

EDITORIAL

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# Ten years of *Heritage Science*

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## Abstract

The article describes the revolutionary new ways of communicating the written word when moving from the Medieval to Modern period in Europe, primarily the use of paper and moveable typeface printing and how these catalysed important cultural developments. A similar revolution has taken place in the last 50 years with the development of the internet. The article looks at how scientific publishing has changed with electronic publishing, including the development of Open Access. The journal *Heritage Science* is placed into this context. Especially important for scientific journals in an era when anyone can post anything on a webpage, is maintaining standards through high quality refereeing which distinguishes formal scientific literature from informal websites.

The journal *Heritage Science* was launched in April 2013, a spin-off of the parent *Chemistry Central Journal* (now renamed *BMC Chemistry*).

Whereas there were (and of course still are) several well established and highly regarded journals publishing work in the scientific study of heritage and conservation at the time of inception, *Heritage Science* was distinct in its origins in that it was golden Open Access (OA), that is all papers were published as OA so that they could be freely accessed throughout the world, allowing small institutes such as museums and galleries access to all articles without a paywall. At the time there were some OA journals in the area, but *Heritage Science* was important in that it was published by one of the largest established international publishers, ensuring a solid foundation and strong editorial support and standards for many years or likely decades into the future.

Presentation of the written word has historically been one of the main driving forces in the change of society and it is important to understand how revolutionary changes in publication procedures can be.

In Europe, the Medieval period lasted approximately between 500 AD and 1500 AD. The main conveyor of written knowledge was via books and manuscripts. Books were very rare and expensive to produce. A typical medieval book was written on parchment or vellum and required according to length typically the hides of 25 to 50 animals (cattle, sheep or goats). As it was written (or copied) by hand, often with elaborate written script, a scribe might take several weeks or even months to complete. In addition, many of the best books were illustrated requiring even more skill, time and expense in the elaborate colouring and illumination. Finally, many books were bound often in a thick leather covering, and for more prestigious books adorned with precious stones and other ornaments.

The result of this was that books were costly and very rare. It has been calculated that in modern day equivalents a book cost about the price of a car. This meant that not many people possessed books. The majority of books were in libraries, often ecclesiastical libraries as monks often were responsible for the production of books, but sometimes books were owned by rich private collectors or universities. Libraries though were often small compared to the modern day, 200 to 300 books would be regarded as a rich library.

Socially this rarity of books had many consequences. First literacy was low in the general population because most people never came across books or formal manuscripts and so never needed to read complex texts. In

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fact, literacy was so rare that anyone who could read text from the Bible in fourteenth century England could automatically be classed as a clergyman, and if accused of a crime, could be tried by clerical courts, and so escape severe punishment. Second learning was slow to spread, the majority of books being religious with only rare books on medicine and science and so on, as not many people could access books for study, research or learning. Similar comments can be made about the spread of political and legal information. In order to access a corpus of learning one had to associate with institutes such as monasteries or a very small number of Universities, presumably either accepting their rules or obtaining income for support and donation. Third vernacular (local) languages were primarily spoken dialects rather than written words. For much of medieval Europe, most formal documents were in Latin which was understood just by a learned elite, whereas the general population could not understand this language. Their spoken languages were not widely recorded and a written literature in the local dialects often did not develop, as it would have been too costly to produce books in the local language since not enough people would buy them and manuscripts were mainly aimed at the clerical and legal elite who communicated in Latin.

Of course, European culture by some criteria was behind China and the Islamic World over most of the Medieval period, but caught up due in part to improvements in learning and literacy. There were two major events that changed how written information was presented between 1450 and 1550 in many European countries. The first was the replacement of parchment and vellum by paper. Although paper had been manufactured in other civilisations for many centuries, it was largely unknown in many parts of Europe until the late fifteenth century. Although the first paper mills reached Toledo in Spain in 1085, it took until 1340 for the first recorded paper mill in Italy, and the first mill in England was recorded in 1490, four hundred years after the first record in Spain. The method of manufacturing changed to make paper cheaper and more widespread. But once widely available it meant that books, and also pamphlets and short documents, were much cheaper and easier to produce. The second is the invention of moveable type printing in the mid fifteenth century. Although other methods of printing such as woodblocks have an older vintage, the use of metal moveable characters that can be covered in ink and impress on a page, meant that it was no longer necessary to pay and find often highly expert scribes to produce books.

Hence over 100 years there was a revolution in how the written word was conveyed. This was an important factor that helped catalyse a large number of developments

moving Europe from the Medieval period to the Modern period. Knowledge could be transmitted more easily. People could afford written material so literacy increased. Vernacular languages were written down : in England, the origins of Modern English developed in this period, eventually with playwrights such as Shakespeare making an impact. More people could understand the legal system. Political participation widened dramatically as people could find out what was happening much faster from pamphlets in their local languages and did not have to be part of a small elite.

This huge change was significantly catalysed by changes in how the written word was conveyed.

A similar revolutionary change has happened over the past 50 years due to the internet. Often people living through change do not realise it and it is left to historians of later generations to define these periods. However, this new revolution critically affects scientific publishing and is thus relevant to the development of this journal.

Fifty years ago, scientific publishing had quite a different feel and aim. The main method for conveying new scientific ideas outside local meetings and seminars, was via papers published in scientific journals. Journals were expensive. Accepted papers often had to be typeset, and in some cases even diagrams such as chemical structures were redrawn by specialist artists.

Refereeing and editing was done differently to the present day. Authors had to submit 3 or 4 copies of their papers either using carbon copies or latterly photocopies, by post, to the editorial office, which sent copies to referees, again by post. Compared to now, referee take-up was much higher, but the burden on referees would have been much lower, and most refereeing was done locally. A journal published in the US would have been refereed primarily by US scientists. Learned societies would often ask their prominent members or attendees at meetings to act as referees.

Because of the cost of postage and copying, often revisions would be few, the days of sending and insisting on 3 or 4 revised versions were not upon the community. For about 20 years, fax machines were used sometimes to communicate whole manuscripts but more realistically for referee comments and proofing corrections. Even during the ten year existence of this journal, for the first few years this publisher routinely sent emails mentioning using a fax as an alternative to email for communication with authors.

As printed journals were expensive, often there would be limited numbers of subscriptions. This had many consequences. First there were many more regional or national journals, so some scientific information was communicated only locally and often was rediscovered in different parts of the world independently. Many

specialised journals were only available in subject libraries of large institutes, and often workers in different disciplines would not visit their colleagues' library, for example not many historians would visit a maths department library, hence knowledge was more compartmentalised, strongly reducing interdisciplinary work in areas such as heritage science. Scientific cross-fertilisation between different linguistic groups and countries would be less. For example, even though many English scientists would have a working knowledge of German, given the important scientific traditions in Germany, they would not have access to many German language journals in their Universities, and might have had to visit a German University to access the literature. Interlibrary loans, or more frequently copies of papers, could be used to access papers whose titles are found in reference lists, but this came at an expense. People sent reprint request cards, but frequently the authors had little time and low postal budgets to comply with all these requests.

The role of refereeing also differed. Journal publishers survived primarily on subscriptions. With these, they usually guaranteed to produce a set number of issues per year. This meant that the number of papers they could publish each year would be limited. It could not be too few, otherwise the subscribers would complain, or too many, otherwise their publication costs would be too high and they would make a loss. So, the editorial job was partly to control the number of papers published each year. Standards could change according to the volume of submissions. As frequent revisions were expensive in photocopying or retyping and postage costs, a major job of the referees would be recommending acceptance or rejection. Some communication journals rarely asked for changes, and a small number of journals published just camera ready articles that could not easily be changed, so revision was less important than whether the paper could be published or not. On the whole many authors of these early papers had excellent linguistic skills and were often assisted by highly trained typists or assistants, and professional journal editors made grammatical and bibliographic corrections so there were less issues with the presentation than with many current articles. The English language was not so universally required for publication so most authors could write in their native languages also for local journals. Some journals allowed papers in several languages.

Disseminating knowledge internationally was harder. Whereas most mid career aspiring scientists can nowadays hop on a plane to go to a far away international conference without difficulties, international travel, such as transatlantic flights, was expensive 50 years ago. A UK scientist wishing to present at a US conference and return after would either have to be a very eminent invitee or

have very significant grants. The alternatives would be to go on a sabbatical in a foreign country and use this as a base for visiting local institutes, or go on a lecture tour abroad. All this required relocation or at least prolonged absence often from a long suffering family. As these options were limited, the most important approach was publication particularly in journals with a wide international profile. Hence scientific journals became the main means a scientist could disseminate their work outside their local environment and so were critically important for the exchange of knowledge.

This approach to scientific publication had developed over many decades, but was to be radically shaken up via the internet, which has transformed how the written word has been conveyed as much as printing and paper transformed European thinking from at the end of the Middle Ages in Europe.

Science was early into the internet. Scientific journals began to start to put papers on-line in the 1990s. Still the definitive version was on paper and still scientific libraries contained shelves of unbound journals and archives of bound volumes from the past. But gradually papers could be read on-line and people stopped consulting physical libraries and printed journals. Slowly refereeing was done by email rather than post or fax and in some cases the first editorial management software was developed.

In the 2000s this pace moved rapidly, with many journals moving to electronic only volumes, and libraries rapidly cancelling print versions. Some libraries, to save space, even sold off or destroyed bound printed volumes in their archives, once publishers started archiving old volumes electronically on-line. By this time very few authors or readers ever consulted or submitted paper versions even to the diminishing number of printed journals.

As print subscription journals became less important and on-line publication dominated, in the 2000s there was a strong development in Open Access (OA). This originated out of ideas for free to read archiving of science. Traditional subscription journals were becoming increasingly expensive and so institutional libraries (whether print or electronic) were reducing their portfolios making it harder for scientists to access new material. OA papers would be open for everyone to read. Initially there were two approaches. The first was informal archiving that did not receive funding and was free to submit and publish. The problem here was that the archives were maintained by enthusiasts who might have other commitments, and could not necessarily operate a full portfolio of editing, proofing, permanent archiving, refereeing and so on : for a relatively small community of enthusiasts as initially this was fine, but significant expansion required professional backroom staff. The other

approach was small dedicated publishers who charged for publication but did try to provide some professional support. Initially these publishers started up relatively small journals, many of which struggled to gain acceptance especially in major databases and some of which did not maintain fully professional refereeing standards partly because they lacked experience and infrastructure.

One consequence of this democratisation of dissemination of scientific information is that anyone can set up a website and announce any scientific result they like. In the days of print journals, the decisions would be in the hands of editors who usually would have established standards of refereeing and acceptance and limited journal space. Now this was no longer necessary. In the area of heritage science, many galleries and museums and conservation institutes could set up informal websites and report their latest endeavours without much scrutiny. Hence no longer was it necessary to convince some senior academic or editor that one's work was innovative enough to be included in a limited space journal, but one just posted on-line whatever one wanted.

This changed the role of journals. Acceptance and rejection was no longer the predominant decision as most journals, if no longer printed, did not have such space constraints. However, refereeing and revision became more important. What distinguishes an informal article from a prestigious scientific publication is refereeing. Established traditional scientific publishers have had decades, some even more than a century, of developing protocols for refereeing.

Such established publishers were originally relatively slow in encompassing OA publishing, preferring on-line subscription journals initially. The economics of OA and of subscription journals is different. In OA journals authors see the costs directly, which involves a change in mentality. In fact, many OA journals are less profitable than subscription journals. And the cost of a subscription journal for a museum or a less well endowed country can be substantial, limiting the dissemination of knowledge only to an elite. In particular in heritage and conservation science, many institutes around the world are small outfits, sometimes with just a modest team of conservation scientists and could in no way afford a fully endowed subscription library. But someone has to pay for professional publishing, and this burden falls more on the authors' institutes, their granting bodies, national agreements and so on.

In 2000, BioMed Central was established as the largest OA publisher of its time, with a full infrastructure that supported over 200 hundred journals. In 2008 this was bought by Springer Nature, which is both a very long standing traditional publisher (the second biggest international STM - Science Technology and Medicine

publisher) and the first major international science publisher to focus on OA journals, which currently now stand at over 600 golden OA journals. Into this stable stepped *Chemistry Central Journal* in 2007 and from there was born *Heritage Science* in 2013.

A major advantage of being part of Springer Nature is that we are incorporated into a large traditional publisher who in particular can maintain the standards of refereeing that distinguish informal webpages from highly regarded scientific articles. Good quality refereeing is the bedrock of our journal, and we thank the large number of outstanding referees that have helped us over the years. It is undoubtedly what makes the journal successful. With the change in opportunities in scientific publishing, evaluation and revision of manuscripts is crucial.

The refereeing system is largely unchanged from the traditional approach. We do have more editorial screening than in the past, about half of the submissions are either rejected usually as out of scope or returned to authors for improvement, prior to refereeing. We do not aim exclusively for speed, surveys of our editorial board suggest that they appreciate a more thorough review than a quick accept / reject decision, and busy scientists are indeed very busy. A good review can take a couple of hours or more, and has to be fit into a strong professional schedule. However, we still aim to get reviews complete for most papers within about 4 weeks of inviting reviewers, apart from a few atypical papers usually at the periphery of our scope. Almost all papers if progressed require detailed revision, which sometimes takes time. However, referees act as invaluable collaborators and members of the community. In return, if referees submit their own work, we hope to be able to improve their own papers.

OA has been slow to take off in heritage science. When the journal started most academic authors preferred traditional journals, and many in museums and galleries were accustomed to publishing in monographs or their own in-house publications. But gradually the concept has lifted off. Many more workers are now convinced of the benefit of refereed papers, and many do want international open access publication. Many funding bodies are starting to mandate this. These trends have led to the increase in publications over the years.

In 2014, we published just 29 papers. In 2022, we published 205 papers. So far in 2023, we have published 227 already, making an annual estimate of around 270.

In the last 12 months, at time of writing (8 October 2023) there have been 616 submissions, of which 282 have been rejected and 186 accepted, the remainder being under consideration or in a small number of cases withdrawn or technically not yet progressed.

**Table 1** Countries publishing in *Heritage Science* in 2022 by main author according to Clarivate Web of Science

China	77	Australia	2	Malaysia	1
Spain	24	Belgium	2	Mexico	1
USA	22	Cyprus	2	Norway	1
Italy	21	Czechia	2	Peru	1
England	19	India	2	Romania	1
Germany	18	Jordan	2	Russia	1
Poland	14	Sweden	2	Singapore	1
Denmark	12	Afghanistan	1	S Africa	1
Egypt	7	Argentina	1	Taiwan	1
France	7	Austria	1		
S Korea	7	Colombia	1		
Netherlands	6	Ecuador	1		
Iran	5	Eritrea	1		
Portugal	5	Ethiopia	1		
Switzerland	5	Greece	1		
Turkiye	5	Hungary	1		
Canada	4	Israel	1		
Scotland	3	Japan	1		
Slovenia	3	Latvia	1		

There has been a tremendous international coverage for this journal, as presented in Table 1 representing the country of origin of the main authors for papers published in 2022 according to Clarivate Web of Science. In 2023 submissions also have a broad international distribution. OA as a culture for publication has developed at different speeds according to geographical region, and so we would expect some less represented countries to increase their proportional contribution to our journal over time. We have a fantastically well balanced international editorial board, who advocate our journal in different corners of the world and is regularly refreshed.

The breadth of topics is tremendous. Most noticeably is the focus on computational techniques such as 3D modelling, expert systems, digital twins and so on. Geographical Information Systems are also a strong topic. We receive many articles about analytical chemistry, particularly of paintings and of paper. Engineering is featured as an example structural stability of historic buildings. Geology has importance in some heritage studies. Biology such as microbiology of stone monuments and fungal deterioration of paper is the focus of some articles. Text and linguistic analysis attracts some elegant articles especially using computational approaches.

The last few years have been exciting. The concept of scientific publishing has changed even in the last decade, and heritage / conservation scientists are starting to embrace it, although progress is still very regional. However, from the seed of an idea ten years ago, a major tree

is growing and we look forward to the next decade in anticipation. Scientific journals such as ours are founded on good refereeing and hope to stand out as a forum of dissemination by maintaining these high standards as mandated by one of the world's best established scientific publishers.

#### Author contributions

The authors read and approved the final manuscript

#### Declarations

#### Competing interests

The authors declare that they have no competing interests.

Received: 16 October 2023

Published online: 03 November 2023

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