

Loaves and Fishes as Food for Thought

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According to Matthew:

"And the Lord saith unto them, how many loaves have ye? And they say unto him, we have here but five loaves, and two fishes.

And he commanded the multitude to sit down on the grass, and took the five loaves, and the two fishes, and looking up to heaven, he blessed, and brake, and gave the loaves to his disciples, and the disciples to the multitude.

And they did all eat, and were filled: and they took up of the fragments that remained twelve baskets full.

And they that had eaten were about five thousand men, beside women and children."

It's of course a mystery not likely to be solvable by science how these humble morsels could feed so many, but I see these loaves and fishes as allegorical for food for the soul, understanding, insight, wisdom. The more you share it, the more it's worth. And no matter with how many people you share it, you don't run out.

The pursuit of understanding and insight into the mysteries of our world is known as science, and often carried out for the noblest of motives: the quest to understand. Curiosity brought mankind where it is now. Our knowledge and understanding has shaped the world as we know it. We can thank science to a large degree for the health we enjoy, the wealth we enjoy, and the meaning we can give to our lives without having to worry about simply surviving.

Like the loaves and the fishes that were shared, it behoves us to share the knowledge, understanding, and insight we have gained with our scientific activities with others on this earth who have not yet escaped the struggle for life at subsistence levels. The good news is that we do not need miraculous powers to share the loaves and fishes of knowledge. All we need is to make the results of our scientific research accessible to anybody who can use it to better their lives. Science, though perhaps necessarily elitist in its pursuit, should be equitable in the sharing of its results.

Apart from this lofty ideal, there is of course the down-to-earth argument that science itself benefits from unrestricted exchange of information. By analogy to Open Source Software, one could think of science as 'Open Source Knowledge'. That is how science would work most optimally: with all the knowledge freely and universally accessible and then extended, built-upon, improved, verified or falsified, discussed, applied, accepted or rejected, and so on. The efficiency and speed of research could potentially increase dramatically in a true 'open source' environment.

Reason enough, therefore, to make scientific research results freely and universally available as a public good. This has become known as 'Open Access'.

Simple enough, but do we have the powers to make scientific knowledge a universal public good? Sure, we share our research results by publishing them in

journals, so that others can have access to the material and use it and build on it and take inspiration from it. So far so good. Unfortunately, the mechanisms we currently have for publishing are closer to the literal loaves and fishes provided by bakers and fishmongers than to the allegorical ones that can be shared without being depleted. The intrinsically 'shareable' knowledge has artificially been rendered scarce by constructs like copyright; so most publishers are essentially access-rights-mongers. This limits the sharing of information, of course, but the publishing process costs money and these publishing mechanisms and copyright devices have evolved to provide the funds and economic stimuli to engage in the dissemination of knowledge.

This doesn't quite suit scientists, because it would be in their interest to have the widest possible dissemination of their research results, but historically they have had no other choice. Dissemination was expensive, because the only effective information carrier - outside personal communication at conferences and the like - was paper. And copyrights kept the system propped up and ensured sufficient funds to defray the high cost of information dissemination in printed form.

In the last decade or so, this situation has changed fundamentally. A new and strikingly effective carrier emerged in the form of the internet. The technology all of a sudden made it possible to 'broadcast' virtually limitless perfect copies of scientific articles. The miracle of sharing the loaves and fishes of knowledge became reality.

Except that it didn't. Or should that be 'it didn't yet'?

The trouble is that the whole infrastructure and economic models are built and eminently suited for the dissemination and preservation of information printed on paper. There is an enormous amount of vested interest in the status quo. The internet may be used more and more as the carrier for scientific information, but adherence to the paper analogy is jealously guarded, replacing subscriptions with access licences with the same effect of limiting circulation to those who pay to see it.

For scientists, little has changed as yet. The limitation placed on the dissemination of their research, even though it takes place on the internet, still doesn't suit them. First of all it doesn't help their noble quest for knowledge and understanding, but secondly, scientists are people, and have an interest in their careers as much as in the acquisition of the facts that allow them to construct models and theories to achieve this knowledge and understanding. Like everybody else, they live in an 'ego-system': in their case the ego-system of 'publish-or-perish'. Career advancement is dependent on how their ideas and theories are propagated. It's not only 'publish-or-perish', but also 'be read or be dead'. Publishing itself doesn't quite do the trick; the published articles must be seen and used as bricks in the edifice of science. The 'currency' in which this is measured is the number of citations to an article. An author's motto pretty much must be "*I am cited, therefore I am*". In order to be cited scientists need visibility, which would be greatly enhanced by open access.

So we have three reasons why open access is desirable: the equitable spread of knowledge, the efficient working of science, and the career perspectives of researchers.

There is no reason why we shouldn't have open access. The technology clearly is available. And the money, too. Society at large would pay for it. We all pay tax. Scientific research is one of the things paid for out of tax revenues. And tax revenues also pay for the right to read the results of that scientific research, via

the funding of libraries. Unfortunately, library funding is not unlimited. Isn't it more logical then that publicly funded scientific research should become widely disseminated public knowledge rather than be limited to those libraries that can afford to buy it? Would it not be fair to expect the resulting knowledge to become available to everyone? Open access wouldn't cost more than limited access does now and quite possibly less. The difference is how the money is spent. Instead of paying for the output of the publishing process, society could choose to pay for the process itself. In other words: a reversal of the publishing model and payment at input.

Apart from making full and universal open access possible, there are more benefits to such a model. Two of them are worth mentioning here:

- The cost of publishing becomes an integral part of the cost of research itself;
- The '*cui bono*' argument that payment should be on behalf of the beneficiary.

First of all the idea that publication becomes an integral part of the research process. Because an exchange of knowledge is an essential ingredient of science, research is almost by definition supposed to produce a publication in a scholarly journal. Without such a publication the research is basically deemed not to have taken place. The economic burden of publication, though, rests on the shoulders of others: the subscribers to the journal in which the article is published. Payment at input makes it possible that the publication of an article is seen as part of the cost of completing the research. It does away with the anomalous situation that an essential part of the research is dissociated from it by wholly relying on others to fund it.

The '*cui bono*' argument is prone to some confusion but more straight-forward than it might seem. One could argue that the reader is a beneficiary and should pay. This is true, but in an academic setting readers hardly ever pay, and they are not the sole beneficiaries in the first place. The institution or funding body pays on behalf of the reader in the conventional model. If the institution or funding body were to pay on behalf of the author, at input, the result would be open access. Given that the author, his institution, and his funding body are at least as much beneficiaries of research being published as readers are, the input-paid model is to be preferred, because for the same cost or less it enables open access. Indeed, it could be argued that the author is the predominant beneficiary of publication. He needs to survive in a 'publish-or-perish' environment by ensuring that his ideas are propagated and his scientific 'prowess' is noticed and recorded. For him, and for his institutional and financial backers, publication takes on hues of 'propaganda' and 'advertising'. Those are not normally paid for by the reader. The ideal copyright line an author wants on his article is this:

© *The Author. Please copy and distribute this article as often and as widely as possible.* This is just not possible in a system paid for by readers via subscriptions. But it is not only possible in open access publishing; it is the essence of it.

A reminder of what 'open access' actually means*:

1. It applies to articles, not necessarily journals or publishers;
2. The author declares that the article can be used by anyone for any legitimate purpose;

* A more 'legal' definition and an author's copyright and license agreement can be found on the BioMed Central web site <http://www.biomedcentral.com/info/about/license>

3. The article is archived in a suitable format in at least one internationally recognised online open access repository (such as PubMed Central)

So, the big question is not so much 'should there be open access to scientific knowledge', as the answer to that is an increasingly clear 'yes', but rather, 'how do we get to open access from the current situation of very limited access to this knowledge'. If we define 'open access' as we have done above, it points us to a few ways the transition could be facilitated. The fact that open access applies to articles rather than journals or publishers permits a mixed model. That is important for a transition. The amount an average STM publisher currently makes from an average article is in the order of \$5000 (actual amounts vary between \$1000 and \$8000 per article, dependent on the journal, the discipline and the publisher; Andrew Odlyzko¹). If such an amount of revenue per article could be realised from input-charges, at least some publishers would have less of a problem reversing their business models and converting to open access policies. In the mean time, they may be tempted to offer authors the choice and raise sufficient amounts from individual articles for which the author, or his funding body, insists on its free online availability. It may not be realistically possible for authors to come up with the same amount the publisher makes now, especially not if they are toward the high end of the spectrum, but those amounts cover costs that are eventually redundant in an open access environment, such as the cost of print and access control. A transitional mixed model phase (David Prosser²), in which the author is given the choice to pay for open access - or not to pay and accept limited dissemination - may give the publisher some comfort and time to adjust. The stance that an increasing number of funding agencies is taking, namely that the cost of publishing is to be seen as an integral part of the cost of the research itself, is most helpful.

The definition of what open access is also mentions the issue of archiving. The point of archiving articles in open access repositories is that it gives the author and his backers reassurance that the article will be properly preserved. It also reassures the publisher that he doesn't have to commit to long-term investments in maintaining his own archives. (Incidentally, the concept of publishers maintaining archives has only been around for less than a decade, since on-line publication took off seriously; before that, archiving was almost exclusively the libraries' domain).

At BioMed Central we fully adhere to the principles of open access for any research article we publish. Indeed, we have helped to define much of what open access now is. It is not (yet) an easy task. The environment in which we work is still heavily stacked against such radically new ways of publishing scientific results, however beneficial they may be. It is clear to us that not only authors, but the entire scientific community, even society at large, would benefit from open access, yet the onus of effecting the change from the conventional publishing model to an open access model is pretty much on the shoulders of individual authors at the present time. The sad fact is that the existing pressures on authors to conform sometimes prevent them from choosing open access. Regarding publication charges as part of the cost of doing research, as an increasing number of institutions and funding bodies do, will help, as will a commitment on the part of funding bodies and those who evaluate researchers for appointments and promotions to base their judgement on the merit of articles published rather than just on the journal in which they appeared. The growing recognition by funding bodies and institutions alike that an author's decision to publish articles with open access must be seen as a service to science is also most welcome.

References

¹ Odlyzko, Andrew. "The Economics of Electronic Journals". *First Monday* (1997)
(http://www.firstmonday.dk/issues/issue2_8/odlyzko/#III.)

² Prosser, David. "SPARC Europe on Open Access". *SPARC E-News* (February-March 2003)
(<http://www.arl.org/sparc/core/index.asp?page=g29#6>)