



Digital Distribution of Academic Journals and its Impact on Scholarly Communication: Looking Back After 20 Years

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It has been approximately 20 years since distributing scholarly journals digitally became feasible. This article discusses the broad implications of the transition to digital distributed scholarship from a historical perspective and focuses on the development of open access (OA) and the various models for funding OA in the context of the roles scholarly journals play in scientific communities.

Keywords: Open access; History; Serials

INTRODUCTION

The technological innovations that made digitally distributed journals feasible coalescing about 20 years ago have profoundly changed scholarly publication. One of the most important changes, though far from the only one, has been open access (OA) publishing, making the content of scholarly journals freely available and funding the cost of publication via means other than subscription fees. A lively debate has gone on for years as to whether OA should be the dominant economic model for distributing scholarly journals and, if so, how it might be funded. To some extent, this debate has obscured the broad implications of digitally distributing scholarly journals. This article attempts to put OA in perspective as one piece of a far more profound evolution that has impacted on virtually every aspect of scholarly publishing.¹

As it became clear that scholarly journals were going to be distributed digitally, Ann Schaffner argued that in order to understand how a digital system might develop, it would be helpful to start by looking for clues in how scholarly journals developed in paper format.² Schaffner also argued there was a need to consider the various roles that these journals have played in scientific communities and how these roles might impact the development of a new digital distribution system. She identified five unique roles, listed in the order of importance: building a collective knowledge base; communicating information; validating the quality of research; distributing rewards; and building scientific communities.

A BRIEF HISTORY OF SCHOLARLY JOURNALS

Schaffner noted that the technology that made scientific journals possible, the printing press and a viable postal service in Europe, developed well before the launch of *Philosophical Transactions of the Royal Society* in 1665, generally considered the first scientific journal. The key ingredient that precipitated scholarly journals was not technology but science itself. As the scientific method began to take hold the “natural philosophers,” as they were called at the time, began shifting their focus from interpreting and debating the classics to observation and experimentation. This change in focus made it necessary to disseminate the results of small discreet studies and observations. This was done via letters that were often copied and further disseminated through scientific societies, which began forming during the beginning of the 17th century. Henry Oldenburg, the secretary of the Royal Society, was heavily involved in this re-dissemination and *Philosophical Transactions* (*Phil Trans* for short), may have been conceived in part due to his frustration with the highly

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inefficient system of hand-copying to further disseminate these letters.

John Willinsky notes that *Phil Trans* fit in a niche between books, the traditional means of scholarly dissemination, and the letters which had grown in importance for presenting the results of small focused studies during this period.³ Letters provided a flexible and interactive mode of communication albeit a highly inefficient one. Books could not fulfill the need to disseminate small discrete studies but provided a more comprehensive and permanent means of presenting theories along with summarizing and interpreting findings. Journals sat somewhere in the middle, providing an efficient means of communicating discrete studies and observations but less interactive and less timely than letters. Over time, Oldenburg's idea caught on and journals became the main vehicle for disseminating new scientific knowledge in most fields.

The development of journals such as *Phil Trans* also solved another important problem brought about by the inefficient system of informal letters. They clarified the origin of a research finding or idea, giving appropriate credit to the natural philosopher who actually made the discovery. According to Guédon, this was a huge issue and prior to the development of scientific journals, natural philosophers often refrained from sharing their observations and discoveries for fear of others claiming credit for their ideas.⁴ Interestingly, it took quite a while before there was a realization that scholarly journals were forming a comprehensive archive of knowledge, what this author believes most people would agree is the most important function that they serve today. Although books also served this purpose, journals turned out to be much better suited for chronicling the results of individual studies that had become the life blood of science.

Systems for validating scholarly manuscripts and the research results that they contained also evolved slowly and haphazardly and were implemented perhaps more to protect the good name of the learned society that sponsored the journal than anything else.^{5,6} *Phil Trans* was eventually peer-reviewed and is sometimes given credit as the first peer-reviewed journal though similar systems evolved somewhat earlier.⁵ It took until 1752, nearly a century after *Phil Trans* was first published, for it to become peer-reviewed.

The format of scientific journals has evolved slowly over several hundred years. The structure of articles, referencing systems and abstracts have all gradually developed into a very efficient and effective system for disseminating scientific information and allowing scholars⁷ to quickly find the relevant literature and within an article, the specific details that they needed.² Disciplines began to develop their own formats that best suited the nature of the scholarship conducted. The sciences and social sciences, where discreet observation and experimentation is widely used, gravitated towards the use of journals while the humanities, which tend to have a broader, more integrated approach to their scholarship, inclined more towards monographs. In addition, a whole set of norms and conventions developed that have allowed journals to operate effectively. For example, peer-review is expected to be confidential until a manuscript is published and authors are expected to refrain from submitting the same manuscript to more than one journal at the same time.

Journals have traditionally been closely tied to scholarly organizations such as the Royal Society. They largely arose out of these societies and remained closely linked to these societies up until the later part of the 20th century. Again, the road was a bit rocky. For example, *Phil Trans* shut down for five years after Oldenburg's death as operating the journal was largely his own personal project rather than part of the Royal Society. The Royal Society also did not take full fiscal responsibility for the journal until 1752, which is when they also implemented peer-review.⁶

Journals were largely owned by these societies and were operated at a significant cost. They had small circulations outside of societal membership and were expensive to publish. Library budgets for journals were limited. Societies maintained their journals through subsidies and page charges to the authors since these journals were seen

as valuable by the societies. This began to change in the latter half of the 20th century as governments in the industrialized world began investing heavily in research, largely through grants to their university systems and focusing in the scientific, technical and medical (STM) areas. The investment paid off and scientific research grew rapidly. Not only did the number of manuscripts needing to be published grow, but the research spawned whole new specializations such as molecular biology, requiring more and more specialized journals. At the same time, academic libraries and their budgets expanded with the influx of funding to the universities for research, allowing them, at least initially, to cover the increased costs of expanding their journal portfolios.

Commercial publishers, who prior to this time published few scholarly journals, began taking over journals from societies and launching their own journals with the help of individual scientists or scholars as editors and editorial board members. Initially, this was a real service, filling a void in light of the rapidly increasing need to publish more articles in existing journals and for the creation of more specialized journals. Publishers found owning scholarly journals were not only profitable but, in fact, could be extremely lucrative. During the last 25 years of the 20th century, there was a rapid expansion of publisher-owned journals in conjunction with a consolidation of scholarly publishing as the larger publishing houses, seeing a highly productive market, began buying up smaller ones. This continued alongside an increase in subscription fees that, with a few notable exceptions, has far exceeded the subscription fees of society-owned journals in similar fields.⁸ The increase in subscription prices is complex. In part, as publishers have claimed, publishing more and more journals in highly specialized fields is expensive but, clearly, this is not the only reason. Scholarly publishing, which was a money losing proposition prior to the second half of the twentieth century, became very profitable and the pricing of some journals has become, by almost any standard, exorbitant. By 2006, approximately 45% of scholarly journals were owned by commercial publishers with another 17% published by them under contract.⁹ The change is more dramatic in the STM fields where commercial publishing is concentrated in a few publishers and is extremely profitable.

The rapid post-World War II expansion of STM research was characterized by the ensuing commercialization of scholarly publishing and an increase in subscription fees, far exceeding library acquisition budgets. This has resulted in a funding crisis that has strained the symbiotic relationship among publishers, academic libraries and scholars. In this environment of rising tensions, with the evolution of digital networks about 1993, it became technically feasible to move from a paper to a digital distribution system for scholarly journals.

In summary, scholarly journals evolved slowly, gradually filling the roles that they currently serve in scientific and scholarly communities. The formats and conventions that allow the peer-review and publication to work effectively also evolved slowly, most likely through trial and error. The technology that made journals possible, the printing press and a viable postal system, were essential but only one of many factors that were responsible for development of scholarly journals. Journals were closely tied to scholarly societies with varying missions until a rapid expansion of scientific research spawned an increasing number of journals owned and operated by commercial publishers. Social and economic forces as well as the evolving nature of science itself were the real drivers of the evolution of scholarly journals; the format and processes of scholarly publishing took several centuries to develop to its current state.

TRANSITIONING TO A DIGITAL DISTRIBUTION SYSTEM

With paper distribution, there was a symbiotic relationship among publishers, librarians and scholars. Scholars produced the manuscripts, publishers managed the peer-review process and took the raw material through the publication and distribution process with libraries purchasing and archiving the material as well as facilitating

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