

25 The Global Benefits of Open Research and How It Can Change Scientific Publishing

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Research can only be open if its results are. Studies have shown that Open Access publications tend to get cited [1] more [2] often [3]; admit implementing research findings faster, which is particularly important in healthcare [4]; and reduce the time between research and the introduction of new products and services [5]. Aside from that, Open Access facilitates greater knowledge transfer to low-income countries, thus contributing to greater knowledge equity.

Open Research also embraces the principles of Open Data, Open Notebooks, and Open Source, i.e., the aim to make materials and methods used for research publicly available. Society and academia are not required to believe research results in good faith but are given the tools to reproduce them, making it possible to carefully check every step and to question every implicit assumption. This makes science as a whole more trustworthy and accelerates scientific progress. A prime example is the fast-paced development of Deep Learning: Academic source code made available by authors, open source software packages such as Tensorflow [6], Open data such as ImageNet [7], the MNIST database [8], or the UCI Machine Learning Repository [9] allow fellow researchers and interested laypersons to inspect algorithms, implement new ideas effortlessly, and incrementally and quickly advance the state of the art.

But Open Research goes even further. Rather than just making it easy to reproduce, Open Research makes it easy to participate. Laypersons and researchers from all over the world are invited to join efforts to solve a research problem. The result, the data, and the method become open to the public—and so does the process of “getting there”. Open Research thus not only accelerates progress by faster incremental improvements, but has the unique potential to advance science in directions that would otherwise not be pursued: If a researcher has an idea but lacks the required skills, then the idea will not be implemented. Open Research can bring together those with ideas and those with skills more efficiently than any classic scientific collaboration could, in a framework less bureaucratic than any government—or industry-funded project. A recent example of success is the development of an enantiopure version of a drug for a parasitic infection called schistosomiasis [10]. A pill made of this drug would be smaller, less bitter, and

would have fewer side effects, which would be a relief for the hundreds of millions of people affected by schistosomiasis worldwide.

Open Research projects are never finished. At any time, a research group may decide to throw in ideas or work on the current methods to improve the results. This, in turn, has the potential to fundamentally change scientific publishing, beyond continuing the trend towards Open Access. On the one hand, results from the project can be published in progress reports. This admits continued use of traditional publication venues, but may speed up the cycle in which publications are written, published, and become obsolete. On the other hand, though, the project consortium may decide to publish with the aim of informing the world about the state of the art. The publication then needs to change in sync with the results, something that is hardly compatible with today's prevalent publication practices. Indeed, only a few repositories (e.g., arXiv) and publishers (e.g., F1000Research) allow updating of documents while simultaneously keeping track of previous versions. Perhaps the future will tell that the best way to publish is a Wiki, the quality of which is ensured via replacing classical peer review by an open, moderated discussion.

Admittedly, the last paragraph hints at a potential future not everyone will welcome—current, traditional publishers surely will not. Aside from that, however, the benefits of Open Research—truly open collaborations, faster incremental improvements of the state of the art, opening the possibility to pursue new research directions, faster and stronger transfer of knowledge, greater equity in education—are indisputable. But benefits for science are benefits for everyone: As Steven Pinker recently wrote, we live longer, work less, fight less wars, fewer of us are poor, and more of us live in democracies. We owe this to replacing “superstition and magic with science” [11]. What better motivation is there to make research open?

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