishers take the initiative to put out certain databases? How will the public goods be achieved? The answers are straightforward. According to the second fundamental principle, the cost of distributing the results is part of the cost of the research –albeit a very small part of the total cost – and must be included in the funding for the research itself, whenever there is not a feasible and rationally priced commercial market. Research grant budgets very often carry line items for publication costs, typically including estimates of page charges. In other words, granting agencies already pay part of the direct distribution costs. They also can be said to pay part of the distribution costs through the indirect costs that go to the institution of the grantee, insofar as those indirect costs help support the library of the institution. Moreover, scientists and their professional societies manage to find ingenious ways to distribute their results when new vehicles appear. Photocopying led to wide distribution of preprints as well as reprints, among groups of researchers active

in a field. Now electronic distribution is finding its niche in a growing number of fields. All-electronic journals are already multiplying. A possible paradigm for the highly specialized journal in electronic-only format is the American Physical Society's (APS) new publication, *Physical Review Special Topics – Accelerators and Beams*. Others include the independent *Internet Journal of Chemistry* and the new all-electronic journal, *PhysChemComm*, from the Royal Society of Chemistry.

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Paying the costs

Many people are watching closely to learn what it costs to run such a journal on a regular, sustained basis. Clearly the largest componenent is personnel costs. Could the total be half or less than half the total for a traditional print journal? The question is still open, and may hang on whether almost all the interchanges between author, publisher, reviewer, and subscriber can be handled electronically, virtually eliminating paper from the entire production process. (Publishers and libraries might want to make and keep paper copies, as well as electronic copies, for archiving.) All this means that electronic publication by not-for-profit groups may win in a competition with traditional, commercial paper publication of specialized, small-circulation journals. The one obvious course commercial publishers might pursue in order to try to retain their markets for such journals would be to provide the significant added value that a specialized publisher can offer, but that individuals or not-for-profit organizations find too difficult or cumbersome to supply. However, it would not be surprising if some not-for-profit professional societies were at least as advanced and as fast in providing such added value as any commercial publishing house. Every mode that adds public-good value to results of government-supported research is itself valuable. From the viewpoints of both scientists and publishers, finding creative, inventive ways to use electronic communication should be a stimulating challenge.

Now we come to the specifics of realizing the maximum public-good value of that research. To what extent can and should scientific results be distributed? Should an author be able to post any scientific paper on her or his website? Should the author be able to submit a paper to an automatic e-print archive such as 'xxx.lanl.gov'? Should the author be able to present results at a conference and publish a report of the work in the conference proceedings? In the world of paper-only publication, publishers exacted agreements from authors in which authors assigned copyright of a paper to the publisher. Only investigators working in government laboratories or in a few private firms that had made special agreements with publishers were exempt from this. And the use of past tense is not really appropriate here; the practice is normal today. Authors of novels, however, do not normally assign copyrights to their publishers. They give their publishers licenses to publish, and retain their copyrights. The proposal has now emerged in several venues and several specific forms that authors of scientific papers, particularly of papers based on government-supported research, retain the copyright to their papers and give the publishers a license to include the papers in journals and subsequent collections. A parallel proposal for databases ineligible for copyright but for which some new *sui generis* form of protection might appear would be for the producer of the data to hold the new form of protection and grant a license to the database publisher.

Two camps

The science publishing world is currently divided into two camps, which we may call 'Camp A' and 'Camp B'. Camp A consists of those publishers who look on electronic postings as a way for material they publish to be captured and redistributed, even resold, and therefore as a potential form of unfair and perhaps even illegal competition. In Camp B are those other publishers who look on electronic postings as (i) advertising for their published material, and (or perhaps 'or') (ii) inevitable, and therefore to be used and assimilated in a manner as compatible as possible with the uses of the internet most attractive to the scientific community. Many

in Camp A are confident that they can hold their particular constituencies with the policies they now follow, or with relatively small modifications of those policies. (The American Chemical Society will allow authors to distribute, by electronic means, up to 50 copies of their papers from ACS journals.) Whether they are correct may take a decade to determine, but probably not much longer. The publishers in Camp B tend to be in fields in which preprint distribution has been common, and in which electronic communication took root early. This might signal a delay between the wide adoption of electronic media of communication in those fields and a similar adoption in other fields. Alternatively, it may indicate significant differences in how people in different fields want to behave. If the former, then it is likely that in the next decade, new, electronic 'journals' will spring up in fields whose publishers are in Camp A, and that these new media, in Camp B, will compete with those in Camp A; which will win is impossible to predict. That may depend crucially on how inventive the journals become in inventing new forms of added value, especially forms that would be difficult for authors to provide to readers of personal web pages or e-print archives. If the two-culture situation describes the evolving sciences, then we will simply live with two coexisting publishers' camps for a long time.

How to be an effective Camp B journal is still at least partly an open question. From the perspective of the working scientist, this must be the more attractive mode, simply because it is more permissive. The APS, already very permissive toward postings either on personal web pages or on an e-print archive such as the Los Alamos-based 'xxx.lanl.gov,' is exploring ways that one might write a license that would provide the journal with essentially all the positive rights it now has, yet be only a license so that the author would keep the copyright. If the APS succeeds, the major change from the current situation, with the journal holding copyright, would be that the journal would not be able to prevent or prohibit the author from doing whatever he or she chose to do with the paper. In other words, the positive rights of the journal would remain, but its negative powers would disappear.

It is possible that other means might well achieve the same ends. An extreme and unlikely possibility would be the extension of the rules now applicable to results of research from government laboratories to all results stemming from government-supported research. These rules prohibit the researcher from assigning copyright to any publisher; the copyright remains with the government. Extending such rules to all government-supported research would obviously present problems for research supported jointly by government and private funds; in the United States, it might be in conflict with the Bayh–Dole Act, which allows universities and private enterprises to privatize results of government-supported research and earn profits from them. Retention of copyright by the author obviously holds no problems here, because the author can make any sort of arrangement with a commercial supporter of the research. (Commercial support may, however, pose other problems associated with openness of communication of research within the academic community, but this is a topic for another essay.) As an alternative model, publishers might offer copyright assignments that give authors considerably more freedom than typical Camp A copyright assignments now allow.

The scientific community would probably be saddened to see a diminution of the essentially friendly, productive relationship of mutual self-interest it has had with the publishing community. However, just as the publishing community can be expected to put its own interests first in any time of change, so can the scientific community. While there is a spectrum of views within this community, that spectrum lies almost entirely within the domain of Camp B; this writer puts himself very definitely in this group, believing that Camp A behavior will become an anachronism in a very few years. The differences among scientists are largely over the role (but not over the desirability) of refereeing prior to publication, over the role formal publications should play in supporting professional scientific societies financially, and over personal preferences

The scientific community would be saddened to see a diminution of the productive relationship of mutual self-interest it has had with the publishing community

for paper copies or online access with downloading. If a new accommodation can be found, it would be very good for all concerned. The publishing community cannot realistically expect the scientific community to cling to old ways of communicating when people invent other modes that are more effective for meeting the goals of science; scientists will find their own new ways and use them.

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