Building the Library of the Future
Keith Webster

The array of forces that impact upon the library's operating environment makes any modelling of transformation during the coming years an almost impossible task. The political and economic forces that drive the functions and finances of parent institutions, the imperative for commercial publishers to meet investor's demands for earnings per share growth, technological advances from Silicon Valley and beyond, are all part of the world in which the library will have to flourish.

What we can do, however, is look at trends and consider how best to take advantage of these to develop a library that is positioned for success tomorrow. A glance at the world of the academic library in 2017 reveals a few key themes that are conditioning professional practice, resource allocation, and investment priorities. These include the creation of advanced learning environments for students, an increasing move towards a global, distributed collection of information resources, the deployment of tools and technologies required to curate the evolving scholarly record, and a growing expectation of both domain and methodological expertise among recruits to the library profession.

Against this backdrop, in its strategic plan to 2025, Carnegie Mellon University announced its intention to create a 21st century library that serves as a cornerstone of world-class research and scholarship. While a large part of our vision is built upon a large-scale shift to digital forms of content, and web-based services, we are certain that the library will remain a vital presence on campus.

We see a need to celebrate an enduring sense of 'libraryness' – an environment and culture that supports scholarship and provides access to professional librarians in interactive research and study environments.

It is our view that the abundance of scholarly content in digital form brings a degree of complexity that will only increase demand for expertise in information discovery and organisation.

We set out four key themes:

- Develop information specialists as partners in research, teaching, and learning;
- Collaborate with peer institutions to provide co-ordinated access to a global collection of information resources;
- Steward the evolving scholarly record, and champion new forms of scholarly communication; and
- Be recognised globally as a leader in the development of the scholarly information ecosystem.

To understand the world in which these themes will unfold, we need to reflect upon some of the trends evident in today's library. These are neither exhaustive, nor are they mutually exclusive: I make this point to highlight the complex world of the contemporary research environment.

21st-century library spaces for 21st-century learners

Today, many universities are building new, or remodelling old, libraries to meet demands for serious space – learning environments that support interactions with information in a variety of forms. The design of the contemporary library draws heavily upon the space reallocation made possible by advanced storage retrieval systems (bookBots) and the transfer to offsite storage of lesser-used collections, freeing up space to meet student demand. While today's libraries are busier than ever, few students make extensive use of traditional offerings such as lending collections and reference services.

Libraries will continue to be recognised as a place of research and learning for the entire university community, at the heart of the campus-based experience. They will provide an array of spaces to meet a variety of learning needs: individual and group study, collaboration and fabrication spaces, active learning studios, and an array of specialist learning technologies. As access to the contemporary scholarly record in digital form becomes universal, libraries will create specialised facilities for the special collections and archives which distin guish most clearly one library from another. On many campuses, libraries will also serve as an academic commons, providing an opportunity for faculty and students to interact across disciplinary boundaries, and in a space that reflects the diversity of the university community.

Access to a global collection of information resources

Today's library collections remain distinctly hybrid: a blend of print collections acquired over many years, coupled with digital collections purchased or licensed from commercial publishers and learned societies. Institutional and disciplinary repositories have been in operation for more than a decade and are, increasingly, being joined by data repositories as important parts of the scholarly information system. Open access publishers such as PLoS have led the way in

building complex and interactive articles, which are presented alongside data, executable content, and other artefacts of the research process.

We are almost at the point where all scholarly information exists in digital form, and open access to books and journal articles will transform scholarly publishing models. The need to build and own library collections 'just in case' will be overtaken by a network login model. Such a model will operate across a vast array of content, including the huge resource of digitised archives and special collections developed by the academy over the past 20 years, and large-scale collections presented by Google and others. Scholarly content will be discoverable through robust search facilities, and delivered through shared, licensed collections.

The evolving scholarly record
Until the late 1990s, researchers built their information workflows around the library, where both the research record and current content were provided in printed form. In today's digital world, researchers' access to information takes place outside the library, and to remain a vital part of scholarship, libraries must develop their services around the researchers' workflow.

We increasingly recognise the importance of going beyond our role as information providers and into an environment where we provide services and expertise in all information aspects of the research process. This includes the creation and operation of campus research information systems, using proprietary services such as Symplectic Elements, which allow easy curation and re-use of a scholar's publications record, and indicators of the impact of their work from citation and altmetric databases.

We are also offering support in the curation and showcasing of outputs from the research process. Institutional repositories are being augmented by data and software curation services such as Figshare, helping researchers meet the growing open access requirements of their funders and their institutions.

In the near future, the print-centric scholarly record will have shifted to a complex series of digital and networked objects. Data, computer models, lab notebooks, blogs, community review and discussion, interactive and executable content will all form the record of scholarship alongside articles and monographs. Library services will be developed to capture, preserve, and share this record, promoting re-use and curation. Research funder needs will be assessed and managed, for example through the creation of data management plans.

I'm often surprised when people tell me they think the internet put librarians out of business. In reality, our expertise is in even greater demand than it was in the print world, although the skills and domain knowledge have become more complex.

Our colleagues will be recognised as information specialists closely integrated with the academic communities they serve. They will bring expertise in information activities to all aspects of the research process including grant applications, data management planning, measuring and improving research impact, publishing and information discovery, storage, and re-use. They will also be key partners in learning and teaching, building digital learning objects, developing digital literacy skills, and preparing students for careers in the knowledge professions.

At Carnegie Mellon University we appreciate our good fortune in creating our library of the future in a university that is home to one of the world's leading schools of computer science, with a machine learning department specialising in fields such as advanced data manipulation and the development of algorithms to improve search, discovery and retrieval. We see their research interests aligning closely with some of the major challenges of information use in a digital world. For example, how do we best replicate serendipity in a massive-scale digital library? How do we help a researcher sift and understand the key content, when in some fields it is impossible for experts to keep up to date with the volume of core literature being published each year? How do we help a student identify the most relevant material scattered across commercial publishers' sites, university repositories, in print collections and in the open web?

We anticipate an ambitious research agenda to investigate these and other facets of the library of the 21st century. A century ago, Andrew Carnegie created and defined the library of the 20th century. Our ambition is that the university which bears his name will define the library for the next 100 years.

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