SCHOLARLY COMMUNICATION IN AN OPEN SCIENCE ERA

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As a member of the Global Academic Relations team at Elsevier, Federica is involved in the development of strategic initiatives and external partnerships with stakeholders in the academic community in Europe. In this capacity, her external collaborations focus on all matters related to Open Science, from data innovation, to citizen science, Open Access and alternative metrics. Her experience in Scientific Publishing, earned in twelve years at Elsevier, spans from marketing communications to publishing and business development. Her passion for Publishing traces back to her Master's degree in Literature, Press and Publishing History obtained at the University of Milan.

The changing world of research and the role of publishers

The impact of new technologies on the way research is conducted today is transforming the 'world of research' and, consequently, has an influence on the way that scientific outputs are shared and disseminated. Not only do new technologies enable science to benefit from collaborations across the globe and to become more interdisciplinary, they also open up the possibility to communicate much more than just the final research outputs, making all steps in the research process more relevant. Digital scholarly communication helps shed new light on the entire research cycle, making it possible for scientists, for instance, to start sharing data and methods right from the inception of their work. This trend in science of leveraging new technology to make the future of science more collaborative, open, transparent, effective, and efficient – previously called 'Science 2.0' and nowadays referred to as 'Open Science' – also meets the interests of politicians. They see this transformation as an opportunity to boost science and innovation, which in turn can support economic growth and help solve pressing societal challenges.

While to some extent these dynamics are changing the way science is communicated, they are not undermining the authority of the peer-reviewed text. They are rather reaffirming the role of peer review – albeit subject to new experimentations – as an important validation system that looks after the integrity and ethics of research. Scientific articles these days are much richer and much more suitable for effective consumption and communications. Today, scholarly communication is no longer limited to a 'flat' PDF, but revolves around a digitally enriched text supporting datasets, inline supplementary materials, data visualizations such as 3D viewers, interactive plots, and virtual microscopes, and linking to external repositories. This evolution is by no means making the role of publishers less relevant, as is sometimes suggested. On the contrary, it is publishers who develop and invest in the technology to make these enhancements to the online articles, and online technology enables publishers to get closer to the academic communities than ever before. As a result, publishers are able to better understand what kind of services researchers need to do their job more effectively. Publishers also play an important role in providing academics with a broad range of solutions that can help them collaborate with each other and disseminate their content for maximum exposure. In this context, supporting reproducibility of science and enabling sharing of research results are two key focus areas for publishers.

Reproducibility in science – when data objects enrich the text

In line with the community demand for more transparency and reproducibility of research results, new journals with a clear focus on data and data-reuse are emerging. Data journals, micro articles and data sections in existing journals enable authors to have their research data peer reviewed and cited. They also make sure readers can find, (re-)use and analyse the data that are hosted in external databases or submitted as supplementary data. By doing this, authors receive credit for their work while the wider research community benefits

from discovering and (re-)using research data. Beyond journal articles, Elsevier focuses on new article formats such as Original Software Publications (OSP) or Data papers: These new formats combine traditional quality editorial oversight with data and software platforms and analytics. Publishing innovation, such as the recent launch of the open access multidisciplinary journal SoftwareX, is at the core of these new initiatives.[1] The SoftwareX journal, piloting the review of academic software code, won the 2016 Award for Innovation in Journal Publishing at the PROSE Awards, organized annually by the Professional & Scholarly Publishing Association of American Publishers.

Equally adding to the current debate on reproducible science are other forms of innovation in scholarly communication focusing on publishing negative results and scientific methods and analysis. The open access journal New Negatives in Plant Science, for instance, puts the spotlight on negative and controversial data, aiming to avoid the publication bias that is very common in science, favouring positive results. Similarly, Registered Reports journals, such as Cortex, pre-register and review experimental methods and proposed analyses before data are collected. Then, if peer reviews are favourable, authors' articles are accepted in principle. This guarantees publication of their future results providing that they adhere precisely to their registered protocol. Once their experiment is complete, authors then resubmit their full manuscript for final consideration.
Both initiatives can be considered a step change in scientific publishing in the way that they both strive to eliminate publication bias and encourage scientific debate by giving these studies a place of their own.

Sharing research

In recent years, much of the debate around Open Science has been dominated by the discussions on Open Access, and the related requirements for broader access to and sharing of content.

On the Open Access front, we have been witnessing a surge of Open Access publications, and the consequent emergence of a publishing ecosystem that can support different business models and offer authors alternative choices.[2] Publishers have carefully listened to the needs of the academic community and launched Gold Open Access journals accordingly. They have also addressed Green Open Access requirements and came up with solutions that support the sharing needs of universities and funding bodies. Thanks to the use of embedded technologies and API services, for instance, publishers like Elsevier have been able to work with repositories around the globe to create sustainable solutions that enable readers to post a version of the text on the repository, while making sure that the authoritative final version continues to reside on the publisher's platform and in 'dark archives', such as CLOCKSS and Portico, for long term preservation and integrity of the scholarly record.

CHORUS is a good example of a sharing infrastructure fuelled by publishers to support the sharing needs of researchers, in compliance with funders' mandates in the US. The CHORUS infrastructure automates public accessibility of articles reporting on scientific and medical breakthroughs, making them easier to find through Google, PubMed Central, and other search channels. Readers are directed to the best available versions of the articles on the journal publication sites, where they are accompanied by up-to-date information, corrections and retractions, links to related articles, commentaries or editorials, and other essential tools.[3]

While the notion of sharing can open up interesting new online venues for article dissemination, it is important to keep the emphasis on the preservation of the authoritative version of record and the need for responsible sharing as outlined by the Voluntary principles for article sharing on scholarly collaboration networks published by STM on 8 June 2015.[4] Such networks help researchers to create new collaborations, and publishers are already developing solutions to make the sharing of subscription and licensed content simple and seamless for academic researchers so that it is consistent with access and usage rights.[5] ShareLink is a good example of how publishers enable sharing on scientific social media. Elsevier sends a Share Link when an author's article is published; it is a personal, customized short link that provides free access to the article for 50 days and can be shared via email or social media.

An even better example of the instrumental role that publishers can play when it comes to sharing, is a number of initiatives that go well beyond the research community and are meant to bridge the gap between science and society. By enriching the text with audio-slides, for instance,

authors can submit 5-minute presentations about their article using slides and voice-over and are able to embed the same presentation on other websites or post it to YouTube. This way, the general public can get an overview of what the article is about in an easily accessible and understandable format. Similarly, the public benefits from multiple initiatives that 'translate' scientific content into non-specialist language. A good example is the Atlas initiative, showcasing research that could significantly help improve people's lives when implemented. A group of experts, mainly from NGOs, selects an article to be awarded the 'Atlas Prize'. This article is made freely available alongside interviews, expert opinions, multimedia and much more on the Atlas website. These lay summaries have the potential to make research more accessible, improve engagement in science, and benefit wider society.

In conclusion, moving along with the digitization of science, scientific publishers like Elsevier are innovating and investing in new online solutions that support researchers in all the steps of the research cycle. The official version of record remains at the core of science communication, and it becomes even more valuable as it gets linked and enriched by other digital objects and shared for maximum exposure.

Elsevier

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1 Next to offering data-publishing outlets, Elsevier is investing in creating solutions that support researchers and institutions through the entire research data management cycle.
2 With 138 Full OA journals, 200 subsidized OA journals and 1,800 journals with hybrid OA Elsevier is the third largest Open Access publisher in the world (including 'subsidized' and author-pays publishers).
3 'FAQ'. *CHORUS*. Web. 26 May 2016.
4 *Voluntary principles for article sharing on scholarly collaboration networks*. STM. 8 June 2015. Web. 26 May 2016.
5 Mendeley is Elsevier's global research collaboration platform and scholarly social network. Mendeley's desktop, mobile and web applications help people organize, share, and discover new research. The Mendeley API powers more than 300 third-party applications that are making science more social and open, facilitating important interactions and advancing discoveries across all disciplines.