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How and Why Data Repositories are Changing Academia

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A cademic and scholarly communication is unquestionably in the process of undergoing a revolution. It seems, however, that the nature of that revolution is still a somewhat open question. Libraries in particular are undergoing not so much a shift in focus but a diversification of roles. Where the library once consisted primarily of a physical building containing curated collections of books, journals and other resources, it is now a diverse set of services ranging from research assessment to technology support to the new frontier of data curation and dissemination.

Why Should Librarians Care about Data Sharing?

The role of the library as manager of collections of information for the use of patrons is still alive and well. Increasingly, however, libraries have been concerned with recording and curating the output of their institutions. This expansion of role has on some level been driven by a shift in the way that scholars are communicating their work and accounting for its value. Arguably, this trend began around 15 years ago with the rise of open access publishing, which itself was made possible by the shift to more scalable electronic journals. Many libraries have an interest in the new publishing model by either setting up central funds for the payment of article processing charges or supporting and educating scholars in how and why to publish open access. Later, institutional repositories provided avenues for green open access and library publishing operations began to develop during the first decade of the 2000s, culminating in the creation of the Library Publishing Coalition in 2012. Many library publishing operations, in contrast with traditional university presses, aim to support niche areas of scholarship of interest to their own faculty. However, early suggestions that institutional open access paper repositories may replace the role of traditional publishers have proven to be a bridge too far. One can postulate many reasons for this, but publisher brands and the need to publish in high impact factor journals seem the most likely. This is not the case for the emerging requirements of data dissemination. There are as yet no impact factors or prestige publication outputs. This means that libraries may have another opportunity to play a key role in communicating the academic content that comes out of their institutions.

As the open science movement has grown in momentum over the past decade and a half, scholars have sought new outlets for new types of scientific output. The blogosphere has been used to "publish" work almost in real time, resulting in some noteworthy cases. For instance, Rosie Redfield of the University of British Columbia documented her attempts to replicate NASA's claims of discovering arsenic based life on her blog ahead of publishing them in AAAS Science, which debunked the claim. However, this sort of blogging/publishing generally is discoverable and at least somewhat interpretable, so that it is available for re-use and re-analysis when needed. Finally, there’s a need to protect a researcher's ability to fully analyse their own data first through embargoes and also to protect commercially or medically sensitive information.

Taking all this together, data publishing seems to be a fairly complicated issue, but one that the library is well-placed to tackle.

Why Researchers Care

There are a number of potential advantages to scholars of sharing their data. Probably the most compelling reason is the apparent citation advantage. Other reasons include requirements from funders, journals and institutions, as well as a personal desire to make science more open.

Many researchers believe that open data is necessary to make scholarship more effective. The academic system does work, but it can be an inefficient machine. The majority of inefficiencies lie in the inability for academics to directly build on the research that has gone before them — to better stand on the shoulders of giants. Increased transparency can also improve academia’s ability to self-correct through openness to scrutiny and challenge.

Making data sharable and open has the added benefit of encouraging standards and codification — a vital step to making data machine readable. The power of computers means that data can be interrogated and cross referenced in order to automatically look for correlations between research outputs. Of course, today's artificial intelligence won’t enable computers to replicate the peer review process, but it will be important to create systems that are not only robust and scalable, but also very simple and time effective to use.

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Scholarly Publishers and Data

Over the past decade, some traditional publishers have worked with repositories to link raw digitised objects that underlie research to the hypothesis-driven narrative of the article. The goal is to standardize the approach to linking research data to publications, irrespective of the repository, which hosts the data.

Early successful repositories, such as the Protein Databank (http://www.rcsb.org/pdb/) and GenBank (http://www.ncbi.nlm.nih.gov/genbank/) archive molecules and genetic sequences to help reproduce research in the life sciences. Later, generic repositories came to the forefront through projects like Dryad (http://datadryad.org/), which helped motivate ecologists to make all of their one-moment-in-time series data available.

When funders started requiring that data be made available at the point of article publication, academic publishers took steps to help researchers comply with these requirements. Partnerships with repositories such as Figshare (www.figshare.com) allow journals to preview the digital files embedded within the HTML version of the article. The long-term preservation of the data is contractually maintained and each object is individually citable. Later, some publishers developed data journals, like the Geoscience Data Journal (http://onlinelibrary.wiley.com/journal/10.1002/(ISSN)2049-6060) published by the Royal Meteorological Society, that allows researchers to publish short descriptive articles, that aren’t hypothesis driven, linked to data archived in approved repositories.

In 2014, Nature Publishing Group launched Scientific Data, which applies traditional peer review to data descriptor articles: “Acceptance for publication is based on the technical rigour of the procedures used to generate the data, the reuse value of the data, and the completeness of the data description.”

There are movements to codify standards for data sharing outside of publishers, particularly in the sciences. A good example of this is the Open Microscopy Environment project (OME, www.http://www.openmicroscopy.org/). OME develops both standards in microscopy and open source imaging software. Organizations like Research Data Alliance, CODATA, the Data FAIRport initiative and Force11 are working towards standards for data storage, markup and dissemination. The work being carried out by DataCite and ORCID is of particular interest.7 This will enable research repositories to automatically update a researcher’s ORCID profile. This collaboration extends to CrossRef so that all academics should be able to sync their publications as well as their data with no extra effort.

Subject Specific and Structured Repositories

Certain disciplines lend themselves more easily to data sharing, such as astronomy, and the -omics disciplines. Structured repositories require data to comply with format standards thereby encouraging their adoption. They play a key role in data science as community or funder-driven focal points for collaborative and industrial scale efforts to assemble super-data-sets like Zooniverse’s Galaxy Zoo (http://data.galaxyyou.org/) and the NIH’s GenBank.

There are a number of libraries and other groups that maintain lists of these types of databases, perhaps most notable are the Registry of Research Databases (www.re3data.org), which was started in 2012 and is funded by the German Research Foundation (DFG) and Biosharing (www.biosharing.org), which is hosted by Oxford University. Encouraging patron participation in these repositories where appropriate is just one way that librarians can assist the open data movement.

Institutional Data Repositories

Institutional data repositories have been historically designed with a view to managing and curating the output of institutions. In that sense, they are intertwined with both research assessment and library publishing efforts; at some institutions, library publishing and data repository services are provided using the same platform.8 As data dissemination becomes increasingly important, it makes sense to look at some of the work that pioneering library publishing efforts have made in populating and popularizing their repositories.

In her 2001 article Institutional Repositories: Keys to Success,9 Joan Giesecke, then Dean of Libraries at the University of Nebraska-Lincoln, outlined how they successfully transformed their output from what she calls a collection centric viewpoint which assumes faculty participation and focuses on curation, to one of service provision which focuses on making the repository an attractive place to put content. Giesecke notes the danger that institutional repositories can become overly restrictive, focusing too much on the danger that institutional repositories can become overly restrictive, focusing too much on the desire to create an orderly collection, thereby unintentionally creating barriers to participation. By adopting the service driven approach of a university press, with a focus on discoverability, dissemination, search engine optimization and improved user experience, University of Nebraska-Lincoln were able to grow their traffic from zero to 300,000 uses per month in under five years.

Unstructured or General Repositories

With the growth in popularity of data sharing among academics and the increase in funder mandates, it’s clear that all researchers are going to need data sharing solutions. Subject specific and institutional repositories form an overlapping and occasionally incomplete patchwork of coverage for authors looking to place content, particularly data that doesn’t fit into the predefined data formats that structured repositories support.

There has been very little research into the volume of data produced by academics. The true scale and nature of research data is unknown as much of it sits on institutional and departmental servers or on the hard drives of computers under researchers’ desks. Anebdotally, researchers generally have large personal collections of data in a diverse range of formats.
As part of Figshare’s partnership with Nature Publishing Group and their journal Scientific Data, we’ve been able to analyze user behavior and preferences. Scientific Data asks researchers to place data in structured data repositories, institutional repositories or both when suitable ones exist. Tellingly, over 30% of data submissions were made to Figshare, making it the most used repository. We know from this that the majority of researchers require an unstructured repository for their data. The extent to which this will change over time as codification and structuring efforts proceed is arguable. It is our opinion that there will always be a strong need for unstructured repositories because it is the nature of research that many experiments and techniques are novel and unique.

Where Does this Leave Us?

It has taken longer than expected for the promise of the digital age to begin to make a real difference to the way scholars communicate their work. The persistence of traditional measures of quality are the most likely explanation for academia’s apparent conservatism, but with funding bodies increasingly encouraging and mandating the sharing of data, we are finally seeing diversification of what is considered legitimate scholarship.

The publishing industry has made strides over the last decade or so to integrate with institutional, funder and community-based repositories. Together with groups interested in the standardization of data formats, a lot of progress has been made to codify formats in many fields. There remains, however, a large quantity of data on researchers’ hard drives and servers that don’t fit into easily standardized formats because the techniques are either new or unique.

Endnotes


There are still many open questions in data publishing, from how to deal with embargoes or sensitive data to how best to assess the quality of the diverse range of digital research outputs. The field of data publishing is still in its formative stages and represents an opportunity for both publishers and libraries to help academics adapt to new requirements.

Everything Evolves, Even Publishing

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We sometimes hear that for all the promise of the Internet, it is a shame that it has yet to impact scholarly communication in the same way it has other industries. One could argue this point quite effectively: prestige still dominates; the journal name matters just as much as it always has; the same legacy publishers still control most of the literature; Open Access is just a small fraction of all articles, etc., etc. Meanwhile, in other industries it is easy to spot how the old guards have changed and new names have sprung up: Google, Wikipedia, Amazon, Uber and Facebook to name just a few.

On the other hand, does anyone believe Open Access is going away? Will data not become more widely available? Will tools to make publishing faster never be developed? Why have “megajournals” appeared in the past ten years and not just survived, but become the future revenue model for new and old publishers? Why are scholarly societies struggling after decades/centuries of thriving? Why are governments and funders making Open Access mandates? These events contradict the notion that the Internet hasn’t changed things in an “unmovable” 300 year-old industry. Indeed, the evidence actually suggests that we are in the midst of a change so expansive that we don’t quite know how to adapt to it.

We take comfort in the way things worked in the past, as they had slowly developed in manageable timeframes over the 20th century. There was certainty in how to communicate science, who to trust, or what to do for academic career progression. We now live in an era with an alluring future, but one that raises new concerns:

- How will we fund scholarly output? How much should we make open, and how? Is publishing Open Access a bet on the future, or will it negatively affect my students or my career?
- What the last ten years or so have done is to open our minds to questions that many of us never anticipated having to find solutions for. It could be argued that just as the Internet has made us more globally aware, so academia has grown more concerned with its impacts outside of the ivory tower. The decentralization that occurred with the World Wide Web makes it clear how we affect those around us, and this has influenced our professional lives in a similar way. It’s not that scientists are only just now waking up to the fact that they can be open, they just didn’t realize it was possible until recently. Our policies and infrastructures are unprepared for these changes, just as much as our readiness to leave the comfort of the past.
- There Would be no Open or Mega-Journals without the Internet

Just as the printed journal was a forgone conclusion of the printing press, so too was Open Access and the megajournal a natural by-product of the Internet. Perhaps someone continued on page 26