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Scholarly publishing and peer-reviewing in open access[1]

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Introduction

Knowledge, like language, is not a merchandise to be traded; it is the *knowledge commons*[2] that everyone, everywhere, can share and which is preserved for generations to come. Indeed, when a researcher gives an idea to a colleague, she does not lose it. Quite on the contrary, she wins someone with whom she can exchange, and make her idea evolve, in clarifying it, modifying it if necessary and finding applications she did not think of. An idea that is not shared nor preserved is lost forever. The positive-sum exchange of ideas and viewpoints lies at the heart of peer review, whose purpose is to verify, correct and improve the content of scholarly articles before disseminating them. It would, indeed, be damaging for knowledge and research if errors are circulated and reused assuming they are exact.

Peer-reviewing articles written by colleagues is an integral part of a researcher's duty, together with giving seminars and writing articles. This is why researchers, in most cases, do not request any extra payment or advantages to referee an article or to be a member of the editorial board of a peer-reviewed journal. Peer reviewing should deserve more recognition (*e.g.* for career evaluation) because, if done seriously, it is time consuming, requires a highly specialised expertise and sustained attention to details. Peer reviewing is the backbone of the present research system since it guarantees the quality and the originality of the articles published in scholarly journals of all disciplines.

Publicly funded research is financed by taxes that everybody pays, therefore articles presenting the results obtained in this context should belong to everybody (as for *knowledge commons*) or not belong to anybody (as for the *public domain*). In practice, this means that they should be accessible for free the moment they are published. Unfortunately, this is far from being the default case at present. Today, when an article succeeds to pass peer review and is accepted for publication by the journal's editorial board, its authors are required to give without compensation their copyrights to the journal's publisher. The publisher therefore owns the text, figures, codes and

[1] A website complements this chapter http://openscience.ens.fr

[2] Understanding knowledge as a commons: from theory to practice, edited by Charlotte Hess and Elinor Ostrom, MIT Press, 2006.

data presented in the article, and those deposited on the journal's website, until seventy years after the author's death. If the author refuses to give her copyrights away, her article is not published.[3] Thus publishers can sell back scholarly articles to academic libraries, at prices they fix themselves, during more than one hundred years. Hence, most research articles of the 20th century remain locked behind pay-walls. Obviously, the goal of all this is not to ensure an optimal dialogue among researchers; it certainly is not to ensure intellectual property rights for the creators of new knowledge; it is simply to ensure property rights to publishing firms. Some of them manage, through a profit-making conceit, to trump the importance of knowledge creation with a relentless quest for increased revenues.

Because of the transfer of intellectual property rights, publishers can decide under what conditions and at what prices, the research results in the form of articles can now be accessed, exploited, and re-used. Since a few years, the objective of publishers is to link articles to databases. When this will be achieved, transferring the copyrights to publishers will also give them rights on research data (e.g. measures, satellite images, results of numerical simulations, source codes, and more...). This will open the way to transforming data into merchandise, which will be counter-productive for research and contrary to the academic tradition of data sharing. Data are an integral part of knowledge and, like ideas, must be of free use. Therefore data must stay outside the market to preserve the collaboration between researchers that relies on free and multilateral exchange (Ian Mulvany considers the challenges facing Open Data in section 2.5 of this Open Science chapter). The risk is that publishers interfere with this process to take advantage of data and increase their profits at the expense of researchers and taxpayers.

In this section the definition of *open access* published by the European Commission in 2010[4] will be used: '*Open access, a model which provides access, use and re-use free of cost to readers on the Internet. Two basic models exist: "Gold" open access (open access publishing): payment of publication costs is shifted from readers (via subscriptions) to authors. These costs are usually borne by the university or research institute to which the researcher is affiliated, or by the funding agency supporting the research. "Green" open access (self-archiving): the published article or the final peer-reviewed manuscript is archived by the researcher in an online repository before, after or alongside its publication. Access to this article is often delayed ("embargo period") at the request of the publisher so that subscribers retain an added benefit'.*

Note also that, when one writes 'publishers', only the major ones are meant, namely a few commercial companies or not-for-profit societies which dominate and control the

[3] See examples of copyright transfer forms on http://openscience.ens.fr/COPYRIGHTS_AND_LICENSES/

[4] http://openscience.ens.fr/DECLARATIONS/2012_07_17_European_Commission_Towards_better_access_to_scientific_information.pdf

market. Since the advent of electronic publishing they have acquired an oligopolistic position by competing with smaller publishers, that they swallow or push out of the market. When one writes 'articles', only peer-reviewed articles written by researchers to present their results to other specialists of the same discipline are considered. By 'researchers' one means scholars employed by universities or research institutions whose research activity is fully, or partially, funded by public institutions. The arguments developed here are made from the point of view of a researcher who peer reviews (as editor and referee) and publishes in international journals of mathematics and physics. Therefore, some arguments might be specific to these disciplines since practices significantly vary depending on the discipline and scale (national or international) of the scholarly exchanges. The questions addressed here will only concern the data linked to peer-reviewed articles (for referees and readers to verify the article's content).

1. Researchers should own the peer-reviewed journals they create

Today the large majority of peer-reviewed articles are still published with the toll access model, where institutions pay a subscription to publishers in order that their researchers can read scholarly journals. However, the few publishers who dominate the market are imposing the *gold open access* model where, in order to publish, authors or their institutions have to pay *article processing charges*, whose amount is fixed by the journal's publisher. The 'Hybrid model', which is presently the usual way for publishers to propose *open access,* is an even better deal for them, since in this case both readers and authors must pay subscriptions and *article processing charges*.

In 2012 Sir Tim Gowers, professor at Cambridge University, and thirty-three mathematicians from all over the world launched the movement "The Cost of Knowledge" and called to boycott Elsevier[5]. They denounced Elsevier's lobbying for the *Research Works Act*, a bill proposed to the American Congress aimed at prohibiting *open access* mandates for federally funded research and thus reversing the policy of the National Institute of Health (NIH), which requires taxpayer-funded research to be freely accessible online. The mathematicians of "*The Cost of Knowledge*" considered it was also their duty to design alternative publishing models to recover control of the peer-reviewed journals they create and use. In June 2012, they proposed the *diamond open access* model (a terminology inspired from the *Diamond Sutra*, a treasure of the British Library that was printed in 868 in China). This model assumes that researchers should not pay to publish their articles, and should own the journals they create and peer review. The *diamond open access* model[6] is based on three principles:

[5] http://thecostofknowledge.com/
[6] http://openscience.ens.fr/OPEN_ACCES_MODELS/DIAMOND_OPEN_ACCESS/

- the authors keep their copyrights and attach to their article a *Creative Commons* license CC-BY[7] (requiring only the attribution of the paper to its authors, while allowing everyone to publish their article, together with any derivative products such as a translation, and even to earn money for doing so);
- the editorial board is the legal entity which owns the journal (i.e., its title and all its assets), whose members are active researchers (i.e., peers) who take responsibility of peer reviewing, that they perform without being paid (since it is part of their academic duty for which they receive a salary);
- the publisher is no longer the journal's owner but becomes a service provider under contract with the editorial board, whose members can thus choose the publisher they prefer, or look for another one if they are not satisfied by the delivered services.

There already exist many journals which are published in *diamond open access* for which authors or their institutions do not have to pay *article processing charges,* such as IPOL (*Image Processing On Line*)[8]. In order to limit the journal's cost, the peer reviewing and publishing processes are automated using appropriate software, as commercial publishers do for the journals they own. But there is an essential difference between this and the full *diamond open access* model, since the software used to help editors for peer reviewing and publishing their journal are *free open source* software developed by the community of researchers to match their needs, such as OJS (Open Journal System)[9] developed by John Willinsky at Stanford University and PKP (Public Knowledge Project).[10]

In contrast to the proprietary software designed by publishers for their own sake, *free open source software* allows researchers (acting as authors, referees and editors) to make sure they cannot be spied on by publishers willing to automate the peer reviewing process. For some major companies this has unfortunately become one of their practices to improve the journal's productivity (i.e., more articles per issue and less time reserved for peer reviewing) rather than its quality. For instance, on August 13th 2016, the US Patent Office granted to Elsevier a patent entitled "Online peer review and method".[11] Indeed, commercial publishers have first to satisfy their shareholders who consider academic journals as very profitable commodities, without caring about the intellectual value of peer reviewing since they do not pay for it. Unfortunately, some academic publishers, although they are not-for-profit societies, have adopted the same practices to counteract the fierce competition of major commercial publishers and try to remain in the scholarly publication market.

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[7] https://creativecommons.org/share-your-work/
[8] http://www.ipol.im/
[9] https://pkp.sfu.ca/ojs/
[10] https://pkp.sfu.ca/
[11] http://openscience.ens.fr/OTHER/PUBLISHERS/ELSEVIER/ELSEVIER_PATENT_ON_PEERREVIEWING/

Another way to publish in *diamond open access* is to rely on the open repositories developed for *green open access*. This leads to the concept of *overlay journals* (also called *epi journals*), where authors first deposit their article in an *open repository* to be peer reviewed. The authors have then two possibilities, either they mention the journal where they would like to submit their article, or they let different editorial boards find their article (since it is already in *open access*) and propose them to peer review it. An *overlay journal* is simply a set of links to the articles which have been peer reviewed and accepted by its editorial board (e.g., *Discrete Analysis*[12] whose articles are in the open repository *arXiv*[13] and which manages the peer-review process with the software *scholastica*[14]). The prestige of journal should only depend on the expertise of the members of its editorial board and the quality of the peer-reviewing process they perform. The *journal impact factor* is a nonsensical bibliometric indicator, gamed by publishers but actually counter-productive for research assessment, as shown by DORA (San Francisco Declaration on Research Assessment[15]). The *journal impact factor* should be abandoned and replaced by author-based or article-based criteria (e.g., article-level metrics ALM or altmetrics). Since all documents deposited in an open repository can be copied for free, it guarantees that the most interesting and most useful articles (together with their data and codes if they are deposited too) will always remain available. The number of such copies is certainly a much better bibliometric indicator for the value of an article than the *journal impact factor*.

When alternative open access models will have proven to be effective (i.e., for the quality of articles they publish, the efficiency of their dissemination and financial viability), editorial boards might be able to emancipate existing journals. Indeed it might be necessary for a community of researchers to take back control of the best, and often the oldest, journals they use to publish their results. Emancipating a journal means that its intellectual property is transferred from the publisher to the editorial board, the publisher being then paid as service provider and no more the owner of the journal's title, as proposed in 2012 by IMU (the International Mathematical Union[16]). Such a negotiation is complex and requires good lawyers to help the editorial board to recover control of the journal, arguing that its reputation is based on the quality of the peer reviewing of its editorial board, rather than on the quality of the type-setting and printing of its publisher. Emancipating a journal is preferable to creating a new one. Indeed, if an editorial board resigns and creates a new journal, the publisher keeps the title of the original one and has only to ask other researchers to form a new editorial board. The new journal then has a different title and competes with the original journal. Although the chances of survival are quite low for the new journal, some

[12] http://discreteanalysisjournal.com/
[13] https://arxiv.org/
[14] https://scholasticahq.com/
[15] http:///www.ascb.org/dora/
[16] http://openscience.ens.fr/ABOUT_OPEN_ACCESS/BLOGS/2012_10_22_Ingrid_Daubechies.pdf

have succeeded to do so (e.g., in December 2006 the editorial board of "Topology" published by Elsevier resigned and launched the "Journal of Topology", which has been published since 2007 by *Oxford University Press*, and in 2009 Elsevier had to stop the publication of "Topology"). There are quite a few journals, from a very wide range of disciplines, which have managed since 1989 to become emancipated from their publisher and to launch a new journal.[17]

The following actions should therefore be considered:

- *Green open access model with an open access button.* The Green open access model (where one of the authors of an article deposits the author's version in an open repository) is the best solution to guarantee a smooth transition from toll access to open access, while leaving room for innovation and fair competition to design new alternative models. The European Commission could facilitate, and eventually support, the development of a variety of open repositories of different sizes, offering new services for researchers (e.g., Zenodo[18], the open repository of OpenAIRE[19] which is supported by the European Commission). Many solutions should be tested before selecting the most appropriate ones. To ensure that all peer-reviewed articles be available in open access as soon as they are published, open repositories should provide an *open access button* which automatically sends an email to the author of an article retained under a publisher's embargo, asking her to send her author's version to a reader looking for her article.
- *Recognition of preprints as evidence of productivity in proposal evaluation.* For evaluating a proposal the European programmes (e.g., Horizon 2020) or the European institutions (e.g., the European Research Council, ERC) should take into account not only articles which have been published, but also those under peer review, for which a version has already been made public by depositing it in an open repository. For anteriority an article thus freely available in an open repository should be considered to be as relevant as its version published in toll access or *gold open access*. Indeed, the preprint made accessible on an open repository before the peer review has been completed should be recognized as the first report of a new result.
- *Transparency of ownership, processes and cost of publishing.* Projects could be established, supported by the European Commission, to describe and clarify the overall scholarly publishing process. This should include: description and analysis of the ownership of all assets (i.e., articles, journal title, peer review documents, editorial platform, journal's website, metadata, bibliometric data, download data), and how these practices vary between the various disciplines. Links to the best tools describing the current publishing system and estimating its overall costs could also be provided. The aim would be to recommend good practices and

[17] http://oad.simmons.edu/oadwiki/Journal_declarations_of_independence
[18] http://zenodo.org
[19] https://www.openaire.eu/

detect bad ones.

- *Legal support to researchers, librarians and funding agencies.* Legal support could be provided, for example by the European Commission, to analyse the ownership of scholarly journals, articles, supplementary data that authors deposit on the journal's website, articles' metadata, peer review reports and mails exchanged via the journal's editorial platform, the data harvested during peer reviewing and during articles' downloading. It is important to analyse the legal framework for hiring editors, transferring copyrights, subscribing, paying article processing charge, creating and selling scholarly journals. Legal support to researchers who wish to create new journals, or take over existing ones could also be offered.
- *Modification of the European law.* When articles have been peer reviewed (by researchers not paid by publishers) and accepted for publication, most publishers require that authors give them exclusive rights on their work. Contracts concluded by publishers based on such rights are not disclosed, since they are subject to the exemption provided by the European directive 93/37/CEE. There are two main issues: an imbalance between researchers and publishers and a lack of transparency and competition. The European Commission could then propose to declare clauses that grant exclusive rights to publishers unfair and without effect, and to force publishers to disclose these contracts. Furthermore, and consequently to Brexit, the European Commission could reconsider the present negotiation about European copyright law. Indeed, besides United Kingdom, other Commonwealth members and United States of America that are ruled by copyright, most of United Nations members are ruled by author's law. Europe could then play a leading role to promote author's law, to give a better protection to authors and a legal status to *knowledge commons*.

2. Researchers need publicly-owned and open source publishing platforms

There already exists all over the world a very large number of institutional or disciplinary open repositories, registered in DOAR (the Directory of Open Access Repositories[20]), where researchers can deposit a version of their articles, before or after their publication. Depositing articles on a repository may be voluntary or may be requested by authors' institutions or granting agencies. The choice of the version depends on how authors have given their copyrights to the publishers (see examples of the copyright transfer form they have to sign in order their article be published[21]). Unfortunately, many institutional or disciplinary open repositories do not match the appropriate standards for curating metadata and therefore remain hidden to search engines. Moreover, even if someone finds the article she is looking for, she often

[20] http://www.opendoar.org/

[21] http://openscience.ens.fr/COPYRIGHTS_AND_LICENSES/COPYRIGHTS/COPYRIGHT_TRANSFER_FORMS/

cannot download its full text and has only access to its metadata (i.e., title, names and institutions of its authors, abstract). This is due to the embargo period most publishers impose. Several countries are presently modifying their legislation to limit such embargo periods to a minimum, or even to forbid them. For instance, France has voted and adopted a new law, called "Loi n°2016-1321 du 7 octobre 2016 pour une Republique numérique", which limits the embargo period to six months for articles concerning science, techniques and medicine, and to twelve months for those in humanities and social sciences.[22] It is always possible to overcome the publisher's embargo by providing an *open access button (*also called *request eprint* or *Harnad's button)* which, if an article is still under embargo, automatically sends an email to its authors asking them to kindly provide the full text of their article.[23] Thanks to such an *open access button*, we have now the *immediate green open access* model which complies with the policy of Carlos Moedas (the European Commissioner for Research, Science and Innovation) to have full open access to all scientific publications by 2020 and which was accepted on May 27th 2016 by the Council of the European Union[24].

Many publishers currently use electronic platforms to reduce the cost for peer reviewing and publishing their journals. By automating most of the process, they no longer need to provide a secretary to help the editorial board. For instance, Elsevier has developed the electronic platform EVISE[25] (which replaces EES, Elsevier Editorial System) to handle the peer reviewing of all its journals, whatever their discipline, and requires that authors, editors and referees use it. As a result, the whole peer reviewing process of journals is under the control of publishers that own all documents produced by the editorial boards using their editorial platform. This was not the case when peer reviewing was done using email, since editors were then exchanging private mails with authors and referees. What is wrong with this present evolution is that authors, editors and referees have to use the editorial platforms designed by publishers to reduce their costs rather than improve the quality of peer reviewing. A much better solution would be that the editorial platforms be designed by researchers, with the help of software developers, in order to facilitate their task and give them the control of what the platform is actually doing. It is important to use *free open source* software, in order to know which data are harvested doing the peer reviewing process and to share expertise between different editorial boards. This will lead to collaborative development of new innovative methods of peer reviewing, editing and publishing, while converging together towards good practices.

A new component of the system we propose is the establishment of publicly owned

[22] http://openscience.ens.fr/LAWS/FRANCE/2015-2016_LOI_POUR_UNE_REPUBLIQUE_NUMERIQUE/
[23] https://openaccessbutton.org/
[24] see the point 12 of the *Council* conclusions on the transition towards an *open science* system in http://openscience.ens.fr/DECLARATIONS_ON_OPEN_ACCESS/2016_05_27_European_Union_Council_on_the_Transition_towards_Open_Science.pdf
[25] https://www.elsevier.com/editors/evise

and publicly funded publishing platforms, which would be designed to peer review and publish a very large number of journals from different disciplines and to help researchers to freely disseminate their articles. These would publish at no cost *diamond open access* journals that are recognised as being useful to their disciplines and whose editorial boards demonstrate that they are carrying out good peer reviewing practices. The accepted articles would be disseminated with the help of retrained librarians, and possibly publishers under contract, who would be in charge of curating metadata so that all articles could be appropriately located by search engines and freely downloaded. The governance of these publishing platforms would be similar to that of other research infrastructures (e.g., large telescopes, particle colliders, or supercomputers). They should be governed by three independent bodies: a scientific committee in charge of selecting the journals allowed to use the publishing platform for free; an executive committee in charge of designing and maintaining the infrastructure (i.e., choosing computers and hiring technical staff, such as software developers, data managers and publishing specialists); and a user committee in charge of reporting problems to be overcome and requests for better or new services.

The financial support needed to offer for free such publishing infrastructures to researchers could be taken from the budget allocated for public research, on the model of what is done for high performance computing with infrastructures such as PRACE (Partnership for Advanced Computing), an international not-for-profit organisation that provides computing and data management resources all over Europe[26]. Another source of funds would be to sell several kinds of supplementary services providing added value, such as editing, translating, converting files into various formats that can be stored and accessed through different media, such as tablets or cell phones (e.g., the *Freemium* business model used by *OpenEdition*[27]). Several publicly owned and publicly funded publishing service units designed to host open access journals already exist in different countries and provide electronic platforms developed using *free open source* software. In France, CLEO (Centre pour L'Édition Électronique Ouverte) publishes in open access more than 400 journals and 3,000 books of human and social sciences, financed using the *Freemium* model and supported by several public institutions such as CNRS (Centre National à la Recherche Scientifique) and Aix-Marseille Université.[28] In Brazil the State of Sao Paolo finances SciELO (Scientific Electronic Library On Line) which publishes in open access more than 1,200 journals from various scientific domains.[29] In Germany, ZBW (Deutsche Zentral Bibliothek für Wirtschaftswissenschaften[30]), jointly funded by the German Federal Government and the States of Germany, provides the publishing platform *EconStor*[31] which is an infrastructure for the free publication of scholarly literature in economics and business

[26] http://www.prace-ri.eu
[27] http://www.openedition.org
[28] http://cleo.cnrs.fr, http://www.openedition.org
[29] http://scielo.org.
[30] http://www.zbw.eu/en/
[31] https://www.econstor.eu/

administration, and also publishes the open access peer-reviewed journal *Economics*. The MPG (Max Planck Gesellschaft) offers similar services, in particular, the platform *Edition Open Access* for publishing books[32], together with the platform ECHO (*European Cultural Heritage Online)* that gives *open access* to rare scholarly collections which has been digitalised.[33]

The public infrastructures, needed for peer-reviewing and publishing *diamond open access* journals, could also be used as open repositories for the *green open access* model. Indeed, they could ensure the dissemination services and long-term archiving of all peer-reviewed articles, published in toll access journals, which have been deposited on the public platform. Moreover, since articles published in *gold open access* can be copied, thanks to their CC-BY license[34], they could also be copied and stored on the same public platform. Many countries have national public libraries and it is time to have in addition *national digital public libraries,* such as the European digital public library (*Europeana)*[35]*,* the Digital Public Library of America (DPLA)[36] and the digital public library of the French *Bibliothèque Nationale* (*Gallica*)[37]. Importantly, these national digital libraries, linked all over the world with other digital libraries and open repositories, could then form the *knowledge commons*[38] that researchers and everybody needs, not only to access articles for free, but also to publish them for free, with the guarantee that they will not in the future be privately owned or retained again behind pay-walls. Indeed, *knowledge commons* should be considered as a public utility, just like air, water and roadways, and hence be publicly owned, or at least publicly regulated.

An important issue is the long-term status of the *open access publishing infrastructures*, which should be publicly owned and have a legal structure which guarantees that they could not be privatised. This is why the start-up model is not adapted for developing them, unless public institutions buy them when they are successful. What has been observed until now is that, as soon as the services of a start-up are adopted by a large number of researchers, a major publisher buys it. Since it has already happened several times in the past, researchers have become reluctant to collaborate with new innovative projects developed by start-ups. For instance, in May 2016, Elsevier bought SSRN (Social Science Research Network), which was the largest open repository in the world (as ranked by Ranking Web[39]). Likewise, the start-up *Mendeley*, created in 2007 by three German PhD students to develop innovative Web-based tools for sharing articles and fostering research collaboration

[32] http://www.edition-open-access.de,
[33] http://echo.mpiwgberlin.mpg.de
[34] https://creativecommons.org/share-your-work/
[35] http://www.europeana.eu
[36] https://dp.la
[37] http://gallica.bnf.fr/
[38] Understanding knowledge as a commons: from theory to practice, edited by Charlotte Hess and Elinor Ostrom, MIT Press, 2006.
[39] http://www.webometrics.info/en/world

online, was bought by Elsevier in 2013. Moreover, the start-up *Atira,* created in 2012 and funded by the Danish Ministry of Science, Technology and Innovation, developed the software *Pure* that was used by over 47.000 research staff in Denmark as their CRIS (Current Research Information System). *Pure* was bought in 2012 by Elsevier and incorporated into the software *SciVal* that Elsevier sells to research institutions to evaluate and manage their researchers. As a result, Denmark now pays to Elsevier large amounts of public money to use a software whose development was financed by the Danish government. The open repository *arXiv*[40], which exists since 1990 and has become essential to physicists, mathematicians and computer scientists, might be the next open access platform to be bought by a major publishing company, since its economic model is not yet fully secured. On April 4th 2016, during the *Conference on Open Science* organised by the European Commission, the major publisher Springer Nature has already expressed its intention to buy open repositories to further develop its open access business.

The following actions should therefore be considered:

- *Control of bad practices*. Some publishers enhance the productivity of their business by manipulating the peer review process. Their editorial platform gathers data on the peer reviewing practices of editors and referees in order to develop expert systems able to automatically choose referees, or propose some to editors. They are also able to resubmit the rejected articles to other journals belonging to the same publisher without requiring another peer review, since the same referee reports will be used again. In 2016, Elsevier has even obtained a patent from the US Patent Office for "Online peer review and method"[41]. Another bad practice used by some publishers to artificially increase the impact factor of their journals is to oblige authors, at the stage of proof checking, to add new references to articles published in various journals owned by the same publisher.[42] These practices, which harm the quality of peer reviewing and therefore of scholarly articles, should be detected and exposed, for example by the provision of a platform where researchers could denounce such practices (e.g., as a new service of OpenAIRE). Moreover, editorial platforms should be designed for and with the members of editorial boards and should remain under their control. The data they gather should belong to the editorial boards and no longer to publishers.
- *Sustainability of the European open access infrastructure.* The European Commission's current support the *Open Access Infrastructure for Research in Europe* OpenAIRE[43] could be extended to provide a long-term consistent, stable and sustainable *open access* infrastructure integrated to the *European open*

[40] https://arxiv.org/
[41] http://openscience.ens.fr/OTHER/PUBLISHERS/ELSEVIER/ELSEVIER_PATENT_ON_PEER REVIEWING/
[42] http://openscience.ens.fr/OTHER/PUBLISHERS/ELSEVIER/2012_Elsevier_Bad_Practices.pdf
[43] https://www.openaire.eu/

science cloud presently in project. Its aim is to ensure the interoperability between institutional and national open repositories, all over Europe, and to offer to anyone (researchers, companies, citizens) a unique interface to seamlessly access the content of a very large set of open repositories selected for their quality. For this, it should describe how each open repository is operating (its software, metadata format, legal status, ownership, and funding) and recommend the practices of those offering the best services. It should coordinate and help them to improve the quality of their metadata and guarantee that each article is accessible for free and properly archived.

- *Development of new publishing services in open access.* Such an open access infrastructure should allow the design and experiment new online services. In particular, the European Commission could support the development of new publishing services to help researchers to peer-review, publish and archive the articles they produce. This would be the best way to measure the overall cost of electronic publishing, i.e., the investment and marginal cost (probably negligible), in order to estimate the price publishers could reasonably ask for *article processing charges*. It is very important that such costs become public and known by the researchers. The European Commission could also use new tools, such as the ORCID identification system[44] to uniquely identify the researchers who are awarded EC contracts, or the *Digital Open Access Identifier* DOAI[45] which gives priority to the open access version of any published articles over its version locked behind a pay-wall.
- *Open source software and metadata standards.* Support is needed for the development and documentation of *free open source software* to design open repositories, test them on existing platforms and advertise those which have succeeded to gather a large community of users and developers collaborating together to create new services, thanks to open source software. It is also important that the European Commission remains partner of the *Research Data Alliance* RDA[46] to actively participate in the definition of international metadata standards (e.g. *Dublin Core*[47] and *NISO* norms[48]) which ensure the quality and interoperability of open repositories at international scale.

3. Open peer reviewing improves the reproducibility of published results

There already exist several publishers offering open peer review options for some of their journals and this can take different forms:

- *open identity peer reviewing*, where the name and affiliation of the referees are disclosed but not their report;

[44] http://orcid.org/
[45] http://doai.io
[46] https://rd-alliance.org/ and http://europe.rd-alliance.org/
[47] http://dublincore.org/
[48] http://www.niso.org

- *open access peer reviewing*, where referee reports are made public and the name and affiliation of the referees could be disclosed or not (e.g., option offered by the commercial publishers *EMBO Press* and *Peer J* for the journals they publish);
- *open invitation peer review*, where anyone interested can contribute to the peer review process through an open discussion forum provided on the website of the journal (e.g., option offered by the commercial publishers *Copernicus Publications* and *F1000Research* for the journals they publish).

Note that nothing prevents a toll access journal from practicing open identity or open invitation peer review (e.g., it is the case of the four journals published by *EMBO Press*). Note also that open access peer reviewing was a common practice for scholarly journals in the 19th and 20th centuries. Let us then use here the definition of *open peer-reviewing* given by *Julien Bordier*, which *'implies that the referees' reports are disclosed, accessible, signed, and that authors and referees are able to discuss them'*.[49]

A few publishers already offer some open peer reviewing tools for the journals they publish. When researchers are able to use for free some large-scale publishing platforms, they will be able to experiment with new ways of peer reviewing and define themselves the tools they need for this. However, before developing such innovative practices, researchers want to make sure that the platforms they use will be long-lasting and will not, as soon as they are adopted by many researchers, be bought by some major publishers who will control them and reinforce their present oligopolistic system which diverts money from research (e.g., Elsevier bought several platforms and associated software : *Collexis*, *QUOSA*, *Atira* and *Pure* in 2012, *Knovel* and *Mendeley* in 2013*, Newsflo* in 2015 and the *Social Science Research Network* SSRN in 2016). To avoid this, it is essential that:

- the publishing platform be owned, either by one or several public agencies or not-for-profit associations, whose statutes ensure that ownership should remain public or not-for-profit (e.g., the 501 (c) 3 statute);
- the software used to develop those new tools should be *free open source* and made available to anyone on *GitHub*;[50]
- their long-term financing viability be secured by the same public agencies which fund research programmes, since the production of scientific results and their publication should be integrated. Indeed, it is counter-productive to invest public money in research for discovering new results while allowing companies to privatise the publication of those results to sell them back to researchers who have produced them.

[49] https://hal.archives-ouvertes.fr/hal-01302597v1
[50] https://github.com/

Let us now imagine, as a thought experiment, the cooperation between a journal, owned by its editorial board whose members want to experiment with *open peer-reviewing*, and a publicly-owned publishing platform. Let us consider a researcher who submits an article to a journal and deposits the text, figures and data on the website of the journal. The journal's editor in charge of this article first checks it is not nonsense and then opens it to anyone, but without disclosing the name of the author. During a certain period (e.g., one month) chosen by the editorial board any researcher could referee the article and send a referee report (not only a few comments) to the editor. All volunteer referees are identified with their ORCID (which uniquely identifies researchers[51]) and the editor, after checking that the report is consistent enough and well argued, opens it to anyone on the platform, but without disclosing the referee's identity. Thus, a public but anonymous discussion develops between one or several authors and one or several referees, whose role is to criticise (check for mistakes, originality, readability) and improve the submitted article. When the peer reviewing period (e.g., one month) has expired, the editor takes a decision. If the referee reports are insufficient, either in quantity (e.g., less than three), or in quality, or both, the editor assigns referees, as usually done when peer review is not open, and asks them to send their report as soon as possible (e.g., within less than one month). If the referee reports are satisfactory, the editor decides if the article is accepted, rejected, or requires a revision. If the article is accepted for publication, the editor also evaluates the quality of the referee reports and selects the best ones to be published together with the article. This innovation would be an excellent way to motivate researchers to do peer review, since it would give them the chance to have a new publication together with the recognition of the quality of their contribution as referee (e.g., young researchers who have not yet published an article might be recognised by their peers for having found an error in a calculation, or a flaw in a complex argumentation). As soon as the article is accepted, the name of the authors and their affiliation will appear on the journal's platform. Concerning a selected referee report, the procedure will be different and the choice left to the referee to refuse its publication or to accept it, with her name and affiliation being either disclosed or made public on the journal's platform.

If referee reports are made public during the *open peer reviewing* process, referees will be much more careful in their argument and will avoid requiring that the author quote their own papers, which is a distasteful but very common practice. Keeping the referee reports attached to an article might be highly valuable later on for historians of sciences or ethics committees having to investigate misconduct. Indeed, the current peer reviewing process is obscure and the ownership of all documents produced by editors, referees and authors during peer reviewing belongs to the publisher, who could then destroy them if they have no commercial value. Therefore, another important aspect of *open peer review* would be to preserve those documents in open repositories for future needs.

[51] http://orcid.org/