"New Times Always; Old Time We Cannot Keep"[1]

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It was 10 years ago, in October 1995, that I spoke at an ARL gathering here in Washington on "JSTOR and the Economics of Scholarly Communication." If I recall correctly, at the conclusion of that highly speculative talk I presented Duane Webster with a tee-shirt that had on it the words "Free the Bound Periodicals." Amazingly, that is what JSTOR has done in considerable measure—though, as always, there is much more to accomplish. In addition to continuing to add important new content, JSTOR is now contemplating ways of making parts of its content more accessible to public search engines, providing more access to users in the developing world as well as to users unaffiliated with an academic institution, cross-linking articles in the database, and helping the scholarly community find a viable way of archiving born-electronic content.

As you know so well, much has happened in these 10 years, at your libraries and throughout the world of scholarly communication. My objective today is to reflect on some of the big issues we have encountered over this decade and to share some of the lessons we think we have learned along the way, often with the help of people in this room. Those lessons have been drawn from practical experience with a series of "natural experiments," and so today I intend to sketch, ever so briefly, what has happened not only to the JSTOR infant whose fate we pondered together 10 years ago, but also what is happening with its digital progeny, ARTstor and Ithaka, that JSTOR helped inspire. Ithaka, led by Kevin Guthrie, is now busily engaged in

[1] In preparing this talk, I have benefited from good advice proffered by many colleagues and friends, including especially Don Waters, Kevin Guthrie, Michael Spinella, Susanne Pichler, Roger Schonfeld, Gene Tobin, Pat McPherson, and Eileen Fenton. Some of my earlier debts to others, including members of the ARL, are indicated in the text.

incubating still other entities, including Portico and Aluka—"grandchildren," as it were, of JSTOR. The genealogy is itself interesting, and I have described it in detail in the Annual Reports of the Mellon Foundation, which are available on the Web.[2]

As I reflected on this history, it became clear that one of the greatest contributions of JSTOR—entirely unanticipated—has been the insights its experience has contributed to community-wide efforts to explore big issues facing all of us living in what I have called elsewhere "a digitized, commercialized age."[3] I have organized this talk around four of these issues: (1) the need to push for cost savings and productivity gains; (2) the need to build sustainable business models and to come to grips with the complexities associated with intellectual property rights; (3) the critical importance of collaborations, domestic and international; and (4) the case for experimenting with new organizational models. While it is a challenge to derive propositions of value from an examination of the rapidly evolving "lives" of new entities such as Portico, ARTstor, and Ithaka itself, one conclusion is clear. As the title I have chosen for this talk indicates, I do not think that "standing pat" is a viable posture for libraries, publishers, or scholars in an electronic age. The naturalist, John Burroughs, was right when he wrote: "New times always; old time we cannot keep."[4]

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[2] Descriptions of each of these entities can also be found on their respective Web sites. The naming conventions are explained in the Mellon annual reports.

[3] William G. Bowen, "At a Slight Angle to the Universe: The University in a Digitized, Commercialized Age," Romanes Lecture, University of Oxford, October 17, 2000. Reprinted by the Association of Research Libraries, 2001.

[4] Quotation from John Burroughs, on the side of an alabaster calendar given to me by Frank Stanton years ago.

JSTOR: Then and Now

When I spoke here in 1995, JSTOR had just been incorporated as an independent not-for-profit public charity. We decided initially to digitize ten core scholarly journals in two fields, economics and history, with a plan to include additional fields and journals in what came to be called the "Arts and Sciences I" collection. At that time, we asked ourselves if we were foolishly ambitious in setting as a goal signing up 120 participating libraries during a charter sign-up period in the first months of 1997—when early adopters would be asked to pay a one-time fee as well as to make annual payments, all on the basis of a promise by JSTOR to deliver highly searchable electronic content which, in the main, it had yet to produce.

To fast forward, as of the end of August 2005, 2,572 libraries in 95 countries had opted to participate in JSTOR.[5] There were 528 journals online (over 18 million pages of content), and the year-to-year growth in usage was over 40%.[6] The driving force behind these astonishing figures has been the unflagging support of the library community and the enthusiasm of users, worldwide, for this resource—which has changed fundamentally the way scholars and students teach and do research. JSTOR can justifiably claim to have breathed new life into older journal content and to have permitted users to connect and trace ideas in ways that were difficult if not impossible before. The interest of users in older content can be seen in the popularity of articles (judged by the frequency with which they are accessed) such as Milton Friedman's 1968

[5] See Figure 1, appended to this talk, for the historical record of institutional participation (with the numbers of participating institutions grouped into broad categories).

[6] These data were supplied by Michael Spinella, executive director of JSTOR.

commentary on monetary policy[7] as well as by the subsequent decisions of others to digitize backfiles. The depth of commitment of academics to JSTOR can be illustrated by a recent anecdote. A young Chinese scholar who had just finished a PhD in political science at a US university was contemplating returning to China because she thought that she could make more of a contribution there than by teaching in the US. But she made clear to the Chinese that she would go if, and only if, she would have access to JSTOR. Otherwise, she asked, "how could I do my work?"

Thanks to this incredible growth in usage, and to the presence of economies of scale, JSTOR has become financially self-sustaining. Annual Access Fees now cover running costs and, together with Archive Capital Fees, make it possible for JSTOR to continue to upgrade its technology, enhance its functionality, and assure libraries that it will have the resource base required to migrate its content as platforms evolve over time. This is a particularly gratifying achievement in that, from the beginning, JSTOR has adopted a value-based pricing model whereby small institutions, and institutions in poor countries, pay only a fraction of the fees charged to larger institutions in the US. Moreover, JSTOR has never raised the fee for any given collection, and the charge per page of content has therefore declined steadily because of the annual addition of content via JSTOR's moving wall.

In response to requests by many librarians and other users, new collections continue to be created, including some in fields not originally covered by JSTOR; as a result, total payments have increased for those libraries that have chosen to subscribe to new collections. Even so, the

[7] "The Role of Monetary Policy," *American Economic Review*, Vo. 58, No. 1, 1968. Other frequently-viewed articles from the most popular journals in JSTOR include F.A. Hayek, "The Use of Knowledge in Society," *American Economic Review* vol. 35, no. 4, September 1945; Amos Tversky and Daniel Kahneman, "Judgment under Uncertainty: Heuristics and Biases," *Science*, vol. 185, no. 4157, September 27, 1974. Paula Baker, "The Domestication of Politics: Women and American Political Society, 1780-1920," *American Historical Review,* vol. 89, no. 3, June 1984**.**

average cost per title, and the average cost per article used, have continued to decline, especially for the large libraries.[8] The average cost per title, which of course includes access to all earlier issues of each journal back to inception, has fallen from about $60 in 1997 to less than $14 today; the average cost per article "used" (for viewing or printing) has fallen from about $1.40 in 1997 to about 20 cents today. The value proposition seems clear—even without taking account of substantial savings in capital costs and operating costs, and without factoring in the gains in convenience and the time savings for users who enjoy instant access to journal content at any hour and from almost any location.

JSTOR also continues to work closely with publishers and the authors they serve. A guiding principle from the start has been that JSTOR exists to meet system-wide needs—the needs of the broad scholarly community including both producers and consumers of knowledge. As a non-profit entity, JSTOR knew from the start that it would never have "profits" to share, and it was far from clear in early days that its value-based pricing model would generate enough revenues even to cover its bare operating costs. Thus, JSTOR had to explain to publishers that it was not in a position to pay royalties—indeed, that to attempt to do so would force it to charge fees that would inevitably constrain its use. Nonetheless, JSTOR promised that if it generated revenues above threshold levels, it would make modest payments to publishers out of a carefully defined "publisher's pool." The threshold level was reached in 2001 and this year JSTOR expects to make payments in the range of a few hundred to a few thousand dollars per title to scholarly societies and other publishers of JSTOR journals.

Needless to say, getting from "there" in 1995 to "here" in 2005 has been far from simple or problem free. The history of this endlessly fascinating project has been carefully documented,

[8] See Figures 2 and 3, appended.

"warts and all," by Roger Schonfeld in his *JSTOR: A History*,[9] and so I need not cover any of that ground this afternoon except to emphasize, in this setting, the important role played by legions of librarians, including especially Wendy Lougee, then at the University of Michigan, Ann Okerson at Yale, and Richard De Gennaro. I hope it is in order to add that Mellon Trustees have regarded the start-up funding provided by the Foundation as one of the best single philanthropic investments they have ever made. Credit for this path-breaking success deserves to be shared by the leaders of JSTOR, from Kevin Guthrie initially to Mike Spinella today, their hard-working colleagues, and an enormous number of librarians, publishers, and users who have demonstrated their commitment through their active engagement with the resource and unfailingly constructive suggestions for improvement. Later I will say a little more about the leadership provided by the early adopters in the library community, many of whom are here today.

Savings and Productivity

As my colleague, Don Waters, has reminded me, there is a thread of connection between Mellon and ARL that started even before JSTOR, with the study of "University Libraries and Scholarly Communication" authored by Tony Cummings and others in 1992.[10] The Foundation sponsored this study because of widely shared concerns about the long-term consequences of the rising costs of acquiring an ever-expanding volume of scholarly literature. The ARL was important in encouraging us to conduct this study and then in publishing it. The study served both to debunk some myths (including the belief that libraries were consuming a rising share of

[9] Princeton: Princeton University Press, 2003.

[10] Anthony M. Cummings, Marcia L. Witte, William G. Bowen, Laura O. Lazarus, and Richard H. Ekman, *University Libraries and Scholarly Communication*, Association of Research Libraries, November 1992. Ann Okerson contributed a most helpful "Synopsis."

university budgets) and to identify emerging electronic technologies as one way of addressing these concerns. JSTOR was one natural outgrowth of this line of thinking, in that it took on the challenge of finding a cost-effective way of digitizing the back issues of journals which were both hard to access and big consumers of shelf space. Other initiatives, including Project Muse and HighWire Press, worked to facilitate electronic publication of current issues. Then, the Mellon Foundation, JSTOR, and Ithaka, along with others, set out to "close the loop" by seeking a solution to the problem of archiving electronic content so that the full promise of electronic publishing can begin to be realized. Under Don's leadership, Mellon funded a study project in 2000 that involved seven university libraries, and this study in turn led to the provision of start-up funding for what is now called Portico as well as for the LOCKSS project.

At an earlier stage in the preparation of this talk, Duane Webster and I thought that perhaps I should review the development of Portico in some detail. We subsequently decided that that would not be the best use of our time together this afternoon. I understand that Kevin Guthrie is participating in a panel discussion tomorrow about electronic archiving, and he can talk more knowledgably than I ever could about this crucially important initiative. Eileen Fenton, the exceedingly able executive director of Portico, is also here and she and Kevin can answer any questions that you may have. Let me offer only a few summary observations.

Portico is an electronic archiving service with a mission that can be stated simply: To preserve the journal literature published in electronic form and to ensure that that these materials remain accessible, under carefully defined conditions, to future scholars, researchers, and students. So easy to state, yet so tricky to accomplish! Portico has been a particularly challenging project from its inception. One key requirement is sophisticated technology that allows Portico to receive deposits of "source files" of electronic journals and then convert the

proprietary files to a normalized format that will serve archival purposes and can be migrated over time. This is a devilishly difficult task which, fortunately, talented staff at Portico have accomplished. An even more challenging task has been to design an operating-business model that will encourage all of the relevant parties, publishers and libraries, to join the party—cheerfully and with enthusiasm, we hope. This model has undergone various iterations, and it is now at a stage where it seems to me to meet the basic requirements of publishers and libraries alike. The current model emphasizes long-term preservation over short-term access. It is more like a long-term insurance policy than anything else. The archive will be highly inclusive and open to all peer-reviewed journals. Access to content in the archive will only be provided, however, to participating libraries and then only in the case of such established "trigger events" as when a publisher goes out of business, ceases to publish a title, removes back issues from its site, or otherwise fails to provide consistent access. Publishers might also choose to rely on Portico to meet perpetual access obligations. In addition, there would be a standard "auditing" procedure that would allow designated individuals to verify the ongoing integrity of files.

The success of Portico depends utterly on the willingness of publishers to deposit electronic content in it. The decision to emphasize preservation over access has been reassuring, and recent conversations lead us to believe that a wide range of publishers will in fact see the advantages to them of participating. I am very pleased this afternoon to report a late-breaking piece of news that I think all of us can regard as highly promising. The leadership of Elsevier has told Kevin Guthrie that it is fully on board in support of Portico. Elsevier agrees that archiving is a critically important issue for the academic community and has committed not only to contribute its content for preservation through Portico, but also to do whatever else it can to help develop momentum for this approach. The leadership of Elsevier recognizes, and indeed

has emphasized in our conversations with them, that the benefits of archiving are best realized if many publishers and libraries join together in supporting a common solution. Another important publisher, the American Mathematical Society, has also committed to participate and will encourage other publishers to do so. Of course libraries are in a pivotal position to encourage widespread publisher participation by, in effect, demanding archival deposit by publishers as a condition of licensing electronic content.

The sustainability of such an Archive will depend on the willingness of all elements of the "system" to help cover its costs. Charitable foundations such as Mellon and organizations such as JSTOR have already invested significantly in developing Portico's infrastructure, and it was very encouraging to see the recent announcement of the award to Portico of $3 million by the Library of Congress. Publishers can be expected to make annual financial contributions as well as deposit their content, and libraries certainly should be expected to invest in such an enterprise by making reasonable annual payments. Fortunately, the economies of scale are so pronounced that if the community as a whole steps forward, cost per participant (scaled to size) should be manageable.

The time to act is now, and I liked very much the title of the recent statement describing the consensus reached on this subject at a meeting of academic librarians, university administrators, and others: "Urgent Action Needed to Preserve Scholarly Electronic Journals."[11] In its first paragraph, this statement notes:

> ...As the creation and use of digital information accelerate, responsibility for preservation is diffuse, and the responsible parties—scholars, university and college administrators, research and academic libraries, and publishers—have been slow to identify and invest in the necessary infrastructure to ensure that the published scholarly record represented in

[11] Waters, Donald J., ed. "Urgent Action Needed to Preserve Scholarly Electronic Journals: Consensus Statement of Academic Librarians, University Administrators, and Others Who Participated in a Meeting to Discuss Electronic Journal Preservation," New York, September 13, 2005, http://www.diglib.org/pubs/waters051015.pdf.

> electronic formats remains intact over the long run. Inaction puts the digital portion of the scholarly record—and the ability to use it in conjunction with other information that is necessary to advance knowledge—increasingly at risk... For electronic journals, the academy has as yet no functional equivalent in long-term maintenance and control over the scholarly record that 'owning a copy' provided for printed journals.

The case for solving this problem is straightforward, as well as time urgent. We have here, within our grasp as it were, a classic "win-win" opportunity. For the end users, scholars and students, the advantages of accelerating the movement to electronic formats, especially to facilitate search and retrieval, are evident. For publishers, the existence of an established archive can reduce or eliminate internal archiving costs, meet the demand of its "customers" for a trusted third-party archive, satisfy demands by libraries for perpetual access without a negative impact on operating revenues, and facilitate the inevitable movement to electronic-only publishing. For libraries, the existence of Portico creates a mechanism for acting upon their traditional preservation mandate. Moreover, having in place a well-functioning third-party archive, which they can trust to be around for the long term, is essential to achieving a smooth transition to electronic-only journal publishing—with all of the system-wide savings and benefits associated with such a shift. In the absence of such an archive, libraries will be reluctant to give up the processing and storage of print copies of journals, even though moving to an electronic-only mode of operation offers enormous potential savings.[12] Portico reduces system-wide preservation costs by providing a cooperatively designed preservation infrastructure which eliminates the need for each library to archive published literature independently.

[12] For a careful analysis and documentation of such savings at a sample of libraries, see: Roger C. Schonfeld, Donald W. King, Ann Okerson, and Eileen Gifford Fenton, *The Nonsubscription Side of Periodicals: Changes in Library Operations and Costs between Print and Electronic Formats,* Research Report, Council on Library and Information Resources, June 2004. As the authors note, the estimates provided in this report are in many ways highly conservative and, for example, take no account of the saving in subscription costs when subscriptions to print journals are no longer needed. The estimates are also, I am surprised to note, not all that dissimilar from the back-of-the envelope calculations I reported to you in my talk of ten years ago and repeated in my Romanes Lecture.

These potential savings redound to the benefit of the entire college or university (for example, by reducing dramatically the need, over time, for new capital investments), and thereby offer at least a partial response to the growing public demand for greater efforts within higher education to achieve efficiencies—a demand that we ignore at our peril. For this reason, the cost of putting in place a service like Portico and sustaining it should be understood to be a claim on institution-wide pools of resources. It should not be thought of as merely a charge to an already strained acquisitions budget within the library. Savings in funds that otherwise would have had to be spent to "handle" and archive paper journals should be part of the Portico financial equation. The potential productivity gains—translated in this context into dollar savings—are evident and evidently substantial.

Sustainable Business Models—and Intellectual Property Rights

Even this brief discussion of Portico makes clear how crucial it is to find sustainable business models. The early history of ARTstor provides another window on this topic as well as on others, including the handling of intellectual property rights. Under the leadership of James Shulman and Neil Rudenstine, ARTstor is, as you know, busily engaged in building a vast digital repository of images of works of art and related scholarly material. The charter ARTstor library will include 500,000 images, associated cataloging information, and other data. The content ranges from a broad and deep university slide library at UCSD[13] to remarkable specialized collections such as *The Illustrated Bartsch*; the Mellon International Dunhuang Archive, which is a resource essential for the study of Buddhist art and the history of Asia that consists of cave paintings and manuscripts originally located at Dunhuang, on the Silk Road in China, and now

[13] For which much credit goes to Brian Schottlaender, librarian at UCSD, who saw the potential of ARTstor much earlier than many others did. The UCSD slide library is also a great example of a resource created by a single library that has had enormous spill-over benefits.

dispersed all over the world; the Gernsheim corpus of 182,000 old master drawings from photographs taken over a 70 year period; and extraordinary new images of the recently restored sculpture of Ghiberti's Gates of Paradise.

The sustainability challenge faced by ARTstor is clear. The costs of creating ARTstor and making it widely available are far greater than the start-up costs incurred by JSTOR, primarily because the "resource" that ARTstor offers is so different from journal literature. ARTstor is comprised of primary materials for users of visual images, laboriously assembled from a very large range of sources. Unlike JSTOR, ARTstor deals not with the end products of scholarship, but with the visual raw materials of scholarship and teaching. These raw materials are the common "stuff" of the humanities and related social sciences and have very broad potential appeal; but they have to be collected, checked, assembled, and then made available—"presented"—in ways that facilitate their use in different contexts.

There are intellectual property issues and sensitivities aplenty, as I'm sure all of you understand. In order to manage the risk (a risk which ARTstor takes off of the institutions' plates by indemnifying users for authorized uses), and to facilitate active use of the images, ARTstor delivers the content via an active online and offline software environment that is expensive to develop, enhance, and maintain. Working with images requires more than "read only" actions, and the ARTstor software functions in many ways as an instructional technology.

The software in which ARTstor images are imbedded is seen by many institutions as a wonderful resource—as a way they can study and present digital images of many kinds without having to incur the substantial ongoing costs of building and maintaining their own software for presenting and manipulating images. ARTstor is experimenting with providing a "hosting" service that will allow institutions that are so inclined to utilize its software to store and display a

wide variety of images owned by the institution itself (including, for example, a collection of images of insects at Denison University). Because of this possibility, and because images are of great pedagogic value in many fields outside art history—such as area studies, classics, history, political science, literature, and even entomology—it is essential that ARTstor be understood to be a *campus-wide resource*.[14] Obviously, the library has a key role to play—the key role, I would say—in both emphasizing this point and helping the campus community learn how to make optimal use of ARTstor images and its imaging software.

On some campuses, the fact that the content "within" ARTstor ranges from the externally licensed ARTstor images to local hosted content to individual images added by instructors highlights one of the profound changes resulting from the application of digital technologies. Collections are now conveniently (some might say infinitely) replicable and customizable, instead of being held exclusively by a single steward. This development shifts, in a sense, the question of what "collection acquisition" means and what the role of the library is in this context. By gathering up and sharing across the campus—in fact, across many campuses—what one of our colleagues calls "random digital acts of progress," a platform like ARTstor helps us understand and redefine the role played by the library, which can become, as it were, a highly cost-effective nexus of inflows and outflows of local and remote content. The potential for productivity gains and cost-savings is, once again, very considerable.

But change is always hard. Some institutions are embracing and making use of ARTstor more rapidly than others. Not surprisingly, some faculty and others (including both some slide librarians and some information technology staff) are inclined to continue to rely on approaches

[14] For an excellent example of the use of visual resources in teaching outside art history, see John Dower's MIT history department course, "Visualizing Cultures," available through MIT's OpenCourseWare, http://ocw.mit.edu/ans7870/21fj'menu/index.html.

that have served them well in the past, and that depend more on locally developed solutions. Especially at wealthier institutions, there may seem to be less need for ARTstor, or at least for the ARTstor technology. But of course much of the growing content in ARTstor—especially the collections that are either specialized or unique—is available only because of the intellectual property protections that the ARTstor delivery system affords and simply cannot be accessed any other way. The main conclusions I draw from observing such situations are, first, that a good deal of patience and "parallel funding" are going to be required if transitions to a cost-effective centrally provided resource are to occur (with all of their long-term benefits); second, that imaginative efforts will continue to be needed to improve interoperability across systems and to help transitions be as smooth and effortless as possible.[15] In seeking to navigate this terrain, ARTstor definitely needs your advice and your help.

Let me now comment on sustainability more generally. The juxtaposition of descriptions of JSTOR, Portico, and ARTstor drives home a fundamental point: *"sustainability" models, and in particular the mix of user fees and long-term philanthropic investments, will differ substantially across resources*. There is much to be said for seeking diverse funding streams, as Portico is attempting to do, in order to manage risk. But there is also no escaping the financial and operating realities that a project such as ARTstor confronts. In part because of the demanding nature of intellectual property rights in the art world,[16] ARTstor has had no choice but to invest in sophisticated technology that "bundles" tools and some highly valuable digital

[15] For an excellent discussion of this complicated equation, see James Shulman, "'Shades of Purple' or 'Will collaboration around technology really ever save money?'" Talk delivered at Aspen Seminar, September 16, 2005. In his talk, Shulman recounts how Lloyd Shuttle, deputy provost at Yale, advised him that ARTstor would need**, "**to serve our faculty really well, because if you don't do that, nothing else you do will matter. If you *do* accomplish that, then it's up to us [Yale] to figure out what else we *don't* have to be doing."

[16] One specific issue concerns the work of living artists. Fortunately, an important agreement with the Artists' Rights Society was signed in the summer of 2005; this agreement makes it possible to address the intellectual property rights issues that heretofore have prevented ARTstor from including modern art.

content—which simply would not be made available to ARTstor, or to the scholarly world, in the absence of the kinds of protections that ARTstor offers. This "bundling" is not ideal in all respects, but in seeking to include some exceptionally valuable content there is no viable alternative. Similarly, it seems unlikely that ARTstor can expect to develop as broad a constituency as the one that supports JSTOR.[17] So, for reasons of both cost structures and likely limitations on scale, it is unrealistic to believe that the same funding model that works for JSTOR will work for ARTstor. Some undertakings, such as JSTOR, have the potential to harness enough returns through economies of scale that they can become largely self-sustaining on the basis of user fees alone; others, such as ARTstor, are more likely to require some continuing philanthropic investment; still others, such as Portico, will need to rely on many constituencies.

Collaborations—More and More Important All Over the World

One major lesson taught by all of these initiatives, and others, is the critical importance of collaborations if there are to be real breakthroughs in the creation and distribution of digital content. Neither JSTOR nor Portico would be imaginable in the absence of a willingness on the part of many publishers, here and abroad, to contribute content to a common "pool." ARTstor projects such as the Dunhuang collection illustrate dramatically the ways in which collaborations among museums, libraries, and other holders of content worldwide can expose "hidden" collections and lead to aggregations of images and related content that are enormously valuable.

[17] ARTstor is off to a good start in attracting participants. In its first 15 months of operation, ARTstor signed up 460 institutional subscribers in the United States. "Early adopters" include over 90 community colleges, members of the Appalachian College Association, liberal arts colleges from all over the country, art schools, and major research universities. ARTstor will be made available internationally in the near future, and I do not want to underestimate its potential appeal; but it is, in terms of the content that it provides, a more narrowly focused resource than JSTOR.

Let me provide a further, and even more recent example, by mentioning one of the three initial clusters of content being developed by an Ithaka-sponsored entity named Aluka (a name derived from a Zulu word meaning "to weave" [together]).

Aluka's general purpose is to partner with key libraries, archives, scholars, and museums "to build and support a sustainable, online digital library of scholarly resources from and about the developing world, beginning in Africa, for research and teaching worldwide." Its content is not to be limited to one medium and will include not just journal literature and images, but also manuscripts, other primary source documents, oral histories, and perhaps [later on] music and video. The decision to focus first on Africa is due to the need to know more about a continent of great intrinsic importance, to an appreciation of the need for scholars in African countries to have access to their own materials (which otherwise may be lost forever), and to the Foundation's considerable experience working in South Africa.

The first Aluka content cluster to which I want to draw your attention is the African Plants initiative. Built through the leadership of Bill Robertson, a Mellon Foundation program officer with long-standing ties to botanists the world over, the objective is to present over the internet, in an easily searchable format, high quality images of plant type-specimens of every known African species, along with information about the plants and their uses. Already, through an absolutely unprecedented international collaboration, 47 herbaria from 26 countries around the world (11 in Africa), including the Royal Kew Botanical Gardens, the South African Biodiversity Institute, and the National Museum of Kenya, are contributing content and participating in the development of the database. An initial demonstration of the resource was a highlight of the International Botanical Congress in Vienna this summer. The reception was so

positive that thought is already being given to including plants from other regions of the world, perhaps moving next to Latin America.

This cluster illustrates two other points about collaborations: the sophisticated software used to demonstrate the initial plants database was borrowed in large part from the ARTstor software, illustrating the potential for the sharing of technology among the JSTOR Affiliates; and the funding for the African Plants Initiative was provided by the Foundation's Conservation and Environment Program, which would have been interested in the project even in the absence of an Aluka, but which became much more interested when the potential advantages of partnering with Aluka were clear.

This last observation suggests a response to another frequently-asked question: what is the relation between Mellon and these digital entities? The answer is that Mellon is a grantmaker and will continue, under the leadership of Don Waters, to make grants for a wide variety of projects in the broad field of scholarly communication. ARTstor and Ithaka can apply for support like other grantees, and their proposals will be judged on their merits. Entities like ARTstor and Ithaka are highly useful adjuncts to the Foundation's grantmaking programs in that, while they are not grantmakers themselves, they provide "operational services" (including the ability to collect fees from users and raise money from other sources) that the Foundation itself is ill-equipped to provide and that increase the chances that a particular project will flourish. But of course the Foundation's grantmaking program is far broader than these digital initiatives, which, in total, represent less than 5 percent of all grants made in a typical year.

A second collection that is being developed by Aluka is called "Struggles for Freedom in Southern Africa," and it illustrates well the importance of international collaborations in a field very different from botany. A guiding principle is that Aluka must bring to life rich resources

from Africa (such as the personal papers of some of the leaders of liberation movements) and link digitized copies of these primary source materials to valuable collections of related content that are in other parts of the world, such as the Melvill J. Herskovits Library of African Studies at Northwestern University and Rhodes House at Oxford. Taking advantage of the knowledge of a large network of scholars from many countries, Aluka, will aggregate, or weave together, content in Africa, much of it in precarious condition, and related materials elsewhere so that students and scholars can make necessary intellectual connections that otherwise would be difficult if not impossible even to imagine.[18] Scholars in Africa want very much to contribute their ideas and content to the building of a world-wide resource—they do not want to be just "takers" of what scholars outside Africa will give to them and they do not want their resources to be used solely by others elsewhere.[19]

There is a third initial Aluka cluster, called African Cultural Heritage Sites, which I do not have time to describe. Interested parties can consult the Ithaka web site to find information about this fascinating use of laser technology to "map" such important sites as Kilwa Kisiwani in Tanzania, Axum and Lalibela in Ethiopa, Elmina Castle in Ghana, the mosques of Djenne and Timbuktu in Mali, and to combine these maps with historical commentary, including journal literature, pertaining to the sites. Again, the need for international collaboration, and for collaboration across disciplines, is evident. No one educational institution could conceivably mount such projects, which will depend for their success on the achievement of considerable

[18] Even before it has built and delivered a scholarly resource, Aluka is helping to establish digitizing and IT capacities in Africa and is establishing cross-institutional and transnational relationships. Tom Nygren, executive director of Aluka, and his staff are now facilitating 130 active digitization projects at institutions from 23 countries, with the help of a network of over 60 faculty advisors.

[19] For an extensive discussion of the Struggles for Freedom cluster, and Aluka more generally, see the forthcoming article by Allen Isaacman, Premesh Lalu, and Tom Nygren, "Digitization, History, the Making of Postcolonial Archive of Southern African Liberation Struggles: The Aluka Project," to appear in *Africa Today*, January 2006. This project has had to deal with very complicated political sensitivities which are described in detail in this article.

scale. The last point I would emphasize is the importance of reaching across boundaries of every kind, and encouraging scholars and libraries and museums to work together to advance scholarly values at a time when suspicions and tensions (political and cultural) can erode goodwill and a desire to cooperate for the common good.

New Organizational Models

Let me now suggest one other lesson that we think we have learned over the last decade that may have value to libraries and the rest of the scholarly community going forward. It has to do with the potential contributions of new organizational models, with Ithaka serving as an illustrative case. All of its subtleties notwithstanding, it is relatively easy to grasp the essential nature of ARTstor and to understand how it complements JSTOR. A third member of this family, Ithaka, is more complicated, and I am glad to have this opportunity to comment at least briefly on some of its salient features.[20]

Ithaka also grew out of JSTOR in that the early success of JSTOR led members of the academic community, including a number outside the US, to ask JSTOR staff, and especially Kevin Guthrie, to help them with a number of other projects dependent on applications of information technology. "JSTOR" became a verb, and Kevin kept being asked "How do I 'JSTOR' [this that or the other thing]?" Ithaka was created as a vehicle for leveraging the "assets" that had been built up through JSTOR and then ARTstor, but not just, or even principally, those associated with the process of digitization. The assets that seemed to many people to be of broad potential value include: the considerable knowledge and skills of Kevin

[20] Again, more information is available in the Mellon annual reports and on the Ithaka web site http://www.ithaka.org. I wish to acknowledge the debt Ithaka owes to two other foundation funders, in addition to Mellon: the William and Flora Hewlett and Stavros S. Niarchos Foundations joined with Mellon in providing initial funding. All three of these foundations understand the need to employ a long time horizon in making investments in Ithaka. Start-and- stop funding will not work.

and other key staff members who had worked with him, including practical experience in working through legal, business, and strategic issues related to digital content; a wide range of institutional relationships, including those with foundations; the credibility associated with the success of JSTOR; a genuine understanding of the missions of academic institutions and of the ways in which they differ from those of for-profit entities; and, finally, an independence and an "above-the-fray" character that make it possible to be a catalyst without all the baggage associated with the kind of intense institutional competition often found in the academic world (Ithaka has, thank heavens, no football team!).

Ithaka's broad mission is to accelerate the productive uses of information technologies for the benefit of the worldwide scholarly community.[21] Unlike JSTOR and ARTstor, it does not manage one single digitization project. Rather, it is responsible for identifying and nurturing a variety of promising initiatives. It is similar in this respect to venture capital firms in the for-profit world. It is an "incubator" of projects that subsequently may be spun off as independent not-for-profit entities of their own. One great advantage of this organizational approach is that it avoids the need for each nascent project that Ithaka chooses to support to develop its own infrastructure, including a governance machinery, until it is clear that the project is sustainable. Sharing of resources and experience in early days makes all kinds of sense simply in terms of efficiencies.

[21] The international orientation of Ithaka was clear from the outset when the Stavros S. Niarchos Foundation, based in Greece, was an initial funder. Today, Trustees include Mamphela Ramphele, former Vice-Chancellor of the University of Cape Town in South Africa. Lynne Brindley, Chief Executive of the British Library, was a Trustee in the early days of Ithaka, and Andreas Dracopolous, a member of the board of the Stavros S. Niarchos Foundation, continues to serve as an International Advisor.

I have already mentioned two specific entities for which Ithaka is currently responsible, via its "incubation" function: Portico and Aluka.[22] Ithaka also exists to provide strategic advice to a variety of other projects, many of which are funded by other foundations and other donors, even though Ithaka would not have the capacity to incubate these other entities itself (and of course the other entities may well prefer not to be incubated by Ithaka in any case). Ithaka also has a research arm that is committed to documenting experiences with various digital initiatives, so that interested parties can learn from both the disappointments and successes achieved in working on such projects.

Ithaka is, in short, an umbrella organization that is meant to provide a broad range of services to the scholarly community, including its libraries. Ithaka has been involved recently in discussions of new modes of book publishing and of open source software for administrative and instructional activities, which clearly intersect the interests of libraries. Also, Ithaka has participated in some of the discussions of large-scale digitization of books, and may possibly be of help at some point in the evolution of these projects—perhaps by encouraging the appropriate sharing of digital content. More generally, Ithaka is meant to be a meeting place for ideas, as well as an efficient operating organization for the effective execution and implementation of those ideas.

From 36,000 feet....

Without wanting to wear out my welcome (which I may have done already), let me now, finally, ascend to a high platform and offer a few general thoughts about this entire digital

[22] There is a third incubating entity within Ithaka that I have time only to mention. I refer to NITLE (National Institute for Technology and Liberal Education), an entity especially important to liberal arts colleges but focused only in part on libraries.

territory and the crucially important role of the library within it. In the interests of time, I will speak in staccato-like bullets.

- First, this is such an exciting area for all of us because the landscape is ever changing. You certainly see the changes, and the pace of change, from your own angles of vision. For my part, I can say only that I have learned so much, though never enough. If I had known ten years ago what I know today, I might have chosen a different life for myself—but I don't think so. (You may have pondered the same question.) All the complications and aggravations notwithstanding, these projects are tremendously exhilarating; they allow us to do what would have been unimaginable only a few years ago. Needless to say, the countries' leading libraries, and librarians, need to be front and center in these discussions—as they have been.

- There is also a lesson for me about decision-making. Given all the complexities and unknowns, there will always be a temptation to want to have further discussions and to want to learn more before acting. My own conclusion is that while considered decisions are always preferable to acting on impulse, there are many times when the important thing is to "do it, not just talk about it." Learning by doing is of critical importance, and organizations within the academy and those, like Ithaka, that serve it need to be prepared to take some risks. Governance structures (a topic all its own) need to be simple enough to permit nimble decision-making. As Adlai Stevenson once said, "there is... a moment at which democracy must prove its capacity to act. Every man has a right to be heard; but no man has the right to strangle democracy with a single set of vocal cords;"[23] and voting on everything may not, in any case, be the way to go.

- In charting new ways of accessing, managing, and storing information, universities are going to have to learn to be better than many are today at making trade-offs and in learning that

"the best may be the enemy of the good." Advances in information technology pose new organizational challenges for universities, which need to learn to be more willing to exorcise old demons and more capable of insisting that an institution-wide perspective be brought to bear on decisions to support this initiative or that one.

- I probably should have said "system-wide perspective," not just "institution-wide perspective," because it is so clear, at least to me, that many of the most important developments will occur on a system-wide basis, will require new collaborations, and in many instances will need the catalytic contribution that a trusted third party can provide. It is important to avoid being trapped by too much institutional hubris and too much institutional competition. Technology demands a scale larger than that available to any single institution. This is one reason why I think Ithaka and organizations like it that facilitate collaboration across our sector, and others (including public libraries and secondary education), could end up having a valuable role to play in many areas that we cannot even imagine today.

- Let me return for a moment to the theme of "urgency," this time to broaden the context. Those of us in the US sometimes take for granted the preeminence of the US university system. That can be a huge mistake, and it is well to remember that sometimes "the last will be first." Universities in other countries, and I think especially of Asia, are enjoying strong support from their governments, and in many cases they may be able to leap frog developments in this country because they have no (or fewer) legacy systems to jettison. It is wise, I think, to keep a watchful eye on what new competitors are doing and to try and anticipate big developments, not just respond to them after the fact.

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[23] Adlai E. Stevenson, speech to the state committee of the Liberal party, New York City, August 28, 1952.—*The Papers of Adlai E. Stevenson*, vol. 4, p. 63 (1974).

- "Finally" (the most beautiful word in the English language, as a friend once reminded me), I want to celebrate the role of "champions" in the library community in bringing about so much constructive change, especially in these new digital territories. When I discussed the JSTOR experience at the start of this talk, I emphasized the critically important role played by the brave charter participants in the Arts and Sciences I collection, and I append a list of their names to this talk. They are heroes, as is Dick de Genarro, who did so much to encourage libraries to step forward. Our community continues to need champions, and my hope is that the leading research libraries will be strong proponents of taking the steps that simply have to be taken in areas such as electronic archiving. "Hanging back" is not a good strategy, but neither is blasting "full speed ahead" without allies—believing that you can and should do everything on your own in particularly local ways. I am persuaded that we should re-think the possibility for stronger collaborative actions—seeking ways to work together effectively, respecting legal concerns but not being terrified by overly conservative interpretations of what degree of collective action is permitted.

There is a huge upside here, for libraries and librarians. I recognize that having grown up in libraries, and having "lived," as it were, in a number of them, I may not be entirely objective. Nonetheless, let me state my categorical view that a new age for libraries is dawning, and that those that enjoy the best leadership will have an unparalleled opportunity to work across their institutions, and beyond them, in developing new modes of research, teaching and learning. It is a great and exciting time to be a librarian, and I salute all of you who have worked so hard to get us where we are today—and who are now poised to help us cross new boundaries.

Figures and Appendices

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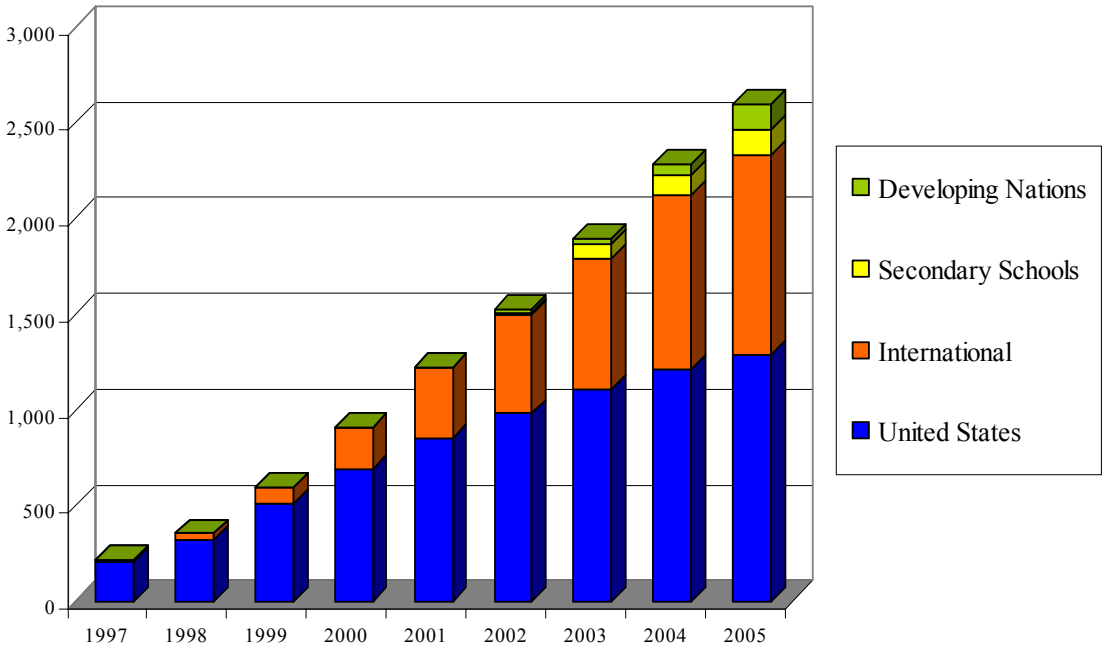
- Figure 3. JSTOR Cost per Article Use, 1997-2005
- Urgent Action Needed to Preserve Scholarly Electronic Journals: Statement

Figure 1. JSTOR Community Growth, 1997-2005



JSTOR: U.S. Charter Participants

Agnes Scott College
Albion College
Alma College
American Philosophical Society
Andrew W. Mellon Foundation
Arizona State University
Arizona State University at the Polytechnic Campus (formerly East Campus)
Arizona State University West
Atlanta University Center
Bates College
Bellarmine College
Beloit College
Boston College
Bowdoin College
Brandeis University
Bridgewater State College
Brown University
Bryn Mawr College
Bucknell University
Carleton College
Carnegie Mellon University
Case Western Reserve University
CDL - UC Berkeley
Central Michigan University
Century Foundation (Twentieth Century Fund)
Claremont University Center
Colby College
College of Charleston
College of St. Benedict/St. John's University
College of Wooster
Colorado College
Columbia University
Concordia University
Connecticut College
Cornell University
Covenant College
CSUL - Sonoma State University
Dana College
Dartmouth College
Davidson College
Denison University
Duke University
Duquesne University
Eckerd College
Emory University
George Mason University
George Washington University
Georgetown University
Gettysburg College
Hamilton College
Harvard University
Haverford College
Hendrix College
Hobart & William Smith Colleges
Hofstra University
Hood College
Howard University
Indiana University, Bloomington
Indiana University, Purdue University Indianapolis
International Monetary Fund & World Bank
Johns Hopkins University
Kalamazoo College
Lafayette College
Library of Congress
Lincoln Memorial University
Loyola University New Orleans
Loyola University of Chicago
Loyola/Notre Dame
Macalester College
Marquette University
Maryville College
Massachusetts Institute of Technology (MIT)
Miami University of Ohio, Hamilton
Miami University of Ohio, Middletown
Miami University of Ohio, Oxford
Michigan State University
Middlebury College
Montana State University System: Billings, Bozeman, Northern & Tech.
National Defense University
Nazareth College
New York Public Library, Research Libraries
New York University
Newberry Library
North Carolina State University
Northeastern University
Northern State University
Northland College
Northwestern University
Ohio State University
Ohio University
Oklahoma State University
Pennsylvania State University
Princeton University
Purdue University
RAND Corporation
Reed College
Rice University
Russell Sage Foundation
Rutgers University -Camden
Rutgers University -New Brunswick
Rutgers University -Newark
Siena College
Skidmore College
Smith College
Somerset Community College

South Dakota State University
Southern Illinois University, Carbondale
Spencer Foundation
St. Cloud State University
St. John's College
St. Lawrence University
St. Louis University
St. Mary's College of Maryland
St. Olaf College
Stanford University
State University of New York, Albany
State University of New York, Binghamton
State University of New York, Buffalo
State University of New York, Stony Brook
Swarthmore College
Syracuse University (includes SUNY College of Environmental Science and Forestry)
Temple University
Texas A&M University
Trinity College
Tufts University
Tulane University
University of Arizona
University of Chicago
University of Cincinnati
University of Cincinnati, Clermont College
University of Cincinnati, Raymond Walters College
University of Colorado at Boulder
University of Colorado at Denver
University of Connecticut (and Univ. of CT Health Center)
University of Delaware
University of Florida
University of Georgia
University of Houston
University of Illinois, Urbana-Champaign
University of Kentucky, Main Campus
University of Maryland at College Park (including Baltimore Law & Medical campuses)
University of Massachusetts, Amherst (& Medical School)
University of Michigan, Ann Arbor
University of Michigan, Dearborn
University of Minnesota - Twin Cities
University of Missouri, Columbia
University of Nebraska, Kearney
University of Nebraska, Lincoln
University of New Orleans
University of North Carolina, Chapel Hill
University of Notre Dame
University of Pennsylvania
University of Pittsburgh
University of Pittsburgh - Bradford
University of Pittsburgh - Greensburg
University of Pittsburgh - Johnstown
University of Pittsburgh - Titusville
University of Redlands
University of South Florida
University of Southern California
University of Tennessee
University of Texas at Arlington
University of Texas at Austin
University of Texas at Brownsville
University of Texas at Dallas
University of Texas at El Paso
University of Texas at San Antonio
University of Texas at Tyler
University of Texas, Pan American
University of Texas, Permian Basin
University of the South (Sewanee)
University of Virginia
University of Washington
University of Wisconsin-Madison
Urban Institute
Vanderbilt University
Vassar College
Villanova University
Wabash College
Wartburg College
Washington and Lee University
Washington College
Washington University
Wellesley College
Wesleyan University
West Virginia University
Westmont College
Wheaton College
Whittier College (includes the Law School Library)
Williams College
Winona State University
Yale University

Figure 2. JSTOR Cost per Title, 1997-2005

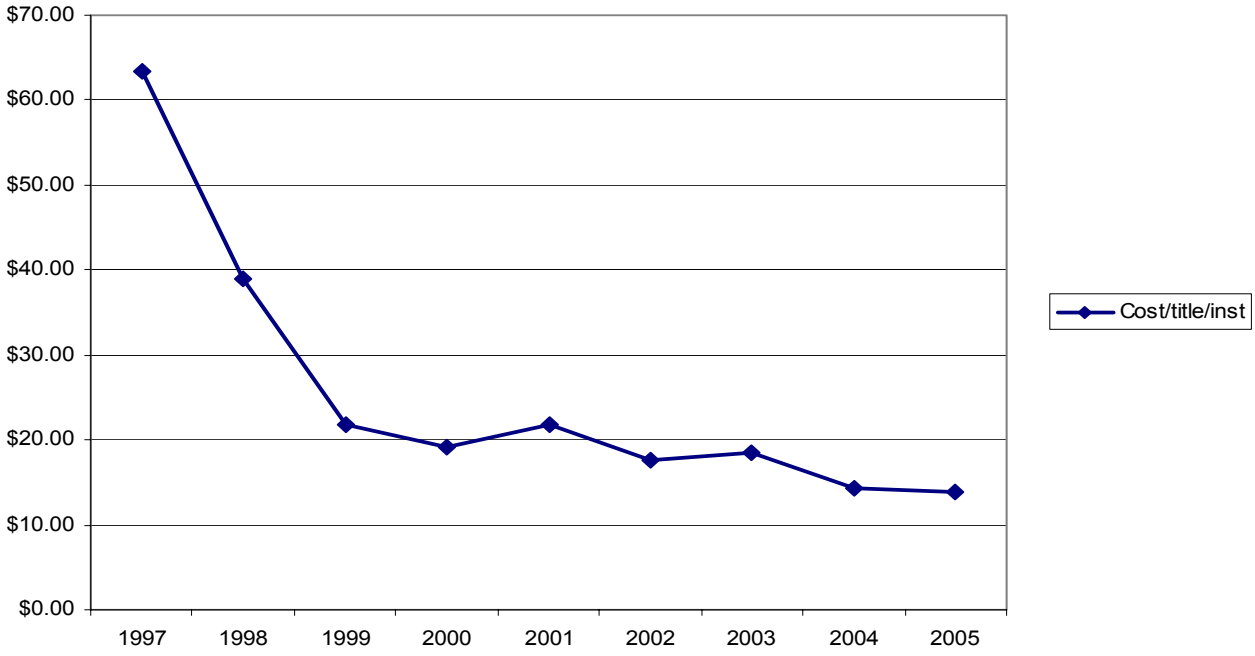
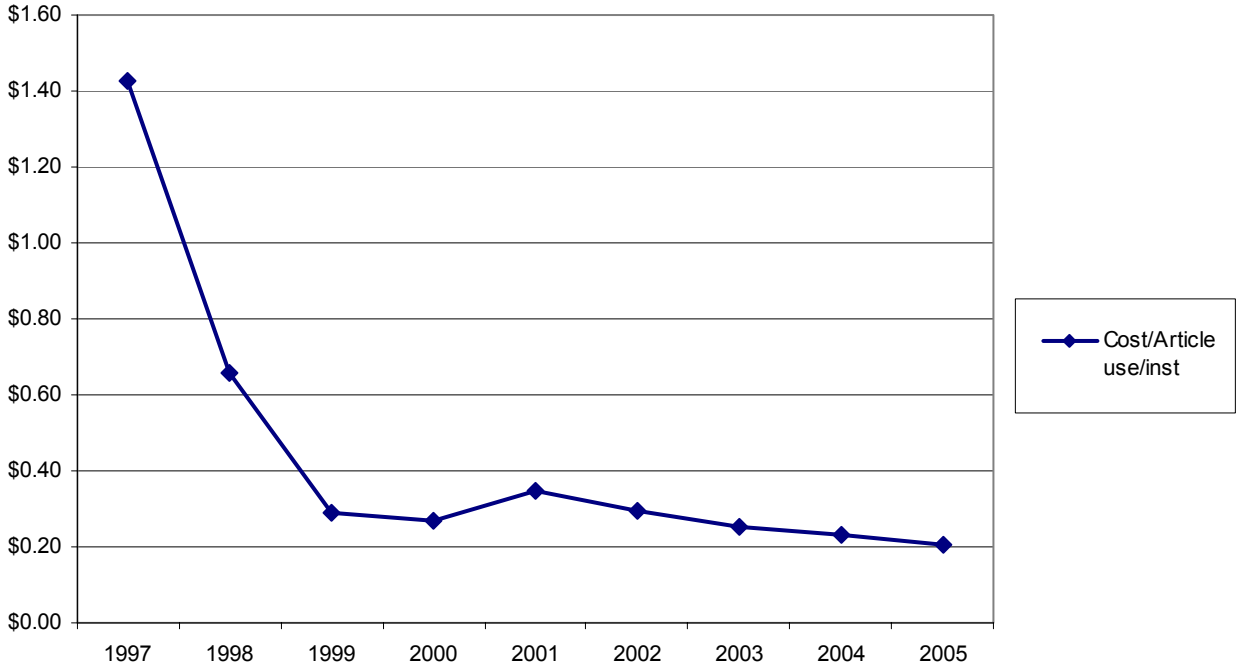


Figure 3. JSTOR Cost per Article Use, 1997-2005



Urgent Action Needed to Preserve Scholarly Electronic Journals

Digital preservation represents one of the grand challenges facing higher education. In field after field, research and teaching are generating data, reports, publications, teaching materials, and other forms of scholarly communication in digital formats. Research and teaching are also increasingly dependent on data mining tools and other computer-based techniques that require the long-term persistence of these various forms of digital information to advance knowledge. Yet as the creation and use of digital information accelerate, responsibility for preservation is diffuse, and the responsible parties—scholars, university and college administrators, research and academic libraries, and publishers—have been slow to identify and invest in the necessary infrastructure to ensure that the published scholarly record represented in electronic formats remains intact over the long-term. Inaction puts the digital portion of the scholarly record—and the ability to use it in conjunction with other information that is necessary to advance knowledge—increasingly at risk, and solutions may require unique arrangements within the academy for sharing preservation responsibility.

The shift from print to electronic publication of scholarly journals is occurring at a particularly rapid pace. Researchers, teachers, students and other readers demand electronic formats because it provides so many advantages over print, especially for search and retrieval. Recognizing the greater capability of the digital medium, editors are treating the electronic versions of journals as the definitive versions of record. Scholarly publishers are shifting their business models accordingly and are pricing print and electronic formats separately so that they can survive as electronic subscriptions supplant print. And research and academic libraries are increasingly canceling print subscriptions in favor of electronic licenses both to satisfy user demands and to avoid the substantial costs associated with ordering, receiving, cataloging, binding, storing, and circulating paper volumes.

In the face of this shift, what makes preservation action so urgent for electronic scholarly journals—and the risk of failure so high for the academy—is the nature of the licensing regime under which these journals are now distributed. When research and academic libraries license electronic journals, they do not to take local possession of a copy as they did with print. Rather, they use content stored on remote systems controlled by publishers, and economies of scale in electronic publishing are driving control of more and more journals into fewer and fewer hands. Although some – but certainly not all – licenses now recognize that libraries have permanent rights to use electronic journal content, these rights remain largely theoretical. If a publisher fails to maintain its archive, goes out of business or, for other reasons, stops making available the journal on which scholarship in a particular field depends, there are no practical means in place for libraries to exercise their permanent usage rights and the scholarly record represented by that journal would likely be lost. For electronic journals, the academy has as yet no functional equivalent in long-term maintenance and control over the scholarly record that "owning a copy" provided for printed journals. Unless and until it creates digital archiving services, the academy cannot fully shift to electronic-only journal publishing, and cannot fully achieve the system-wide savings and benefits associated with such a shift.

Universities and colleges and their libraries have recently been working together to help scholars manage their copyrights and to craft alternatives to high priced forms of scholarly publishing. It is now equally and perhaps even more important that research and academic libraries work with scholars—and their publishers—to sustain future research and teaching by establishing trusted archives in which the published scholarly record in electronic form can persist outside of the exclusive control of publishers, and in the control of entities that value long-term persistence**.** Four key actions are essential.

First, research and academic libraries and associated academic institutions must recognize that *preservation of electronic journals is a kind of insurance*, and is not in and of itself a form of access. Preservation is a way of managing risk, first, against the permanent loss of electronic journals and, second, against having journal access disrupted for a protracted period following a publisher failure. Storing electronic journal files in trusted archives outside the control of the publisher addresses the first risk. Mitigating the second risk requires investment in substitute access systems, which may cost more or less to construct depending on the quality and duration of disruption that the academic community would be willing to tolerate in the event of a failure.

Second, in order to address these risk factors and provide insurance against loss, *qualified preservation archives would provide a minimal set of well-defined services*. Such archives are beginning to emerge and must at least:

- Receive files that constitute a journal publication in a standard form either from a participating library or directly from the publisher;
- Store the files in non-proprietary formats that could be easily transferred and used should the participating library decide to change its archives of record;
- Use a standard means of verifying the integrity of ingoing and outgoing files, and provide continuing integrity checks for files stored internally;
- Limit the processing of received files, in order to keep costs down, but provide sufficient processing so that the archives could locate and adequately render files for participating libraries in the event of loss;
- Restrict access by the participating libraries to archived files that are under copyright in order to protect the publisher's business interests, except when (a) the publisher goes out of business or is otherwise unable to provide consistent access; or (b) the content is no longer protected by copyright**.**
- Offer an open, transparent means of auditing these archival practices.

Certifying agencies might recognize qualified preservation archives that provide these services with a publicly visible symbol of compliance. Additional preservation services for specific purposes beyond this minimal set, and provision of data-mining and other value-added services based on the preserved materials, would depend on the funding available to the archives, the permission of the publisher or other rights holder, and possibly both.

Third, *libraries must invest in a qualified archiving solution*. A library may itself operate a qualified archive as defined above. Otherwise, research and academic libraries may collaborate in the form of an insurance collective, or mutual assurance society. Such an

entity may be governed in a variety of ways, but libraries would exercise their preservation obligation, in part, by paying fees to support the archive. In the event of a loss of access to an archived journal through the publisher, only paying participants would be able to have access to lost content through the archive. The collective would institute financial and other measures to ensure that potential participants who might choose initially to withhold support would pay their full fair share should they eventually need access to preserved materials.

Finally, *research and academic libraries and associated academic institutions must effectively demand archival deposit by publishers as a condition of licensing electronic journals*. Standard form clauses need to be crafted and implemented that require publishers to transmit all files upon publication either directly to a qualified archive or to the licensing library for deposit in a qualified archive. To express demand via such a contractual mechanism, research and academic libraries may need to seek support from university administrators and faculty governing bodies. They may also need to mobilize membership organizations, such as the American Library Association, the Association of Research Libraries, and the International Federation of Library Associations; local, regional, national, and international consortia; and services such as LibLicense. In addition, libraries must both urge publishers to describe their archiving provisions publicly and prominently in their publications, and educate authors and readers to consider these archiving provisions in evaluating the suitability of journals as a durable record of scholarship.

These actions may not be easy, but in a scholarly environment that is increasingly dependent on information in digital form, preservation of electronic journals is necessary and urgent. It will provide critical infrastructure and serve as a model for the preservation of other forms of digital information. In the end, those institutions that invest in digital preservation to ensure the persistence of and enduring access to the scholarly record will secure widely shared values of scholarship, and scholars and the public who are committed to those values will recognize the competitive advantage that preservation efforts afford in their ability to advance knowledge in service of the public good.

This document represents a consensus of the following academic librarians, university administrators and others who participated in a meeting to discuss electronic journal preservation at The Andrew W. Mellon Foundation offices in New York on September 13, 2005: Paul Courant (University of Michigan), Sam Demas (Carlton College), Nancy Eaton (Pennsylvania State University), David Ferriero (New York Public Library), Daniel Greenstein (California Digital Library), James Hilton (University of Michigan), Deborah Jakubs (Duke University), Micheline Jedrey (Wellesley College), Paula Kaufman (University of Illinois at Urbana-Champaign), Robert Kieft (Haverford College), Clifford Lynch (Coalition for Networked Information), Carol Mandel (New York University), James Neal (Columbia University), Elliott Shore (Bryn Mawr College), Sarah Thomas (Cornell University), Karin Wittenborg (University of Virginia), and Ann Wolpert (Massachusetts Institute of Technology).

Edited by Donald J. Waters
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http://www.diglib.org/pubs/waters051015.htm