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Surfing the Third Wave: The Added Value of a Publisher in a Changing World*

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ABSTRACT

Scientific publishing finds itself in a period of turbulent change as publishers strive to embrace the new technologies of a digital age. This paper looks at the basic functions of a scientific journal and the role that a publisher plays in the process. It considers how a publisher offers added value to authors and readers through dissemination, validation, registration and archiving. These functions are discussed in the light of the impact of new technology. The changing economic situation is also reviewed. Since the currency of the digital age is information, publishing has a unique role to play in the change process itself. The paper concludes that those publishers able to deliver added value will survive.

INTRODUCTION

Publishing is communication. It is the process of taking authors' work and disseminating it to readers. Scientific publishing is a highly structured form of publishing in which specialised work is communicated to a relatively small group of readers who are able to appreciate the content. At its most esoteric, for instance in obscure corners of pure mathematics, an article may only be fully understood by perhaps 20 scientists around the world. This does not mean that the work is uninteresting: the proof of Fermat's Last Theorem was reported on CNN although the article describing it is impenetrable to all but a select few.

The concept of a scientific journal stems from a proposal by Robert Hooke to the Royal Society in England in 1663: "A weekly printed publication providing a brief discourse of what is new and considerable…from all parts of the world…what the learned and inquisitive are doing and have done…". In subsequent letters between Robert Boyle and Henry Oldenburg, Secretary of the Royal Society, the key elements are thrashed out:

> *"ye registering of ye time when any observation is first mentioned…as well the person and the matter itselfe";*
> *"the opportunity of having some of my memoirs preserv'd that is like to be lasting as usefull";*
> *"licensed under charter by the Society, being first reviewed by some of the members of the same" [1].*

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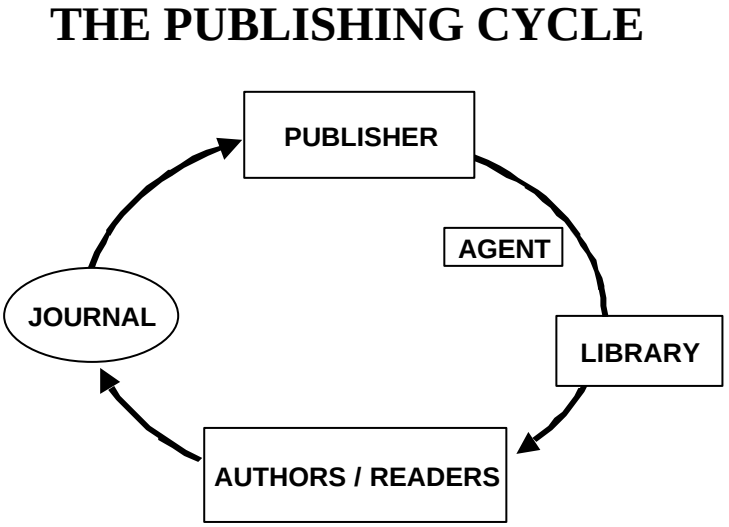
In other words, they proposed a regular publication, international in scope, in which scientists announced their breakthroughs (*dissemination*), fixed the ownership and priority of the work (*registration*), created an *archive* of the collected work, and had the content reviewed by peers before publication (*validation*). We call this publication a scientific journal and it provides the same functions today as when they were first proposed.

The functions of a scientific journal may not have changed since its inception but the environment in which a journal operates has. In his book *The Third Wave*, published in 1980, Alvin Toffler [2] describes three periods of economic evolution: the agricultural wave, lasting from 8000 BC until the mid-eighteenth century, the industrial wave lasting until the twentieth century, and finally the information wave, which will last for many decades to come. The first wave was driven by physical labour, the second by machines and the third by information technology. The transitional periods between these waves are turbulent as old systems are dismantled and new ones developed using the new technology. The second wave economy was dominated by mass production, economies of scale, cost-benefit analysis, budgets and control. The third wave is driven by service organisations with knowledge and intellect becoming the new currencies. As we move into the 21st century we are seeing the demise of the second wave economy giving way to the third wave, the digital age. Turbulent times indeed.

What does this change mean for publishing? For a publisher? This paper looks at the basic functions of a scientific journal and the role that a publisher plays in the process. It considers them in the light of the transition to a third wave economy where service, added value, and customer loyalty will be the keys to success [3].

DISSEMINATION

The publishing cycle connects author to reader. The author seeks dissemination of his work to other researchers in the same field of study worldwide. The reader looks for information that is relevant to his field of study.



In the more fundamental disciplines almost all scientists publish articles; consequently, the author and reader communities overlap strongly with each other. The result is often a tight community with strongly developed networks between scientists. There are few journals but all have well-defined aims and scope. A good example is the field of high-energy physics. In more applied disciplines, however, there are readers who do not necessarily publish articles or at least not all in the same set of core journals that cover the discipline. Communities are looser and often no more than a collection of small sub-disciplines. There are typically some journals with a broad scope and many highly focussed, niche titles. An example might be chemical engineering with its multitude of sub-disciplines.

The author in a tight community has a clear idea of the reader he is addressing and indeed probably knows him personally. It is easy for the reader to judge what is relevant for him to read by simply recognising the author. In the more applied fields, authors have a clear view of their own niche but their work is often relevant way beyond this niche in ways that are hard for the author to appreciate at the time of writing. In such cases readers need pointers to help them identify what is relevant. Traditionally publishers have helped by placing articles in the right context, adding keywords and index terms to assist the reader.

A good example of the added value of a publisher in giving context and relevance is the patent alerting business. All patents are available free of charge from the web sites of the patent offices. Notwithstanding, Derwent and others are able to charge large amounts for patent digests, alerting bulletins, and rich databases full of index terms. The value is not in the patent content but in the context that the publisher is able to create to help readers find what is relevant to them [4].

Publishers also manage the networks of scientists that make up a scientific discipline in order to match authors with readers. If an author perceives that those scientists he regards as being important read a particular journal, he is more likely to submit to that journal. Similarly, the perception of the marketing, sales and promotion efforts help convince an author of the likely audience for his work. Readers too look for signs that a journal is relevant to them: the aims and scope, the names and affiliations of the Editors and Editorial Board, names of respected authors who have published in the journal and so forth.

Publishers spend a great deal of effort to ensure that the right people are involved in their journals, that the Editors are representative of the scientific discipline, that the Editorial Board reflects the breadth of topics covered, and that there is geographic balance. Above all much is done to maintain the relevance of the journal by regularly checking that the aims and scope match the content and that the journal keeps abreast of new scientific developments. Some of the most difficult situations arise when a community splits and factions are formed that support one journal against another. Such splits do happen and they can lead to the demise of journals. Most publishers, however, manage to tread a fine line between a strong alliance with a scientific community and a healthy distance from scientific politics.

Before Robert Hooke's proposal, scientific communication was essentially a one-to-one exchange of letters between individual scientists. Scientific societies were founded and these same letters were read out in public to the members; in network terminology this is one-to-many communication or broadcasting. Hooke, Boyle and Oldenburg may have formalised these practices into scientific journals, but the basic process was broadcasting of one author's

work to many readers; it remains so today. However, with the third wave came the Internet. Suddenly a new level of communication is possible: the Internet allows direct interaction between author and reader (one-to-one), it further allows many to tune into the interaction (one-to-many), but crucially it also allows all to interact with each other in real time (many-to-many). Many-to-many networks are characterised by an exponential capacity for the exchange of information. Thus the Internet allows a huge leap in the level of interaction between author and reader.

One has to look no further that the huge numbers of chat boxes, discussion lists and the like to see examples of many-to-many communication. As yet there appear to have been few successful attempts by publishers to exploit the power of networking in this way. One recent development has been to use virtual networks to explore the viability of a new emerging scientific field. The Physics of Life web site [5] aims to bring scientists from biology and physics together united by a common interest in non-linear dynamics. The Editors make efforts to demonstrate the relevance of featured articles to readers who would not normally read the journals in which they appear. There is a Who's Who section that tries to bring this new community together. Another initiative is Living Reviews in Relativity [6] where authors are encouraged to update their articles and readers can easily comment directly to the authors.

VALIDATION

What started as filtering by the great and the good of the Royal Society has now become peer-review. Submitted articles are sent to known experts ("peers") in the field covered by the article. They act as referees, assess the quality of the article, and recommend acceptance or rejection to the Editor. In practice, most articles are sent back to the author for revision before acceptance. In this way, peer-review is both a quality improvement and quality assurance step.

It is clear that this is a process based upon trust and reputation. Publishers go to great lengths to defend the impartiality of the peer-review system since a whiff of bias can destroy the reputation of a journal [7]. In this respect publishers have an important role to play in judging the judges. Most consider that the responsibility for the scientific content of a journal lies solely with the Editors but where abuse of the system occurs, publishers respond quickly to replace the Editor concerned. In managing the process of validation, publishers strive for an impartial, balanced position.

Peer-review by itself is not enough; there is also a perception of quality associated with a journal. There is plenty of evidence to show that all articles are published eventually since most authors do not accept rejection lightly and will submit again to another journal, usually one in which they perceive as being more responsive to them. In this way, a pecking order of journals is established headed by those that are hard to publish in (e.g.: Nature or Science with high rejection rates). Most scientists are easily able to rank journals in their discipline in order of chance of being rejected; indeed many will try to match the level of their work to the journal. Research anecdotally being 90% perspiration and 10% inspiration, it is only natural that the vast mass of published work is preparatory or supporting, with only rare breakthroughs. The ranking of reputation allows readers to assess the likely level of the research published in the journals.

Thus, the system of validation exists for the benefit of both authors and readers. Authors can demonstrate to all that their work has been worthwhile while readers can be sure that the articles they read are worth reading. Publishers guard the integrity of this system.

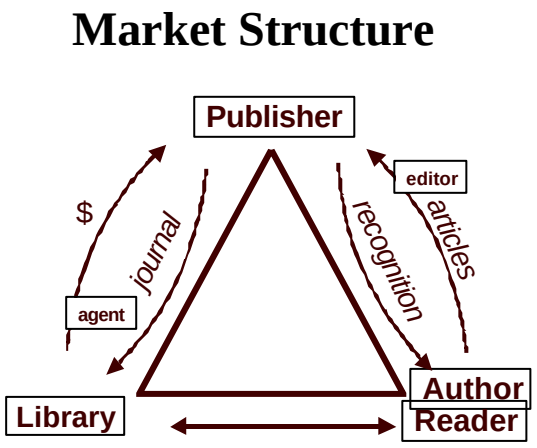
Some feel that the concept of peer review will be undermined by the developments brought on by the third wave. There are Internet search engines like Google [8] that rank web sites based upon how often the sites are linked to by other sites. Pages with many links pointing to them are considered as "authorities", and are ranked highest in search returns. It is a small step to imagine such an engine becoming a democratic form of peer review: if your article is available free to all and is referred to by many "authorities" then it must (*sic*) be a good article.

Nevertheless, such is the stranglehold of peer-review and such is the dependence of reward systems for scientists upon this system that most feel that it will remain important alongside other means for assessing the quality of an article. It seems likely that readers will explore new methods of ranking and sorting articles using new quality measures whereas authors will remain quite content with peer-review. One thing is certain however: publishers will still manage the process of validation

REGISTRATION

One of the common criticisms of the peer-review process is that it prejudices against true breakthrough research: if the work is so ahead of its time how can a peer judge its worth today? History is littered with examples of scientific breakthroughs that went unrecognised at the time of publication in obscure, backwater journals. Hence the function of a journal is in providing a formal structure by which an author may register his work in time, fixing ownership and priority.

It is the publisher, together with the academic library, that forms the structure of journal publishing. The structure is stable since each interaction between the parties involves an



exchange of services or money. Authors submit articles to publishers via Editors and receive recognition for their work in return (this helps build their careers and allows them to obtain funding for future research). Publishers distribute journals to libraries via agents in return for money (subscriptions). The libraries make the journals available to readers since this is one of the core functions of a library.

Most publishers consult constantly with their author base in order to manage this structure ensuring optimal efficiency. Most have large customer support organisations to provide service to libraries. Libraries in turn are responsive to the needs of the readers.

The third wave has the potential to destroy this stable structure and replace it with something completely new. MightyWords.com [9] show how an alternative structure might look. Authors upload their documents ("eMatter") to the MightyWords site. Readers are free to tour the site and browse through the collection on offer. The author sets the price of his eMatter with MightyWords taking a royalty for each copy sold. There seems to be no publisher, simply authors directly in contact with readers. The reality of course is that MightyWords is both publisher and bookseller having created a radical new structure in which authors and readers can communicate directly with each other. They have called this the Mighty Network.

MDL Information Systems [10] sell software to pharmaceutical companies that allow them to integrate their own in-house company data with data that MDL provides via licensing. Is MDL a publisher?

A particularly good example of adding value to the structure of scientific publishing is the CrossRef initiative. This is a collaboration of the major scientific, technical, and medical publishers to form a service that will link reference citations to the online content that those references cite, typically located on a different server and published by a different publisher [11]. The presentation by Karen Hunter to the Faxon Institute Colloquium should leave no one in doubt that adding links adds value [12]. The fact that the DOI Handle System that is used to resolve CrossRef links currently receives around 400,000 hits per month shows that this value is appreciated by readers [13].

ARCHIVING

Publishers have not traditionally played a role in archiving other than providing systematic numbering systems to assist libraries in information retrieval and acid-free paper.

It is clear that the third wave brings the potential for huge change in the way archiving is managed. This is largely due to the fact that most information is now accessed using client / server architecture with data being held on a remote host. Increasingly the remote host is the publisher. The large costs associated with maintaining enormous databases across time prohibit all but the largest libraries from considering local hosting, even though some publishers (e.g. ScienceDirect Onsite) do offer this option [14].

Most major publishers are committed to electronic storage of information that is device-independent (e.g.: SGML or XML). They are increasingly making promises for the long-term integrity of this data. Some, for instance the American Mathematical Society, have formal

escrow plans for their electronic content. For some time JSTOR [15] was the only commercially available electronic archive but no longer. In the last year a number of publishers announced plans to scan back issues of their journals extending back to the first issue and make these available for purchase [16].

THE NEW ECONOMY

Typically, journals are available for purchase by subscription. Many have differential pricing for institutions (libraries) and individuals (personal subscriptions, society members). In addition, it is possible to purchase individual articles through document delivery services. Libraries are able to use the Inter-Library Loan (ILL) system to borrow journals or individual articles.

As scientific research has developed since the 17th century, the number of journals and published scientific articles has grown. The number of articles published doubles every 15-20 years [17]. It has always been a struggle for libraries to match the pace of this growth but in the mid-1970's the gap between R&D funding and library expenditure began to widen dramatically. The "serials crisis" was born.

Opinions are divided as to the cause of the serials crisis. Odylzko [18] maintains that it is really a library cost crisis but others dispute this. There is no doubt however that the crisis was deepened by the actions of journal publishers. In response to lower revenues as a result of cancellations, publishers simply raised the price of their journals. Libraries responded by cancelling further. The American Physical Society reports a steady decrease in subscriptions of 3% per year [19] others mention figures of 3-5%. The alternative to subscriptions has been document delivery or ILL, both highly unsatisfactory from the scientists' point of view.

The third wave economy offers a way out of this increasingly vicious circle as licences replace subscriptions and business models become more flexible. Database pricing, for instance, allows for an optimum combination of subscription and pay-per-view that can be tailored to suit.

From the scientists perspective perhaps the most exciting development that the Third Wave promises is the opportunity to turn back the cancellation cycle. The eagerness on the part of some libraries and publishers to break the serials crisis has led to successful negotiations of affordable licences to entire databases of journals. These licences not only give the scientists access to journals that are subscribed to by the library but more importantly to those not held in print.

Such deals are clearly appreciated by scientists since usage for articles in the unsubscribed journals is significant wherever such licenses exist. For instance, OhioLink report that as much as 58% of all article downloads come from journals that are not held in print [20]. Not everyone is convinced, however, as is shown in this recent exchange of letters in D-Lib Magazine [21].

In reviewing the recent merger between Reed Elsevier and Harcourt General, the UK Competition Commission noted "There can be little doubt that acceptance of electronic means

of delivery is growing fast in STM research. And many of those to whom we have spoken have told us that we are within a year or so of the e-journal supplanting print as the norm – if we are not there already in some areas" [22]. The scientists' dream of unhindered access to all scientific journals is becoming a reality.

CONCLUSIONS

As the world prepares itself for the third wave economy, we are experiencing an extended period of turbulent change. Publishing is not exempt. However, the discussion above shows that the fundamental functions of scientific communications are likely to remain valid even though the form and structures may change dramatically. Publishing is a service and as such it will survive and prosper in the third wave economy. Since the very currency of the digital age is information, publishing has a unique role to play.

However, the fundamental precept of the third wave is adding value. Those that cannot will not survive. Those that can deliver added value will find it an endless struggle to please the never satisfied customer.

NOTES AND REFERENCES

[1] For more information on the origins and development of scientific publishing see A.J. Meadows, *Development of Science Publishing in Europe* (Amsterdam, Elsevier Science Publishers, 1980)

[2] Alvin Toffler, *The Third Wave* (London, Pan Books, 1980)

[3] For a detailed analysis of the impact of the information age see Jeremy Hope & Tony Hope, *Competing in the Third Wave* (Boston, Harvard Business School Press, 1997) or Peter F. Drucker, *Post-Capitalist Society* (Oxford, Butterworth-Heinemann, 1993)

[4] In their own words "Derwent's value-added coverage of global scientific and technical developments will help you monitor your competitors, develop your research and business strategies and protect your patent portfolio." www.derwent.com

[5] See www.elsevier.nl/locate/physoflife

[6] See www.livingsreviews.org

[7] For example, Arnoud de Kemp (Springer Verlag) in Information World Review February 2000, page 8

[8] www.google.com see also ResearchIndex (citeseer.nj.nec.com/cs) a search engine that searches not the content of articles on the web but the citations to and from them.

[9] See www.mightywords.com

[10] See www.mdli.com

[11] CrossRef (www.crossref.org) was formed in 1999 and uses the Digital Object Identifier or DOI standard (www.doi.org) to identify articles across platforms. The first applications are already operational on electronic journal platforms such as Springer LINK, Academic IDEAL, ScienceDirect, and Blackwell Science Synergy.

[12] *Adding Value by Adding Links,* Karen Hunter, The Journal of Electronic Publishing March, 1998,Volume 3, Issue 3 (www.press.umich.edu/jep/03-03/hunter.html).

[13] *CrossRef Turns One*, Amy Brand, D-Lib Magazine, May 2001,Volume 7 Number 5

[14] ScienceDirect Onsite (www.sciencedirect.com) offers a local solution for the institution interested in maintaining local control of their digital library. Libraries can choose to their institution's own preferred platform or create a bespoke solution using ScienceServer (www.scienceserver.com). Many libraries choose to integrate both local storage and remote access.

[15] Originally conceived by the Mellon Foundation, JSTOR began as an effort to ease the increasing problems faced by libraries seeking to provide adequate stack space for the long runs of backfiles of scholarly journals. The basic idea was to convert the back issues of paper journals into electronic formats. JSTOR is an independent not-for-profit organisation (www.jstor.org).

[16] The American Chemical Society promise to start delivery of their backfile in late 2001 (http://pubs.acs.org/liblink/01let.html). ScienceDirect made a backfile of organic chemistry journals available in April 2001 and announced that others will follow: http://www.sciencedirect.com/science/page/static/scidir/static_scidir_splash_prod1.html#backfiles

[17] Michael Mabe (Elsevier Science) in a lecture entitled "The Journal: Past, Present and Future"

[18] A. M. Odlyzko, *Competition and co-operation: Libraries and publishers in the transition to electronic scholarly journals*, Journal of Electronic Publishing 4(4) (June 1999) (www.dtc.umn.edu/~odlyzko/doc/competition.cooperation.pdf)

[19] APS News Online 1997 (www.aps.org/apsnews/articles/11232.html)

[20] Tom Sanville, *A Method Out of the Madness: OhioLINK's Collaborative Response to the Serials Crisis, Three Years Later-Progress Report.* Paper presented at the North American Serials Interest Group Conference, University of California, San Diego, June 22-25, 2000

[21] Letters to the Editor, D-Lib Magazine, April 2001,Volume 7 Number 4 (www.dlib.org/dlib/april01/04letters.html)

[22] UK Competition Commission report on the proposed merger of Reed Elsevier and Harcourt General. Published in July 2001 (http://www.competition-commission.org.uk/reports/457reed.htm)

FURTHER READING

The web site of the Association of Learned and Professional Society Publishers contains links to relevant resources (www.alpsp.org.uk/resource.htm) and some results of a research study on the motivations and concerns of contributors to scientific journals (www.alpsp.org.uk/pubs.htm).

Andrew Odlyzko has published many papers on scientific (scholarly) publishing, some more controversial than others (www.dtc.umn.edu/~odlyzko/doc/eworld.html). Three of them are particularly relevant:

- *The slow evolution of electronic publishing*, A. M. Odlyzko, in Electronic Publishing '97: New Models and Opportunities, A. J. Meadows and F. Rowland, eds., ICCC Press, 1997, pp. 4-18;
- (www.dtc.umn.edu/~odlyzko/doc/slow.evolution.txt); Reference [16] above;

- *The rapid evolution of scholarly communication*, A. M. Odlyzko. To appear in Learned Publishing and in Bits and Bucks: Economics and Usage of Digital Collections, W. Lougee and J. MacKie-Mason, eds., MIT Press (www.dtc.umn.edu/~odlyzko/doc/rapid.evolution.pdf).

The Journal of Electronic Publishing (www.press.umich.edu/jep) is another good source of information.

The Mellon Report on University Libraries and Scholarly Communication is a study prepared for The Andrew W. Mellon Foundation. The Association of Research Libraries published it in 1992. The review of serials pricing in Chapter 6 is remains relevant today.

