Open Access:

Toward the Internet of the Mind

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Introduction

On February 14, 2002, a small text of fewer than a thousand words quietly appeared on the Web: titled the "Budapest Open Access Initiative" (BOAI)[2], it gave a public face to discussions between sixteen participants that had taken place on December 1 and 2, 2001 in Budapest, at the invitation of the Open Society Foundations (then known as the Open Society Institute).

Actually, the Budapest meeting was the seat of impassioned (and often divergent) analyses and critiques of various dysfunctional aspects of scientific communication: the slowness of the editorial process, the high price of journals, and the failure to take advantage of the Internet were all cited as obstacles to the deployment of an optimal communication system for scholarly research. At the end of the day, however, as no agreement had emerged, the idea of crafting a position paper, a kind of manifesto, emerged: it was felt that the very effort needed to make such a result possible would help cement the small group that had been convened in Hungary, and help it to move forward - despite initial differences.

Thanks to the miracles of Internet communication, creating a position paper worked. Convergence was achieved in the form of the document that emerged on Valentines Day 2002. In fact, the virtual conversation among the participants had brought forth an energy and an enthusiasm that quickly transmuted a term – Open Access – into a movement. It must be added that the textual crafting of the BOAI was masterfully conducted by Peter Suber, who also lent his felicitous writing style to the document. It started with a beautiful and ringing statement that conferred a form of historical necessity to Open Access:

> "An old tradition and a new technology have converged to make possible an unprecedented public good."

Wedding the old – the scientific ethos – with the new – computers and the Internet – elicited a powerful, historically grounded synthesis that gave gravitas to the BOAI. In effect, the Budapest

2   The "Budapest Open Access Initiative," http://www.budapestopenaccessinitiative.org/read.

Initiative stated, Open Access was not the hastily cobbled up conceit of a small, marginal band of scholars and scientists dissatisfied with their communication system; instead, it asserted anew the central position of *communication* as the foundation of the scientific enterprise. Communication, as William D. Harvey famously posited, is the "essence of science,"[3] and thanks to the Internet, scientific communication could be further conceived as the distributed system of human intelligence. This profoundly human project – really, that of the Scientific Revolution – corresponds to the bootstrapping of humanity to ever-rising levels of understanding reality.

The very values of science that the great sociologist of science, Robert K. Merton had identified were the age-old foundations, the *ethos* that emerged with the Scientific Revolution. Indeed, thanks to new possibilities offered by print technology, a distributed form of human intelligence had begun to scale up in the 17th century. Now, with the rise of global computer networks, the next stage in the rise of distributed human intelligence is clearly in the offing. Open Access is simply a way to express the cross-fertilization of the very culture of science with new technologies to create the optimal communication system science needs.

With a few relatively simple steps, or so it seemed in 2002, the power of networked brains could be unleashed, and it could be done swiftly, so obvious and compelling was Stevan Harnad's image of "skywriting"[4] as it first emerged in the late '80's. Fifteen years after the BOAI, however, history is teaching us once more that we must be both persistent and patient. Much has happened, and much of it is positive, but taking stock of what has been achieved has also become an urgent task, if only to get a clear sense of our bearings: while Open Access is now here to stay, it also displays a variety of forms that do not all conform with the project of distributed human intelligence with which it is associated. Lesser, degraded, forms of Open Access have also and gradually emerged, sometimes as the result of power plays by powerful actors, sometimes out of compromises proposed by people of good will. At the same time, the very multiplicity of social actors now involved in Open Access has made the field much more complex than it was fifteen years ago.

Meanwhile, digital culture is progressing apace, and its effects are profound, not just technological. For example, the very notion of document as a tool to structure thought, memory and verifiable predictions is undergoing deep transformations that will not be fully understood for decades. It took centuries to understand print documents. Open Access is a spin-off of digital culture, and it cannot be understood without reference to it.

In the absence of computers and networks, access to knowledge was limited to what book dealers and libraries could offer. As a subsidized reader, a scientist was limited to what was available in the local library, and this was the best kind of access that could be offered in the print world. When the same

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3   Garvey, William D. *Communication, The Essence of Science: Facilitating Information Exchange among Librarians, Scientists, Engineers and Students*. Pergamon International Library of Science, Technology, Engineering and Social Studies. Oxford: Pergamon Press, 1979.

4   S. Harnad, S. "Scholarly Skywriting and the Prepublication Continuum of Scientific Inquiry", *Psychological Science*, 1990, 1: 342 - 343 (reprinted in *Current Contents*, November 11 1991, 45: 9-13).

limitations were maintained with digital documents transmitted over networks, many challenged its rationale. Perhaps legitimate for novels and cookbooks, whose authors received payment for the material they contributed, these artificial barriers made no sense for knowledge production. Open Access, on the other hand, did make sense. This is precisely what the BOAI expressed in 2002.

II

Open Access:
The core of a distributed communication system among producers of knowledge

Access means access. Whenever access to documents is impeded, the quality of human communication suffers. Impeding access can take a wide variety of forms, ranging from limiting who can work with documents, to delaying when such work can take place. Financial barriers and embargoes, for example, seek objectives that can only look paradoxical from a scientist's perspective: if the financial underpinning of a communication system leads to difficulties for scientists, what should be changed? The answer is simple, and it is a question of simple priorities: the communication system of science and its objectives trump business plans, not the reverse. Short of arguing that the science communication system is not a communication system at all, but rather an archive, or a way to adjudicate paternity to some idea, theory or concept, treating scientific communication as a set of saleable services, and not as the fundamental underpinning of knowledge creation and validation, makes little sense. The best demonstration of the primacy of communication over business plans becomes blindingly clear when an emergency arises. The Ebola and the Zika epidemics encouraged researchers and some publishers to open up access to the needed literature and data to fight the scourge back[5]. However, the need to access validated knowledge is not limited to times of crisis; it also affects every moment of knowledge creation.

The reach of a distributed system of human intelligence is ultimately limited by the constraints placed on human communication. The notion of Open Access aims precisely at describing how far a distributed system of human intelligence, unencumbered by artificial shackles, may reach. This is what

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[5] Nathan L. Yozwiak, Stephen F. Schaffner, Pardis C. Sabeti, "Data Sharing: Make Outbreak Research Open Access", *Nature*, Feb. 25, 2015, vol. 518, 477-9. doi:10.1038/518477a. http://www.nature.com/news/data-sharing-make-outbreak-research-open-access-1.16966. See also "Don't Think Open Access Is Important? It Might Have Prevented Much Of The Ebola Outbreak," Techdirt blog https://www.techdirt.com/articles/20150409/17514230608/dont-think-open-access-is-important-it-might-have-prevented-much-ebola-outbreak.shtml. See also, regarding the Zika emergency, "Sharing data during Zika and other global health emergencies" February 10, 2016. https://wellcome.ac.uk/news/sharing-data-during-zika-and-other-global-health-emergencies. A long list of publishing organizations accompanies the Wellcome Statement. Springer-Nature appears to be the only large, commercial, publisher who signed on to this commitment.

BOAI expressed in a few, strong, words: The "... literature will be freely accessible when users may read, download, copy, distribute, print, search, or link to it, pass it as data to analytic software, or use it for any other purpose, without financial, legal, or technical barriers other than those of gaining access to the internet itself."

To be sure, a distributed system of human intelligence must pay attention to participating individuals, for example to motivate and reward them, but its overriding concern remains the communication system itself, and its evolution. Rewarding and recognizing individuals, in any case, should be kept separate from the imperative of making knowledge circulate and accessible.

The considerations extended to individuals, including print-derived notions such as "authorship,"[6] can reinforce the distributed nature of the system, but, from the perspective of communication, the individual takes second place to the overall system. The growing number of scientific "authors" in the published articles of essentially all disciplines underscores the fact that the production of knowledge relies on networked individuals, and not just on self-reliant individuals. However high a particular researcher may tower over his scientific colleagues, he/she will still be dependent upon other scientists and researchers. "Standing on the shoulders of giants" is a well-rehearsed saw from the 12th century (Bernard de Chartres), through Newton, to the present sociological literature, and Newton may well have poked uncharitable fun at Hooke, given the latter's diminutive stature, when he used this phrase. However, even Newton could not avoid connecting his achievements to his predecessors and colleagues.

The form of scientific production which associates large numbers of individuals contributing their results and data to the building of ever more complex models also runs in this direction. What counts in the end is the degree to which validated forms of knowledge are retained, not their authors. These forms of knowledge are retained not on the basis of glory or authority, but because they seem to offer the best expression of what we, as a species, apprehend as reality. The result of our system of distributed intelligence is always an uncertain form of knowledge that can always be swept aside. But when it is swept aside, it is by some other expression of reality: scientific knowledge is certainly refutable, but it is not mere opinion.

These remarks about distributed human intelligence are meant to reiterate one simple, central tenet: the core of the scientific enterprise is based on human communication. Communication is, indeed, the essence of science.

To produce knowledge as well as is possible, identifying worthwhile interlocutors that can be part of a fruitful conversation is fundamental. Furthermore, the resulting work has to be put in a stable form so as to facilitate its critical assessment. In the print world, "articles" or "monographs" play this role. Communities of trusted members form around them and feed further conversations, further debates. Thus is the "Great Conversation" of science built up.

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6   Rose, Mark. *Authors and Owners: The Invention of Copyright*. Cambridge, Mass.: Harvard University Press, 1995.

In the digital world, the need for stable forms of expression supported by trusted communities of researchers does not disappear[7]. For the moment, we still rely on the print-derived forms of publishing, known as "articles" and "monographs," but we transcribe them into PDF file formats. However, the best way to interpret this transposition of printed materials into digital publications is to accept that we are still living through the age of "digital incunabula"; in the future, new perspectives - and formats - will undoubtedly emerge[8]. Once the proper documentary flows, appropriate to the digital context of scientific and scholarly work emerge and stabilize, it will be clear that Open Access was always essential to unleashing its full potential.

III
Open Access: How does it look from where you are?

a. Budapest: The initial two roads to Open Access

In 2002, many elements of the digital revolution affecting scientific publishing were even more difficult to perceive than nowadays. Early supporters of Open Access, such as the author of these lines, tended to take it as a given that articles and journals were a necessary part of any strategy leading to Open Access. Many still do, and this belief has obviously affected the ways in which Open Access debates have evolved. It was also the starting point of a discussion that started with the BOAI, and it is still going on.

The two approaches identified within the BOAI famously rest either on creating or flipping subscription-based journals to Open Access, or self-archiving articles in Open Access repositories. This framing of the best ways to attain Open Access immediately raised a series of subsidiary issues, which, in the first instance, included the question of suitable business models for journals, or, in the second instance, some way to coordinate and organize the various servers that harboured the self-archived publications. In the latter case, a meeting in Santa Fe held in October 1999 at the initiative of Herbert Van de Sompel, Paul Ginsparg and Rick Luce[9] gave rise to the "Santa Fe Convention," a method to allow e-print servers to expose their metadata to each other. This work actually reached well beyond e-print servers to appeal to libraries, museums, and even journal publishers. It also led to the creation of an "Open Archive Initiative" (OAI) in 2000, and the first version of the protocol destined to be known

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7   On this issue, see Thomas W. Jensen and Jean-Claude Guédon, "Crystals of Knowledge Production. An Intercontinental Conversation about Open Science and the Humanities", *Nordic Perspectives on Open Science*, 2015, edited by Niels Stern, http://dx.doi.org/10.7557/11.3619. Available on-line at http://septentrio.uit.no/index.php/nopos/article/view/3619/345.

8   Gregory Crane, David Bamman, Lisa Cerrato, Alison Jones, David Mimno, Adrian Packel, David Sculley, Gabriel Weaver, "Beyond Digital Incunabula: Modeling the Next Generation of Digital Libraries" in Julio Gonzalo, Costantino Thanos, M. Felisa Verdejo, Rafael C. Carrasco, eds., *Research and Advanced Technology for Digital Libraries. 10th European Conference, ECDL 2006, Alicante, Spain, September 17-22, 2006. Proceedings*, Springer, 2006, pp. 353-66.

9   A picture is available here: https://www.openarchives.org/meetings/SantaFe1999/rhp.htm. Thanks to Herbert Van de Sompel for pointing me to it. He informs me that, even then, a split had begun to emerge between those favouring pre-prints, and those wanting the peer-reviewed path. H. Van de Sompel's own position is available at https://www.clir.org/pubs/archives/pain/pain06.html#repositioning.

as OAI-PMH was made public early in 2001. As a result, and not surprisingly, e-print servers were quickly noticed within the library world.

On the side of journals, financial questions emerged almost immediately. First, the print world had transformed printed copies into a commodity, unlike manuscripts that had been produced as a service. Second, scientific and scholarly journal, fitting themselves within this commodity-driven perspective, had adopted the subscription as their business model. The issue of journal subscription costs had long been a secondary concern because costs had generally remained fairly reasonable. However, it had moved front-and-center for libraries, starting in the 1970's. Librarians regularly documented the rapid rise of journal subscriptions, and complaints over the rising costs had been multiplying all over the world[10].

Eugene Garfield's Science Citation Index was partially to blame for this new situation: it claimed to identify a limited set of journals as "core" journals, and it proceeded to rank them on the basis of a citation-based metric – the impact factor – that referred to visibility within this limited set of journals, but was too quickly assimilated to quality. Librarians, trying to establish value for money, lined themselves up like iron filings within a magnetic field: they began to envision the "core" journals as "must have", which led to the emergence of an inelastic journal market. The situation was promptly exploited, first by commercial publishers, and later by the broader community[11]. It eventually led to a medley of reactions, ranging from early attempts to create open repositories such as the E-biomed project (proposed by Harold Varmus), to an on-line petition (the first incarnation of the "Public Library of Science"), led again by Varmus, along with Pat Brown and Michael Eisen in early 2000. Publishing ventures appeared almost immediately (BioMed Central in 2000, and the second incarnation of the Public Library of Science in 2001).

When the meeting in Budapest took place in late 2001, quite a bit of history had already and effectively contributed to skewing the general dynamics of the meeting. Had the meeting leading to the BOAI been held two years earlier, it is probable that the towering example of Paul Ginsparg's ArXiv would have dominated the discussions. The repository for high-energy physics papers, which had taken shape at the Los Alamos National Laboratory, had been serving the needs of physicists for ten years. Transposing the same solution to other disciplines had initially appeared to be a no-brainer. However, when it was proposed in earnest, journals, particularly highly-rated publications, immediately expressed caution. In short, the budgetary concerns of journals became dominant, and the barely-emerging repository world was faced with unenviable options ranging from hosting articles that had not been peer-reviewed to, at best, articles from lower-tier journals[12]. By the time the BOAI meeting took place, the repository solution looked far more problematic than in 1999, and the journal solution appeared far more promising.

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10   Marcia Tuttle's ALA/RTSD Newsletter on serials pricing issues saw its first issue appear in early 1989.
11   In Jean-Claude Guédon, *In Oldenburg's Long Shadow: Librarians, Research Scientists, Publishers, and the Control of Scientific Publishing*, Washington, D.C., 2001: ARL, this point is much more developed.
12   Paul Smaglik, "E-Biomed becomes Pubmed Central", *The* Scientist, Sept 27, 1999. http://www.the-scientist.com/?articles.view/articleNo/19586/title/E-Biomed-Becomes-Pubmed-Central/.

During the Budapest meeting, credit should be given to Stevan Harnad for saving the repository solution. He did so despite his minority position, and the difficulty he had in making his case convincingly. Not that this difficulty was his fault: once issues of intellectual property emerged, concerns surrounding whether depositing papers in repositories could be assimilated to infringing on copyright emerged. Worries of this order, at one point, had led Harnad to suggest that a paper in its final form could be deposited in two instalments, the first corresponding to a version preceding peer-review, and then, once a definitive copy was accepted, a secondary file documenting the differences between the original submission and the final, ready-to publish, copy could be added. Needless to say, it was difficult to easily imagine the success of such a complicated process for both authors and readers. In later years, other solutions were brought forth, but to many researchers, the complications of self-depositing, real or imagined, acted as good pretexts for not doing anything. It remained, however, that Harnad's persistent defence of the repository turned out to be a very important element in defining both what Open Access meant, and what arsenal of tactics and strategies could be deployed to protect and extend it[13].

In the end, the BOAI incorporated the two well-known strategies that have accompanied all the discussions of Open Access ever since. For their part, the terms "Green" and "Gold" roads appeared somewhere around 2003, probably floated by Stevan Harnad himself. The stage was then set for the two distinct dynamics to develop: on the one hand, largely under the push of libraries, repositories began to multiply rapidly all around the world. At just about the same time, BioMed Central, under the directorship of Jan Velterop, another veteran of the Budapest meeting, was beginning to test the economic viability of flipping costs from readers to authors (or some proxy organization fulfilling this role). The "Article Processing Charge" (APC) emerged as a new business model, supporting BioMed Central, and shortly afterwards, the Public Library of Science (PLOS), as it became a publishing venture thanks to an important infusion of capital from the Gordon and Betty Moore Foundation.

In three short years, from 1999 to 2002, the possible futures of scientific publishing had shifted dramatically: following a series of scattered explorations in electronic publishing which had started slightly before 1990, the new possibilities in accessing the scholarly literature had become increasingly visible, and made the existing situation of the scientific communication system less tolerable. The advent of computers and networks made clear what the solution could look like. But when the moment came to implement the vision (or the dream), pragmatic difficulties quickly became obvious. Repositories were immediately affected, and experiments with electronic journal publishing proceeded cautiously and somewhat slowly, as publishers tested the financial parameters of these new ventures.

From the standpoint of Open Access advocates, the future looked complex: should the future focus on the creation of a new generation of journals, or should it rely on the flipping of existing journals into OA while relying on some new business model, for example APCs? At the same time, what could be done with the repositories? They were being built at an impressive clip, but filling them beyond a mere

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13   An interesting, if late (May 25th, 2015), comment on the Budapest debate is provided by Michael Eisen in his blog (it is NOT junk": "The inevitable failure of parasitic green open access", http://www.michaeleisen.org/blog/?p=1710.

15-20% of their potential seemed to be the main problem. To make the situation a little more complicated, some advocated one solution – green or gold – at the exclusion of the other.

The twists and turns of Open Access have sometimes been described in terms of the relative efficiency with which the Gold and Green roads have respectively opened up access to research results. These discussions contributed to maintaining the two roads, Green and Gold, as divided rather than complementary. It also failed to take into account the deeper forces of digital culture at work. Finally, it often undervalued the specific characteristics and stakes of the important actors in the debate: funding agencies, libraries and their host institutions, large publishers, and government ministries. More surprisingly, the very people for whom the communication system of science exists remained largely on the sidelines: researchers directly involved in the OA debates remained few in numbers, and they did not always share a single perspective. Publishers and librarians, on the other hand, took centre stage: not surprising, given the fact that the majority of the money supporting the scholarly communication system flowed directly from the latter to the former. However, it also meant that the shaping of the future of science communication was not always in the hands of those who needed it most to communicate and work.

b. First, they ignore you; then they laugh at you; then...?

Let us start with publishers and their take on scientific communication. Among them, a small group of important, international, and for profit, companies must be singled out. They have shaped the very meaning of Open Access. Some large society publishing houses, for example the American Chemical Society, have often behaved in ways that do not differ so much from the first category of publishers, but they should be treated separately nonetheless. The motives differ: keeping investors happy remains different from keeping dues-paying members happy.

The term "science publishing" covers many facets of a trade that, until recently, was confined to some form of print output. Books and journals saw their relative importance shift with time and according to disciplines. For the purpose of Open Access, a convenient backdrop can reasonably start after the Second World War. A few needed points are introduced here, if only to underscore the fluidity of a landscape that is still shifting rapidly.

- The decade following the Second World War witnesses a brutal acceleration of scientific research (and scientific publishing). Commercial publishers take advantage of this new situation as society publishers find it difficult to scale up;

- Bibliographies become strategic tools for international scientific competition. More fundamentally, Eugene Garfield's Science Citation Index (SCI), first proposed in *Science* in 1955, and launched in 1964, leads to slicing the world literature into two categories: "core"

publications inserted in the SCI, and the rest excluded from it. By proposing a way of ranking journals thanks to a metric based on citations, Garfield creates a competitive framework for the "core" publications. This has led to reorganizing the whole world of scientific publishing in profound ways;

- Starting in the '70's, the Serial Pricing Crisis, as it has long been known, begins to pick up speed: "core" publications have become part of an established inelastic market. Increasingly large commercial publishers enjoy enviable levels of profit;

- Starting in the late '80's, commercial publishers begin to explore the possibility of publishing electronically. In 1991, Elsevier announces the TULIP experiment. Taking a page off the software industry playbook, Elsevier abandons the sale of journal issues and of books in favour of licencing access to them. Libraries now purchase a right of access to documents, rather than owning them. The whole concept of collection building in libraries begins to erode;

- In the late 90's, publishers begin to offer access to ever-larger subsets of their journal collection. The publishers' servers gradually becomes dominant; the local Online Public Access Catalogue (OPAC) becomes a way to control access and limit it to "legitimate" users in a striking reversal of the traditionally welcoming attitude of libraries to walk-in users of all stripes. As publishers gradually extend services made possible by the digitization of their publications, the notion of platform emerges beyond the original "portal" concept to begin to encompass a whole user environment;

- In 1996, Academic Press introduces the "Big Deal."[14] It refers to a bundling practice which offers a discount to an institution that buys access to a whole set of journals. At the same time, the bundle is set up to cost more than the set of journals initially targeted by a library, thus increasing the revenue stream of the publisher. It also protects the publisher against libraries trying to cut back on subscriptions by making it quite costly. The deal is generally justified by a decrease of cost per title, but it does not decrease the cost per consultation, on the contrary. It also erodes the concept of collection. Finally, in a period of tightening library budgets, "Big Deals" accelerate the concentration of publishers by putting smaller publishers at a competitive disadvantage.[15] The business model is quite successful and is adopted by other big publishers.

- In 1998, Thomas Walker and the *Florida Journal of Entomology* offer the possibility for authors to buy greater exposure by paying for what effectively was Open Access for their articles. In 2003, David Prosser, an Open Access advocate, examines the possibility of ensuring a steady transformation of subscription-based journals by offering authors the possibility to opt

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14   See Velterop's interview at http://poynder.blogspot.ca/2012/10/open-access-in-uk-reinventing-big-deal.html.
15   For a critique of the "Big Deal", see Kenneth Frazier, "The Librarians' Dilemma: Contemplating the Costs of the "Big Deal", *D-Lib Magazine*, March 2001. http://www.dlib.org/dlib/march01/frazier/03frazier.html. The "Big Deal" was often justified, including by librarians, by the fact that it tended to be accompanied by a lower per-title cost. However, the whole point of a collection is to tune the holdings of journals to the needs of the targeted research community so as to decrease the cost per consultation.

in favour of Open Access for their articles. Prosser's idea will be taken up by various publishers, and will be generally implemented as "Hybrid journals", meaning journals that are part pay-walled, and part Open Access. In 2004, Springer begins experimenting with the idea under the name of "Open Choice." In 2005, Jan Velterop moves from BioMed Central to Springer to oversee the Open Choice programme of the publishing giant;

- In 2004, Elsevier launches SCOPUS as a rival to the Web of Science (itself derived from SCI). The idea of coupling a publisher with the Web of Science had occurred with Robert Maxwell, but he never managed to reach his goal despite vigorous attempts to do so (including a lawsuit against E. Garfield).[16] The sale of Pergamon to Elsevier may have helped carry Maxwell's idea within the publishing giant, but with a twist: Elsevier undertook to build a new Web of Science;

- In 2006, partially as a result of financial difficulties, PLOS invents the so-called "mega-journal" as a way to strengthen PLOS' financial stability. A mega-journal innovates in a number of ways:

  ◦ It separates the concern for quality from editorial orientation. Impact and importance are to be decided by users;

  ◦ It aims at publishing thousands of articles per year (hence, the "mega" qualification): PLOS One peaked at 31,500 articles in 2013 and has gradually decreased to 22,054 articles in 2016;

  ◦ It substitutes the notion of platform for that of journal;

  ◦ Although granted an impact factor by JCR, the mega-journal metric means little: such a platform publishes on a wide variety of topics in varying proportions, with each corresponding to a distinct citing culture.[17]

  Since 2006, PLOS One has had many imitators, if only because it turns out to be quite a lucrative business. Variations on this business plan are also being experimented with by publishers like *PeerJ*;

- In October 2008, BioMed Central is acquired by Springer: this is presented as Open Access going "mainstream"[18] – meaning it was adopted by one of the "majors" of international scientific publishing.

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16   "Eugene Garfield – Transcript of an Interview" Conducted by Robert V. Williams, p. 42. http://garfield.library.upenn.edu/papers/oralhistorybywilliams.pdf
17   On megajournals, see S. Wakeling, P. Willett, C. Creaser, J. Fry, S. Pinfield, V. Spezi (2016), "Open-Access Mega-Journals: A Bibliometric Profile", *PLoS ONE* 11(11): e0165359. doi:10.1371/journal.pone.0165359, as well as Peter Binfield, "Open Access MegaJournals – Have They Changed Everything?" available on-line at http://creativecommons.org.nz/2013/10/open-access-megajournals-have-they-changed-everything/.
18   See http://newsbreaks.infotoday.com/NewsBreaks/Open-Access-Moves-Into-the-Mainstream-BioMed-Central-Purchased-by-Springer-51149.asp.

- After 2008, most commercial publishers begin to jump onto the Open Access bandwagon. They begin offering a wide variety of publishing solutions ranging from full Open Access journals (including mega-journals) to subscription venues (non-OA), with hybrid-journals in between;

This brief description of the evolution of commercial scientific publishers allows us to distinguish several distinct periods:

- The post-war period of rapid growth in scientific research (1945-1970) confirms the role of commercial publishers as powerful actors in scientific publishing;

- The last period of print publishing (1970-1995) corresponds to the Serial Pricing Crisis; it sees the financial power of the commercial publishers consolidating;

- The period ranging from 1995 to 2005 sees the publishers experimenting with digital publishing while generally ignoring or resisting Open Access. "Big Deals" dominate this period;

- Since 2005, large commercial publishers have gradually added Open Access to their business plans, either as full OA journals, or more commonly, by opening their subscription journals to the possibility of making individual articles OA (hybrid-journals).

While commercial publishers managed to occupy a dominant (and oligarchic[19]) position in scientific publishing, society publishers travelled widely divergent roads. The serial pricing crisis encouraged many societies to also raise the price of their journals. In this manner, they became dependent on revenues that could be used to support other activities: conferences, scholarships, etc. This strategy worked particularly well for "core" scientific journals and large scientific societies, particularly English-language ones, who tended to navigate this transition with ease.

On the other hand, smaller societies with "non-core" journals found themselves gradually squeezed out of the subscription market, particularly after the "Big Deal" came into play. For such societies, there were few choices but to sell or lease their journal operations to larger commercial publishers. Many did so, even though, in many cases, it also meant that the name of the journal became the property of the large publisher.[20] The humanities and the social sciences journals tend to fall in this category.

The problems that smaller societies have faced are similar to those regularly encountered by scientific publications in developing or emerging countries: in most cases, such publications are regularly ignored in citation indices and bibliographies. Though they may be crucial for the management of careers on the national or local scene, they nonetheless are kept in a secondary role, as publishing in

19   V. Larivière, S. Haustein, P. Mongeon (2015), "The Oligopoly of Academic Publishers in the Digital Era". *PLoS ONE* 10(6): e0127502. doi:10.1371/journal.pone.0127502.
20   See Cameron Neylon's nicely argued exposition of the situation in "PolEcon of OA Publishing: What are the assets of a journal?", available in line on https://cameronneylon.net/blog/polecon-of-oa-publishing-what-are-the-assets-of-a-journal/.

"international" journals – another name for "core" journals – remains the "gold standard," and so-called "national" journals are often dismissed as mediocre publications.[21]

The category of pseudo-journals (or "predatory" journals) needs to be mentioned. Such journals have exploited the APC-Gold business model. One could add that without APCs, the "predatory" journals could not exist. Part of the attraction of the APC model is that it provides a risk-free way to publish, since all costs are covered upfront. Some "creative" businessmen have simply dispensed with peer-review altogether, and push articles out on the web as a means to justify collecting APCs. A market exists for this lunacy, but only because many authors feel their careers depend on publication at all costs. Naive or not, they are ready to pay for the appearance of being published. The first consequence of this illegitimate business strategy is a pollution of the scientific archive.[22] The second result is more indirect: the presence of "predatory" journals makes all journals with lesser-known titles more questionable. Uncertainty about them increases. Symmetrically, the presence of "predatory" journals tends to reinforce the status of the "core" journals, as they will presumably be considered "safe."

c. What role for libraries?

Libraries, traditionally, have stood between publishers and users (researchers, teachers, students), and they have managed the acquisition budgets that justified the erecting of the magnificent temples of knowledge that continue to dominate university campuses until now. The McLennan Library at McGill University echoes this ambition when it upholds (engraved in stone) that "Beholding the bright countenance of truth in the quiet and still air of delightful studies," is its *raison d'être.* The next fifty years, alas, have eroded much of this superb stance.

The Serial Pricing Crisis did much to whittle down the ambitions of libraries. As library budgets remained largely flat, or in many cases, experienced regular reductions, maintaining journal subscriptions soon required diverting significant resources from book acquisition, this hitting the social and humanistic disciplines particularly hard. It also hit the university presses that had always shouldered the considerable and important task of producing important books that could not be produced by commercial presses. Charged with recovering their costs, and no longer quietly subsidizing non-commercially viable ventures, the presses began to emulate commercial presses and, therefore, to compete with them, while facing a shrinking market.

Then came the next difficulty: negotiating journal subscription access contracts is vastly different from purchasing a set of books and journals for purchase. In fact, back in the '90's, many libraries found themselves ill prepared to take on this new task. This led to the creation of consortia, and it also

21   For a first analysis of the problems raised by this general characterization of indigenous publications, see Vessuri, H., J.-C. Guédon, et A. M. Cetto. « Excellence or Quality? Impact of the Current Competition Regime on Science and Scientific Publishing in Latin America and Its Implications for Development ». *Current Sociology*, 4 décembre 2013. doi:10.1177/0011392113512839. http://eprints.rclis.org/23682/.
22   See Shen and Björk, "'Predatory' open access: a longitudinal study of article volumes and market characteristics", *BMC Medicine* (2015) 13:230 DOI 10.1186/s12916-015-0469.

encouraged the development of collective "Big Deals" covering dozens of institutions at once. In Canada, for example, the Canadian National Site License Project (CNSLP) – the forerunner of the Canadian Research Knowledge Network – covered over sixty institutions, i.e. most of the universities in the country. The Canadian Consortium rapidly favoured negotiating "Big Deals" with the arguments that the cost per title was going down, and that such arrangements created an "even playing field" for research in all universities, large and shall. However questionable the claimed results, it was felt that they had to be protected by maintaining a good "relationship with the vendors," as the phrase went. But there was never any way to verify such claims as the Consortium, still in the name of "good relationships", all too readily acquiesced to confidentiality and non-disclosure clauses.

While these manoeuvres were going on between publishers and libraries, a number of facts were becoming obvious. The cost of journals was not, in fact, really going down; the ability of libraries to organize bespoke collections for their local constituencies was being swept aside by the "Big Deals". The technical services that the libraries provided to users were becoming ever more complex, while the real control over the servers these services live on stayed in the hands of the publishers. At the same time, the increasing availability of access from anywhere, through a password system or VPN connection, meant that fewer and fewer people physically visited the great monuments of the sixties. As more and more materials were secured in digital format, and as older print collection were undergoing some degree of pruning, the libraries suddenly discovered that, contrary to their fears in the '80's, they were having perhaps too much space. At that point, libraries came up with plans to re-occupy their walls with coffee machines and study rooms of all kinds, all equipped with the latest computers which allowed to do in the library what could be done from home.

It is in this context that libraries seized upon the repositories as a way to redeploy themselves and see their way to a new and different future. Alas, their objectives often remained fuzzy while ideas about what should be put in a repository varied from one institution to another. Answers varied from the faculty's publications to the students' theses and dissertations, and to all kinds of grey literature pertaining to the local research activities. Administrative documents were also regularly mentioned. Some universities even saw digital servers as a new form of archives. Caught between the administration and the faculty, but reporting to the former, each library tried to steer a middle course and thus tweaked the functions of its repository accordingly.

To complicate the situation further in some universities, the library sometimes found itself reporting to the computer services because digitizing the library was deemed to be the urgent call of the day. However, such a line of reporting to "techies" also tended to downplay some of the long-held traditions of libraries, such as helping to behold "...the bright countenance of truth": in effect, the cultural dimension of the library was downplayed. At the same time, the increased concern for technical issues quickly revealed a deeper anxiety for the profession: what could librarians really do in this new context that either specialists of contract negotiations and IT specialists could not do?

Preservation seemed to migrate in the direction of the publishers; navigating knowledge was increasingly expressed in opaque algorithmic formulae that, at the very least, mixed two different agenda: on the one hand, of course, the goal was to help the user identify useful literature; on the other, the publisher was attempting preferably to steer users to documentation also located within the same platform. In line with the imperatives of an "economy attention, publishers were beginning to use their platforms to stimulate the use of their own publications and, thereby, stimulate citations. The platform itself was beginning to act like a distorting lens that foregrounds certain publications at the expense of others. In a world driven by competition and measured by the impact factor, such behaviour is comprehensible: a publisher neglecting such possibilities would not be fulfilling its duties to its investors.

Libraries often felt as if they were caught in a nostalgic time warp, and began considering that they were cluttered by an obsolete technology called "books." On some campuses, major projects were planned to bury them underground in compact-shelving systems without anyone apparently paying much attention to the symbolic charge of such a move. In short, the library world, from the 1990's until now, has met with some difficulties in defining its mid- to long-term objectives: within digital culture proceeding apace, the ownership, as well as control, over digitized documents were inexorably slipping away from them.

Regaining an unquestionable role in this context requires redefining libraries. In particular, it requires them to abandon their perception of being a splendid, yet isolated, knowledge silo. Libraries, instead, must see themselves as interconnected nodes that help a knowledge infrastructure to emerge. Actually, this interconnected vision is of even nobler proportion than the old temples of knowledge that hark all too easily to the old "ivory tower" syndrome.

For many libraries, the Open Access repositories kept up the hope, and perhaps to some extent the illusion, that they possibly constituted a response to the financial demands of the commercial publishers. With a certain degree of militancy, libraries seized upon Open Access and the repositories to wage the good fight and roll back the effects of enormous price increases in the scientific literature.[23] However, they quickly encountered limits to their good will. When asked to self-archive, researchers did not always respond enthusiastically to the new demands placed upon them: between working in the laboratory, writing grant proposals, and drafting publications, little time was left to ensure the depositing of one's publications in the local repository. Furthermore, the purpose of depositing their work into repositories was not always clear to researchers, and this was compounded by uncertainty over what they were permitted to do by copyright.

Additionally, while many good claims existed to demonstrate better impact with publications in Open Access – the well-known OA advantage – enough dissenting voices and studies maintained a sufficient

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23   Richard Poynder offers an interesting analysis of the various hopes and objectives that repositories incarnated, starting with the Santa Fe meeting in 1999. See his "Q&A with CNI's Clifford Lynch: Time to rethink the institutional repository? http://www.richardpoynder.co.uk/Clifford_Lynch.pdf. This dates from September 2016.

degree of uncertainty to blunt its effects. At the end of the day, researchers also knew very well that the evaluation of their work did not rest on the impact of individual articles, but on the rankings of the journal where they published. Ranked journals are those present in the Web of Science; that is where career salvation lies.

Libraries alone could not drive Open Access on their campuses. Only when administrators and, occasionally, convinced researchers became involved, did the agenda of Open Access progress. Libraries always tried to help. They tried by offering to take on most of the work for self-archiving, which required resources, of course, but that too generally proved insufficient. Left to their own devices, repositories seemed to stall around 20% of their potential. Yet many librarians, thankfully, kept on supporting their repositories, perhaps hoping that Open Access would eventually contribute to solving their budgetary problems. The problem is that Open Access is about scientific communication, not library budget. This disconnect between the two objectives has led to many difficult and ill-targeted debates between Open Access advocates of all feathers. Somehow, libraries, rather than being caught between a rock and a hard place (the faculty and students on the one hand, the administration on the other) had to find ways of making the various constituencies of their respective campus finally see what their common objectives were, and these centred on communication issues, not university budgets.

More recently, the library front has begun to move again in interesting ways. It has regularly learned to catalyze the movement toward Open Access to the point where it is better to let faculty senates and/or administrations take the ownership of the last phase of the movement. In a few institutions, thanks to either the dynamism of a faculty Senate, or through the leadership of a senior administrator, often ably seconded by the local librarian, strong obligations to deposit have been enacted. One of the more interesting examples in this regard has been the University of Liège, in Belgium. The Rector (as a President is called in Belgium), Bernard Rentier, thought that depositing the publications of the faculty would both save money to his university, and would allow him to have a much better idea of the publishing output of his university. Years later, he orally admitted that the first hope was never fulfilled, but the second point went well beyond his wildest hopes: when the local repository began to fill in earnest, the University of Liège could boast a level of publication around 80% higher than expected. Needless to say, this was a precious piece of information for a University President. It also contributes to realigning the Open Access debates with the communication imperative.

How did Liège manage to fill the repository? The recipe is quite simple, but requires some degree of autonomy on the university: the President simply stated that any evaluation process, be it triggered by a promotion, a tenure, a grant, would be evaluated simply on the basis of what was deposited in the local repository, and nothing else. In a number of cases, it took strong nerves, especially with important, yet obstreperous, researchers, but it ultimately worked. Adding to the recipe ways to promote the visibility and success of the researchers certainly helped, but this simply adds a carrot to a simple principle which can be easily readily derived from Bishop Berkeley's dictum: Esse est percipi ... in repositorio (To be is to be perceived... in a repository).

Making it hard to evade the duty of depositing is crucial for a successful repository, but it is not enough, and that is another point that has not been sufficiently underscored: a repository standing alone will have but limited use and very little impact. Yet, the problem is that librarians are working within the constraints of an institution that is caught up in its own kind of competition. Many of the university rankings, for example, will pay attention to the size of a university library. As a result, a library tends to privilege how it compares to other libraries rather than seeing how it can collaborate. Collaboration goes on, of course, but always on a limited, cautious, scale. Moving toward collaboration, and eschewing competition is the challenge that librarians must face if they want their repositories to bring about the benefits expected from Open Access. A collection of silo-like repositories will not do, even when indexed by a powerful search engine; only a fully networked, interoperable, system of repositories makes sense.

Recently, two elements have contributed to re-energizing the repository world, and the possibility to see Open Access at last reach some of the objectives expressed and dreamed in the '90's. The first one is the OpenAIRE project in Europe, while the second one rests on the brilliant idea expressed by Lorcan Dempsey, of OCLC: the "inside out" library. The two points actually complement each other.

OpenAIRE is a project supported by the European Commission, which links the repositories in all the countries of the European Union, plus a number of associated countries (such as Norway and Turkey) and their repositories. The important and critical point of OpenAIRE is that, while starting from a large set of repositories, it has decisively moved to the level of a full network. This leads to the creation of a distributed server system making possible the recovery of any document deposited anywhere in the network. The network is built on top of national systems and it is woven together through a set of protocols and standards to ensure inter-operability. In achieving these objectives, OpenAIRE had to deal with the specific systems of a large number of nations, some more proud and less cooperative than others. This is precious experience for any further extension of the network.

Added to this mainly technical infrastructure comes an obligation to deposit research results from work that have been financed by the European Commission. The result of this mandate has been extremely useful for the funding agency. As a result, several other national funding agencies have been exploring the ways in which they too they can benefit from a capacity that is rapidly turning into a service. Finally, other documentary resources have also been gathered across the years, so that OpenAIRE increasingly looks like a research infrastructure for Europe (and beyond) harbouring millions of documents.

OpenAIRE has begun to extend its reach to various parts of the globe. In particular, it has established a serious cooperation with the Latin American network of repositories, *La Referencia*. The latter network spans nine Latin American countries. Discussions are also going with other national networks or emerging regional networks, and the collaboration of the Consortium of Open Access Repositories (COAR) has been extremely helpful in this regard.

A number of services that could eventually enrich the possibilities of OpenAIRE have been introduced. For example, ways to link publications and their underlying data sets are being implemented, possibilities of open peer review are explored, algorithmic tools to perform various forms of Text and Data Mining (TDM) on the large collections of documents held by OpenAIRE are being designed. Indeed, because OpenAIRE is much more than a collection of repositories, it can begin to play a number of roles that are usually viewed as publishing services. In so doing, it backs the thesis that the two basic strategies to bring about Open Access, the Green and the Gold roads, are destined to converge[24]. Rather than treating the Green and Gold roads as separate, or worse, as antagonistic paths to Open Access, it envisions the set of servers, platforms and services that can be created around them as coming together into a coherent whole. In this, OpenAIRE also finds itself moving closer to the concept of mega-journals which stands somewhere between platforms and journals. With clustering techniques also included among the services of OpenAIRE, the possibility of presenting research articles in different "packages" becomes a possibility simple enough to implement. In so doing, OpenAIRE begins to present itself as a platform. The term journal, on the other hand, is also relevant to this discussion: a journal, if one moves beyond the object that print has made familiar, refers more to the communities that form around collections of texts; it characterizes a discipline, a speciality, or delineates a problem that is complex enough to engage a large group of people, sometimes for years or even decades.[25] On a platform, clustering sets of documents in different ways can lead to the creation of temporary journals that evolve in a flexible manner. A single paper could even belong to several such "journals" with obvious advantages for visibility.

The Green and the Gold roads intersect both platforms and journals, which explains why the four terms are converging. At the same time, the convergence process helps foregrounding terms such as functions rather than objects – e.g. the journal-function, the platform-function, and the server-function. In the digital world, the emphasis on functions refers to the fundamental principle that processes constantly tend to replace objects. Speaking about functions, rather than things will probably facilitate and deepen our understanding of the meaning of articles, books, journals, platforms and so on. In short, our comprehension of our rising digital culture will grow.

Envisioning an evolving network of servers harbouring repositories with active, publishing-related, possibilities dovetails beautifully with a brilliant idea proposed by Lorcan Dempsey: the "inside-out library."[26] Dempsey encourages us to look at libraries entirely differently. At the same time, he brings us right back to repositories. What Dempsey argues is that libraries should not be viewed as purveyors

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24   For early thoughts on this possible convergence of the two roads, see Jean-Claude Guédon, "The "Green" and "Gold" Roads to Open Access: The Case for Mixing and matching », *Serials Review*, vol. 30 no 4 (2004), 315-28, http://eprints.rclis.org/5860/ and "Mixing and Matching the Green and Gold Roads to Open Access – Take 2". *Serials Review* Vol. 34 (2008). 41-51, http://eprints.rclis.org/11791/ .
25   On some stimulating ideas regarding what a journal has been and can be, see Cameron Neylon, "A Journal is a Club (New Working Paper)", April 28th, 2016 on his blog *Science in the Open*. http://cameronneylon.net/blog/a-journal-is-a-club-new-working-paper/.
26   Lorcan Dempsey, 2016 "Library collections in the life of the user: two directions", *Liber Quarterly*, 26(4). DOI: http://doi.org/10.18352/lq.10170. https://www.liberquarterly.eu/articles/10.18352/lq.10170/.

of "stuff" selected to serve local needs. The acquisition mentality, be it linked to buying objects or signing access contracts, should be given up for a different kind of project: sweep all that is worth sweeping within one's hosting institution, store it, curate it, add the right metadata to it, preserve it. Then comes the crucial step: <u>link into a network of other libraries (and repositories)</u>. Then, each library contributes to a number of crucial operations around the stored documents: they should be easy to discover, easy to identify, easy to navigate, easy to cluster with other documents. Means should exist that will permit having some idea of the value and quality of each document, for example, a number of metrics having to do with views, downloads, comments, corrections. All these "traces of interest," of use, of appropriation, and also of corrections and of refutations, would form the "reputation" of a given document. But the latter functions would be carefully kept separate from the communication issues.

Thanks to various standards, protocols, and evaluation procedures, the network of repositories would assist the building of an efficient system of distributed human intelligence. Each library can use its resources to bring to light the best of what the hosting institution allows to produce. In this regard, it acts in a way that is not so different from the scientific associations of old. Communities of users begin to work on top of these sets of documents, of their associated data, and the needed software to manipulate them, in order to produce new work, new knowledge.

The OpenAIRE repositories are evolving in the direction just described; yet, for the moment, they remain elements of libraries that, otherwise, continue to function as they have always functioned, largely in isolation. Dempsey challenges us to position the repository at the heart of the inside-out library, rather than treating it as an uneasy, small, annex that sits poorly with the whole concept of library.

OpenAIRE, once again, provides some good ideas about the ways to move forward. The Liège approach to collecting local publications is the first step: it demonstrably allows reaching levels of deposits that are at least 90% of their total potential. That is, incidentally, the joint task of administrators and faculty members. Simultaneously, thanks to the existence of the OpenAIRE network, peer review services, preferably open, as well as various form of packaging the information according to various communities can begin to work across institutions and thus give credence to the new forms of evaluations that beginning to emerge. At the same time, the administrations of these institutions can adapt their evaluation procedures to this new situation: the criteria of evaluation could be based on the actual quality of the work exposed, and not on a variety of proxies, such as the impact factor of a journal.

When a network like OpenAIRE exists, a strong subset of committed institutions within the network can demonstrate how the new functions can work. This in turn will greatly encourage more institutions to join the movement. In the end, libraries can point out the fact that their future role actually points in in two, apparently opposite, yet deeply complementary directions: on the one hand, they plunge deeply into the local production scenes since they aims at systematically sweeping, storing, preserving, and curating all that is produced in their hosting institution; at the same time, the libraries, with their sister

institutions, are involved in the task of ensuring a vibrant knowledge-nurturing life for their documents: they will circulate, be discoverable, be interoperable, be evaluated, etc. With the first function, each library ensures it safe and strong function within its host institution; with the second function, the libraries connect to bring the knowledge infrastructure that we all really need.

The repositioning of the library that Dempsey suggests also dovetails with other skills also present inside the universities, and particularly the publishing skills of the university presses. Already, a powerful movement is making these components gravitate closer together, and it should also quickly affect how repository networks may begin to behave. As publishers, while research institutions may not presently appear to amount to much, they own and can deploy all the need publishing functions they need, and they can do so by restructuring the work flow itself.

d. What about the funding institutions?

Some funding institutions, mostly public, embraced the Open Access movement. As public institutions, supported by taxpayers' money, they have a fundamental need to demonstrate that they serve the public good. The National Institutes of Health (NIH), for example, under Harold Varmus and his successors, quickly engaged with Open Access issues. The list of signatories at the first Berlin conference in 2003 also reveals the early presence of funding agencies from major European countries. But battle lines were soon drawn; when funding agencies began to entertain the idea that publicly supported research should be made freely publicly available, publishers fought back. The obligation to deposit for NIH grantees became law in 2008, after a five-year battle with publisher lobbyists. In many countries, agencies are not allowed to lobby. As a result, other organizations had to do the fighting for them. In the United States, for example, it was the Scholarly Publishing and Academic Resources Coalition (SPARC) that fought the publishers. It is in this context that new terms began to emerge that actually broadened the social meaning of Open Access: "public access" refers to the basic rights of citizens to knowledge, and the "Alliance for Taxpayer Access" is a needed reminder that taxes form a large part of the funds collected by publishers.

The NIH Public Access Policy is particularly clear in foregrounding the importance of the public good:

> *The Public Access Policy ensures that the public has access to the published results of NIH funded research. It requires scientists to submit final peer-reviewed journal manuscripts that arise from NIH funds to the digital archive PubMed Central upon acceptance for publication. To help advance science and improve human health, the Policy requires that these papers are accessible to the public on PubMed Central no later than 12 months after publication*[27].

The intensity of the publishers' lobbying effort can be partially illustrated by reference to the introduction of two bills designed to overturn the NIH policy, and to prohibit open-access mandates for

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[27]   See https://publicaccess.nih.gov/policy.htm. Note the 12-month embargo that remained. How would an immediate opening up of the research results help science and advance health objectives?

federally funded research[28]. The Fair Copyright in Research Works Act, introduced in 2009, and the Research Works Act, introduced in 2011, were both successfully stopped by supporters of Open Access. Notably, Elsevier removed its support for the "Research Works Act" (102 H.R. 3699) when it came to light that Elsevier-related personnel had made 31 contributions to various members of Congress, out of which 12 went to Representative Carolyn Maloney (D-NY), a primary sponsor of the Research Work Act.[29]

In 2009, legislation was passed to make the NIH policy a permanent statute, and in 2011, additional legislation successfully extended the policy to cover the U.S. Department of Health and Human Services, the Department of Education, and Department of Labor.[30] The Federal Research Public Access Act (FRPAA) was also proposed in early 2006 in the United States, and went through several re-introductions in Congress. In 2013, the Obama Administration issued a sweeping Executive Memorandum, requiring all U.S. Departments and Agencies who fund scientific research to make both articles and data resulting from that funding publicly available. To date, 21 U.S. Agencies have implemented or announced such policies.[31] The FASTR (Fair Access to Science and Technology Research) Act would codify these polices into permanent law has passed through various hurdles in the U.S. Congress, but has yet to be implemented as law.

The battles over "mandates" by funding agencies have been joined in around the world. Canada, through its Canadian Institutes of Health Research, managed to implement a first obligation to deposit in 2007. This finally led, in 2015, to the Tri-Agency Open Access Policy on Publications[32].

In Europe, 2006 also marked the beginning of a move toward Open Access. A "Study on the Economic and Technical Evolution of the Scientific Publication Markets in Europe"[33] called for Open Access in the European Union. The implementation of hard-fought "Horizon 2020" requirements for Open Access to the results of all European Commission-funded research went into effect in 2014. As a funding agency, the European Commission also decided to explore the possibility of an Open Access research infrastructure, and this led to the beginning of the OpenAIRE infrastructure that has been discussed above.

A different and perhaps more decisive battle took shape in the United Kingdom. It culminated in a report published in 2012 and entitled: "Accessibility, sustainability, excellence: how to expand access

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28   See http://sparc.arl.org/blog/oppose-hr3699.
29   See Michael Eisen's entry "Elsevier-funded NY Congresswoman Carolyn Maloney Wants to Deny Americans Access to Taxpayer Funded Research" into his blog: http://www.michaeleisen.org/blog/?p=807.
30   The battles over "mandates" by funding agencies had been joined in 2006. Canada, through its Canadian Institutes of Health Research, managed to implement a first obligation to deposit in 2007. This eventually led, in 2015, to the Tri-Agency Open Access Policy on Publications.
        See https://en.wikipedia.org/wiki/Open-access_mandate for a survey of such obligations in several countries.
31   https://www2.icsu-wds.org/files/ostp-public-access-memo-2013.pdf.
32   See https://en.wikipedia.org/wiki/Open-access_mandate for a survey of such obligations in several countries.
33   Available at http://bookshop.europa.eu/en/study-on-the-economic-and-technical-evolution-of-the-scientific-publication-markets-in-europe-pbKINA22021/.

to research publications". It is generally known as "The Finch Report" [34]. A quick way to summarize it was published on the Web, out of a Cambridge-based blog:

- Everyone (yes everyone – government, publishers, politicians) think Open Access is a GOOD THING;
  Moving to Open access will cost money;
  The UK publishing industry is so important we mustn't do anything to harm it.[35]

Essentially, the outcome of the Finch report was to recommend freeing all publicly funded research, which sounded good. However, the depository, self-archiving, road was largely abandoned in favor of the Gold road. It was further conflated with APC-supported OA publishing, as if the Gold Road had been conceived with a particular business plan in mind. In the wake of the Finch report, which was largely accepted by the UK Government, the Research Councils of the UK quickly required that all papers funded by the Councils should be made OA, and APC-Gold was to be preferred over Green.

Suddenly, in the UK, the road to Open Access appeared narrowed – some on the publisher side might say "simplified" – to paying APCs to journals, be they OA or hybrid journals. In effect, the whole debate between publishers, libraries and funding agencies had been re-organized as if its most important point was no longer the communication system of science, but rather the well-being of the publishers. The message conveyed by William Garvey, "Communication: The Essence of Science" had been surreptitiously transformed into "Commercial Publishing: The Essence of Science."

Open Access the new British way quickly turned out to be expensive. Offering publishers a risk-free form of publishing with large payments upfront could be obtained only if significant supplementary amounts of money were provided. Sums of £50-60 million were mentioned, and block grants were discussed for this purpose. Considerations to research-intensive universities also had to be introduced. Complicated financial mechanics were required, all to ensure a central, powerful, and lucrative position for a few large, international, publishers. At the same time, the same publishers could lengthen at will the embargo policies applied to self-archiving, under the pretext that subscription revenues had to be protected. The new Open Access horizon brought to light by the Finch disaster amounted to little more than a steady state of hybrid journals. Years before, in Frankfurt, Derk Haank's had casually cast off the remark that he had never imagined deriving new revenue streams from funders.

Between 2006 and 2012, large commercial publishers had indeed come to the conclusion that they could safely embrace Open Access, at least a certain version of it: with OA, not only could they maintain their position in the publishing world, but they could even improve it by adding new business models to their old, print-inspired, subscription revenue stream. In fact, the agreements inspired by the Finch report are pointing in a direction that Jan Velterop has identified when calling for a new kind of

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34   See http://www.carlosqg.info/index.php/documentos/func-startdown/12/. Tracking down the original document turned out to be something of an exercise as many links turned out dead. See also Cameron Neylon's "First thoughts on the Finch Report: Good steps but missed opportunities," published on his blog on June 9, 2012: http://cameronneylon.net/blog/first-thoughts-on-the-finch-report-good-steps-but-missed-opportunities/.
35   https://blogs.ch.cam.ac.uk/pmr/2012/06/19/reaction-to-the-finch-report/.

"Big Deal." Such a new "Big Deals" would include a double national agreement: one covering a national licensing agreement to provide access to pay-walled publications; the other corresponding to a national procurement service whereby OA publishing services would be purchased for the whole country[36]. Where there used to be only one business model (subscriptions), there would now be two, thanks to the added selling of services.

In a similar spirit, the wholesale purchasing of publishing services has been explored by various groups, including libraries, funding agencies, and research centres. One example is the Sponsoring Consortium for Open Access Publishing in Particle Physics (SCOAP3), which involves a large number of libraries and a variety of funding and research organizations. Together, these libraries essentially buy Open Access publishing services for all authors. After many years of hard work, ten journals have agreed to participate in SCOAP3, but two important journals from the American Institute of Physics, *Physical Review C* and *D*, have pulled out[37]. It is not clear that this is a success, and, as some libraries have pointed out in this particular case, the presence of ArXiv already provides a large proportion of the desired publications. So, why pay at all, and why stay in SCOAP3?

In 2015, another, more global, proposal emerged out of the Max Planck Digital Library in Munich. A policy paper aiming at disrupting the subscription business model was issued with the ostensible goal to achieve large-scale Open Access[38]. The argument presented by Ralf Schimmer and his colleagues relies on the idea that there is currently plenty of money in the system to support it wholly without going through all the hoops and loops of either subscriptions, or APCs. Armed with common sense, the authors of this Max Planck policy white paper derive an important consequence from this observation:

> "There needs to be a shared understanding that the money currently locked in the journal subscription system must be withdrawn and re-purposed for open access publishing services. The current library acquisition budgets are the ultimate reservoir for enabling the transformation without financial or other risks."

The Max Planck policy paper has the advantage of underscoring a crucial fact: the source of money for the whole science communication system lies first with the libraries. Re-allocating these funds to build a different system is appealing, but how to proceed remains elusive. The Max Planck authors appear to support offsetting as a way to propel hybrid solutions to an entirely new level of openness, however, on the publishers' side, the incentives do not appear obvious. More probably, as many observers of the OA scene would point out, the hybrid model would continue to do what it had actually been designed to do – namely preserve both the subscription and the APC-Gold business models. While harbouring the

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36   R. Poynder, "Open Access in the UK: Reinventing the Big Deal", October 1, 2012.
http://poynder.blogspot.ca/2012/10/open-access-in-uk-reinventing-big-deal.html.
37   R. Van Noorden, "Particle-Physics Papers Set Free", *Nature*, vol. 505, No 141 (January 9, 2014).
doi:10.1038/505141a.
38   R. Schimmer, K. K. Geschuhn, A. Vogler, "Disrupting the subscription journals' business model for the
      necessary large-scale transformation to open access" April 28th, 2015. http://dx.doi.org/10.17617/1.3.

elusive promise of a transition, the hybrid-journal business plan can also indefinitely behave like a steady (and profitable) cash cow. Ambiguity is the name of its game.

The response of the International Association of Scientific, Technical, and Medical Publishers (STM) to the Max Planck paper is interesting in its own way[39]: among a variety of points, STM supports the "pay-to-publish route to OA" (which, as usual, is mislabelled as Gold) and the approach proposed by the "Finch Group." It even, almost unexpectedly, "...recognises the need for green open access options." But, as expected, it emphasizes, difficulties in the transition, and it begins by listing a series of problems as the Association sees it: for example, the Gold – read APC-Gold – model does not yet enjoy a sufficient level of consensus, and it varies a great deal from discipline to discipline. Furthermore, STM claims, it has progressed from only 3 to 13% of "the total produced each year" in the last ten years.

One of STM's most telling comments refers to the alleged mismatch between users of the literature (estimated at more than 15,000 institutions) and the number of producing institutions (presented as much smaller) would lead research institutions to shoulder a disproportionate cost of the system. However, this claim is a direct consequence of substituting APC-Gold to Gold. If, for example, all concerned institutions put in trust the amount of money they use every year to provide access to the literature, and used this money to reconstitute the system, and if some money were left at the end of the conversion operation, as is most probable once you get rid of thirty percent profits or more, it would not be difficult to reimburse each institution in proportion to its contribution, and the "mismatch" would disappear

In conclusion, Planck's flipping model remains difficult to envision. By contrast, the steps alluded to in the discussion of the possibilities opened by OpenAIRE appear far more realistic. They can be made more plausible if a number of libraries begin to reallocate their funds in a coordinated and convergent fashion toward a well-defined common goal. At the recent meeting, "Envisioning a World Beyond APCs/BPCs" held at the University of Kansas on November 17-18, 2016, several participants warmly greeted the idea of gradually growing the financial support for a comprehensive inside-out library project. Such a vision would rely on a number of leading libraries deciding to decrease their annual acquisition budget by a certain percent each year. Reallocating funds in this manner could catalyze a powerful movement and gradually attract even more institutions to the point of being irresistible. In such a context, a framework such as OpenAIRE might be a good starting point to provide the initial momentum and provide the needed common operational framework.

A discussion of funding agencies cannot conclude without casting a glance in the direction of publishing ventures. The idea behind this step often seems to be obvious: over and over again, OA supporters have made the same points:

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[39]   http://www.stm-assoc.org/2015_12_04_STM_Response_to_MPDL_Open_Access_Transition_White_Paper.pdf.

- Scientific research has never been sustainable. Ever since the 17th century, it has been heavily subsidized;

- The cost of communicating scientific research is a tiny fraction of the cost of research, somewhere between 1 and 2%;

- Why should we ask that particular phase of the research cycle to obey particular financial rules couched in terms of "sustainability" while the overwhelming part of scientific research has to be constantly subsidized?

Part of the answer to the question is the legacy of the print era. The digital world works differently.

Armed with these or similar arguments, a number of funding agencies have explored the possibility of devoting a small part of their capital to support the dissemination of research results. For the Wellcome Trust, with the collaboration of the Howard Hughes Medical Institute and the Max Planck Society, it has led to the creation of a new journal, *eLife*. Its first articles appeared in October 2012 and it presently publishes over 100 articles per month. Since January of 2017, APCs of $2,500 are charged to authors, while, for the period ranging from 2017 to 2022, the three funding agencies have decided to commit £25 million.

In deciding to create such a journal, the three funding agencies obviously wanted to have a direct voice in shaping scientific communication. For example, eLife includes an interesting requirement for editorial tasks: unlike journals such as Nature, Science or Cell, the editorial work would be in the hands of scientists that are really in activity.[40] Yet, one cannot but express regrets that three large and rich granting agencies use only a miniscule fraction of their budget to support such an important venture. High APC fees involve a form of financial elitism that runs contrary to the objectives of a health science communication system. It could have been easily picked up by the budgets of enormous research institutions with individual budgets around or over a billion dollars each. Finally, with APC grants in place in these three institutions, what is the point of transferring APC funds from the research grants to the eLife budget? Is it the hope to draw few thousand dollars from APC grants coming from other funding agencies?

Perhaps more excitingly, the Wellcome Open Research programme squarely addresses the role of funding agencies in integrating the communication system of science in the full cycle of research financing while recognizing that the "Great Conversation" of science requires transparency and well-ordered flexibility. Started in April 2016, this project will be the object of recommendations to the Wellcome Board of Governors in April 2017. Its potential is deeply transformational, especially if it is followed by other major funding agencies.[41]

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40   E. Callaway, "Open-access journal *eLife* gets £25-million boost," *Nature* June 1st, 2016.
http://www.nature.com/news/open-access-journal-elife-gets-25-million-boost-1.20005
41   https://wellcome.ac.uk/what-we-do/our-work/open-research.

The São Paulo Research Foundation (FAPESP) began to move in directions that were fundamentally close to those recently followed by the Wellcome Trust when it decided to support Brazilian scientific journals. Starting late in the 20th century, the SciELO platform that emerged remains wedded to more classical visions of journals, and that is easy to understand. Nonetheless, the funding agency of the State of São Paulo understood that the best way to make Brazilian journals noticed and respected in the world involved not only placing them in Open Access, but also allowing authors to contribute their work without paying. By seeing the dissemination of scientific research as an integral part of the research cycle, SciELO simply decided to wrap the cost of publishing into the cost of doing research. It has led to an impressive platform of over 1,200 journals spreading over most countries of Latin America, plus Spain, Portugal, and South Africa.[42]

In conclusion, the role of funding agencies in the recasting of the rules regulating the dissemination of scientific results cannot be overstated. There is one last point, however, that should be emphasized: when applying for research funds, submitting scientists should never be judged according to the journals where they publish, but rather by the quality of their work. Back in 2003, at the Open Access meeting in Bethesda, Mark Walport, then Director of the Wellcome Trust, stated that papers presented by grant applicants should not obviously be associated with any journal. Realistic or not – specialists tend to know where their colleagues' important papers have appeared – Walport's remark reveals a very legitimate concern: work should be judged in itself, and not through the proxy of artificially constructed journal prestige. The decision by the French-speaking research funding agency of Belgium, the Fonds National de la Recherche Scientifique (FNRS) to evaluate researchers on the basis of what is accessible through the repositories of their universities works in the same direction. Incidentally, it will also help these same Belgian universities in populating their own repositories.

e. And what about the administrators of University and research centres?

Administrators of universities and research centres, Janus-like, tend to present themselves to the world in ways which are not always entirely coherent. For example, in evaluating researchers for promotion, tenure and funding, administrators tend to rely on the usual, familiar elements that are deemed to characterize a "good" or "not so good" career. Publishing in highly visible, prestigious journals is such an element. As a result, researchers seeking promotion or tenure will play the game accordingly by publishing their papers "where it counts". All this, of course, reinforces the warped manner in which symbolic capital, visibility and prestige are currently generated in the scientific communication arena. The journals that do best in this kind of competition will tend to see their impact factor increase, and this will illogically be interpreted as an increase in quality. For the administrator such an outcome also appears positive because the institution under his/her stewardship is ranked by various organizations, and most of them also look at where the faculty publish. From such rankings, important consequences

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42   Abel Packer, "WThe SciELO Open Access: A Gold Way from the South", *Canadian Journal of Higher Education,* Volume 39, No. 3, 2009, pages 111-126. http://journals.sfu.ca/cjhe/index.php/cjhe/article/view/479/504.

ensue, such as recruiting good post-graduate students to populate the labs with able hands. With publicly supported universities, or with prestige-driven university governors, rankings also play a role in evaluating, curiously, if there is value for money in the present administrative policies.

There is, however, a downside to all of this, and it has already been mentioned earlier: the highly ranked journals justify extraordinary pricing demands from the publishers. The same institution that, through its evaluation behaviour, increases the legitimacy of journal rankings also ends up having to pay for it through the library budget. The left hand does not always measure its effects on the right hand. Here again, Mark Walport's admonition deserves being recalled: it is the intrinsic quality of the work that should always count, and reliance on proxies, allegedly to save money through streamlined evaluation procedures, ends up being costlier down the line.

In any case, highly-placed members of the administration should accompany the librarians in their negotiations with publishers.[43] The experience would undoubtedly be just as valuable for deans and departmental heads. Directly witnessing the negotiations around scholarly publications would probably lead many administrators to revise their evaluation procedures. It could also underscore the importance of accessing the local production in one's own institution: supporting a strong Green policy would constitute an important step forward in this regard, and the model of the University of Liège, mentioned earlier, is a good example to follow. Reformulating the role of libraries to an "inside-out" functionality could equally strengthen the ability of research institutions to regain command and control of the communication system of science.

f. Last, but not least (despite appearances): the researchers

It is a strange paradox that a long – probably too long – discussion of the science communication system should end with the observation that researchers' role in the scientific communication process may well be quite marginal. How did this happen? As authors of articles and other forms of publications, including monographs in some disciplines, researchers are obviously crucial to the science communication process. However, after looking at the way science communication works, they clearly communicate through a system that they do not control. Worse, the communication system, beyond supporting the "Grand Conversation" of science, acts like a powerful tool to manage careers and reputations.

So, what is the role that researchers really play in the science communication system? Quite obviously, as producers and users of knowledge, they sit at both ends of the chain. Once the scientific work is done, i.e. observations and experiments, scientists move on to writing up the results of their work. Then they start another project, which means that they begin reading again.

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43   This is also a suggestion made, in a different context, by Peter Suber. See his comments about the deal between the Dutch Universities and Elsevier, https://plus.google.com/+PeterSuber/posts/Kew4R9A1Jgs.

Most researchers, of course, do more than that. For example, they are regularly asked to peer-review articles, and this task can become very demanding on one's time. Occasionally, they are also asked to be part of an editorial board, or even invited to be the editor-in-chief of a journal. In short, a significant proportion of researchers are deeply engaged in the publication process of research results. More precisely, researchers who act as editors-in-chief of journals are in direct contact with a publisher.

The interface between the world of research and the world of publishing is not well documented, especially when the entity on the publishing side is a commercial, for-profit, publisher. What are the rewards, including financial, of editors? What are the means of support that can be distributed to various journals, and for what reasons? How closely are the journals monitored by the publisher's personnel, and how are they monitored? By impact factors? All these questions largely remain without clear answers, particularly as access to the relevant data is essentially absent. This said, we know of problems that have occasionally surfaced at that interface: we have heard of editors that may ask authors to cite articles elsewhere in the journal to improve its impact factor. We know of publishers who encourage citations from other journals that they control (and thus make the ploy harder to detect), in order to help raise the total rankings of their journals.[44]

Regarding the impact factor, one could also add the perfectly bizarre, yet common, way of using three decimals to express it in figures. Garfield himself has given a muddled, yet revealing, explanation for this practise:

> Furthermore, I myself deplore the quotation of impact factors to three decimal places. ISI uses three decimal places to reduce the number of journals with the identical impact rank[45].

In other words, the three decimals of the impact factor, just like the timing of sprinters to the one hundredth of a second, are designed mainly to intensify competition between journals. And that is exactly what editors and publishers are obsessed with. In admitting both the inane character of the three decimals, and the need ascribed to ISI to avoid two journals with the same metrics, Garfield reveals both the artificial and the extreme nature of the competition that dominates so much of science communication.

A competition that is designed exclusively around journals, but then it is extended as a proxy to evaluate individuals, institutions, and even countries, can only serve publishers: the journal becomes the anchoring point of the power to evaluate scientific achievements. Owning a journal is wielding power. The needed presence of researchers as editors and members of editorial boards also creates a zone of ambiguity where the interests of some researchers begins to align with those of publishers, and

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44   Peng Dong, Marie Loh, Adrian Mondry, "The "impact factor" revisited," *Biomedical Digital* Libraries, 2005, **2**:7 DOI: 10.1186/1742-5581-2-7. https://bio-diglib.biomedcentral.com/articles/10.1186/1742-5581-2-7.
45   E. Garfield, "The Agony and the Ecstasy – The History and Meaning of the Journal Impact Factor", text presented in Chicago on September 16, 2005 at the International Congress on Peer Review And Biomedical Publication. http://garfield.library.upenn.edu/papers/jifchicago2005.pdf. By 2005, Garfield had retired from ISI. It would be interesting to know whether his views ever changed on this point.

where possibilities for the shaping of researcher hierarchy, beyond those justified by the intrinsic intellectual qualities of each researcher, begin to open up.

The Declaration on Research Assessment issued in San Francisco on December 2012 was a waking call in this regard, and it was eloquently echoed by Bruce Alberts, then the Editor-in-chief of the journal *Science*. Notable was the following remark:

> The misuse of the journal impact factor is highly destructive, inviting a gaming of the metric that can bias journals against publishing important papers in fields (such as social sciences and ecology) that are much less cited than others (such as biomedicine).[46]

What Alberts states corresponds to the reality of the situation, but he does not go far enough: institutional behaviour goes beyond the gaming of the impact factor metric. Fundamentally, regulating the management of careers around a metric as flawed and unreliable as the impact factor rests on a mistaken notion that the best efforts that can be extracted from any individual is only through extreme competition. And that competition between researchers is regulated by a variable that is not under their control as a community.

In a recent paper, Stefano Balietti and his colleagues created an experiment to test the side effects of competition on peer review. One of their conclusions is telling and appears to be without appeal: "...competition does not improve the average quality of published works."[47] Yet, science, thanks to the impact factor, tends to looks like a sport competition. The oft- repeated quest for excellence bears more than a glancing likeness to the quest for a gold medal. But there is a difference here: the objective of the gold medal is the gold medal in itself, but the objective of doing science, for most scientists, is simply the opportunity to do good science and thus bring one's contribution to the distributed system of human intelligence. The communication of scientific results is not designed to identify geniuses, but to associate many forms of intelligence to create the best knowledge possible. To put it yet another way, the Olympic Games identify champions; the scientific and scholarly efforts identify solid concepts, theories, laws which all contribute to our ability to do a few things with the fraction of reality that we sufficiently apprehend.

In earlier sections, the effects of competition have been observed percolating down the various layers of the scientific enterprise. The rankings of universities, which are themselves partially determined by impact factors, are bound to affect the ways in which individual scientists will respond to this kind of regulation. Such reactions go beyond the attempt to publish in the highest ranked journals. They make possible a series of distortions that profoundly taint the scientific enterprise and make it far less than what it could be. Some of these effects can be quickly summarized as follows:

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46   The DORA declaration can be found at http://www.ascb.org/files/SFDeclarationFINAL.pdf. Bruce Alberts, "Impact Factor Distortions", *Science*, vol. 340 No 6134 (May 16th, 2013), 787. doi: 10.1126/science.1240319. http://science.sciencemag.org/content/340/6134/787.
47   S. Balietti, R. L. Goldstone, D. Helbing, "Peer Review and Competition in the Art Exhibition Game" July 26th, 2016, http://www.pnas.org/content/113/30/8414.full.

- A journal editor, all other things being more or less equal, will tend to select better-known authors over lesser-known authors. The same will be true of the affiliation: a prestigious affiliation does not hurt. What has this got to do with quality?

- A scientist will avoid risks by avoiding truly innovative work. This is what Bruce Alberts, in his remarks about the impact factor, calls "me-too science". Identifying impact factor champions may well work against precipitating important paradigm shifts;

- Journal editors will tend to select topics that are considered "sexy," but "sexiness" depends on locales and times, and systematically choosing such research areas will inevitably cut out other problems. How is "sexiness" of topics related to quality?

Researchers, for the most part, are trying to do the best work they can while surviving in large, sometimes bureaucratic, organizations, and while responding to pressures that aim at stimulating both their productivity and the quality of their work, sometimes in very strange fashion. They know that they need documentation, but know little about the ways in which journal production is organized. They publish according to a *perception* of what is better, and what is not so good, but it all rests in the end on impact factor rankings. Small elites of editors do manage to graft themselves onto the system with some rewards attached to the position, but in so doing, they find themselves exposed to the kinds of social rules that guide the quest for power and influence, rather than quality and integrity. Such scientists, acting a little like the *burguesia compradora*, may be tempted to throw their lot with the big publishers or the managers, especially if the editorship of a new journal – a new investment for a publisher – is offered to them. Meanwhile the great majority of researchers pursue their dream of contributing something of value to the whole scientific tribe: producing valid knowledge still means quite a bit for many of them. It may be a modest dream, but it is so very honourable. That is what should be rewarded in science and scholarship.

The organizational elements just described largely contribute to explain why scientists and scholars have tended to remain on the sideline of the great Open Access debate around scientific communication. It also explains why convincing scientists that they should get engaged with the issues of open access has remained difficult. Leading a faculty member to understand, accept and finally support an obligation to deposit his/her publications in a local repository is not easy. When grant season begins, budgets decrease, and the future of a laboratory depends on the success of an application, Open Access issues may easily appear as a luxury. How many people can sail through the hurdles of promotions and tenure in a completely serene and secure manner? In the end, most researchers, although deeply dependent upon the system of scientific communication, are probably among the people that understand it most superficially - certainly more superficially than librarians and publishers.

In conclusion, examining the situation of researchers, young or old, from rich or poor institutions, from so-called "developed" countries or from emerging or developing nations, leads to an inescapable observation: as long as the whole scientific system is driven by a competitive system, scientists and

scholars will do their best to survive and to avoid the worst of the secondary effects that distort the scientific enterprise.

This is not to say that there is no place for competition, but simply to recommend that competition be carefully calibrated to generate the best kinds of results in very precisely defined circumstance. It is probable that pitting Watson and Crick against Linus Pauling in the quest for the understanding of the structure of DNA did something for science, but most of sciences is not being done by Watsons, Cricks and Paulings; it is done by solid practitioners without which the Nobel prize winners could not do their work. And it is also for this reason that berating researchers is senseless: if they do not engage with Open Access, it is not because they are stupid or lazy. It is not a simplistic issue of keystrokes, as some have argued. These researchers are simply doing their best to respond to a very poorly, not to say perversely, designed system of competition. Demonstrating to researchers that they could have a much more productive, constructive and serene way of doing science with the help of Open Access appears far more useful to both science, and to Open Access as well.

IV

APC-Gold disguised as Gold:

the publishers' versions of Open Access and their perils

The recent evolution of Open Access leads to some rather puzzling observations. On the one hand, publishers have relentlessly pursued active campaigns of lobbying to stop or slow down various forms of legislation favourable to Open Access (this has been particularly true in the United States and in Europe, but not exclusively). At the same time, major publishers publicize statements in favour of Open Access. Elsevier, for example, states their commitment "... to providing researchers with both green and gold open access options."[48]

This apparent contradiction could be taken at face value if we assumed, somewhat naively, that the publishers' left hand does not know what the right hand is doing. However, other possibilities are readily available: muddying the water is certainly part of the game plan, as is offering a benign facade to the world, and particularly to politicians. However, this is merely tactical and, as such, a weak hypothesis. Better is it to see that the publishers are indeed intent on blocking forms of Open Access that they see inimical to their business, while, at the same time, promoting their own version of Open Access. That is what must be understood with the publishers' version of Open Access. Its function is to increase revenue streams.

Let us take the example of Elsevier. The company actually lays out a broad programme for Open Access. Interestingly, it includes every possible variant of Open Access, including "subsidized

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48   https://www.elsevier.com/about/open-science/open-access.

journals." Amusingly, subsidized journals are defined as journals where "the APC is subsidized by an organization or society," as if subsidies could take only the form of subsidies.[49] This fits well, of course, with the attempt to pass off Gold as being exclusively APC-Gold.

Elsevier both owns journals and sells publishing services to external journals. However, this apparently benign variety of roles includes details that reveal a keen eye for control: for example, the content of all journals is "permanently preserved" in Elsevier's "digital archives." For good measures, safety nets are added to the fundamental Elsevier setup: CLOCKSS, the Dutch National Library e-Depot, and Portico's dark archive demonstrate the existence of serious preservation measures, should the Elsevier facility fail for any reason. This is a most reassuring message directed at the library community, but it deals only with rather unlikely events. For the rest, Elsevier remains securely in control of what it considers to be its holdings.

There are other signs of control in the Elsevier system. In the digital context, versions of documents easily multiply. This is the natural consequence of being able to disseminate and copy at essentially no cost. The way Elsevier deals with various versions of papers obviously deserves being scrutinized: Elsevier deploys the use of the CrossRef-derived CrossMark system, which is designed to point to one and only one authoritative version of a document. CrossRef, let us remember, was launched as a cooperative by publishers, not by librarians. The "authoritative" version is stored in the Elsevier servers.

If a researcher should deposit a copy of his/her publication in a local repository, that copy would not be considered authoritative (by Elsevier), but would be treated as some inferior version of the authoritative copy. The only function, therefore, of the copy deposited in a local repository appears to provide eye contact with its content. Presumably, it should not be cited as such, even though a good university name and an honourable author's name may stand behind it. In fact, it may even lead to interesting paradoxes: for example, if, in the process of self-archiving, the author(s) decide(s) to correct some minor errors, to eliminate a few typos, or marginally to improve some of his/her formulations, the self-archived version of the document would be "better" - yet, (according to Elsevier) it should not be the version cited!

In the digital context, the situation just described amusingly brings us back to the manuscript age when copies were judged against each other. Lineage and provenance were the criteria of trustworthiness. Better scriptoria could be distinguished from lesser ones. In similar fashion, the Elsevier copy attempts to set itself up as the "better" copy, and the criterion of quality, here, is not the author, but the publisher. It is he that stamps the CrossMark onto a particular "version of record." Elsevier wants to own the version of record. Or is it a version of reference? Given the reputational role DOIs play, it is

49   Heather Morrison, "Elsevier: Among the World's Largest Open Access Publishers as of 2016," *The Charleston Advisor*, January 2017. doi:10.5260/chara.18.3.53 , https://www.ruor.uottawa.ca/bitstream/10393/35779/1/Elsevierfinal.pdf. In 2016, Elsevier sported 511 fully OA journals of which 315 do not charge APCs to authors. Morrison suggests that most of these journals are being supported by a society or a university.

easy to assimilate version of record with version of reference, and this derivation of one to the other has already been the object of public discussions.[50]

In insisting on owning the "version of record" or "reference" as the case may be, publishers seek to position themselves at the centre of the communication system of science. From their perspective, this is easy to understand, but is this the right solution to an important question? In other words, should the transition to the digital age be allowed to proceed only if it ensures an equivalent, or even enhanced, role for publishers at the centre of the communication system of science? Or should it proceed to enhance the communication system of science and then decide from there what the role and position of the publishing functions should be? If it is argued that the two objectives are not necessarily antagonistic to each other, should not the communication system and its overall qualities at least clearly prevail over the status of publishers, rather than the reverse?

An alternative vision of digital publishing would take advantage of the fact that digital texts can evolve much more flexibly than printed texts. Indeed, versions multiply. Attaching comments and increasing links of related information are also ways to characterize digital texts as pertaining to a "society of documents." All this differs markedly, of course, from the kind of relatively isolated and fixed objects that print made familiar in the last few centuries. As a result, dealing with digital documents and their full potential requires a rational system of versioning. Such a system, it turns out, can be designed without having to anchor it into one particular and authoritative text or document. We do not have to design a digital environment on the model of canonical texts as we meet them within various religions. Science does not live by tradition and fixity; on the contrary it feeds on the sound and the fury of change, of controversy, of debates.

Software writers have long known how to deal with these problems - after all, software writing is probably the best and first example of digital writing. In fact, it is this very possibility that allows free software to work as well as it does.[51] Transposing these lessons to digital documents should not be difficult to imagine. Rather than trying to restore the conditions of documentary existence familiar to print, a versioning system would open up the full potential of distributed human intelligence. It seems that the Wellcome Open Research project mentioned earlier includes such a versioning system. Amusingly, it can be observed that the daunting energy of free software projects has never been anything more than a translation of the extraordinary intellectual energy of the Scientific Revolution; it is only fair to see this energy paid back as the scientific world takes fuller advantage of the digital context of communication, and takes a leaf out of the free software textbook.[52]

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50   See Alex Ball, "Making Citation Work: A British Library DataCite Workshop", *Ariadne* (2013), http://www.ariadne.ac.uk/issue71/datacite-2013-rpt. Ball makes the interesting point that, unlike plain handles, DOIs "...have greater mind shareand recognition among researchers and publishers".

51   Eric S. Raymond, *The Cathedral and the Bazaar*, http://www.catb.org/~esr/writings/cathedral-bazaar/cathedral-bazaar/index.html. Perfectly coherent with itself, this document is presented with its full revision history.

52   Jan Velterop has introduced the notion of nanopublication which is clearly inspired by distributed software writing and which he defines as follows: "Nanopublications combines an assertion, the provenance of the assertion, and the provenance of the nanopublication into a single publishable and citable entity. Both the assertion and provenance are

Elsevier's discussion of the Green road reveals other interesting biases: Green is presented as a derivative: each Green article is nothing more than a "version of a subscription article." As a result the "published" article has been conflated to the "subscription" article, which reduces it to a purely economic form of existence. Indeed, according to Elsevier, this is possible only because "subscribers pay all the expenses needed to support the publication process." Elsevier, here, clearly alludes to the "free rider" issue, and addresses a sly wink at Garrett Hardin's "tragedy of the commons". To keep this tragedy under control is obviously important to Elsevier – a form of "moral hazard" no doubt – and it is ultimately simple: make sure that the commons are somehow less than commons, and present this substitution as a way to be fair to the subscribers: as good payers, like good boys and girls, they should have immediate access to a subscription article; the "bad" free riders, for their part, are penalized in the form of a time-based embargo.

Elsevier's arguments are not unique to this company, but, in exemplary fashion, they provide an analysis entirely constructed around an economic, rather than a communication, imperative. Designing an optimal communication of scientific information is thoroughly subordinated to "the business of a business". Communication may have been once the "essence of science," but it is now back-pedalled to the point of fitting an exclusively profit-seeking motive. Communication, to the extent that it remains a visible variable in the Elsevier vision, is actually dissociated from the essence of publishing, and is both conflated with, and subordinated to, its economic essence.

The concern for the industry's economic health – i.e. its ability to maintain a certain profit level to please investors – is also and often referred to in the literature as "sustainability." For example, in the document produced by STM in reaction to the Max Planck Policy paper discussed earlier, we can read the following sentence: "We ... share the belief that the most sustainable open access future is a Gold one." Sustainability, actually, is a term derived from ecology, and it refers to biological systems working well over very long periods of time, for example in terms of diversity. Ecological sustainability, therefore, appears quite different from what the major publishers appear to refer to when they make use of this metaphor: their objectives, if only measured by the relentlessly increased concentration within the industry, do not augur well for the future of a sustainable diversity. However, speaking of "sustainability" has a rhetorical function: it conceals the differences between those speaking in terms of durability and efficiency, and those speaking in terms of profitability. Note finally that STM's Gold is, once more, APC-Gold. *Nil novi sub sole...*

By now, it has become clear that a certain form of Open Access has been taken over by large publishers: Open Access has simply been apprehended as a business model and cleverly recast as such. In the publishers' perspective (and, alas, sometimes beyond), Open Access has been constantly redefined as APC-Gold, but, of course, it has not been labelled as such. By simply disguising APC-Gold as if it were simply "Gold", even the business model tends to vanish from sight. This is the

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represented as RDF graphs." http://nanopub.org/guidelines/working_draft/. RDF refers here to the "Resource Description Framework" that has been promoted by the World Wide Web Consortium (W3C). What Velterop essentially does is to generalize the Wikipedia implementation of distributed contributions by linking it to the semantic web.

ultimate and proverbial fig leaf. Reducing all forms of financing to APC-Gold, and then labelling it as "Gold", indeed performs a double function: while pushing the business motives into the background, as does the use of "sustainability," it actually promotes strategies that fit the publishers' business needs, rather than the communication needs of researchers. Moreover, Gold is promiscuously applied to a variety of situations: APC-driven journals, hybrid-journals offering APC-OA article options, even so-called "subsidized" journals. In the latter case, it is a little difficult to see how APCs apply, but no matter... "Anything is Gold" in the publishers understanding of Open Access.

In its reaction to the Max Planck policy white paper, the International Association of STM Publishers argues most interestingly that there is not yet "a consensus" about Gold Open Access (meaning again APC-Gold, of course). This also demonstrates why the conflation of APC-Gold with Gold is important: it is meant to facilitate the building of this consensus. Meanwhile, of course, Green cannot yet be taken entirely off the table, even though it is not optimal from the publishers' perspective. However, it can be temporarily accepted, albeit reluctantly, thanks to the device of embargoes: those can be modulated at will, and with little warning. Finally, once the "Gold consensus" is reached, publishers will likely favour hybrid journals, as these will allow mixing subscriptions and APCs with maximum and efficient flexibility. Far from being the transitional tool that David Prosser had tried to conjure up in the early days of Open Access, the hybrid journal may point to a form of Open Access-subscription steady-state equilibrium which can be easily made to work best in about any kind of market and simply by adapting the needed parameters.

The beauty of this strategy is that it makes Open Access appear "victorious" and may even attract some Open Access advocates to adopt it. However, the victory of this kind of Open Access would also spell the defeat of the vision of Open Access that the BOAI expressed: the practitioners of science and scholarship have desired to interact with as little interference from the communication system as possible while using, re-using, re-purposing, and re-mixing all that could be found lying on the shoulders of a motley crew of giants, midgets, and any other size in between.

Building on what could be described as "Internet wisdom" may be useful here. The Internet is sometimes described as a "network of networks" where all the intelligence lies at the edges, in the computers, and very little intelligence is contained in the network. This is in marked contrast to other computer-network schemes where the intelligence lies in the network, and the edges enjoy but very limited autonomy. Call this the "Minitel" approach[53]. The Minitel approach wanted to leave the maximum amount of control (and of profitability) in the hands of an organization called "France Telecom".

The Internet philosophy, in its early years, optimized interactions between users and sought to limit power relationships to a minimum. Contemporary debates around Net neutrality echo these early choices. It was also the lovely time of spontaneous "netiquette" practised by conscientious "netizens."

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53   https://en.wikipedia.org/wiki/Minitel.

The science communication system, like the Internet, spontaneously places the intelligence of the system at the edge, in the scientists' heads, and lives little intelligence in the communication system. Alas, the kind of "Open Access" being proposed by the likes of Elsevier, while ostensibly mouthing the vocabulary of openness and of sharing, rests on a vision of networks where control lies in the communication network and begins to interfere with the very doing of science itself. For example, it is impossible to justify the presence of embargoes if optimal communication between researchers is the real objective.

If we go back to the very beginning of the Open Access movement, advocates of Open Access often separated around two attitudes: some were in favour of communication reform, and saw Open Access as part of it; others claimed simply to seek access without the need to affect the communication system in its present form. Reality has not proved kind to those supporting the second scenario. Already, the recognition that obligations to deposit, or mandates, were indispensable began to demonstrate that the communication system had to be changed. Without such mandates, the repositories could not demonstrably fill up. But even the presence of mandates did not solve all problems. If all the repositories were to fill up nicely, how should the world's archive of science come to life? Would Google Scholar fill the gap? Something else? And if Google, will it really better than Elsevier? Furthermore, would libraries ever abandon subscriptions?

Once again, reality came roaring back: yes, mandates work well…if. If you can get them, and if they are supported by proper incentives and rewards. However, the political work and energy to achieve a mandate is considerable. Sometimes, an enlightened administrator appears within a university: Minho in Portugal, and Liège in Belgium are regularly mentioned examples in this regard, and rightly so. A number of other institutions have followed suit. However, the overall impact of all the repositories in the world, after fifteen years of hard work, still appears very unequal to the task,[54] and certainly inferior to what something like Sci-Hub has managed to do in a couple of years.[55]

The reason for the success of Sci-Hub is simple: It is a one-stop shop where anyone can access millions of journal articles. It is a "service," – albeit an illegal one – that publishers simply cannot emulate easily, if only because of competition among themselves: how could publishers build a single, collective platform together? By hacking, covertly or with internal help, into unknown numbers of institutions, Sci-Hub simply aggregates the resources of many universities into one large database. When scholars are hitting a wall because some document is not available locally, many of them turn to Sci-Hub, if only out of frustration. That frustration, incidentally, is the exact measure of the distance between the communication needs of researchers, and the economic needs of the publishers.

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54   In a very recent text (January 19, 2017), Clifford Lynch offers a particularly depressing and pessimistic vision of repositories which, in our opinion, completely neglects the networking possibilities of IRs. See his "Updating the Agenda for for Academic Libraries and Scholarly Communications – Guest Editorial," *College & Research Libraries* 78:2 (February 2017), pp 126-130. doi:10.5860/crl.78.2.126. Available at http://digitalcommons.unl.edu/scholcom/40/.
55   Among many other articles see John Bohannon, "Who is Downloading Pirated Papers? Everyone", *Science*, April 28, 2016. http://www.sciencemag.org/news/2016/04/whos-downloading-pirated-papers-everyone.

Researchers need a good communication system, and Sci-Hub provides a concrete example of what such a system could begin to look like if everything were free. But researchers also need ways to manage visibility, authority and prestige. The question we should ask is *whether the communication system and the reputational system of science and scholarship should be one and the same*[56].

The present science communication system, as we have seen earlier, conflates communication and evaluation through the status granted journals. Publishers do not sell authors; they sell journals. But, for obvious reason, authors cannot be entirely left out of the equation and publishers, thanks to the impact factor, have managed to link their fate with that of the journals. Judging the quality of an author by the reputation of a journal entirely foots this bill. It reinforces the privileged status of journals, and it ensures that the communication system ultimately serves the journal system, rather than the reverse. The APC-OA business model applied to journals, as noted earlier, simply adds the sweet security of upfront payments: investors intensely dislike uncertainty, we are told. It does not challenge the conflation between communication and evaluation.

From all that precedes, it becomes obvious that the kind of Open Access really needed should dissociate communication from evaluation. And the dissociation may be easier to achieve if one accepts the notion that the two functions of communication and evaluation do not need to be taken up by different entities. On the contrary, and with a few safeguards, these functions can be left in the stewardship of one single institution. For example, if we return to the example of the OpenAIRE network, it easily appears as a powerful tool to facilitate all kinds of communication between researchers. At the same time, when it experiments with open peer review, text and data mining, clustering, etc., it is designing new evaluation tools. Indeed, OpenAIRE can handle both tasks in parallel, but it does not conflate them, and it does not attempt to leverage one to market the other.

The quality of any work, ultimately, is to be found in a direct study of the work itself, exactly as Mark Walport had clearly stated in 2003 in Bethesda; the quality of the communication, for its part, should be assessed as a general characteristic of the network, and not as a proxy for the quality of its content. In other words, there is no need to try relating bandwidth-related issues with the quality of what is being transmitted. The number of citations that a piece of work gathers in other pieces of work points to a density of connections between research results, nothing else. That density of connections is due to a wide variety of reasons that all enter into understanding what visibility is. However, visibility and quality are two entirely different variables. In short, science research results should not be evaluated by criteria that apply to the visibility of music or movies. In fact, even in films, popularity does not sit easily with quality.

In the past fifteen years, advocates of Open Access have been eager to point to areas of success. In the early years, the preoccupation for low-hanging fruits, and approximations of Open Access often seemed "good enough" and were legitimately hailed as forms of success. They contributed to the

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56   Jan Velterop makes this point very well in "On the dangers of SciHub and hybrid journals", published on March 22nd, 2016 on the SciELO blog at http://blog.scielo.org/en/2016/03/22/on-the-dangers-of-scihub-and-hybrid-journals/.

energy of the movement. However, caution should be exercised. For example, when discussions recently emerged around Elsevier being the largest Open Access publisher in the world,[57] Heather Morrison quickly pointed out troubling elements in the developing landscape: "Elsevier OA," she argues, "involves a deceptive (deliberate or not) practice of author nominal copyright that is in essence copyright transfer."

Yet, many Open Access advocates will argue that some progress is better than none. Stated this way, the argument appears compelling. However, there are many ways of "sophisticating" an objective. A sophisticated individual may appear cultured and worldly; however, the etymology reveals something far less palatable: derived from sophistry, the term was first used to describe medicines that had been corrupted, generally for venal reasons. Preferring some corrupted OA to no authentic OA is deceiving oneself in the best of cases; it is deceiving others in the other cases. Going beyond BOAI15 should keep this danger clearly in mind.

V

Conclusion

In the fifteen years that separate us from the 2002 BOAI, the fate of Open Access has shifted markedly: from a small and marginal movement, it has come to occupy centre stage in debates among publishers, librarians, funding agencies, research administrators and researchers. Positions have been reversed, to the point that many publishers, including all the large and important ones, are now actively promoting a form of Open Access, or what appears as such. Such reversals, striking as they are, particularly among powerful publishers, suggest that the very shaping of Open Access is now at stake. In particular, the publishers' promotion of Open Access, presented as Gold, but limiting itself to APC-Gold, represents a clear indication that the battle around Open Access has been reshaped in a new way: does OA deal with a communication system that can help science, or is it a business model masquerading as OA designed to reinforce the position of some publishers.

One simple criterion allows pointing unerringly to the central issue: who controls what? And if it appears that the control of scientific communication escapes the research communities, to what extent does it threaten to corrupt the very nature of scientific communication. Seen from the perspective of the developing or emerging countries, i.e. seen from the perspective of about 80% of humanity, the answer is clear. Finding it difficult to pursue certain lines of research while receiving the kind of recognition that such work should deserve is the common lot of many researchers in many parts of the world. Neglected diseases, agricultural problems left without good solutions, are all part of a situation where the autonomy to set up one's research agenda is severely constrained.

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57 See note 49.

In richer countries, the situation is different, but it creates its own distortions. In effect, a network of powerful research institutions help populate the editors and editorial boards of a large, yet minority, number of scientific journals in the world. They are mainly the journals indexed in the Web of Science or in Scopus. Together, these journals are engaged in an endless system of competition that is supposed to energize research globally, and serve its intrinsic objectives. In actuality, the system acts as the pressure system that, in rich countries, keeps armies of scientists in line. Choosing a particular journal, with its specific impact factor, has something to do with career opportunities and advancement, not with quality. Fitting oneself as well as one can within the collective forcefield of these journals is how one manages a career, advances in it, or merely survives in the game thus defined. The point is that the evaluation rests on the proxy of the journals. Whether the communication system and the reputational system of science should be one and the same is the fundamental question that must be brought to light, debated, and ultimately replaced by a different structure. Science needs two independent layers. In the first one, the optimal dissemination of scientific knowledge can be allowed to take place freely. Call it the "net neutrality" of the Internet of the mind. In the second layers, the process of evaluation can proceed, as it should, i.e. on the values and objectives of the research communities themselves, not on the manipulated metrics favoured by publishers.

The present status of journals – an exorbitant privilege, actually – allows conjoining economic and intellectual value together. Furthermore, by expressing it simplistically with a single metric, the impact factor, it becomes the universal tool of decision-making from the simple doctoral candidate to the Nobel Prize winner, from the university administrators to the librarians, from the science policy specialists to the leaders of the funding agencies, all this for the greater benefit of the publishing industry. The impact factor also exacerbates competition at all levels, reaching well beyond what is required for the optimal well-being of the scientific enterprise. Increasingly, sloppy results, tainted research, cheating and unreliable data are coming to light.[58] These are signs that should not be ignored.

In evaluating the various forms that Open Access can take, the health of the communication system of science must be considered, and placed at its very centre. In observing the evolution of Open Access itself, the powerful effects of digital culture and of networks should also be at its centre. In no case should economic interests be allowed to interfere with the full potential of a free communicating system designed and destined to help humanity – the whole of humanity – grow knowledge. Unleashing the full power of the distributed system of human intelligence remains the fundamental objective. Open Access (*well-crafted* Open Access, that is) stands at its very heart. That is what going beyond BOAI15 really means.

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58   For examples of documented, lamentable, behaviour, check http://retractionwatch.com/. If this is not enough, go on to http://www.badscience.net/. Devotees of Dante may particularly enjoy "The Nine Circles of Scientific Hell", *Perspectives on Psychological Science*, (2012), 7(6) 643–644. Available at http://pages.ucsd.edu/~cmckenzie/Neuroskeptic2012Perspectives.pdf and attributed to "Neuroskeptic".