New Bedford, Massachusetts was one of the wealthiest cities in the United States during the 19th century, having amassed its fortune through the whaling industry. During the peak of New Bedford's prominence in 1850, kerosene was invented – fuel that would soon replace the expensive whale oil that served as a lighting fluid during this period.[1] Although the invention of kerosene didn't have an immediate impact on whaling profits, wise ship owners recognized the imminent demise of the industry and looked for alternative industries in which to invest. Like the impact of kerosene on whaling, the debut of the first electronic journal (e-journal) *New Horizons in Adult Education* in 1987 spelled doom for print journals. Although a handful of print journals will no doubt hold on for several more years, not unlike the sentimental and ignorant whale ship owners who refused to accept the inevitable, the tremendous growth of e-journals in the marketplace has forced libraries to rethink their means of providing access to these coveted resources. Over the past 20 years, methods to connect users to e-journals have taken different shapes, fluctuating among a plethora of theories, ideologies, and technologies. This chapter will attempt to synthesize the access methods employed by academic libraries over the past two decades to provide seamless e-journal access to their users.

EVOLUTION OF JOURNAL ARTICLE ACCESS

Today's college student seems incredulous to the idea that there once was a time when journal articles weren't online. Those from my generation and earlier regularly contended with densely-bound volumes near impossible to photocopy, and improperly wound microfilm reels with their attitudinal viewers. Discovering which bound volume or microfilm reel to retrieve came only after identifying citations through bibliographies or printed indexes such as the *Readers' Guide to Periodical Literature*. Such an index provided access to citations by either author name or subject heading. Today's ubiquitous keyword search was many years away from the common user. Technology has enabled a rapid progression from the research methods described above to those enjoyed today. Along the way libraries have developed means of leveraging and promoting these advancements, while trying to develop the most efficient means of providing journal access to an increasingly convenience-driven clientele.

Commercial release of the DIALOG, ORBIT, and BRS systems in the 1970s was a breakthrough that added considerably to the arsenal academic libraries maintained for access to journal literature.[2] These early online indexing services, known at the time as "mechanized information retrieval" systems, required expert search preparation and execution by a librarian who, once connected to the system, would incur per-minute access charges for her library.[3] These services were in fairly widespread use by the 1980s, with librarians mediating searches on behalf of users. Not until the late-1980s would unmediated computer-based citation searching be made commonly available to patrons. The debut of stand-alone indexing workstations, such as InfoTrac in 1985,

launched the beginning of unmediated access to journal citation indexes.[4] InfoTrac was a self-contained system that first used laserdiscs, then cd-roms, to store journal citations that were accessed via commands typed into the workstation.   Not long after index publishers such as the H.W. Wilson Company began producing searchable cd-roms for sale to libraries. This marketing advance made available a much wider selection of discipline-specific computerized indexes, and mainstreamed unmediated journal citation searching.   As the Internet gained stability and the Mosaic, and soon thereafter Netscape, browsers illuminated the World Wide Web, cd-rom-based indexes gave way to network-based indexes, further entrenching unmediated journal citation searching as common practice.

THE DEBUT OF E-JOURNALS

During the period when cd-rom indexes first began appearing in academic libraries, the low-key emergence of a new information medium debuted. In 1987, Syracuse University's e-journal *New Horizons in Adult Education* appeared inconspicuously.[5] The BITNET and Internet distribution of *New Horizons in Adult Education* and a handful of other e-journals produced at universities in the late-1980s and early 1990s attracted few students and scholars.   This fact comes as no surprise, since these journals, although peer-reviewed, were obscure, visually unappealing, and of such a small number as to make little impact on their respective disciplines. Writing in 1991, Ann Okerson considered the pioneering e-journals of the day as "brave, exciting, innovative experiments" that might set the stage for profound improvements to the scholarly publication process.[6] Despite development of the gopher protocol at the University of

Minnesota in the early 1990s, a system that provided a hierarchical means of information retrieval on the Internet, it wasn't until the invention of the World Wide Web and particularly the release of the Mosaic browser in 1993 that commercial interest in electronic journals took hold.

Journal giants Elsevier, Wiley, and Springer were each piloting e-journal systems by the mid-1990s. One of Springer's early tests, "Red Sage," was a partnership with the University of California San Francisco and Bell Laboratories. It featured an online alert system that sent users articles based on profiled keywords, commonly referred to today as a "Selective Dissemination of Information" or SDI alert.[7] It seems like a ridiculous notion in hindsight, but at the time publishers weren't sure whether there would be a market for electronic versions of print publications. Despite Mosaic, and soon thereafter Netscape Navigator's popularity, network access wasn't as ubiquitous as it is today. The Web was still in its infancy, and accessible mostly through university networks. It would still be years before every academic office was wired, and years more before graphics could be displayed with comparative sharpness to printed journals. As a result of this uncertainty, many publishers provided free access to the online equivalent of journals held by libraries in print. University presses were also interested in experimenting with the new medium. Johns Hopkins created Project Muse in 1995, seeing the promise of the Web even at that early stage. As Donnice Cochlear remarked, "Users [of Project Muse] will be able to access files from their own workstations, multiple users will be able to access the same article simultaneously, and the articles will always be 'on the shelf.'"[8]

Project MUSE
Scholarly journals online

SEARCH | JOURNALS | ABOUT MUSE | CONTACT US

Title List | Subject List | Collection List

SEE ALSO

Upcoming Journals

Request Journal Alerts

Sample Full-Text Issues

Create List of Muse Journal Holdings

Browse all Project MUSE journals by title.

A B C D E F G H I J K L M N O P R S T U V W Y

A

Advertising & Society Review (2000-)
Africa: The Journal of the International African Institute (2006-) **NEW**
Africa Today (1999-)
African Studies Review (2005)
Aleph: Historical Studies in Science and Judaism (2004-)
American Annals of the Deaf (2003-)
American Imago (1995-)
The American Indian Quarterly (sum 2000-)
American Jewish History (1996-)
The American Journal of Bioethics (2001-spring 2004; archive only)
American Journal of Mathematics (1996-)
American Journal of Philology (1996-)
American Literary History (2000-)
American Literary Scholarship (1998-)
American Literature (Sept. 1999-Dec. 2004; archive only)
American Periodicals: A Journal of History, Criticism, and Bibliography (2003-)
American Quarterly (1996-)
American Speech (fall 1999;2000-2004; archive only)
The Americas (Oct. 2000-)
Anthropological Quarterly (July 2000-)
Arethusa (1996-)
Arizona Quarterly: A Journal of American Literature, Culture, and Theory (2006-) **NEW**
Asian Music (2005-)
Asian Perspectives (2000-)
Asian Theatre Journal (fall 1999-)

The Project Muse innovators also recognized that the Web would soon offer the ability to provide more content than the print medium. Full-text searching and enhanced graphics would make the e-versions more useful and therefore more popular. The confidence with which these assumptions are made within Cochlear's paper are amazing given the overall "pie in the sky" literature of the period.

Not to be overlooked are the cataloging advancements of this period. Despite a dramatic growth in e-journals both academic and commercial, without a gateway to them they would remain obscure. The first gateway built by libraries was the online catalog (opac). In 1995, the MARC 856 "electronic location and access" field was approved for use,

which spawned rapid development of web-based catalogs. Also in 1995, the first edition

of Nancy Olson's *Cataloging Internet Resources: A Manual and Practical Guide* was

published, giving catalogers much-needed guidance in cataloging e-journals within the

opac. CONSER also revamped its serials cataloging policy to accommodate e-journals.

Thus in a short span of time, a deluge of e-journals were met by the tools to describe,

organize, and provide access to them in a traditional way. In large part, this means of e-

journal access remains intact today.

WEB LISTS

While catalogers were employing tried and true means of providing access to e-journals,

staff members typically in other parts of the library were devising a less rigorous means

of access. University web pages were first appearing in the mid 1990s, and many

academic libraries were at the forefront of providing a web presence on their campus.

One of the standard library web pages by the late-1990s was that of the e-journal list – an

alphabetical listing of all e-journals available to members of the institution.[9] The novelty

of e-journals warranted their showcasing, which was typically accomplished in a manual

fashion; that is, the webmaster would either maintain the list by inserting e-journals and

their corresponding URLs into the page via a text editor, or via an HTML editor such as

Adobe PageMill.   Given the redundancy of providing access to e-journals through both

the catalog and the library's web site, it wasn't long before a debate emerged as to the

better gateway. Ideologically, should the catalog, which had heretofore been an

inventory system, provide links to resources not housed or owned by the library?[10,11] The

fuel for this fire came from the popularity of web lists, and the recognition that large sets

of e-journals such as JSTOR and SpringerLink could not be quickly cataloged in a conventional manner. These large sets could, however, be quickly added to a web page.

NEW RESEARCH METHODS

As the new millennium approached, the environment in which research was performed was drastically different than only 15 years earlier, the e-journal's growing ubiquity being a major reason for this change. By 2000, e-journals were a normal part of the cataloging workflow, yet new means of access to them were also being developed. Web developers were migrating manually coded web lists to databases that served alphabetical and subject-arranged lists of e-journals to the web. Most of the solutions were home-grown using applications such as Microsoft Access, FileMaker Pro, and the open source MySQL database. These custom tools replaced the drudgery of list maintenance with a more sustainable means of recording information and propagating it to various pages within a web site. Although web-based catalogs continued to evolve into more attractive systems, their progress could not keep up with the means available to web developers, and thus the debate as to the preferred means of patron access to e-journals was beginning to turn away from the catalog.[12] Coincidentally, the move to database-driven web site maintenance, particularly as it impacted the administration of e-journals, had another positive effect: it provided libraries a space to record internal notes about e-journal licensing terms – effectively becoming the precursor to today's electronic resource management systems.

Although several publishers offered their journals through home-grown interfaces, several others opted to outsource the hosting of their e-journals to interface platforms such as HighWire Press, which was established by the Stanford University Library in 1995.

Highwire now boasts the largest collection of free full-text life science articles in the world, with over 1.3 million articles from over 250 journals.[13] Highwire Press and other intermediaries such as MetaPress and IngentaConnect provide a stable platform for publishers who choose not, or are not positioned, to host their own content.

More transient but nevertheless equally appealing access to e-journals for users comes from aggregated collections such as EBSCOHost, Gale Expanded Academic ASAP, and Proquest Research Library. These entities provide federated searching across thousands

of electronic journals, yielding rich sets of full-text results. These services became

common in late 1990s, and currently are a staple of most academic library offerings.

Since the content is licensed with hundreds of publishers, however, the rights to make

available these e-journals change frequently. Nonetheless, they serve a useful purpose

for students in need of a starting point for their research.

CROSSREF, OPENURL, and a FLEDGLING SEARCH ENGINE

Few would argue today that the best applications for bringing users to e-journal content

have been developed outside of libraries.   Near the turn of the 21st century three such

technologies revolutionized access to e-journals. They capitalized on the notion of

bringing the item to the user's point of need. In contrast, library catalogs and web sites

operate on the assumption that users will seek e-journals through these interfaces, drilling

down as necessary. Although these library-developed means of access continue to serve

a useful purpose – both for discovery and known-item searches – their utility is being

diminished by technologies that more immediately bring users to electronic content. The

editor of this book wrote a piece several years ago where he noted that library users

shouldn't need to figure out which gateway is best – that there should be a technological

solution to this problem.[14] Three significant solutions appeared within months of each

other that had a profound impact on the way users access e-journals.

CrossRef

In June 2000, CrossRef, a non-profit cooperative of publishers, libraries, and other

affiliates, was released. CrossRef provides a means of linking from bibliographic citation

to cited article through the Digital Object Identifier (DOI) system.[15] DOIs are unique

identifiers or addresses which facilitate retrieval of electronic content. Although

CrossRef links to various types of electronic documents, such as books, technical reports,

and white papers, as well as other intellectual property, the thrust of its development was

as a means of connecting users to electronic journal articles by way of reference linking.

This functionality remains CrossRef's proverbial bread and butter. As Amy Brand,

CrossRef's Director of Business and Product Development, noted in 2001, "[T]he key

enrichment for academics and others navigating a scholarly corpus is linking, and in

particular the linking that takes the reader out of one document and into another in the

matter of a click or two. Since references are how authors make explicit the links

between their work and precedent scholarship, what could be more fundamental to the

reader than making those links immediately actionable?"[16] Prior to CrossRef, a

collaboration which now serves over 1,600 publishers, article-level access to e-journals

was a cumbersome process which required use of a gateway, generally in the form of an

online catalog or web list of e-journals.[17] CrossRef leveraged the DOI infrastructure to

profoundly change the means through which users could follow ideas in an online setting.

Perhaps of greater note, CrossRef was a means of circumventing library-provided

gateways to e-journals through more direct access to electronic information – access

provided at point of need.

OpenURL

The OpenURL protocol has proved to be an even more powerful means of linking library

users to electronic journal content. Developed by Herbert van de Sompel, OpenURL is a

mechanism for linking users to appropriate copies of electronic resources or surrogates of

these resources.[18] The protocol relies on databases and e-journal systems being

"OpenURL aware"; that is, being able to understand a request and respond accordingly.

An OpenURL is a URL with encoded citation metadata.[19] This URL is passed to an

OpenURL resolver, such as Ex Libris' SFX, which reads the URL and presents options to

the user based on information contained within the resolver's knowledge base.   The

following illustration typifies the way a user might interact with an OpenURL resolver:

In this example, the "Find It" button is a command to the link resolver to check the

knowledge base for existing copies of the cited article. The OpenURL, put to work by

the "Find It" button, looks as such:

```
<a href="http://sfx.exlibrisgroup.com:9003/haverf?sid=hc:FB&issn=[FMP-
FIELD: standard_number]&date=[FMP-FIELD: year]&volume=[FMP-FIELD:
journal_volume]&issue=[FMP-FIELD: journal_issue]&pages=[FMP-FIELD:
pages]" TARGET="top"><img src="sfx.gif" BORDER=0></A>
```

Elements such as ISSN, date, volume, issue, and pages provide sufficient uniqueness for

the resolver to query its knowledge base. The example above advises the user to check

the catalog for a print version of the journal, or to complete an interlibrary loan form for

the article. In cases where an electronic version of the article is available, the link

resolver would either direct a user to it immediately, or present the user with an option

for connecting to it. As more citation indexes adopt the OpenURL protocol and more libraries purchase OpenURL resolvers, access to e-journals at the article level will become ever more simplified and immediate.

Google

Like ESPN and email, it's hard to remember the days before Google. Although Google was established in the mid-1990s, it wasn't until 2000 that this innovative application began its reign as king of search. The impact of Google on information access has been revolutionary. With regard to e-journal access specifically, Google provides a simple means by which to locate journal home pages, and subsequently link to articles in cases where the user has institutional access. *Scholar*, a recent addition to the Google stable, advances the means by which users can access e-journal articles. Scholar restricts its cache of resources to those academic in nature, thus providing an even greater chance of users locating useful content. In this sense, Google Scholar operates like a federated search service, with the notable exception that Google, not individual libraries, determines what resources are being indexed. Despite this apparent limitation, it's likely Google's role as gateway to articles will continue to increase as time goes by.

TODAY, TOMORROW, AND BEYOND

The Open Access (OA) movement provides free access to an increasing body of scholarly literature, including articles from several e-journals. The Bethesda Statement on Open Access Publishing provides a concise definition of OA, excerpted below:

The author(s) and copyright holder(s) grant(s) to all users a free, irrevocable, worldwide, perpetual right of access to, and a license to copy, use, distribute, transmit and display the work publicly and to make and distribute derivative works, in any digital medium for any responsible purpose, subject to proper attribution of authorship, as well as the right to make small numbers of printed copies for their personal use. A complete version of the work and all supplemental materials, including a copy of the permission as stated above, in a suitable standard electronic format is deposited immediately upon initial publication in at least one online repository that is supported by an academic institution, scholarly society, government agency, or other well-established organization that seeks to enable open access, unrestricted distribution, interoperability, and long-term.[20]*

Governmental mandates in the U.S. and elsewhere in the world are fostering a culture of OA, though the threat of cancelled subscriptions is causing publisher concern. In response to this fear, some publishers such as Springer, Wiley, and Cambridge University Press have introduced open access programs designed to provide free, perpetual access to articles that are subsidized by their authors. Numerous OA subject-related repositories such as arXiv (physics, math), RePEc (economics), and E-LIS (library & information science) that provide free access to deposited papers, many of which are pre- or post-prints of published journal articles. Institutional repositories, such as DSpace, offer an additional means of accessing freely-available content.   The Open Archives Initiative Protocol for Metadata Harvesting provides a framework by which the contents of conforming repositories can be indexed effectively by harvesters such as the University

of Michigan's OAIster. Clearly as the OA culture takes hold, access to e-journal

literature will be further expanded.

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