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KEEPING THE MINUTES OF SCIENCE

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INTRODUCTION

Scientific journal publishing differs markedly from most other kinds of publishing. Born out of the exchange of letters on scientific topics and results, it has evolved into as much a service to scientists who need to publish the results of their work, as a service to those who need to be kept abreast of scientific developments elsewhere. Unlike most other publishing, scientific journal publishing has as much to do with the proper recording of scientific activity as with the conveyance of information. As far as the latter is concerned, scientists do not rely on scientific journals alone any more, in order to keep informed. Journals are only one of the variety of ways in which scientists gather scientific information. However, scientific information that comes to a scientist via a scientific journal still carries the highest degree of authority for information, as it has been peer reviewed and gone through a certification and validation process before reaching the reader.

For the author a scientific journal is essential. There are currently no other ways for a scientist to get his work certified and validated than publishing in a journal of good reputation. This certification and validation process is of immense value to science. It is to a large degree the result of a long self-organising process that has grown into a highly sophisticated structure (including a "pecking order" of journals) in which scientific results are placed in a hierarchical context, are 'taxonomised', standardised, formalised, made accessible through a uniform and globally accepted reference system. It forms the backbone of a scientific archive.

Scientists, libraries and publishers share a responsibility to protect and safeguard this elegant system of "keeping the minutes of science". Collapse of this system is something science can ill afford, even though in the future it is quite possible that new systems will arise and eventually be standardised and become globally accepted. A hiatus of a number of years, however, will do great damage to the continuity of scientific research and if there is to be a transition into a new situation, it has to be carefully managed.

This paper does not deal with the issue of print journals versus electronic journals. Journal publishing is discussed as a concept, independent of the medium. It is obviously recognised that the introduction of digital technology can change the way journals are being used and this technology can help achieve efficiencies that were hitherto impossible. But the concept of a journal remains essentially unchanged.

PROPOSITIONS

1. If not properly published, scientific results are fairly useless — because usually indistinguishable from speculation.

In most democracies, anybody is free to publish anything that is not obscene or libellous, and there are quite a few countries where one can get away with that as well. Whether it is true, whether the argument is not flawed, whether it is ambiguous, whether it is informative, whether it is new, whether it is original, *etcetera*, is quite another matter. The level of reliability of unaccredited publications is not known. It may be high or dismally low. Although the unaccredited material may be intrinsically reliable, the fact that it is not reasonably certain that it is, makes it unreliable. In order to substantially increase the chance that all or most of the above can be relied upon as representing the current state of knowledge, peer reviewed scientific journals evolved.

In the beginning, at the time the first scientific journals were established (1655, LE JOURNAL DES SÇAVANS, France, quickly followed later in the same year by PHYLOSOPHICAL TRANSACTIONS of the Royal Society of London), peer review did not yet exist. But it became clear fairly soon that not everything submitted was fit for publication and criteria for admission were developed, although journal articles were initially not regarded as definitive publications, as the mature research results would still finally be written up in monographs¹.

It would be a mistake to believe that peer review ensures quality and integrity of the material at all times. The American of Research Integrity (ORI) can testify to that. However, the chance of finding total nonsense in established peer reviewed journals is slight. Peer review does not only ensure a good measure of QIVAS (Quality, Integrity, Veracity, Accuracy, and Security)², but also a hierarchy, not just of importance, but of relevance to the central issues of the discipline concerned as well. On top of this, publication in a journal provides priority and authority (in the original sense of established authorship). Results cannot easily be ‘hijacked’ any more once they are received by, and published in, a reputable journal and (undetected and uncontested) plagiarism becomes pretty difficult, too. Published results have, by virtue of having been published in a peer reviewed journal, become part of the accepted and acknowledged body of scientific knowledge or theory.

2. The growth in numbers of scientific papers is outside the influence or control of publishers.

The laws of supply and demand do not apply in a straightforward way to scientific information. As Bernard Naylor has described it: “If there is an excess of supply over demand in the journals industry, and there seems no prospect of an increase in demand, the obvious alternative is that supply ought to fall. However, whichever way you look at it, supply is tending to increase. The normal self-readjusting tension between supply and demand fails to operate”³.

But we should not forget that it is the scientists’ very job to uncover and add to the body of knowledge!

Currently, the number of scientific articles published per year seems to be increasing fairly constantly within the order of 4 to 6 percent. This poses great problems to the global scientific community. ‘Twigging’ of disciplines and further specialisation is still the most common response. As long as the need and desire for insight into natural

phenomena grows, scientific activity grows, and with scientific activity, scientific publications. Scientific papers are, however, not just used to record and convey results. They are also used to advance careers and boost egos. Indeed, in many situations they are the single most important measure of a scientist's performance. And not just scientists are being measured by the number of their papers, but entire departments and whole research institutions as well.

Growth of scientific material seems inevitable. It is becoming more and more difficult, of course, to be sure that one's paper will actually be seen by the majority of the intended audience. So apart from 'slicing' their results into many papers which one would do for reasons of career advancement, some researchers resort to this technique in order to increase their chance to be 'found'. Further growth of the amount of published material will only make this a more attractive (some would say necessary) option, in order to increase the 'signal to noise ratio', so to speak.

Publishers do not increase the amount of scientific articles; scientists do, driven by 'publish-or-perish' and performance criteria, but essentially just doing what they are expected to do and what they are paid for. Publishers only respond to the phenomenon and as often as not, also experience it as a problem. The irony is that the very same governments that insist on proving maximum performances with published papers are the first to cut the budgets that, by way of paying for subscriptions to the journals, support the mechanisms that make publication of those papers possible.

3. Scientific articles should be published only for their scientific merit, not for their commercial merit.

One of the attractions of the current model in which articles are published in the context of journals is that no commercial judgement is passed. The only reason why an article is accepted or rejected is its quality or relevance to the particular forum that the journal constitutes. This is done exclusively by the active scientists who act as editors-in-chief, members of editorial boards, and reviewers of the journals, with no interference from the publisher. Particularly not if the publisher is independent of a particular scientific constituency and is unencumbered by any possible scientific (or even political) controversy or secret agenda.

Independent journal publishing differs markedly from book publishing, where the market potential also has a large influence on the decisions, made by the publishers, on whether or not to publish. Scientifically worthy books are, as a rule, not published if insufficient prospective buyers can be found.

The fact that journal articles are published on their scientific merits only is worth preserving. Market forces may (and will) introduce an improper bias. Just as it is improper to sell academic degrees, it would be improper to give undue preference to scientific results coming from wealthier institutes or companies. This would be likely to happen, though, if commercial criteria were introduced for the publication of primary research results. Wider distribution than the normal journal circulation is already being sponsored for certain articles. This is a welcome source of income to publishers and likely to influence decisions if the current system of publishing purely on scientific merit is compromised.

This is a realistic risk, though, as publishing on exclusively scientific criteria is being threatened by the advent of P3, or Pay-Per-Paper, a.k.a. Pay-per-View (in electronic

environments), document delivery (DocDel) or individual article supply (IAS). After all, except in extraordinary circumstances, no publisher, independent or associated with a scientific society, will want to commit resources to the publishing of an article which offers no, or very limited, potential for recouping the investment through sales of the article. Such an IAS system is likely to favour publication of articles with clear commercial potential. In practice, this is likely to mean articles written by well-known scientists from English speaking countries, especially the United States (for that is where a major market will be found), and from universities or research centres with resounding names, or companies with deep pockets which are willing to sponsor the publication. It is not difficult to imagine claims of cultural and commercial imperialism in such a scenario.

4. Information is not a commodity.

The Oxford dictionary defines ‘commodity’ as “...a thing of use or value, *spec.* a thing that is an object of trade, *esp.* a raw material or agricultural crop”. The only faithfully recorded instant when commodities behaved like information occurred almost 2000 years ago. It concerned loaves and fish, and the emphasis should be on ‘faithfully’, not on ‘recorded’. Since then, it has not happened again that one could give away a commodity like a loaf of bread and still have it. It can be done with information, though!

It follows that information cannot truly be expected to have the same economic properties as commodities. Sharing information does not mean the same as sharing a bushel of wheat, unless it takes the form of keeping the first five pages of an article to oneself and giving the other five to someone else. Hence the virtually worldwide establishment of legal constructions like copyright, which are awkward and imperfect, but the only means currently available to make sure that the necessary resources remain to be committed to the recording and dissemination of information. It would be attractive for purchasers of information to treat it as a commodity, especially given its ‘loaf-and-fish’ properties. What really is copying of information and document delivery is known as ‘resource sharing’, or sometimes goes under the euphemism of ‘interlibrary loan’. The potential is enormous: take out one subscription per country and share it with all the other libraries. The law permits it! It doesn’t take a rocket scientist to see the consequences, though.

5. The real product of scientific journal publishers is not paper, not distribution, not content, but the service of providing a structured forum for scientific discourse.

But alas, information is not a commodity and it is not even the publishers’ product. Stevan Harnad, editor of the electronic journal PSYCOLOQUY, describes in his paper “Implementing Peer Review on the Net: Scientific Quality Control in Scholarly Electronic Journals”⁴ how his eyes were opened in a conversation with a television network executive, who told him that TV’s product is not the programmes that are broadcast, but the viewers’ eyeballs which are sold to the advertisers (although in many countries outside the USA this would be either not or only partially true). In a similar vein, scientific journal publishers’ product is not the content (that is the authors’), not the printed paper (that is the printers’), not the distribution (that is the mail’s), but the provision of a forum for the conduct of scientific discourse, which facilitates the proper keeping of the minutes of science. A journal is a concept, not necessarily a physical entity. The publisher provides a structured (‘pecking order’) and controlled (‘quality label’) forum, complete with gatekeepers (editor and reviewers), organisers (indexers for secondary literature and databases), and

‘translators’ (although the accepted *lingua franca* of science seems to have become English, the ‘real’ language of science is more than this: it is a closely knit framework of standardisations, rules and conventions, in the interest of precision and the avoidance of ambiguities, which amounts to a ‘grammar’ and ‘idiom’ that few scientists fully adhere to; hence the need for ‘translators’, better known as subeditors or technical editors, who often also provide conventional translation services for those authors whose native tongue is not English). Almost as an afterthought, publishers also arrange for composition (typesetting for print; SGML-coding for electronic dissemination), printing or mounting on servers, and subsequent dissemination.

The service of providing a structured and controlled forum is as important for authors as it is for readers of journals. It is not for nothing that many scientific societies are charging the authors for publication of their articles. It is inherently fair that both authors and readers contribute to the maintenance of the forum. Societies are finding it difficult to keep up the system of page charges, as most independent publishers are not levying them. The American Physical Society is currently examining its page charge levies, after an experimental period of suspending page charges for manuscripts submitted electronically to PHYSICAL REVIEW C. One of the arguments used for continuing the system of page-charges is “...that it is reasonable to expect research grants to bear some of the publication costs, since publication could be considered an important aspect of research”⁵. Most independent publishers have concentrated on subscriptions as the sole source of financial support for the journals. Should this lead to journals accepting only papers from researchers at institutions or companies underwriting and supporting the journal via a subscription? It would be fair, but hardly feasible and introduce a similar potential bias as discussed under Proposition 3.

6. Economic models for journal publishing exclusively based on subscriptions are becoming less viable; the ones based on individual article sales (document delivery) have never been, nor will ever be viable.

The flaw in the previous proposition is, of course, that publishers in reality derive their income basically from treating content, printing and dissemination as their product. Content is first converted into a pseudo-commodity, with the aid of copyright, and then sold on a just-in-case basis by the subscription, and, reluctantly, on a just-in-time basis (or just-too-late, as Bernard Naylor aptly describes it!) by the individual article. The transactional document delivery model is particularly badly suited to the forum concept of a journal. It reduces the intricate fabric of written scientific discourse to the one-way street of information provision, devoid of much contextual and meta information that makes the package of a journal so valuable (even aside from concessions document delivery makes to browseability and serendipity). Also, each individual article would have to be purchased hundreds of times at the prices that currently seem usual, or carry a price tag that is substantially higher, in order to make it possible that investments in the publication of the articles could be recouped. But a more serious danger lies in the fact that document delivery leads to a model in which articles are no longer published on their scientific merit, but on their commercial merit, as already discussed under Proposition 3. Subscriptions are not satisfactory any longer either. Library budgets have decreased in real terms over the last decade, pretty much worldwide. Resource sharing and inter-library loan are a result, and subscriptions, in combination with fair-use and library privileges provided by law, are ideally suited to that. Or so it seems. The natural

course of events is now that numbers of subscriptions will go down, interlibrary lending up, subscription prices also up as a consequence, with the result that users' access to material becomes more difficult or cumbersome; libraries spend their budgets on administrative chores connected with inter-library loan instead of building collections in order to optimally serve their constituencies; authors see the potential of chance encounters of their articles with readers dwindle; scientific societies cease to exist or are forced to minimise the service to their members; and publishers go out of business. In short, everyone loses, except, of course, the suppliers of photocopiers and the paper they churn out.

7. Academic Press is convinced that there are viable alternatives that do much more justice to the needs of authors, libraries, users, and publishers, without, on the whole and in total, costing more.

Fortunately, there may be other scenarios. Academic Press clearly sees the plight of the libraries, which is, by extension, the plight of the entire scientific community. Supply is not decreasing but increasing, demand is not increasing but decreasing (economic demand, by the entities that pay; not the end-user demand or the demand from authors for a vehicle to publish their papers in), so the only alternative left is to reduce costs. Academic Press is working on paradigms in which subscriptions are essentially replaced with licences, giving subsequent free electronic access to every user affiliated with the library taking the licence, thereby essentially reacting to increasing end-user demand, while at the same time accommodating the dire financial situation the libraries find themselves in. Options to grant major incentives to consortia of libraries for taking licences that span a whole range of journals are currently being explored. We are even including the possibility of offering such licences to loose consortia of all libraries in a given province, state, or even country, which are then free to share all the material amongst all members of the consortium in whatever form (electronically or on paper) and however frequently as is desired. This scheme is called APPEAL, for Academic Press Print and Electronic Access Licence.

In the view of Academic Press, the paradigm of an APPEAL licence would potentially offer promising benefits to all parties concerned:

- the authors would have the assurance that their papers are directly available to a much larger potential audience than is the case now;
- the libraries would be able to offer the research, teaching and student community much wider instant access to much more material;
- the barrier to turning to and browsing through many more sources would be removed for researchers, students and other library users;
- the publishers would be able to make the necessary investments in improving the sophistication of the 'forum' and the cost per unit-of-information ratio.

All this for substantially the same amount of money that is being spent on scientific literature by libraries now. On top of that, the libraries would be able to make appreciable savings on costly inter-library loan and cut down, or even eliminate, expenses for commercial or semicommercial (BLDSC) document delivery, at least regarding current journal material.

CONCLUSION

A form of formal publishing, whether in print or electronic, remains essential for the structuring and preservation of the body of scientific knowledge, however many problems the unrestricted growth of scientific knowledge poses to the global scientific community. It is imperative that sufficient resources continue to be made available for this. However, the resources currently used for 'keeping the minutes of science' can be used far more efficiently, doing much more justice to the scientific efforts carried out and catering much better to the identified needs of the scientific community.

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