"Our Cultural Commonwealth" The Report of the American Council of Learned Societies Commission on Cyberinfrastructure for the Humanities and Social Sciences

By:

American Council of Learned Societies Commission on Cyberinfrastructure for the Humanities & Social Sciences

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C O N N E X I O N S

Rice University, Houston, Texas

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[1] This content is available online at <http://cnx.org/content/m14143/1.2/>.

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Public Information-Gathering Meetings

April 27, 2004, Washington DC

May 22, 2004, Evanston, IL

June 19, 2004, New York, NY

August 21, 2004, Berkeley, CA

September 18, 2004, Los Angeles, CA

October 26, 2004, Baltimore, MD

Testimony and Background Materials

http://www.acls.org/cyberinfrastructure/cyber.htm[2]

[2] http://www.acls.org/cyberinfrastructure/cyber.htm

Foreword[3]

Foreword

I am pleased to commend Our Cultural Commonwealth to what I hope will be the many readers who will find in the report a vision of the future and a guide to realizing that future.

One role of the American Council of Learned Societies is to convene scholars and institutional leaders to consider challenges important to the advancement of humanistic studies in all fields. The effective and efficient implementation of digital technologies is precisely such a challenge. It is increasingly evident that new intellectual strategies are emerging in response to the power of digital technologies to support the creation of humanistic knowledge. Innovative forms of writing and image creation proliferate in arts and letters, with many new works accessible and understood only through digital media. Scholars are increasingly dependent on sophisticated systems for the creation, curation, and preservation of information. In 2004, therefore, ACLS asked John Unsworth, Dean of the Graduate School of Library and Information Science, University of Illinois, Urbana-Champaign, to chair a Commission on Cyberinfrastructure in the Humanities and Social Sciences. Dean Unsworth selected the other members of the Commission and its advisers, who worked with dedication and determination. The analysis and recommendations of this report are theirs, but the responsibility for grappling with the issues they present lies with the wider community of scholarship and education.

The convergence of advances in digital technology and humanistic scholarship is not new. Indeed, this publication is at least the sixth major report focused on technology and scholarship in the humanities and interpretive social sciences issued by our Council. [4]In 1965, ACLS began a program of providing fellowships to scholars whose projects experimented with "computer aided research in the humanities." A forty-year-old statement of that program's purpose remains convincing: "Of course computers should be used by scholars in the humanities, just as microscopes should be used by scientists. . . [t]he facts and patterns that they—and often they alone—can reveal should be viewed not as the definitive answers to the questions that humanists have been asking, but rather as the occasion for a whole range of new and more penetrating and more exciting questions." [5]For the past forty years increasing numbers of individual scholars have validated and re-validated that assertion. We now have arrived at the point, however, where we cannot rely on individual enterprise alone. This report is therefore primarily concerned not with the technological innovations that now suffuse academia, but rather with institutional innovations that will allow digital scholarship to be cumulative, collaborative, and synergistic.

Those institutional innovations are the "cyberinfrastructure" advocated by the following pages. We are grateful to the National Science Foundation and to Dan Atkins, who chaired the NSF Advisory Panel on

[3]This content is available online at <http://cnx.org/content/m14151/1.2/>.

[4]Herbert C. Morton and Anne J. Price, The ACLS Survey of Scholars: The Final Report of Views on Publications, Computers, and Libraries (Washington: University Press of America, 1989). Herbert C. Morton et al, Writings on Scholarly Communication: An Annotated Bibliography of Books and Articles on Publishing, Libraries, Scholarly Research, and Related Issues (University Press of America, 1988). Scholarly Communication: The Report of the National Enquiry, (John Hopkins University Press, 1979). "Computerized Research in the Humanities," ACLS Newsletter, Special Supplement, June 1966. Pamela Pavliscak, Seamus Ross, and Charles Henry, "Information Technology in Humanities Scholarship: Achievements, Prospects, and Challenges—The United States Focus,"ACLS Occasional Paper #37,1997.

[5]Charles Blitzer, "This Wonderful Machine: Some Thoughts on the Computer and the Humanities," ACLS Newsletter, Vol. XVII, April 1966, No. 4.

Cyberinfrastructure that issued in 2003 a report on the subject, for giving the term currency and meaning. (Dr. Atkins also served as an adviser to the ACLS Commission.) In addition to the "Atkins report," the NSF commissioned a report on the cyberinfrastructure needs of the more quantitative social sciences. [6]With the publication of Our Cultural Commonwealth, which concerns the humanities and interpretive social sciences, we now have all of the fields of the arts and sciences in common cause.

ACLS's earlier reports focused within the academy and concerned the potential of new information technologies to empower research on traditional objects of study. That orientation is the starting point for this effort, and the evidence there is compelling. But the widespread social adoption of computing is transforming the very subjects of humanistic inquiry. In 2006 most expressions of human creativity in the United States—writing, imaging, music—will be "born digital." The intensification of computing as a cultural force makes the development of a robust cyberinfrastructure an imperative for scholarship in the humanities and social sciences. Political scientists must take account not only of polling data, but of the blogesphere. Architectural historians must be able to analyze computer-aided design. What we once called "film studies" increasingly will be research on digital media. If these materials are to be preserved and accessible, if they are to be searched and analyzed, we must have the human and institutional capacities called for in this report.

Many thanks are in order. The Andrew W. Mellon Foundation provided essential resources: the Foundation's financial support made the report possible, and the advice and counsel of Program Officer Donald J. Waters helped refine it. Many institutions extended themselves in providing venues for the public sessions that helped form the report: the New York Public Library; Northwestern University; the University of California, Berkeley; the University of Southern California; the Research Libraries Group; the Institute of Museum and Library Services. Numerous scholarly leaders gave presentations to the Commission, and many others submitted comments on earlier drafts of this report. I wish to express thanks also to Abby Smith, who served first as Senior Editor and subsequently as an adviser to the Commission; to Marlo Welshons, the report's editor, who worked tirelessly yet cheerfully to bring together the words and ideas of the report's many authors and reviewers; and to Sandra Bradley, who helped maintain the Commission's own infrastructure.

This report addresses its recommendations to college and university leaders, to funders, to scholars, and to the public that ultimately supports the scholarly and educational enterprise. It is heartening to know that some of the recommendations of the report already are being acted upon. With the support of the Mellon Foundation, ACLS has begun offering Digital Innovation Fellowships designed to advance digital scholarship and to exemplify the infrastructure necessary for further advances. Chairman Bruce Cole's announcement of the Digital Humanities Initiative of the National Endowment for the Humanities is especially promising. One early fruit of that initiative is a new partnership between the Endowment and the Institute for Museum and Library Services to help teachers, scholars, museums, and libraries work together to advance digital scholarship and present it to the widest possible public. The John D. And Catherine T. MacArthur Foundation has begun a major new effort to understand and develop digital technologies for learning in early education. We can hope that other foundations and funders will join the Mellon Foundation in extending that focus to higher education. The ACLS remains committed to continuing its work in this area through the direct support of scholars and by cooperating with our member societies in hopes of providing leadership in this rapidly changing domain.

"Commonwealth" is defined both as "a body or number of persons united by a common interest," and as the "public welfare, general good or advantage." With this report the former meaning, as represented by the Commission and ACLS, presents a framework for action that, we believe, will advance the latter, the general good.

Pauline Yu
President
American Council of Learned Societies

[6]Francine, Berman and Henry Brady, "Final Report: NSF SBE-CISE Workshop on Cyberinfrastructure and the Social Sciences" www.sdsc.edu/sbe/ (<http://www.sdsc.edu/sbe/>) .

Preface: Who Is the Intended Audience for This Report?[7]

Preface: Who Is the Intended Audience for This Report?

This report is addressed to several related audiences:

- Senior scholars in the humanities and social sciences in a university setting, who have the power to change scholarly practice and the responsibility to exercise that power. These individuals need to address themselves to their national and professional representatives and, locally, to their colleagues, their academic deans, provosts, and presidents.
- Leaders of national academies, scholarly societies, university presses, and research libraries, museums, and archives, who share the power and responsibility of senior scholars and who can speak to leaders at the campus, state, and national levels.
- University provosts, presidents, and boards of trustees, who must decide in the coming decade what strategic investments to make with the limited resources of their institutions and who can influence legislators.
- Legislators at the local, state, and national level charged with making decisions about funding for public schools, public community colleges, public universities, and federally supported research, who have the same responsibility to the public with respect to cyberinfrastructure as they do for physical infrastructure, and for the same reasons—because ultimately, good infrastructure promotes good citizenship and good government by promoting tolerance, understanding, and prosperity.
- Federal agencies and private foundations that promote research in the humanities and social sciences. These organizations have the power to influence individual scholars directly, as well as university provosts, university presses, and scholarly societies.
- Lifelong learners outside the academy who have an abiding interest in the pursuit of knowledge in the humanities and social sciences, including those who enjoy visiting museums and public libraries or informing themselves by reading a book or surfing the Web. Such individuals give voice to the intelligence of the general public and, through their active support and interest in self-education, can influence legislation and funding at the campus, local, state, and national levels, simply by making themselves heard.

Finally, it is important to note that each of these audiences has a responsibility to carry the message of the report to other, broader audiences. Without the active participation such a process implies, this report cannot effect change.

[7] This content is available online at <http://cnx.org/content/m14154/1.1/>.

Executive Summary[8]

[8] This content is available online at <http://cnx.org/content/m14150/1.2/>.

Executive Summary

The emergence of the Internet has transformed the practice of the humanities and social sciences—more slowly than some may have hoped, but more profoundly than others may have expected. Digital cultural heritage resources are a fundamental dataset for the humanities: these resources, combined with computer networks and software tools, now shape the way that scholars discover and make sense of the human record, while also shaping the way their findings are communicated to students, colleagues, and the general public. Even greater transformations are on the horizon, as digitized cultural heritage comes into its own. But we will not see anything approaching complete digitization of the record of human culture, removal of legal and technical barriers to access, or revolutionary change in the academic reward system unless the individuals, institutions, enterprises, organizations, and agencies who are this generation's stewards of that record make it their business to ensure that these things happen.

The organized use of networks and computation for the practice of science and engineering was the subject of a 2003 report to the National Science Foundation (NSF), Revolutionizing Science and Engineering through Cyberinfrastructure. [9]In both the NSF report and this one, the term cyberinfrastructure is meant to denote the layer of information, expertise, standards, policies, tools, and services that are shared broadly across communities of inquiry but developed for specific scholarly purposes:cyberinfrastructure is something more specific than the network itself, but it is something more general than a tool or a resource developed for a particular project, a range of projects, or, even more broadly, for a particular discipline. So, for example, digital history collections and the collaborative environments in which to explore and analyze them from multiple disciplinary perspectives might be considered cyberinfrastructure, whereas fiber-optic cables and storage area networks or basic communication protocols would fall below the line for cyberinfrastructure.

Recognizing that a revolution similar to the transformation of science and engineering addressed in the NSF report is inevitable for the humanities and the social sciences and that these disciplines have essential and distinct contributions to make in designing, building, and operating cyberinfrastructure, the American Council of Learned Societies (ACLS) in 2004 appointed a Commission on Cyberinfrastructure for the Humanities and Social Sciences. This report reflects the reach of its sponsoring organization, the ACLS, by focusing on the needs of the humanities and nonnormative social sciences, that is, social sciences that are interpretive.

The ACLS Commission was charged with three tasks:

1. To describe and analyze the current state of humanities and social science cyberinfrastructure
2. To articulate the requirements and potential contributions of the humanities and social sciences in developing a cyberinfrastructure for information, teaching, and research
3. To recommend areas of emphasis and coordination for the various agencies and institutions, public and private, that contribute to the development of this infrastructure

Commission members include humanities scholars, social scientists, administrators, and entrepreneurs from universities and organizations public and private, large and small. All were selected for their experience with digital technologies. The Commission's deliberations were informed by the testimony of scholars, librarians, museum directors, social scientists, representatives of government and private funding agencies, and many other people, gathered in a series of public meetings held in Washington, DC; New York City; Chicago; Berkeley; Los Angeles; and Baltimore during 2004; by national and international reports by other groups on related missions; by advisors to the Commission, selected for particularly relevant expertise; and by responses to the draft report, which was made available for public comment from November 2005 through January 2006.

The Commission heard from those who wanted more advanced software applications, greater bandwidth, and more access to expertise in information technology. We also heard from many who spoke about the potential for cyberinfrastructure to enhance teaching, facilitate research collaboration, and increase public

[9]National Science Foundation, Revolutionizing Science and Engineering through Cyberinfrastructure: Report of the National Science Foundation Blue-Ribbon Advisory Panel on Cyberinfrastructure (January 2003) http://www.nsf.gov/cise/sci/reports/atkins.pdf (<http://www.nsf.gov/cise/sci/reports/atkins.pdf>).

access to (and fair use of) the record of human cultures across time and space. As a result, this report addresses the particular needs and contributions of those directly engaged in teaching, research, and cultural work; but it also places those needs and contributions in a larger context, namely, the public good that these activities, collectively, produce.

As more personal, social, and professional time is spent online, it will become increasingly important to have an online environment that cultivates the richness of human experience, the diversity of human languages and cultures, and the full range of human creativity. Such an environment will best emerge if its design can benefit from the strengths of the humanities and social sciences: clarity of expression, the ability to uncover meaning even in scattered or garbled information, and centuries of experience in organizing knowledge. These strengths are especially important as the volume of digital resources grows, as complexity increases, and as we struggle to preserve and make sense of billions of sources of information.

Many who work in the humanities and social sciences have come to recognize that knowledge in these disciplines is on the edge of some fundamental changes, and that it would be better to approach these changes with specific goals in mind. This report suggests what some of those goals might be. The Introduction answers a few fundamental questions: What is cyberinfrastructure? What do we mean when we refer to the humanities and social sciences? And what are the distinctive needs and contributions of these disciplines in cyberinfrastructure?

As the title of this report is meant to indicate, the online world is a new cultural commonwealth in which knowledge, learning, and discovery can flourish. Our aim, therefore, is to show how best to achieve this cultural commonwealth for the betterment of all.

Chapter 1 makes the case for the transformative potential of an improved cyberinfrastructure with respect to the preservation and availability of our cultural heritage. A coordinated effort to build cyberinfrastructure for the humanities and social sciences, the Commission argues, will benefit the public and the specialist alike by providing access to the breadth and depth of the cultural record.

Chapter 2 explores the constraints that must be overcome in creating such a cyberinfrastructure—insufficient training, outdated policies, unsatisfactory tools, incomplete resources, and inadequate access. These constraints are not primarily technological but, instead, cultural, economic, legal, and institutional. They include:

[U+25CF]the loss, fragility, and inaccessibility of the cultural record;

[U+25CF]the complexity of the cultural record;

[U+25CF]intellectual property restrictions on the use of the cultural record;

[U+25CF]lack of incentives to experiment with cyberinfrastructure in the humanities and social sciences;

[U+25CF]uncertainty about the future mechanisms, forms, and economics of scholarly publishing and scholarly communication more generally;

[U+25CF]insufficient resources, will, and leadership to build cyberinfrastructure for the humanities and social sciences.

Chapter 3 provides a framework for action. It first articulates five goals for an effective cyberinfrastructure, namely, that it should

1. be accessible as a public good;
2. be sustainable;
3. provide interoperability;
4. facilitate collaboration;
5. support experimentation.

In chapter 3, the Commission also recommends the following measures necessary to achieve these goals (and to meet the challenges described in chapter 2):

1. Invest in cyberinfrastructure for the humanities and social sciences, as a matter of strategic priority.

Addressed to: Universities; federal and private funding agencies

Implementation: Determine the amount and efficacy of funding that now goes to support developing cyberinfrastructure for humanities and social sciences from all sources; through annual meetings and ongoing consultation, coordinate the goals this funding aims to achieve; and aim to increase both funding and coordination over the next five years, including commercial investments that are articulated with the educational community's agenda.

2. Develop public and institutional policies that foster openness and access.

Addressed to: University presidents, boards of trustees, provosts, and counsels; university presses; funding agencies; libraries; scholarly societies; Congress

Implementation: The Association of American Universities, in collaboration with other organizations such as the National Humanities Alliance, the Scholarly Publishing and Research Coalition, and the National Academy of Arts and Sciences, should take a leadership role in coordinating the engagement of the humanities and social sciences with issues of information policy.

3. Promote cooperation between the public and private sectors.

Addressed to: Universities; federal and private funding agencies; Internet-oriented companies

Implementation: A private foundation, a federal funding agency, an Internet business, and one or more university partners should cosponsor recurring annual summits to explore new models for commercial/nonprofit partnerships and to discuss opportunities for the focused creation of digital resources with high educational value and high public impact.

4. Cultivate leadership in support of cyberinfrastructure from within the humanities and social sciences.

Addressed to: Senior scholars; scholarly societies; university administrators; senior research librarians and research library organizations; academic publishing organizations; federal funding agencies; private foundations

Implementation: Increase federal and foundation funding to one or more scholarly organizations in the area of humanities and social science computing so that they can work with member organizations of the American Council of Learned Societies (ACLS) and others to establish priorities for cyberinfrastructure development, raise awareness of research and partnership opportunities among scholars, and coordinate the evolution of research products from basic to applied.

5. Encourage digital scholarship.

Addressed to: Universities; research libraries; the National Endowment for the Humanities (NEH); the National Endowment for the Arts (NEA); the Institute of Museum and Library Services (IMLS); the National Academies; the National Archives; major private foundations; major scholarly societies; individual leaders in the humanities and social sciences

Implementation: Federal funding agencies and private foundations should establish programs that address workforce issues in digital humanities and social sciences, from short-term workshops to postdoctoral and research fellowships to the cultivation of appropriately trained computer professionals. The ACLS should lead its member organizations in developing uniform policies with respect to digital scholarship in tenure and promotion.

6. Establish national centers to support scholarship that contributes to and exploits cyberinfrastructure.

Addressed to: Universities; Congress; state legislatures; public funding agencies; private foundations

Implementation: Universities should develop national and international fellowships at existing humanities and social science computing centers, and develop new centers with such programs, with a combination of university, federal, and private funding.

7. Develop and maintain open standards and robust tools.

Addressed to: Funding agencies, public and private; scholars; librarians; curators; publishers; technologists

Implementation: University consortia such as the Committee on Institutional Cooperation should license the SourceForge software and make it available to open-source developers in academic institutions. The National Endowment for the Humanities (NEH), National Archives and Records Administration (NARA), and the Institute of Museum and Library Services (IMLS) should support the development, maintenance, and coordination of community-based standards such as the Text Encoding Initiative, Encoded Archival Description, Metadata Encoding and Transmission Standard, and Visual Resources Data Standards. The National Science Foundation (NSF), the Andrew W. Mellon Foundation, the IMLS, and other funding agencies should support the development of tools for the analysis of digital content.

8. Create extensive and reusable digital collections.

Addressed to: The National Endowment for the Arts (NEA), the National Endowment for the Humanities (NEH), the Institute of Museum and Library Services (IMLS), the National Archives and Records Administration (NARA), and other funding agencies, both public and private; scholars; research libraries and librarians; university presses; commercial publishers

Implementation: National centers with a focus on particular methods or disciplines can organize a certain amount of scholar-driven digitization. Library organizations and libraries should sponsor discipline-based focus groups to discuss priorities with respect to digitization. When priorities are established, these should be relayed to the organizers of annual meetings on commercial and nonprofit partnerships, and they should be considered in the distribution of grant funds by federal agencies and private foundations. Funding to support the maintenance and coordination of standards will improve the reusability of digital collections. The NEA, NEH, and IMLS should work together to promote collaboration and skills development—through conferences, workshops, and/or grant programs—for the creation, management, preservation, and presentation of reusable digital collections, objects, and products.

Finally, in light of these requirements and in order to realize the promise of cyberinfrastructure for research and education, the Commission calls for specific investments—not just of money but also of leadership—from scholars and scholarly societies; librarians, archivists, and curators; university provosts and university presses; the commercial sector; government; and private foundations.

Chapter 1

Introduction

Chapter 2

What Is Cyberinfrastructure?[1]

2.1 What Is Cyberinfrastructure?

We need first to define our terms—especially the term that is most essential to this report: cyberinfrastructure. The infrastructure of scholarship was built over centuries. It includes diverse collections of primary sources in libraries, archives, and museums; the bibliographies, searching aids, citation systems, and concordances that make that information retrievable; the standards that are embodied in cataloging and classification systems; the journals and university presses that distribute the information; and the editors, librarians, archivists, and curators who link the operation of this structure to the scholars who use it. All of these elements have extensions or analogues in cyberinfrastructure, at least in the cyberinfrastructure that is required for humanities and social sciences.

The 2003 National Science Foundation report Revolutionizing Science and Engineering through Cyberinfrastructure (hereafter referred to as the "Atkins report," after Dan Atkins, who chaired the committee that produced it) described cyberinfrastructureas a "layer of enabling hardware, algorithms, software, communications, institutions, and personnel" that lies between a layer of "base technologies . . . the integrated electro-optical components of computation, storage, and communication" and a layer of "software programs, services, instruments, data, information, knowledge, and social practices applicable to specific projects, disciplines, and communities of practice." In other words, for the Atkins report (and for this one), cyberinfrastructure is more than a tangible network and means of storage in digitized form, and it is not only discipline-specific software applications and project-specific data collections. It is also the more intangible layer of expertise and the best practices, standards, tools, collections and collaborative environments that can be broadly shared across communities of inquiry. "This layer," as the Atkins report notes, "should provide an effective and efficient platform for the empowerment of specific communities of researchers to innovate and eventually revolutionize what they do, how they do it, and who participates." As the NSF panel issuing that report further noted, "if infrastructure is required for an industrial economy, then we could say that cyberinfrastructure is required for a knowledge economy."

One characteristic of infrastructure is that it is deeply embedded in the way we do our work. When it works efficiently, it is invisible: we use it without really thinking about it. When we drive a car, we rely on an infrastructure that includes physical systems of minor and major roads; societal and governmental systems for licensing drivers, setting speed limits, and codifying driver conduct; and economic systems of license fees and gasoline taxes to maintain and expand the roads. The technical and societal systems that make up cyberinfrastructure will need to support the entire range of research goals, legal requirements, and objects of attention for the natural sciences, social sciences, and humanities.

Infrastructure becomes an installed base on which other things are built. Because it is extensive and expensive, infrastructure tends to be built incrementally, not all at once nor everywhere at once. [2]In the hu-

[1]This content is available online at <http://cnx.org/content/m14162/1.1/>.

[2]Susan Leigh Star and Karen Ruhleder, "Steps toward an Ecology of Infrastructure," Information Systems Research 7.1

manities and social sciences, we have been building extensive and widely used collections—digital libraries—over the last fifteen years or more, and we have been developing standards for expressing, exchanging, and preserving these collections. Now it is time to build the tools that will enable new learning and teaching and to develop new audiences who can benefit from this scholarship.

(1999): 111-34.

Chapter 3

What Are the Humanities and Social Sciences?[1]

3.1 What Are the Humanities and Social Sciences?

One definition of the humanities is provided in the National Foundation on the Arts and the Humanities Act [2]of 1965:

> *The term "humanities" includes, but is not limited to, the study of the following: language, both modern and classical; linguistics; literature; history; jurisprudence; philosophy; archaeology; comparative religion; ethics; the history, criticism and theory of the arts; those aspects of social sciences which have humanistic content and employ humanistic methods; and the study and application of the humanities to the human environment with particular attention to reflecting our diverse heritage, traditions, and history and to the relevance of the humanities to the current conditions of national life.*

The social sciences, as they are understood in this report, are actually more difficult to define. The American Council of Learned Societies represents "interpretive" social sciences, that is, social sciences that are more qualitative than quantitative in their methods. But the Commission is not interested in staking out territory, nor does it seem necessary that there should be a one-to-one correspondence between disciplines and commissions or their reports: indeed, the twenty-seven reports on cyberinfrastructure currently listed on the NSF Web page devoted to "Cyberinfrastructure and Its Impacts" [3]make clear that the blurring of these boundaries is one of the characteristics of cyberinfrastructure. If the emerging cyberinfrastructure is to support creativity, inquiry, and the broadest increase of knowledge, it must include the contributions of the humanities and the interpretive social sciences.

[1]This content is available online at <http://cnx.org/content/m14161/1.1/>.

[2]National Endowment for the Arts http://arts.endow.gov/about/Legislation/Legislation.html (<http://arts.endow.gov/about/Legislation/Legislation.html>).

[3]National Science Foundation http://www.nsf.gov/od/oci/reports.jsp (<http://www.nsf.gov/od/oci/reports.jsp>).

Chapter 4

What Is Digital Scholarship?[1]

4.1 What Is Digital Scholarship?

In recent practice, "digital scholarship" has meant several related things:

1. Building a digital collection of information for further study and analysis
2. Creating appropriate tools for collection-building
3. Creating appropriate tools for the analysis and study of collections
4. Using digital collections and analytical tools to generate new intellectual products
5. Creating authoring tools for these new intellectual products, either in traditional forms or in digital form

It may seem odd to some that creating collections and the tools to use them should be counted as scholarship, but humanities and social science research has always required collections of appropriate information, and throughout history, scholars have often been the ones to assemble those collections, as part of their scholarship. Moreover, scholars have been building tools since the first index, the first concordance, the first scholarly edition. So, while it is reasonable to regard (d) as the core meaning and ultimate objective of "digital scholarship," it is also important to recognize that in the early digital era, leadership may well consist of collection-building or tool-building. In addition, tool-building is dependent on the existence of collections, and both collections and tools get better and more general as there is more use of digital information. If we hope to see new intellectual products, we should give high priority to building tools and collections. Finally, it is worth noting that although (a), (b), (c), and (e) require a great deal of cooperation, it is still imaginable that (d) can be the work of a single individual.

[1] This content is available online at <http://cnx.org/content/m14163/1.1/>.

Chapter 5

What Are the Distinctive Needs and Contributions of the Humanities and Social Sciences in Cyberinfrastructure?[1]

5.1 What Are the Distinctive Needs and Contributions of the Humanities and Social Sciences in Cyberinfrastructure?

In the National Foundation on the Arts and Humanities Act of 1965[2]—the legislation that created the National Endowment for the Humanities—two of the leading arguments presented for the act are:

> *(3) An advanced civilization must not limit its efforts to science and technology alone, but must give full value and support to the other great branches of scholarly and cultural activity in order to achieve a better understanding of the past, a better analysis of the present, and a better view of the future.*

> *(4) Democracy demands wisdom and vision in its citizens. It must therefore foster and support a form of education, and access to the arts and the humanities, designed to make people of all backgrounds and wherever located masters of their technology and not its unthinking servants.*

Both of these arguments remain true as we enter into an "advanced civilization" that depends on technology for the daily business of the culture as well as for its education and its research. The humanities and the social sciences are critical players in the development of cyberinfrastructure because they deal with the intractability, the rich ambiguity, and the magnificent complexity that is the human experience.

In the Atkins report, cyberinfrastructure consists of

- grids of computational centers;
- comprehensive libraries of digital objects;
- well-curated collections of scientific data;
- online instruments and vast sensor arrays;
- convenient software toolkits.

Humanities scholars and social scientists will require similar facilities but, obviously, not exactly the same ones: "grids of computational centers" are needed in the humanities and social sciences, but they will have

[1] This content is available online at <http://cnx.org/content/m14160/1.2/>.

[2] National Endowment for the Humanities http://www.neh.gov/nehat40/founding/legislation.html (<http://www.neh.gov/nehat40/founding/legislation.html>).

to be staffed with different kinds of subject-area experts; comprehensive and well-curated libraries of digital objects will certainly be needed, but the objects themselves will be different from those used in the sciences; software toolkits for projects involving data-mining and data-visualization could be shared across the sciences, humanities, and social sciences, but only up to the point where the nature of the data begins to shape the nature of the tools. Science and engineering have made great strides in using information technology to understand and shape the world around us. This report is focused on how these same technologies could help advance the study and interpretation of the vastly more messy and idiosyncratic realm of human experience.

Building a cyberinfrastructure for the humanities and social sciences presents an opportunity to take advantage of prevailing economic, organizational, and technological forces. We have remarkable opportunities to bring new analytic and interpretive power to bear on the materials and the methods of the humanities and the social sciences: by so doing, we can advance our understanding of human cultures past, present, and future. In the process, however, scholars, librarians, publishers, and universities will also have to re-examine their own academic culture, rethinking its outward forms, its established practices, and its apparent assumptions.

The case for why and how to seize this opportunity is presented in the following chapters. Chapter 1 articulates a vision for the future of the humanities and social sciences. Chapter 2 highlights some of the fundamental constraints that could limit our ability to achieve that vision. Chapter 3 presents a framework for making the changes needed to overcome those constraints and for undertaking the online integration of the cultural record.

Chapter 6

Chapter 1: Possibilities

Chapter 7

A Grand Challenge for the Humanities and Social Sciences[1]

7.1 A Grand Challenge for the Humanities and Social Sciences

In the 1970s experimental networks emerged from the university and were, at first gingerly, picked up by the general public. At this stage the most interesting applications for these networks came out of the university world: the Ethernet protocol was developed in Robert Metcalfe's (initially unsuccessful) Harvard dissertation (1973); twenty years later, in April 1993, Mosaic—the first graphical web browser, from which are descended all other browsers that we use today—was released from the National Center for Supercomputing Applications (NCSA) at the University of Illinois, Urbana-Champaign. In the next year, Web traffic grew at an annual rate of 341,634%. [2]By 2004, just about a decade after Mosaic, the networks had become completely public in nature, and they are now thoroughly naturalized by the public. According to the Pew Internet & American Life Project, more than 60% of Americans are online:

> *On a typical day at the end of 2004, some 70 million American adults logged onto the Internet to use email, get news, access government information, check out health and medical information, participate in auctions, book travel reservations, research their genealogy, gamble, seek out romantic partners and engage in countless other activities. That represents a 37% increase from the 52 million adults who were online on an average day in 2000 when the Pew Internet & American Life Project began its study of online life. . . . The Web has become the "new normal" in the American way of life; those who don't go online constitute an ever-shrinking minority.*

By 2005, the Pew Survey reports, the percentage of American adults online had increased—in one year—from 60% to 73%. [3]But it is teenagers (12-17) who have the highest share of Internet participation (87% are online): they regard e-mail as "something for 'old people,"' and they have "embraced the online applications that enable communicative, creative, and social uses. [They] are significantly more likely than older users to send and receive instant messages, play online games, create blogs, download music, and search for school information." [4]

The challenge for scholars and teachers is to ensure that they engage this outpouring of creative energy, seize this openness to learning, and lead rather than follow in the design of this new cultural infrastructure. And, in fact, over the last fifty years, a small but growing number of scholars in the humanities and social sciences have been using digital tools and technologies with increasing sophistication and innovation,

[1]This content is available online at <http://cnx.org/content/m14141/1.2/>.
[2]Hobbes' Internet Timeline v8.0 http://www.zakon.org/robert/internet/timeline/ (<http://www.zakon.org/robert/internet/timeline/>).
[3]http://www.pewinternet.org/pdfs/Internet_Status_2005.pdf (<http://www.pewinternet.org/pdfs/Internet_Status_2005.pdf>).
[4]http://www.pewinternet.org/pdfs/PIP_Generations_Memo.pdf (<http://www.pewinternet.org/pdfs/PIP_Generations_Memo.pdf>).

transforming their practices of collaboration and communication. Some have been true media pioneers, testing the limits of the systems, policies, and funding sources that support digital scholarship. These digital groundbreakers have provided breathtaking views into what could be achieved with a more robust humanities and social science cyberinfrastructure. What new heights would be reached if a leveraged, coordinated investment, as outlined in this report, were undertaken?

Were such an infrastructure available, scholars would not be the only beneficiaries: everyone online could explore connections within a cultural record that is now scattered across libraries, archives, museums, galleries, and private collections around the world, under varying conditions of stability and accessibility. A better understanding of ourselves, our world, and our past would result, as well as a richer framework for learning and scholarship.

In spite of high-profile efforts such as Google Book Search, [5]most of the human record has not yet been digitized, nor is it likely to be for some time to come. For the humanities and social sciences, then, an effective cyberinfrastructure will have to support the computer-assisted use of both physical and digital resources, and it will have to enable communication and collaboration using a range of digital surrogates for physical artifacts; in fact, it will have to embody an understanding of the continuity between digital and physical, rather than promoting the notion that the two are distinct from or opposed to one another. A cyberinfrastructure for humanities and social sciences must encourage interactions between the expert and the amateur, the creative artist and the scholar, the teacher and the student. It is not just the collection of data—digital or otherwise—that matters: at least as important is the activity that goes on around it, contributes to it, and eventually integrates with it.

Creating such an infrastructure is a grand challenge for the humanities and social sciences, and indeed for the academy, the nation, and the world, because a digitized cultural heritage is not limited by or contained within disciplinary boundaries, individual institutions, or national borders. The resources that make up our cultural record are often found far from the site of their creation and use, carried off as spoils of war, relocated to museum exhibitions or storage, or hidden away in private collections. We now have an opportunity to create an integrated digital representation of the cultural record, connecting its disparate parts and making the resulting whole more available to one and all, over the network.

Creating this integrated, networked cultural record will require intensive collaboration among scholars as well as cooperation with librarians, curators, and archivists; the involvement of experts in the sciences, law, business, and entertainment; and active participation from and endorsement by the general public. Enabling anything like seamless access to the cultural record will require developing tools to navigate among vast catalogs of born-digital and digitized materials, as well as the records of physical materials: it will also require addressing daunting problems in digital preservation, copyright, and economic sustainability. The return on this investment will be a humanities and social science cyberinfrastructure that will allow new questions to be asked, new patterns and relations to be discerned, and deep structures in language, society, and culture to be exposed and explored.

Librarians, curators, archivists, and the private sector are already joining forces with the objective of creating universal access to knowledge anywhere and everywhere. The Open Content Alliance has shown that commercial, nonprofit, and university content creators can cooperate in powerful ways to increase open access to cultural resources. Google has as its stated mission "to organize the world's information and make it universally accessible and useful"—albeit not on open-access terms. From a technical perspective, Google Book Search has shown that we can digitize collections of millions of books, although it needs to be acknowledged that even those millions of books constitute only a tiny fraction of the cultural record that exists in archives, museums of all types, and rare book collections as well as, of course, in music, visual arts, maps, photography, movies, radio, television, video games, and other forms of new media.

Librarians speak increasingly today of building the "global digital library," while museum curators talk of "heading toward a kind of digital global museum"; archivists have been experimenting with virtual finding aids that provide unified online access to records that are physically dispersed. [6]Yet the digital medium

[5]http://books.google.com/intl/en/googlebooks/about.html (<http://books.google.com/intl/en/googlebooks/about.html>).

[6]See Deanna Marcum, "The Sum of the Parts: Turning Digital Library Initiatives into a Great Whole,": keynote address to the Joint Conference on Digital Libraries, Denver, Colorado (8 June 2005); and Ben Williams, lead librarian at the Field Museum, quoted in James Gorman, "In Virtual Museums, An Archive of the World," New York Times, 12 Jan. 2003.

is compelling and effective not just because it integrates materials otherwise divided in space and time, but also because it integrates these various genres in ways that make it possible to extend study relatively seamlessly across them. Every day, these nontextual materials proliferate faster than does text, and every day, they grow in importance to fields throughout the humanities and social sciences. Our communications environment already includes not just text but still and moving images, audio files, and social interactivity forums, making it imperative that the humanities and social sciences be included in the process of designing cyberinfrastructure.

As the Internet becomes home to more of our cultural heritage, the issues of access, management, and preservation become ever more critical. In their study "How Much Information," Peter Lyman and Hal R. Varian have tracked the steadily increasing amounts of information produced each year, in all media. In 2003, analyzing chiefly 2002 data, they estimated production of 300 terabytes (TB) of print, 25TB of movies, 375,000TB of digital photography, 987TB of radio, 8,000TB of television, 58TB of audio CDs—and their estimates do not include software (such as video games) or materials originally produced for the Web, or more ephemeral forms of digital information such as phone calls or instant messaging. [7] A Wall Street Journal article in late 2005 described the effort that the National Archives and Records Administration is making to manage the digital output of the federal government: from President George W. Bush's administration, the expected volume of e-mail alone is estimated to be more than 100 million messages. [8]

The challenge is indeed grand in scale; hence, now is the time for ambitious thinking about what advances in information technology and communications networks have to offer the humanities and social sciences, and, in turn, and how such advances can ultimately serve the public.

[7] Peter Lyman, and Hal R. Varian, "How Much Information" (2003) http://www.sims.berkeley.edu/how-much-info-2003 (<http://www.sims.berkeley.edu/how-much-info-2003>).

[8] Anne Marie Squeo, "Oh, Has Uncle Sam Got Mail: As Digital Documents Pile Up, The National Archives Worries about Technical Obsolescence." Wall Street Journal, 29 Dec. 2005.

Chapter 8

Decades of Accelerating Change[1]

8.1 Decades of Accelerating Change

The recent transition to an Internet culture is documented by a series of surveys and reports by the American Council of Learned Societies (ACLS) and the Research Libraries Group (RLG). In the mid-1980s, the ACLS surveyed almost four thousand scholars in the humanities and social sciences to learn what they "think about a wide range of issues of greatest concern to their careers, their disciplines, and higher education in general." The survey's first finding was the "rapid increase in computer use." "In 1980," the report notes, only "about 2 percent of all respondents either owned a computer or had one on loan for their exclusive use." But by 1985, it observes with obvious excitement, "the number was 45 percent, most of whom used it not only for routine word processing but for other purposes as well." Those "other purposes" were, however, clearly minority pursuits. Only about one in five scholars reported using online library catalogs or databases; only one in ten used e-mail; just 7 percent (most of them in classics or linguistics) said that they had used a computer for "theme, text, semantic, or language analysis." [2]

In 1988 RLG published a detailed assessment of information needs in the humanities and social sciences. [3]The responses of the humanists interviewed were consistent across disciplines: they wanted more machine-readable catalogs, indexes, and other finding aids. There was little interest in making full texts available in digital form, partly because the technology was new and untested, but also because scholars were accustomed to the informal, book-based, and often serendipitous browsing methods of research that had been fundamental to humanities scholarship for centuries. Image databases for two- and three-dimensional objects were largely beyond the capacities of the technology— and the budgets—of the time.

The RLG report showed the social sciences to be more dependent on technology than were the humanities; almost every social science discipline in 1988 had a trusted machine-readable index associated with scholarship and research in the relevant academic fields. The social sciences were interested in the availability of electronic databases and datasets for research support; for example, the census and Inter-University Consortium for Political and Social Research (ICPSR) materials were already well established in several disciplines. Scholars in the social sciences also expressed interest in using technology to improve access to conference papers, unpublished research, and technical reports.

In 1997 the ACLS issued a study focusing on information technology in the humanities. [4]Published fewer than ten years after the RLG report, it revealed greater acceptance of technology in the humanities,

[1]This content is available online at <http://cnx.org/content/m14148/1.1/>.

[2]Herbert Charles Morton, Anne J. Price, and Robert Cameron Mitchell, The ACLS Survey of Scholars: Final Report of Views on Publications, Computers, and Libraries (Lanham, MD: University Press of America, 1989).

[3]Constance Gould, Information Needs in the Humanities: An Assessment (Mountain View, CA: Research Libraries Group, 1988).

[4]Pamela Pavliscak, Seamus Ross, and Charles Henry, "Information Technology in Humanities Scholarship: Achievements, Prospects, and Challenges—The United States Focus". (New York: American Council of Learned Societies, 1997). ACLS Occasional Paper No. 37 http://www.acls.org/op37.htm (<http://www.acls.org/op37.htm>).

greater technical knowledge, and a belief that information technology could enrich and influence research. Its chief recommendations included a call for a national strategy for digitizing texts, images, sound, and other media pertinent to the cultural heritage as well as for coordinated large-scale projects to effect this digitization; more pervasive technical standards; greater attention to the challenges of preservation of digital information over time; and a need to promote within the universities a more hospitable environment for computer-supported arts and humanities.

The findings and recommendations of the 1988 RLG report seemed almost quaint to those scholars interviewed less than a decade later, underscoring revolutionary advances in information technology now taken for granted. Almost every scholar regards a computer as basic equipment. Information is increasingly created and delivered in electronic form. E-mail and instant messaging have broadened circles of communication and increased the amount and, arguably, the quality of debate among dispersed scholarly communities. These changes were the result of the availability and usefulness of first-generation cyberinfrastructure.

Networked access to information sources in the humanities and social sciences has increased dramatically in recent years, largely because of the widespread adoption of the Web as a kind of first-generation, all-purpose cyberinfrastructure. Through the Web, Project MUSE [5]offers more than 250 online, full-text contemporary journals in the humanities, arts, and social sciences. The journals can be searched by keywords, and the reader can follow links to relevant footnotes and other related journal articles. JSTOR [6](an abbreviated designation for Journal Storage) is a large archive of older publications, some extending back a hundred years. Currently JSTOR contains 614 journals from 375 publishers, with more than fourteen million pages. Another project, ARTStor, [7]modeled on JSTOR, focuses on art images drawn from many time periods and cultures. ARTStor holds hundreds of thousands of images contributed by museums, archeological teams, and photo archives, as well as tools and indexes that facilitate productive use of this vast collection. InteLex Past Masters [8]is a large dataset of full texts, usually in the form of complete works of major thinkers in the social sciences—particularly economics, political thought and theory, and sociology. Social scientists and students often turn to this Web site for trusted editions of, for example, Charles Darwin, Herbert Spencer, or Adam Smith. For authors who wrote in languages other than English, an English translation is provided. Cogprints [9]is often the first place scholars go for information pertinent to the study of cognition: psychology, anthropology, and other social sciences that include elements of cognitive study are represented by a wealth of digitized research.

[5]Johns Hopkins University http://muse.jhu.edu/ (<http://muse.jhu.edu/>).
[6]http://www.jstor.org/ (<http://www.jstor.org/>).
[7]http://www.artstor.org/ (<http://www.artstor.org/>).
[8]http://library.nlx.com/ (<http://library.nlx.com/>).
[9]Cognitive Sciences Eprint Archive http://cogprints.org/ (<http://cogprints.org/>).

Chapter 9

Cultural Infrastructure and the Public[1]

9.1 Cultural Infrastructure and the Public

In 1990 the World Wide Web was just an idea—or, more specifically, a proposal entitled "Information Management" [2]being circulated by Tim Berners-Lee at CERN (Conseil Européen pour la recherché nucléaire/European Organization for Nuclear Research). In 1993 there were two hundred known Web servers. [3]Ten years later, in 2003, there were forty million servers, and in 2006, that number has doubled to more than eighty million servers hosting billions of Web pages. [4]For many people, access to the Internet and its resources is now indispensable, but it is more than a place where people shop, seek information, or find entertainment. According to the Pew Internet & American Life Project study, [5]the Internet "creates new online town squares" and "enhances the relationship of citizens to their government."

Putting the historical record online opens it to people who rarely have had such access it before. For example, the Library of Congress allows high-school students into its reading rooms only under special circumstances, but any student may enter its American Memory site [6]to view the virtual archive on the same terms of access as the most senior historian or member of Congress. If digitized properly, many online texts and images are accessible to those with visual impairments or other disabilities through screen readers and other supportive technologies.

Digital collections also allow for juxtapositions of works that are held in disparate physical collections. For example, the William Blake Archive [7]not only makes the works of Blake available to the general public but also allows users to juxtapose and compare works that are physically housed in libraries, museums, and art galleries around the world.

This remarkable connectivity has brought scholars into broader communication with nonscholarly audiences, as well. Humanists and social scientists now routinely hear from students and members of the general public who have found their e-mail addresses and have questions. Scholars who have created Web sites based on their work are often pleasantly surprised that their work has found entirely new audiences—or, rather, that new audiences have found that work. Nonacademic users of the University of North Carolina's archival Web site Documenting the American South [8]speak eloquently of feeling "privileged to have access to these primary sources, as if they had entered an inner sanctum where they did not fully belong," reports former

[1]This content is available online at <http://cnx.org/content/m14146/1.1/>.

[2]Tim Berners-Lee http://www.w3.org/History/1989/proposal.html (<http://www.w3.org/History/1989/proposal.html>).

[3]http://www.w3.org/History.html (<http://www.w3.org/History.html>).

[4]Netcraft, "April 2006 Web Server Survey" http://news.netcraft.com/archives/2006/04/06/april_2006_web_server_survey.html (<http://news.netcraft.com/archives/2006/04/06/april_2006_web_server_survey.html>).

[5]Pew Internet & American Life Project, "Internet: The Mainstreaming of Online Life" http://www.pewinternet.org/pdfs/Internet_Status_2005.pdf (<http://www.pewinternet.org/pdfs/Internet_Status_2005.pdf>).

[6]Library of Congress, American Memory http://memory.loc.gov/ammem/index.html (<http://memory.loc.gov/ammem/index.html>).

[7]Library of Congress http://www.blakearchive.org/blake/ (<http://www.blakearchive.org/blake/>).

[8]http://docsouth.unc.edu/ (<http://docsouth.unc.edu/>).

university librarian Joe Hewitt.

Still, access is far from universal. Those who use freely accessible resources will find materials published before World War I more plentiful than newer materials, owing to copyright limitations. Scholars and members of the public who are not affiliated with research universities will find that access to a significant number of resources is by subscription only, and that subscription is priced at a level that only institutions can afford. One independent scholar of history and respondent to a survey on use of digital resources (conducted in the course of the Commission's work by the Center for History and New Media), speaks for many when she says:

> *I am an independent scholar [and] so do not have the kind of access to facilities that academics do. A research associateship at the Five College Women's Studies Research Center allows me the access via Mount Holyoke College, [but] only during the term of the association. So yes, there are problems for those of us not attached to a subscribing institution.*

In addition to digitizing materials, projects to collect and preserve born-digital content are critically important. In 1994, for example, film director Steven Spielberg established Survivors of the Shoah Foundation, with a mission to videotape and preserve the testimonies of Holocaust survivors and witnesses. Today the USC Shoah Foundation Institute's Visual History Archive [9]at the University of Southern California has collected more than fifty-two thousand eyewitness testimonies in fifty-six countries and thirty-two languages, all of which are extensively indexed so that sophisticated searching in the archive can be easily conducted by anyone via the Internet. In 1996 The Internet Archive [10]was founded with the purpose of offering permanent access for researchers, historians, and scholars to historical collections that exist in digital format.

[9]http://www.usc.edu/schools/college/vhi/ (<http://www.usc.edu/schools/college/vhi/>).
[10]http://www.archive.org/index.php (<http://www.archive.org/index.php>).

Chapter 10

Seeing in New Ways[1]

10.1 Seeing in New Ways

Evolving technologies not only provide unprecedented access to a variety of cultural artifacts but also make it possible to see these artifacts in completely new ways. Thanks to high-end digital imaging, we can examine and compare ancient cuneiform inscriptions with new precision and clarity. [2]We can see the much-damaged manuscript of Beowulf in a way that renders the text more legible than the original, and we can "peel back" successive conservation treatments to see how the varying states of the artifact over time have influenced interpretation. [3]Other ambitious and comprehensive editing projects reproduce the complex genealogy of a medieval text [4]or recreate the many sources and states of the works produced across an entire lifetime by an influential nineteenth-century author working in the age of print. [5]Three-dimensional modeling makes it possible to recreate Roman forums, [6]medieval cathedrals, [7]and Victorian exhibitions. [8]These models may provide more than just a sense of place for the user—in the process of building the model, scholars often learn surprising new things about how the originals must have been constructed.

Digital video reformats fragile film and thus gives us access to rare footage of dance performances from the early decades of the last century. [9]Mapping technology allows us to understand the rapid spread of religious hysteria in the Massachusetts Bay Colony during the seventeenth century [10]or to observe the evolution of the built and natural environment around Boston's Back Bay over two centuries. [11]The Valley of the Shadow project contains extensive records in the form of digitized diaries, letters, newspapers, statistical records, and

[1]This content is available online at <http://cnx.org/content/m14157/1.1/>.

[2]University of California, Los Angeles, and Max Planck Institute, Cuneiform Digital Library Initiative (2005) http://cdli.ucla.edu/; InscriptiFact and University of Southern California, West Semitic Research (2004) http://www.inscriptifact.com/ (<http://www.inscriptifact.com/>).

[3]British Library, The Electronic Beowulf (2003) http://www.uky.edu/∼kiernan/eBeowulf/guide.htm (<http://www.uky.edu/∼kiernan/eBeowulf/guide.htm>).

[4]University of Virginia, The Piers Plowman Electronic Archive (2005) http://jefferson.village.virginia.edu/seenet/piers/ (<http://jefferson.village.virginia.edu/seenet/piers/>).

[5]University of Virginia, Institute for Advanced Technology in the Humanities, The Rossetti Archive (2005) http://www.rossettiarchive.org/ (<http://www.rossettiarchive.org/>).

[6]University of California, Los Angeles, Cultural Virtual Reality Lab (2005) http://www.cvrlab.org/ (<http://www.cvrlab.org/>).

[7]University of Virginia, Institute for Advanced Technology in the Humanities, Salisbury Project, Cathedral Model (2005) http://www3.iath.virginia.edu/salisbury/model/index.html (<http://www3.iath.virginia.edu/salisbury/model/index.html>).

[8]University of Virginia, Institute for Advanced Technology in the Humanities, The Crystal Palace (2005) http://www.iath.virginia.edu/london/model/ (<http://www.iath.virginia.edu/london/model/>).

[9]See, e.g., the Library of Congress's American Memory site's List of Variety Stage Films http://www.memory.loc.gov/ammem/vshtml/vsfmlst.html (<http://www.memory.loc.gov/ammem/vshtml/vsfmlst.html>).

[10]University of Virginia, The Salem Witch Trials (2005) http://etext.virginia.edu/salem/witchcraft/home.html (<http://etext.virginia.edu/salem/witchcraft/home.html>).

[11]University of Virginia, Institute for Advanced Technology in the Humanities, Evolutionary Infrastructure (2005) http://www3.iath.virginia.edu/backbay/ (<http://www3.iath.virginia.edu/backbay/>).

photographs and other images of the period leading up to and following the Civil War; it also has animated maps of battles that visually reconstruct troop movements, points of battle engagement, and other data drawn from army and navy records of the time. [12]

These and other digital projects show how digital technology can offer us new ways of seeing art, new ways of bearing witness to history, new ways of hearing and remembering human languages, new ways of reading texts, ancient and modern. With some extension, the same infrastructure used for such projects can also allow us to work in collaboration with distant colleagues who provide complementary expertise, and whom we may meet face-to-face only rarely. And all of this is about access: access to colleagues; or access through digital representations to distant, damaged, or disappeared physical artifacts; or intellectual access to the meaning or significance of these artifacts.

[12] University of Virginia, The Valley of the Shadow (2005) http://valley.vcdh.virginia.edu/ (<http://valley.vcdh.virginia.edu/>).

Chapter 11

Working in New Ways[1]

11.1 Working in New Ways

In the last decade, users of the Web have gained unprecedented access to pre–twentieth-century cultural materials, but the real promise of our digital collections has yet to be realized. There is still a long way to go before we achieve even basic access to primary sources that will allow scholars and public researchers to work in new ways. A survey of special collections that was conducted by the Association of Research Libraries in 1998 found that the uncataloged backlog of manuscript collections represented one-third of repository holdings. A similar survey conducted in 2003–2004 showed that 34% of archives and manuscript repositories have at least half of their holdings unprocessed; 60% have at least one-third of their collections unprocessed. [2]"Unprocessed" and "uncataloged" mean that no online catalog entries exist, nor are there in-house catalogs, indexes, or finding aids.

Users of these massive aggregations of text, image, video, sound, and metadata will want tools that support and enable discovery, visualization, and analysis of patterns; tools that facilitate collaboration; an infrastructure for authorship that supports remixing, recontextualization, and commentary—in sum, tools that turn access into insight and interpretation. Examples might include humanities text-mining (discussed more specifically below), as in the Nora project, [3]or works of seemingly more traditional scholarship that rely on digital tools, such as Ed Ayers's book In the Presence of Mine Enemies (Norton, 2003), which unfolds a tale of the daily life of ordinary people during the Civil War that could not have been researched and developed without access to the gigabytes of digitized historical sources that constitute the Valley of the Shadow project. [4]

If the promise of cyberinfrastructure is to be realized, humanists and social scientists must take the lead in directing the design and development of the tools their disciplines will use. We will require support systems for that development: research centers that are national repositories of expertise, postdoctoral programs that emphasize digital scholarship, and graduate programs that train the rising generation in the methods of digital research and scholarship.

What will those tools, customized for the humanities and social sciences, do? A general answer to that question was offered to the Commission in its first public hearing by Michael Jensen, electronic publisher for the National Academies Press: "Human interpretation is the heart of the humanities. . . . devising computer-assisted ways for humans to interpret more effectively vast arrays of the human enterprise is the major challenge." In practice, this means that tools for use with digital libraries will need to enable the user to find patterns of significance (heuristics) in very large collections of information, across many different types

[1]This content is available online at <http://cnx.org/content/m14164/1.1/>.

[2]Mark A. Greene and Dennis Meissner, "More Product, Less Process: Revamping Traditional Archival Processing," American Archivist 68 (Fall/Winter 2005): 208-63.

[3]http://www.noraproject.org/ (<http://www.noraproject.org/>).

[4]University of Virginia http://valley.vcdh.virginia.edu/ (<http://valley.vcdh.virginia.edu/>).

of data, and then interpret those patterns (hermeneutics). In the humanities and social sciences, heuristics and hermeneutics are core activities.

In the world at large, the activity of discovering and interpreting patterns in large collections of digital information is called data-mining (or sometimes, when it is confined to text, text-mining), but data-mining is only one investigative method, or class of methods, that might become more useful in the humanities and the social sciences as we bring greater computing power to bear on larger and larger collections and more complex research questions, often with outcomes in areas other than that for which the data was originally collected. Beyond data-mining, there are many other ways of animating and exploring the integrated cultural record. They include simulations that reverse-engineer historical events to understand what caused them and how things might have turned out differently; game-play that allows us to tinker with the creation and reception of works of art; [5]role-playing in social situations with autonomous agents, or using virtual worlds to understand behavior in the real world. [6]

We can design the software tools, computer networks, digital libraries, archives, and museums that are needed to assemble, preserve, and examine the human record in all of its "variety, complexity, incomprehensibility, and intractability," as Henry Brady, Professor of Political Science and Public Policy and Director of The Survey Research Center at the University of California, Berkeley, described it during his August 2004 testimony to the Commission. [7]But many barriers stand between us and a future in which we might realize something approaching the unification of the cultural record. Some of these barriers are technical, but the more formidable ones are human and societal—whether legal, organizational, disciplinary, political, or economic. Humanists and social scientists, being experts in human culture and social problems, should be well trained to address these challenges, but they will need to begin with their own organizations, disciplines, politics, and reward systems. The next chapter addresses these challenges.

[5]Applied Research in Patacriticism, IVANHOE (2005) http://www.patacriticism.org/ivanhoe/ (<http://www.patacriticism.org/ivanhoe/>).

[6]See, e.g., Joshua Epstein, Generative Social Science: Studies in Agent-Based Computational Modeling (Princeton: Princeton University Press, 2006), and Edward Castronova, Synthetic Worlds: The Business and Culture of Online Games (Chicago: University of Chicago Press, 2005).

[7]http://www.acls.org/cyberinfrastructure/cyber_meeting_notes_august.htm#brady_summary (<http://www.acls.org/cyberinfrastructure/cyber_meeting_notes_august.htm#brady_summary>).

Chapter 12

Chapter 2: Challenges

Chapter 13

Ephemerality[1]

The Commission has identified six key challenges that must be engaged if we intend to build a robust cyberinfrastructure:

- The ephemeral nature of digital data
- The nature of humanities and social science data
- Copyright laws
- The conservative culture of scholarship
- Uncertainty about the future mechanisms, forms, and economics of scholarly publishing and scholarly communication more generally
- Insufficient resources, will, and leadership to build cyberinfrastructure for the humanities and social sciences

13.1 Ephemerality

The study of human cultures and creativity is founded on access to the records of the past. Preserving and ensuring the authenticity of the artifacts and records of the past is one of the most valued functions of libraries, archives, and museums—and yet we have only begun to learn how to do these things with the political, economic, social, and cultural record of our increasingly digital civilization. [2]Digital data are notoriously fragile, short-lived, and easy to manipulate without leaving obvious evidence of fraud. Therefore, such content is best preserved in trustworthy repositories, without which there will be critical breaks in the chain of evidence. Although sites such as YouTube, Flickr, Facebook, and MySpace [3]have become popular for hosting digital collections, they are not repositories that ensure long-term access to the content. The rapid turnover in digital hardware and software often leaves digital data marooned on media or in formats that can no longer be accessed and that are highly susceptible to deterioration and loss. Preservation requires the scrupulous management of data from the moment it enters a repository through the steps of validation, storage, migration, and delivery to parties that have been authenticated and authorized to receive it. These are complex technical procedures dependent on standards and protocols that work quickly and reliably. Preservation was once an obscure backroom operation of interest chiefly to conservators and archivists: it is now widely recognized as one of the most important elements of a functional and enduring cyberinfrastructure.

[1]This content is available online at <http://cnx.org/content/m14149/1.1/>.

[2]For an overview of some of the preservation issues and literature, see Daniel J. Cohen and Roy Rosenzweig, "Preserving Digital History," in Digital History: A Guide to Gathering, Preserving, and Presenting the Past on the Web (Philadelphia: University of Pennsylvania Press, 2005) http://chnm.gmu.edu/digitalhistory/preserving/ (<http://chnm.gmu.edu/digitalhistory/preserving/>).

[3]YouTube http://www.youtube.com/ (<http://www.youtube.com/>); Flickr http://www.flickr.com/ (<http://www.flickr.com/>); Facebook http://www.facebook.com/ (<http://www.facebook.com/>); MySpace http://www.myspace.com/ (<http://www.myspace.com/>).

Chapter 14

The Nature of Humanities and Social Science Data[1]

14.1 The Nature of Humanities and Social Science Data

Digitizing the products of human culture and society poses intrinsic problems of complexity and scale. The complexity of the record of human cultures—a record that is multilingual, historically specific, geographically dispersed, and often highly ambiguous in meaning—makes digitization difficult and expensive. Moreover, a critical mass of information is often necessary for understanding both the context and the specifics of an artifact or event, and this may include large collections of multimedia content: images, text, moving images, audio. Humanities scholars are often concerned with how meaning is created, communicated, manipulated, and perceived. Recent trends in scholarship have broadened the sense of what falls within a given academic discipline: for example, scholars who in the past might have worked only with texts now turn to architecture and urban planning, art, music, video games, film and television, fashion illustrations, billboards, dance videos, graffiti, and blogs.

The archive of the University of Southern California's USC Shoah Foundation Institute for Visual History and Education [2]is a good example of the value of critical mass or functional completeness. The tale of what happened to one or two families, in one or two villages, in one or two countries, during the Holocaust is worth recording and disseminating. But we can gain far more knowledge from the record of some fifty-two thousand testimonies. In history, art history, classics, or any other scholarly enterprise that benefits from a comprehensive comparative approach, quantity can become quality.

The problems of digitizing cultural documents are multiplied when these documents have many audiences. Within the social sciences and humanities, there can be numerous subject specialists who want access to the same sources for different reasons. For example, the Roman de la Rose Project, a stunning digital collection of the major illuminated manuscripts of the Roman de la Rose, a popular medieval literary work, [3]is used by literary scholars, art historians, linguists, social historians, and preservation specialists, each of whom has a different disciplinary perspective and vocabulary. Students and the general public often use such documents as well, and since those audiences want further contextualization, the data or evidence itself needs to carry, within itself, more self-description and more cues about the context in which it belongs.

[1]This content is available online at <http://cnx.org/content/m14159/1.1/>.

[2]http://www.usc.edu/schools/college/vhi/ (<http://www.usc.edu/schools/college/vhi/>).

[3]Johns Hopkins University and the Pierpont Morgan Library, Roman de la Rose http://rose.mse.jhu.edu/ (<http://rose.mse.jhu.edu/>).

Chapter 15

Copyright[1]

15.1 Copyright

The framers of the U.S. Constitution sought to balance the rights of the creators of intellectual property and the claims of the larger community. Article 1, Section 8, grants Congress the power to give "authors and inventors the exclusive right to their respective writings and discoveries," but it also specifies that such rights be granted only "for limited terms" and with the purpose of promoting "the progress of science and the useful arts." Today, because of the scale of investment that is required in order to create a unified cultural record online, the participation of commercial entities is essential, and yet many people (including most of those from whom the Commission heard) believe that the balance has been upset and that the property claims of rights holders are interfering with the promotion of intellectual and educational progress.

The most notable recent U.S. Supreme Court decision on copyright—Eldred v. Ashcroft (2003)—involved someone who was seeking to disseminate works in the humanities to a broad public. Eric Eldred was the organizer of the Eldritch Press Web site, [2]dedicated to providing, for free, works bynineteenth-century authors such as Nathaniel Hawthorne. Eldred had wanted to add to his Web site Robert Frost's poetry collection New Hampshire, which was slated to pass into the public domain in 1998, [3]but the Sonny Bono Copyright Term Extension Act of 1998 (CTEA) halted his plans. Eldred sued to overturn CTEA on the grounds that its twenty-year extension subverted the constitutional provision of "limited" copyright terms and did nothing to promote new creativity. Eldred's case was heard and his argument was rejected by the Supreme Court. Unrestricted access to our cultural heritage in digital form currently ends in 1923: all of Hawthorne is up on the Web, but most of F. Scott Fitzgerald is not. Copyright restrictions will limit the Library of Congress's planned World Digital Library: because the project intends to digitize only material in the public domain, it will have to exclude the great majority of cultural works of the twentieth century.

Obtaining permission to digitize books, even if they are out of print, entails high transaction costs: it can be difficult, if not impossible, to locate the current owners of copyrighted works. In a study assessing the feasibility of obtaining permission from 209 publishers to digitize 277 titles published between 1920 and 2000, librarians at Carnegie Mellon University found that a quarter of the publishers could not be located, only half of the publishers responded after repeated efforts to contact them, and, in the end, permission was granted for only 25% of the titles. [4]

It is equally frustrating that many lesser-known creative and cultural works—not just books, but also photographs, drawings, films, and other materials—from the 1920s and later years cannot be made available

[1]This content is available online at <http://cnx.org/content/m14145/1.1/>.

[2]http://www.ibiblio.org/eldritch/ (<http://www.ibiblio.org/eldritch/>).

[3]See http://www.legalaffairs.org/issues/March-April-2004/story_lessig_marapr04.msp (<http://www.legalaffairs.org/issues/March-April-2004/story_lessig_marapr04.msp>).

[4]Denise Troll Covey, Acquiring Copyright Permission To Digitize and Provide Open Access to Books, October 2005, Digital Library Federation and Council on Library and Information Resources. Persistent URL http://purl.oclc.org/dlf/trollcovey0509 (<http://purl.oclc.org/dlf/trollcovey0509>).

online simply because the rights holders are difficult or impossible to find. Because recent copyright law has eliminated the requirement that rights holders formally apply for renewal, the copyrights of these so-called orphan works are automatically extended. Although such works often lack commercial value, the expense and difficulty of locating the rights holders blocks their digitization. Most institutions want to avoid the risk of litigation should rights holders surface after the works have been made broadly accessible. In January 2006 the U.S. Copyright Office issued a report [5]on orphan works; hearings were held in the House and the Senate, and, as of this writing, it seems likely that legislation will be introduced to remedy this situation.

Even more complex issues arise in providing access to unpublished works (manuscripts and letters, for example), a category of particular importance to the humanities. Many sound recordings, too, are effectively "protected" from being reproduced in the practice of scholarship until the latter half of the twenty-first century, when any scholar now engaged in research is likely to be dead. [6]

Current copyright laws not only keep most twentieth-century works from becoming available in digital form but also threaten the preservation of born-digital works. Although the copyright code currently has several important provisions that enable libraries and archives to make copies for preservation, these provisions are threatened by the transition to digital distribution. Section 108 of the copyright code is one such provision. It allows libraries and archives to duplicate works under copyright (in quantities specified by case law) to preserve their intellectual content. This provision covers the right of libraries and archives to copy works from one medium to another, such as brittle paper to microfilm or nitrate film to safety stock, and permits copying to digital form for preservation purposes (not for access). Yet it is not clear that all the forms of copying needed for secure digital archiving are allowable under the law.

The provisions of Section 108, created for the world of print, need to be recast for the age of digital replication. As the 1998 Digital Millennium Copyright Act (DMCA) demonstrates, when recasting copyright law, it is important to consider unintended consequences. The DMCA lacks all of the fair use provisions outlined in Section 107 of the Copyright Act [7]and criminalizes all efforts to circumvent devices that prevent duplication of digital materials, including efforts made to copy electronic materials for preservation. Without such an exception, the preservation of published electronic materials is seriously jeopardized, and the problem is bound to escalate as more and more content is distributed digitally. The DMCA has also eroded the ability of public libraries, and, indeed, of any library that is not exceptionally well funded, to serve its patrons in a digital age, while putting at risk many digital projects such as those described earlier. In other words, we could become much worse off than we have been, historically, simply because existing law thwarts a reliable and cost-effective means to preserve cultural content as a public service. [8]

[5]U.S. Copyright Office http://www.copyright.gov/orphan/ (<http://www.copyright.gov/orphan/>).

[6]Most sound recordings issued before 1972 are protected until 2067. Before 1972, sound recordings were protected by varying state laws rather than by federal law. The 1976 Copyright Act exempted recorded sound from federal protection until 2047; this date was changed to 2067 with the passage of the 1998 Sonny Bono Copyright Term Extension Act. The implications of these protections for preservation are explored in a recent report by June M. Besek, Copyright Issues Relevant to Digital Preservation and Dissemination of Pre-1972 Commercial Sound Recordings by Libraries and Archives, December 2005, Council on Library and Information Resources and Library of Congress http://www.clir.org/pubs/abstract/pub135abst.html (<http://www.clir.org/pubs/abstract/pub135abst.html>).

[7]Section 107 lists the purposes for which the reproduction of a particular work may be considered "fair," such as criticism, comment, news reporting, teaching, scholarship, and research. For a discussion of fair use, see Marjorie Heins and Tricia Beckles, Will Fair Use Survive? Free Expression in the Age of Copyright Control, 2005, Brennan Center for Justice at the New York University School of Law http://www.fepproject.org/policyreports/WillFairUseSurvive.pdf (<http://www.fepproject.org/policyreports/WillFairUseSurvive.pdf>).

[8]For a concrete example of the effects that legal issues have on archiving efforts, see Jeff Ubois, "New Approaches to Television Archiving," First Monday 10.3 (March 2005) http://firstmonday.org/issues/issue10_3/ubois/index.html (<http://firstmonday.org/issues/issue10_3/ubois/index.html>).

Chapter 16

The Conservative Culture of Scholarship[1]

16.1 The Conservative Culture of Scholarship

In response to the Commission's invitation for public comment on the draft of this report, Dickie Selfe (director of Michigan Technological University's Center for Computer-Assisted Language Instruction) observed that the "challenge of cyberinfrastructure is primarily a challenge to our own academic cultures. This report is an opportunity to admit to that challenge and to commit to cultural change." The university is an ancient institution, so it is not surprising that its culture is conservative, especially in the humanities—one of the oldest faculties of the university. Robert Darnton, a prominent scholar of French history, remarked at the Commission hearings that the structural elements of the academy have not changed, even though the world has. A recent study of the state of online American literary scholarship identified several cultural features among humanists that seem to militate against change. [2]Despite the demonstrated value of collaboration in the sciences, there are relatively few formal digital communities and relatively few institutional platforms for online collaboration in the humanities. In these disciplines, single-author work continues to dominate. Lone scholars, the report remarked, are working in relative isolation, building their own content and tools, struggling with their own intellectual property issues, and creating their own archiving solutions.

Many have contrasted this pattern to that found among technology-intensive sciences and engineering, in which "large, multidisciplinary teams of researchers" work "in experimental development of large-scale, engineered systems. The problems they address cannot be done on a small scale, for it is scale and heterogeneity that makes them both useful and interesting." [3]In contrast to this collaborative model, Stephen Brier, Vice President for Information Technology and External Programs of the City University of New York, told the Commission, "Humanists tend to be more focused on individual theorizing and communicating of ideas and information about their disciplines. Technology is not seen as a necessary, let alone a required, tool for collaboration in the humanities the way it is in the sciences."

Most people the Commission interviewed expressed hope that an investment in cyberinfrastructure would allow humanists and social scientists to "conduct new types of research in new ways." To take advantage of the technology, one must engage directly with it, and one must allow traditions of practice to be flexibly influenced by it. One such tradition in the humanities is that of the "individual genius." Nevertheless, many of the examples cited in this report show us that humanists can be highly collaborative and that by working in groups, they can sometimes address research questions of greater scope, scale, and complexity than any individual—even a brilliant one—could address in isolation.

[1]This content is available online at <http://cnx.org/content/m14158/1.1/>.

[2]Martha Brogan, A Kaleidoscope of Digital American Literature (Washington, DC: Digital Library Federation and Council on Library and Information Resources, 2005).

[3](Chatham, 11)

Chapter 17

Culture, Value, and Communication[1]

17.1 Culture, Value, and Communication

The European Commission's Web site Knowledge Society [2]posits that:

> *Our society is now defined as the "Information Society", a society in which low-cost information and ICT [Information and Communication Technology] are in general use, or as the "Knowledge (-based) Society", to stress the fact that the most valuable asset is investment in intangible, human and social capital and that the key factors are knowledge and creativity. This new society presents great opportunities: it can mean new employment possibilities, more fulfilling jobs, new tools for education and training, easier access to public services, increased inclusion of disadvantaged people or regions.*

One of the strategic goals set for Europe by the European Council is "to become the most competitive and dynamic knowledge-based economy in the world" by 2010. Clearly, other developed nations understand that economic growth is a function of knowledge and creativity, and that information is increasingly the core asset held by companies, the key social good produced by governments, and the determining factor in individual quality of life.

A key component of the knowledge society is education, and education requires preservation of the record of the past as well as ongoing scholarship and research. Education, scholarship, and research all require the sharing of data and the communication of results. The system of scholarly communication includes scholars, publishers, libraries, and readers. Readers receive work that is produced by scholars using resources made available by publishers and held in or found through libraries. Scholars create value by doing research, thinking, and writing. Publishers add value through peer review, editing, and design. Libraries add value by collecting, organizing, and preserving scholarship, and, of course, by making it accessible. At least three economies are at work in this system:

1. A prestige economy, primary for scholars and important but secondary for the other players
2. A market economy, primary for publishers, usually not very important to scholars, and important but not primary for libraries
3. A subsidy economy, primary for libraries, which are subsidized by universities, less available to publishers than it used to be, and more important to scholars than they generally know

It should be no surprise that a system that comprises three different economies is difficult to operate successfully. When it does work, it has a certain elegance: each party contributes from its own sense of mission, and each gets paid in its own currency. The system has not always worked this way, though, and it may not

[1]This content is available online at <http://cnx.org/content/m14147/1.1/>.
[2]http://ec.europa.eu/employment_social/knowledge_society/index_en.htm (<http://ec.europa.eu/employment_social/knowledge_society/in

continue to work this way much longer: at present, there seems to be general agreement that the system is broken, or breaking. [3]

Scholarship cannot exist without a system of scholarly communication: the cost of that system is a necessary cost of doing academic business. One could say that every part of this system is subsidized—from faculty to presses to libraries—and one could equally well say that every part operates under significant financial constraints. In the case of university-based publishers, institutional subsidy has declined in recent years, forcing university presses to behave more like commercial entities. [4]If, however, we take a longer view of the information life cycle in universities, revenue from sales may not be the best measure of the value of scholarship. It may make more sense to conceive of scholarly communication as a public good than as a marketable commodity.

The phrase "public good" often refers to the idea that there are good things—things of special social value—that ought to be produced for free public use rather than as a marketable commodity. [5]Common examples of public goods are national defense, vaccination programs, the GPS navigation system, dams, and public art. Education is often spoken of in these terms, and although education is to some extent exclusive (or there would not be systems of limited admissions), knowledge itself—as represented in scholarship and research—is not. Thomas Jefferson put it most eloquently: "He who receives an idea from me, receives instruction himself without lessening mine; as he who lights his taper at mine, receives light without darkening me." [6]Private goods are a clear contrast to this: if one person eats an apple, a second person cannot eat the same apple; but one person can teach another how to spell apple without thereby losing that knowledge. In the case of public goods, charging a price invariably reduces social welfare relative to what is possible.

On the other hand, although public goods can be extended to more users at or near zero cost, they can be quite costly to produce in the first place. The case of digitally produced scholarship is an excellent example. Economic theory tells us is that we ought to charge nothing for it at the margin: we ought to give it away. On the other hand, it tells us nothing about how to pay for its production or how much of it to produce. It does tell us that markets will underproduce this kind of good, though, and it also tells us that, as a general matter, the solution of public-goods problems requires collective action.

Collectively, then, we should act to support the system of scholarly communication as a public good—and this collective action must be as broad as possible, including not only those universities with presses, but also all universities with faculty, libraries, students, and public outreach. After all, the social value produced by the system as a whole is enjoyed by all of these constituents.

[3]For an in-depth look at the pressures faced in one part of the system, by scholarly publishers, see John B. Thompson, Books in the Digital Age (Cambridge: Polity Press, 2005). Concerning the pressures faced by scholars, the Modern Language Association (MLA) has appointed a Task Force on Evaluation of Scholarship for Tenure and Promotion, which will complete its work this year and is expected to address how the tensions within the scholarly communication system are affecting junior faculty: see http://www.insidehighered.com/news/2005/12/30/tenure (<http://www.insidehighered.com/news/2005/12/30/tenure>)for summary. information. For a library perspective, see the series of reports collected under the heading "Managing Economic Challenges" at the Council on Library and Information Resources http://www.clir.org/pubs/reports/managing.html (<http://www.clir.org/pubs/reports/managing.html>), or OCLC Online Computer Library Center, Environmental Scan: Pattern Recognition (2003) http://www.oclc.org/reports/escan/ (<http://www.oclc.org/reports/escan/>).

[4]According to Peter Givler's "University Press Publishing in the United States" http://aaupnet.org/resources/upusa.html (<http://aaupnet.org/resources/upusa.html>)(fn. 14) (originally published in Scholarly Publishing, ed. Richard E. Abel, Lyman W. Newlin, and Katina Stauch [New York: Wiley 2002]), From 1988 to 1998, the average parent institution support among reporting presses declined from 10.4 percent of net sales to 6.3 percent, for a loss of 4.1 percent; during the same period, outside gifts and grants increased, as a percentage of net sales, by only 1.6 percent, for a net loss in non-publishing income of 2.5 percent.

[5]There is also an economic construct—not unrelated, but not the same—called a "pure public good." This more abstract concept derives from the production and use of a good, and it is worth noting that pure public goods (for example, air pollution) may not always be good things. The defining characteristic of a pure public good is that one can add more consumers without diminishing the quantity of the good available to others. National defense, the system of contract law (as distinct from litigation itself), standards, and information are all examples of pure public goods.If, for the pure public good, the cost of adding another consumer approaches zero, then it follows as a matter of economic efficiency that the market price ought to be zero, because to charge something for an item that costs nothing to produce at the margin is to pass up possible value—the value of making someone better off while doing no harm.

[6]Thomas Jefferson, "To Isaac McPherson," 13 Aug. 1813, in Writings of Thomas Jefferson, ed. H. A. Washington, vol. 6 (Washington, DC: Taylor & Maury, 1853–1854) 180-81.

In considering how best to organize the publishing side of scholarly communication, it will also be important to be open to new business models. Received opinion and settled assumptions may be very costly, both in terms of missed opportunities and in terms of unforeseen expenses. For example, defying conventional wisdom, the National Academy Press has for some time now been distributing the content of its monographs free on the Web, and (thanks in part to a carefully thought-out strategy for doing that) it has seen its sales of print increase dramatically.

By comparison with print, born-digital scholarship will be expensive for publishers to create and, over time, even more expensive for libraries to maintain. Even considering these costs, however, owning and maintaining digital collections locally or consortially, rather than renting access to them from commercial publishers, is likely to be a cost-cutting strategy in the long run. If universities do not own the content they produce—if they do not collect it, hold it, and preserve it—then commercial interests will certainly step in to do the job, and they will do it on the basis of market demand rather than as a public good. If universities do collect, preserve, and provide open access to the content they produce, and if everyone in the system of scholarly communication understands that the goods being produced and shared are in fact public goods and not private property, the remaining challenge will be to determine how much, and what, to produce.

Such questions would normally be answered with reference to demand, and, indeed, one analysis of the "crisis in scholarly publishing" is that it is a crisis of audience. Average university-press print runs are now in the low hundreds, and although digital printing lowers the unit cost for printing short runs of books, selling fewer books raises the cost per copy to the library or scholar and makes it harder for the publisher to cover pre-press costs, which are still the most significant portion of the total cost of producing a book or article. On the other hand, university presses could (and should) expand the audience for humanities scholarship by making it more readily available online. Unless this public good can easily be found by the public—by readers outside the university—demand is certain to be underestimated and undersupplied.

We note that some university presses have already made great strides in electronic publishing—Johns Hopkins's Project MUSE, [7]Illinois's History Cooperative, [8]and the University of Virginia Press's Rotunda [9]series, to name a few. The Rice University Press, closed in 1996, is being brought "back to life as the first fully digital university press in the United States." [10]Some scholarly societies, such as the American Historical Association, also have experimented with publishing born-digital scholarship. These and other experiments in electronic publishing in the humanities and social sciences, and experiments in building and maintaining digital collections in libraries and institutional repositories, need to be supported as they move toward sustainability, and they need to be funded (by universities, by private foundations, and by the public) with the expectation that they will move toward open access—an area in which many of the natural sciences and some social sciences are conspicuously ahead of the humanities. [11]Open-source software is an instructive analogue here, and the experience in that community suggests, strongly, that one can build scalable and successful economic enterprises on the basis of free intellectual property. [12]It is worth noting, too, that the "Economy of Regard" (that is, prestige) is one of the factors used to explain why this open economy works. [13]

As in the open-source community, [14]however, there are real resources in play, and those who contribute to them must have some motivation to do so. According to Kate Wittenberg, director of Electronic Publishing

[7]http://muse.jhu.edu/ (<http://muse.jhu.edu/>).

[8]http://www.historycooperative.org/ (<http://www.historycooperative.org/>).

[9]http://rotunda.upress.virginia.edu/ (<http://rotunda.upress.virginia.edu/>).

[10]Rice University Press http://ricepress.rice.edu/ (<http://ricepress.rice.edu/>).

[11]See John Willinsky, The Access Principle (Cambridge: Massachusetts Institute of Technology Press, 2005).

[12]See Bruce Perens, "The Emerging Economic Paradigm of Open Source" http://perens.com/Articles/Economic.html (<http://perens.com/Articles/Economic.html>)(2005).

[13]See Paul A. David and Rishab Aiyer Ghosh, "Free and Open Source Software Developers and 'the Economy of Regard': A Quantitative Analysis of Code-Signing Patterns within the Linux Kernel," Stanford Institute for Economic Policy Research, SIEPR-Project NOSTRA Working Paper, 2004 http://siepr.stanford.edu/programs/OpenSoftware_David/Free%20and%20Open%20Source%20Software.html (<http://siepr.stanford.edu/programs/OpenSoftware_David/Free%20and%20Open%20Source%20Software.html>).

[14]See Jill Coffin, "An Analysis of Open Source Principles in Diverse Collaborative Communities," First Monday 11.6 (June 2006) http://www.firstmonday.org/issues/issue11_6/coffin/index.html (<http://www.firstmonday.org/issues/issue11_6/coffin/index.html>).

in Columbia (EPIC), such enterprises must "find a way in which the technical infrastructure and some aspects of workflow systems might be created centrally and then shared by a variety of projects in the humanities and social sciences." She adds, "For EPIC and similar organizations, finding an answer to this challenge would be extremely valuable: [it would make] use of existing infrastructure to create efficiencies in organizations with minimal staffing." [15]One model of shared infrastructure outside the United States is Érudit, an initiative of Les Presses de l'Université de Montréal. Érudit offers a range of services tailored to different kinds of academic publications and "is intended to serve as an innovative means of promoting and disseminating the results of university research." [16]Another model might be a scaled-up version of EPIC itself, which is a collaboration among Columbia University's press, libraries, and academic information systems. [17]The cooperation between the University of California Press and the California Digital Library is another promising example.

[15]http://www.acls.org/cyberinfrastructure/cyber_meeting_notes_june.htm#wittenberg_summary (<http://www.acls.org/cyberinfrastructure/cyber_meeting_notes_june.htm#wittenberg_summary>).
[16]Érudit http://www.erudit.org/en/index.html (<http://www.erudit.org/en/index.html>).
[17]EPIC http://www.epic.columbia.edu/ (<http://www.epic.columbia.edu/>).

Chapter 18

Resources[1]

18.1 Resources

By any standard, investment in an American cyberinfrastructure is meager, as is U.S. research funding in general. [2]In 2003 the Atkins report recommended annual expenditures of $1 billion to create a cyberinfrastructure for science and engineering; in 2005 funding specifically designated to shared cyberinfrastructure at the National Science Foundation (NSF) was about $123 million. On a per capita basis, Australia, Canada, and the United Kingdom and other European countries have made proportionally much greater investments in developing a broadly accessible cyberinfrastructure than has the United States. The countries of the European Union arguably are far ahead of the United States, especially in the humanities and social sciences areas, given their recent investments in digital cultural heritage. [3]

One example of the kind of resource we need to develop here in the United States is the UK Data Archive, a "centre of expertise in data acquisition, preservation, dissemination and promotion and . . . curator of the largest collection of digital data in the social sciences and humanities in the UK." The Data Archive is funded by the Economic and Social Research Council (ESRC), the Joint Information Systems Committee (JISC) of the Higher Education Funding Councils, and the University of Essex. [4]

In the United States, the only similar institution is the Inter-University Consortium for Political and Social Research (ICPSR), established in 1962. There is no direct equivalent of the Arts and Humanities Data Service (AHDS), mentioned in the UK Data Archive description and founded in 1996 as a "UK national service aiding the discovery, creation and preservation of digital resources in and for research, teaching and learning

[1]This content is available online at <http://cnx.org/content/m14156/1.1/>.

[2]According to Vinton Cerf and Harris N. Miller in the Wall Street Journal (27 July 2005), "our total national spending on R&D is 2.7% of our GDP, and now ranks only sixth in the world. The federal government's share of total national R&D spending has fallen from 66% in 1964 to 25%" in 2005.

[3]See, e.g., these recent publications, which describe serious investment in humanities and social sciences cyberinfrastructure in the United Kingdom and the European Union: British Academy, E-resources for Research in the Humanities and Social Sciences—A British Academy Policy Review (2005) http://www.britac.ac.uk/reports/eresources/ (<http://www.britac.ac.uk/reports/eresources/>)(20 May 2005).British Academy, Future Directions for Social Science: A Response from the British Academy (2004) http://www.britac.ac.uk/news/reports/esrc-0904/esrc0904-html.htm (<http://www.britac.ac.uk/news/reports/esrc-0904/esrc0904-html.htm>)(20 May 2005).Guntram Geser and John Pereira, eds. (2004a). Resource Discovery Technologies for the Heritage Sector (Vol. 6): European Commission.Guntram Geser and John Pereira, eds. (2004b). Virtual Communities and Collaboration in the Heritage Sector (Vol. 5): European Commission.J. M. Jose (2004). Personalization techniques in information retrieval. Resource Discovery Technologies for the Heritage Secto, ed. Guntram Geser and John Pereira, European Commission. DigiCULT Thematic Issue 6.S. Ross, M. Donnelly, and M. Dobreva (2004). Emerging Technologies for the Cultural and Scientific Heritage Sector (Vol. 2): European Commission.S. Ross, M. Donnelly, M. Dobreva, D. Abbott, A. McHugh, and A. Rusbridge (2005). Core Technologies for the Cultural and Scientific Heritage Sector (Vol. 3): European Commission.British Academy, 'That Full Complement of Riches': The Contribution of the Arts, Humanities, and Social Sciences to the Nation's Wealth (2004) http://www.britac.ac.uk/news/reports/contribution/pdf/contribution.pdf (<http://www.britac.ac.uk/news/reports/contribution/pdf/contribution.pdf>)(23 Aug. 2005).

[4]UK Data Archive, http://www.data-archive.ac.uk/about/about.asp (<http://www.data-archive.ac.uk/about/about.asp>).

in the arts and humanities." [5]The AHDS is jointly funded by JISC and the Arts and Humanities Research Council (AHRC), whose closest U.S. equivalent would be a combination of the National Endowment for the Humanities (NEH) and the National Endowment for the Arts (NEA). The AHRC has recently committed several years of new funding to the Methods Network to provide a "national forum for the exchange and dissemination of expertise in the use of Information and Communication Technologies (ICT) for arts and humanities research." [6]

The lack of a similar coordinated effort in the United States is troubling, and even in the national context, support for humanities and social science research is dwarfed by other governmental spending commitments. Health research accounts for more than half of federal spending on basic (nondefense) research: the National Institutes of Health's budget request in fiscal year 2006 was about $28.5 billion. The National Science Foundation budget, which provides some funding for the social sciences and almost none for the humanities, was $5.6 billion. Of that amount, about 10%, or $509 million, went to the Directorate for Computer and Information Science and Engineering (CISE), which until recently had the primary responsibility for cyberinfrastructure. (The CISE budget also funds NSF's portfolio of basic research in the computer and information sciences and related areas.) The NSF now has an Office of Cyberinfrastructure, which will guide the agency's investments in cyberinfrastructure for science and engineering, funded at $123 million. Federal funding for humanities-related projects is tiny by comparison. The fiscal-year 2006 budget requests of the most important agencies—the National Endowment for the Humanities ($138 million) and the Institute of Museum and Library Services ($247 million)—combined equal less than the budget for CISE, which is itself only one-tenth of the NSF budget. And the ability of the NEA, NEH, and IMLS to fund cyberinfrastructure directly is diminished because much of the money in these agency budgets goes to states through block grants over which the agencies have little control.

Private foundations are important sources of support in the humanities and the social sciences, but they cannot make up for the low level of federal funding. For example, no single private foundation in the United States—with the exception of the Bill & Melinda Gates Foundation, which primarily funds health initiatives—has annual funding that equals the budget of CISE. [7]Among the large private foundations, few are focused on humanities and social sciences. Nevertheless, philanthropic sources have so far played a disproportionately large role in funding the experimentation in digital projects in the humanities. Foundations such as the Andrew W. Mellon Foundation, the Getty Trust, the Carnegie Corporation, and the William and Flora Hewlett, David and Lucile Packard, and Alfred P. Sloan foundations have made strategic investments in building resources or seeding projects. There have also been remarkable instances of individual philanthropy from committed individuals, such as Brewster Kahle (the Internet Archive [8]), Rick Prelinger (Archive Films [9]), and David Rumsey (the David Rumsey Map Collection [10]), who not only collect high-value resources for the humanities and social sciences but also make them freely available on the Web. These are the Carnegies of the digital age, building digital libraries just as Andrew Carnegie built physical ones.

New federal funding is urgently needed for cyberinfrastructure in the humanities and social sciences and also for research and demonstration projects that explore new, sustainable business models for digital humanities and social science. Received wisdom on the limits of the market for ideas has been radically reoriented by the rise of networked communities, and, at this point, scholarly communication may well stand to lose more by failing to experiment than from experiments that fail. Universities need to connect with commercial information-technology innovators in order to understand these new information markets, experiment with business models, and think creatively about the value that is produced by research and teaching in the humanities and social sciences. In fact, corporate supporters and partners have played an important, often foundational, role at campus-based technology and media laboratories such as the Entertainment Technology Center at Carnegie Mellon; the School of Literature, Communication, and Culture

[5]Arts and Humanities Data Service http://www.ahds.ac.uk/ (<http://www.ahds.ac.uk/>).

[6]Methods Network http://www.methodsnetwork.ac.uk/ (<http://www.methodsnetwork.ac.uk/>).

[7]The Foundation Center, "Foundation Growth and Giving Estimates" (2005) http://fdncenter.org/research/trends_analysis/pdf/fgge05.pdf (<http://fdncenter.org/research/trends_analysis/pdf/fgge05.pdf>).

[8]http://www.archive.org/ (<http://www.archive.org/>).

[9]http://www.archive.org/details/prelinger (<http://www.archive.org/details/prelinger>).

[10]http://www.davidrumsey.com/ (<http://www.davidrumsey.com/>).

at Georgia Tech; the Massachusetts Institute of Technology Media Lab; the Entertainment Technology Center at the University of Southern California; and the Institute for Advanced Technology in the Humanities at the University of Virginia. Commercial partners in these ventures may understand better than their academic counterparts how to communicate value to those who will pay for it, and academic institutions may understand better than their commercial counterparts how to ensure that value is not only circulated in the present but handed down in the future. There is a public interest even in privately held cultural materials, so it is inevitable that some difficult issues will arise where public and private meet; yet the creation of a robust cyberinfrastructure will require vigorous collaboration across this boundary. [11]If such bridges can be built and crossed, the resulting traffic will be good for education, good for business, and good for civic life.

[11]See Peter B. Kaufman, "Marketing Culture in the Digital Age: A Report on New Business Collaborations between Libraries, Museums, Archives and Commercial Companies (2005) http://www.intelligenttelevision.com/marketingculture.htm (<http://www.intelligenttelevision.com/marketingculture.htm>).

Chapter 19

Chapter 3: Framework

Chapter 20

Framework[1]

20.1 Framework

In the years following the Civil War, the land grant universities transformed American higher education. After World War II, the GI Bill further propelled that transformation from an elitist educational system to one open to the public. The GI Bill itself created no institutions, nor did it mandate institutional behavior; but this direct means of distributing opportunity and resources dramatically expanded the number of people who considered college a possibility and prompted colleges and universities to see themselves as national, rather than local or regional, institutions. Established institutions that were responsive to the new opportunities, such as the University of California, flourished.

When the federal government began the direct support of advanced research, the National Science Foundation (NSF), the National Institutes of Health, and, later, the National Endowment for the Humanities and the National Endowment for the Arts adopted the extramural grant mechanisms pioneered by philanthropic foundations. They combined these mechanisms with the peer-review practices developed within universities to distribute research support on the basis of competitive applications. The competitive "market" for research support reinforced standards of scholarly excellence and relied on the research ambitions of individual scholars to motivate the institutional response of universities in developing their local research infrastructures.

The response of American higher education to the GI Bill, and the process developed by the federal government to fund advanced research, demonstrate that frameworks for action can challenge institutions to build upon existing capacities. This report suggests that cyberinfrastructure is another such framework for guiding decisions, allocating resources, and setting directions. Thinking about structures naturally requires also thinking about functions and their schematic relationship. That the NSF has already adopted cyberinfrastructure as such a framework underlines the need for strategic thinking. The cyberinfrastructure of the humanities and social sciences does not and will not exist independently of the larger academic infrastructure, where the sciences thus far have set priorities. Similarly, academic stakeholders must take account of the even larger social and commercial cyberinfrastructure that is, increasingly, the platform on which human creativity and social interaction—the subjects of the humanities and social sciences—is expressed and takes place.

There follows a framework for action. First, we present five necessary characteristics of a robust cyberinfrastructure in the humanities and social sciences. Second, we identify eight actions that must be undertaken to make that infrastructure possible.

[1] This content is available online at <http://cnx.org/content/m14152/1.1/>.

Chapter 21

Necessary Characteristics[1]

21.1 Necessary Characteristics

An effective and trustworthy cyberinfrastructure for the humanities and social sciences will have the following characteristics:

21.1.1 1. It will be accessible as a public good.

We have argued that digital information has an inherently democratizing power—but that power can be unleashed only if access to the cultural record is as open as possible, in both intellectual and economic terms, to the public. On the one hand, the Web has made a great deal of human knowledge available for free: with its nine million items, the Library of Congress's American Memory program is but one example. On the other hand, commercial entities have taken an increasingly prominent role both in digitizing public-domain cultural heritage and in digitizing cultural heritage materials still under copyright; these collections are often only available to organizations (such as major research libraries) able to pay substantial subscription or license fees. If public funds are involved in the creation of a digital resource, proportional elements of those resources should be freely available to the public.

21.1.2 2. It will be sustainable.

Sustainability is often thought of as primarily a financial issue: how will a project persist after start-up funding is spent? The digital transformation has raised questions about how to finance research, scholarly communication, and preservation that previously were obscured by the practices of libraries and university presses. Many humanists may have first encountered the concept of sustainability in discussions with potential funders of digital projects. As Diane M. Zorich noted in 2003, we need to avoid treating digital initiatives "as 'special projects' rather than as long-term programs." [2]Although funding is critical to a program's viability, sustainability goes beyond simply paying the bills: intellectual sustainability requires human capital. Digital projects need to draw on a pool of trained and engaged personnel, and therefore universities need to develop the programs and the opportunities that produce people with this kind of expertise. As Kevin Guthrie, the first director of JSTOR and now president of Ithaka, [3]remarked to the Commission, "individual experience is not scalable."

[1]This content is available online at <http://cnx.org/content/m14153/1.1/>.

[2]Diane M. Zorich, A Survey of Digital Cultural Heritage Initiatives and Their Sustainability Concerns (Washington, DC: Council on Library and Information Resources, 2003) http://www.clir.org/pubs/reports/pub118/contents.html (<http://www.clir.org/pubs/reports/pub118/contents.html>).

[3]http://www.ithaka.org/ (<http://www.ithaka.org/>).

21.1.3 3. It will provide interoperability.

Access to data should be seamless across repositories. This will require standards-based tools and metadata that ensure interoperability and enable use for a variety of purposes. Cyberinfrastructure must be designed to be open, modular, and easily adaptable to new technologies so that the pursuit of interoperability does not become a source of delay and constraint. It must also be built to foster and support knowledge communities, which themselves must include information professionals who understand the standards issues. As NSF director Ardent L. Bement, Jr., observes, "with today's electrical grid. . . my neighbor and I can use different appliances to meet our individual needs; as long as the appliances conform to certain electrical standards, they will work reliably," and a sufficiently advanced cyberinfrastructure will work similarly: researchers will have "easy access to the computing, communication, and information resources they need, while pursuing different avenues of interest using different tools." [4]In sum, cyberinfrastructure must serve geneticists and genealogists, historians of Buddhism and collectors of Delta blues, filmmakers and dancers, those in the academy, those working in business and industry, and those home-schooling their children.

21.1.4 4. It will facilitate collaboration.

Digital technology favors openness and collaboration. Defining and building cyberinfrastructure should be a collaborative undertaking involving the humanities and social sciences communities in the broadest sense. It is equally important that the cyberinfrastructure be designed to foster and support collaboration across disciplinary and geographical boundaries and to bring new perspectives to bear on the exploration of the cultural record. Collaboration will be especially important as institutions of higher education seek to preserve and archive digital materials. Digital preservation will require leveraging talent, resources, and commitment in the academy, in the commercial sector, and in government. Each sector has already made significant contributions, each has a leadership role to play, and each needs to be further involved in the curation of our cultural heritage.

21.1.5 5. It will support experimentation.

Although cyberinfrastructure itself should be stable and reliable, it will need to support ongoing experimentation, and it will need to evolve. Researchers in the social sciences and humanities will need to experiment, and that experimentation will be crucial to bringing change to those disciplines. Institutions must encourage risk-taking by creating frameworks through which junior scholars and students are rewarded for ambitious research programs. Offering this encouragement means providing laboratories, postdoctoral grants, and other support that allows these research programs to be worked out and critically assessed. Institutions also need to allow their libraries and university presses to experiment and take chances in order to find more successful models of scholarly communication. It is important to foster a culture of experimentation by underwriting explicit mechanisms and traditions for capturing and sharing the lessons learned through innovation. True experimentation always carries with it the possibility of failure, as the necessary price for success, yet informative failures are essential to moving forward into the unknown, and they should be reported without prejudice and duly valued on that account. [5]

[4]Ardent L. Bement, Jr., "From Concept to Confluence: Framing Our Cyberinfrastructure," remarks, SBE/CISE Cyberinfrastructure Workshop (16 March 2005).

[5]John Unsworth, "The Importance of Failure," The Journal of Electronic Publishing 3.2 (December 1997) http://www.press.umich.edu/jep/03-02/unsworth.html (<http://www.press.umich.edu/jep/03-02/unsworth.html>).

Chapter 22

Recommendations[1]

22.1 Recommendations

The necessary characteristics outlined above may be thought of as specifications for a humanities and social science cyberinfrastructure. Actually building something that answers to those specifications will require sustained effort and commitment in at least eight areas:

22.1.1 1.Invest in cyberinfrastructure for the humanities and social sciences, as a matter of strategic priority.

Addressed to: Universities; federal and private funding agencies

Implementation: Determine the amount and efficacy of funding that now goes to support developing cyberinfrastructure for humanities and social sciences from all sources; through annual meetings and ongoing consultation, coordinate the goals this funding aims to achieve; and aim to increase both funding and coordination over the next five years, including commercial investments that are articulated with the educational community's agenda.

Senior scholars, research librarians, university leaders, state and national legislators, and members of the public interested in the cultural record should regard the development of the humanities and social science cyberinfrastructure as an essential strategic priority. Other countries already recognize this to be so. In European countries and in Canada and Australia, humanities and social science cyberinfrastructure is more generously funded (relative to the size of the population) than in the United States, and research frameworks integrate the support of humanities and social sciences with the support of science and engineering.

In 2005 the British Academy issued an academic policy review in which the leading recommendation was that "relevant UK institutions and bodies adopt a coordinated and coherent strategic approach to e-resource provision and access, based on research community needs." [2]

The German e-Science Initiative was announced by the German Ministry for Research and Education (BMBF) in March 2004, coupled with a call for proposals in the areas of grid computing, e-learning, and knowledge management. The e-Science Initiative and D-Grid were launched on September 1, 2005. Currently, BMBF is funding over a hundred German research organizations with €100 million [$124 million] over the next five years. For the first three-year phase of D-Grid, the support is almost €20 million [$25 million]. One of seven projects currently funded under this initiative is TextGrid, described as a "community grid for text-based disciplines." [3]

[1] This content is available online at <http://cnx.org/content/m14155/1.1/>.

[2] British Academy, E-resources for Research in the Humanities and Social Sciences—A British Academy Policy Review (2005) http://www.britac.ac.uk/reports/eresources/ (<http://www.britac.ac.uk/reports/eresources/>)(20 May 2005).

[3] See Federal Government of Germany, Federal Ministry of Education and Research http://www.d-grid.de/index.php (<http://www.d-grid.de/index.php>).

In Australia $542 million Australian dollars ($405 million) is targeted for the National Collaborative Research Infrastructure Strategy, a major initiative under the Australian government's "Backing Australia's Ability—Building Our Future through Science and Innovation" program. This program "aims to bring greater strategic direction and coordination to national research infrastructure investments" while providing researchers with "access to major research facilities and the supporting infrastructure and networks necessary to undertake world-class research." [4]One of ten areas of emphasis in this program is "platforms for collaboration," described in the strategic road map as aimed in part at the needs of the humanities and social sciences. [5]

Investments in cyberinfrastructure are organized differently in each country, but from the point of view of this Commission, the salient fact is that they do include the humanities and social sciences. More importantly, the humanities and social sciences are a fully integrated part of the conversation and planning in these countries in a way that has not occurred in the United States. The United Kingdom, Germany, and Australia are only three of the nations gearing up strategic efforts in cyberinfrastructure with the humanities and social sciences in mind. The United States must make similar investments if we are to compete internationally—for students, corporate funding, and cultural impact.

22.1.2 2.Develop public and institutional policies that foster openness and access.

Addressed to: University presidents, boards of trustees, provosts, and counsels; university presses; funding agencies; libraries; scholarly societies; Congress

Implementation: The Association of American Universities, in collaboration with other organizations such as the National Humanities Alliance, the Scholarly Publishing and Research Coalition, and the National Academy of Arts and Sciences, should take a leadership role in coordinating the engagement of the humanities and social sciences with issues of information policy.

Open access is critical to constructing and deploying meaningful cyberinfrastructure, and it will be important for the humanities and social sciences to engage in active dialogue and then to lobby effectively concerning legislative and policy developments in this area—for example, in support of the Federal Research Public Access Act of 2006. The Open Content Alliance offers one good platform for the dialogue the Commission wishes to promote; it lists as its members a number of libraries and museums as well as commercial content providers, software companies, and search engine companies. We encourage scholarly societies and university presses—currently unrepresented—to join the Alliance. [6]

The Commission also strongly encourages the funders of research in the humanities and social sciences to require from applicants a plan for sharing and preserving data generated using grant funding, and we urge universities with commercial digitization partners to address long-term ownership and access issues when creating those partnerships. We also call on university counsels, boards of trustees, and provosts to provide aggressive support for the principles of fair use and open access, and to promote awareness and use of Creative Commons licenses. [7]We call on senior academic leaders to ensure that their own practices (as producers of intellectual property and as editors of journals) and the practices of university presses, libraries, and museums support fair use and open access. And, finally, the Commission calls on scholarly societies and universities to advocate that Congress redress imbalances in intellectual property law that currently prevent or inhibit preservation, discourage scholarship, and restrain research and creativity.

Laws, policies, and conventions surrounding copyright and privacy are an implicit part of the cyberinfrastructure in the social sciences and humanities. We must align current law with the new realities of digital knowledge environments. Laws that support these knowledge environments must take into account the characteristics of digital content and the practices that make that content productive. The recent effort

[4]See Government of Australia, Department of Education, Science, and Training http://www.dest.gov.au/sectors/research_sector/policies_issues_reviews/key_issues/ncris/default.htm (<http://www.dest.gov.au/sectors/research_sector/policies_issues_reviews/key_issues/ncris/default.htm>).

[5]See Government of Australia, Department of Education, Science, and Training http://www.dest.gov.au/sectors/research_sector/policies_issues_reviews/key_issues/ncris/documents/ncris_strategic_roadmap_pdf.htm (<http://www.dest.gov.au/sectors/research_sector/policies_issues_reviews/key_issues/ncris/documents/ncris_strategic_roadmap_pdf.htm>).

[6]http://www.opencontentalliance.org/index.html (<http://www.opencontentalliance.org/index.html>)(30 April 2006).

[7]http://www.creativecommons.org/licenses/by-nc-sa/2.5 (<http://www.creativecommons.org/licenses/by-nc-sa/2.5>).

of the Copyright Office to address the problem of "orphan works"—works with uncertain copyright status, which therefore cannot be used with impunity by scholars and others—is a welcome example of a key agency in this debate taking an appropriate leadership role. [8]We urge Congress to pass legislation that adopts the statutory language recommended by the Register of Copyrights in her report. Another example of such leadership is the Library of Congress's current study of Section 108 of the copyright code and its implications for preservation.

The Commission can offer no simple solutions to complex issues of intellectual property. Scholars, after all, create as well as use intellectual property and so are on both sides of these contentious debates. But researchers have traditionally embraced openness and sharing, and that spirit should be encouraged and facilitated in the digital environment. They should not be intimidated by the efforts of rights holders to restrict valid educational uses of materials. Scholars should, for example, be encouraged to take full advantage of the "fair use" provisions of the copyright laws.

While scholars advocate public and legal policies of openness and access, they similarly must advocate these policies within their own communities to the greatest extent practically and legally possible. The Massachusetts Institute of Technology's Open CourseWare is an interesting and instructive example at the level of the core instructional activities of faculty: it freely distributes course materials. Universities need to consider the impact of their technology transfer and intellectual property policies; university presses and scholarly societies need to envision creative dissemination models that reflect academic values, and then lobby for the actual resources needed to realize those models; museums need to make their digitized surrogates freely available, as they already increasingly do. All parties should work energetically to ensure that scholarship and cultural heritage materials are accessible to all—from a student preparing a high-school project to a parent trying to understand the issues in a school-board debate to a tourist wanting to understand Rome's art and architecture.

22.1.3 3.Promote cooperation between the public and private sectors.

Addressed to: Universities; federal and private funding agencies; Internet-oriented companies

Implementation: A private foundation, a federal funding agency, an Internet business, and one or more university partners should cosponsor recurring annual summits to explore new models for commercial/nonprofit partnerships and to discuss opportunities for the focused creation of digital resources with high educational value and high public impact.

Universities and those who fund them (privately or publicly) need to reallocate resources to support digital cultural activities and develop new financial models for making those activities sustainable. For-profit companies that work with digital cultural heritage materials or publish humanities and social-science research need to address long-term preservation and access issues.

Nearly every discussion in the course of the Commission's investigations emphasized the urgent need for new funding and new models of financial sustainability to fund certain core areas, such as preservation and curation of cultural materials, innovative research in the humanities and social sciences, electronic publication, and development of tools and resources for classroom use. Recent partnership agreements between research university libraries and Google represent one model of financial sustainability, although some question the long-term harmony of interests and missions in these partnerships. Even if such questions persist, continued experimentation with new forms of cooperation between the private sector and cultural institutions remains of utmost importance. Commercial and nonprofit partnerships are possible, and commercial investment has often benefited scholarship and the dissemination of cultural heritage content in North America. [9]Such partnerships can contribute a great deal to innovation as well as promote entrepreneurial engagement in challenges (such as digitization) that the cultural sector will be unable to address by itself.

[8]To read the Copyright Office's report, see http://www.copyright.gov/orphan/ (<http://www.copyright.gov/orphan/>). For a general overview, see Scott Carlson, "Whose Work Is It, Anyway?" The Chronicle of Higher Education (29 July 2005) http://chronicle.com/free/v51/i47/47a03301.htm (<http://chronicle.com/free/v51/i47/47a03301.htm>).

[9]The American Antiquarian Society, for example, the leading repository of pre-1800 printed Americana, has enjoyed a business partnership with ReadEx-Newsbank for 50 years, a partnership that has resulted in the investment of millions of dollars in digitizing and disseminating the cultural record of early America.

Still, there will always be scholarship, teaching, and research that can be conducted only with public subsidy, either directly from the government or from tax-exempt private philanthropy. Government funding agencies, most notably the National Endowment for the Humanities (NEH) and the Institute of Museum and Library Services (IMLS), should continue their support of digital projects, including digital tools and other elements of the cyberinfrastructure. We believe that increased support from the National Science Foundation (NSF) for work in the digital humanities will benefit both the humanities and computer science. The recent joint initiative of the NEH, NSF, and Smithsonian Institution to fund the documentation of endangered languages demonstrates that such a partnership can succeed. [10]Other areas of digital library development should be cosponsored with federal agencies such as the Library of Congress, IMLS, Smithsonian, National Archives and Records Administration, NSF, and National Institute of Standards and Technology.

The Andrew W. Mellon Foundation is a both a leader in and a leading funder of the application of digital technologies to the humanities and social sciences. The William and Flora Hewlett Foundation, the Packard Institute for the Humanities, the Rockefeller Foundation, and others have also provided support to critical initiatives. While many other private funding agencies have supported digital projects, these efforts have not so far been coordinated purposefully to achieve the kind of cyberinfrastructure envisioned in this report.

22.1.4 4.Cultivate leadership in support of cyberinfrastructure from within the humanities and social sciences.

Addressed to: Senior scholars; scholarly societies; university administrators; senior research librarians and research library organizations; academic publishing organizations; federal funding agencies; private foundations

Implementation: Increase federal and foundation funding to one or more scholarly organizations in the area of humanities and social science computing so that they can work with member organizations of the American Council of Learned Societies (ACLS) and others to establish priorities for cyberinfrastructure development, raise awareness of research and partnership opportunities among scholars, and coordinate the evolution of research products from basic to applied.

Librarians, rather than scholars, have provided much of the recent leadership within the academy on issues of cyberinfrastructure in the humanities and social sciences. Reflecting the conservative culture of scholarship, some scholars have questioned librarians' investments in building digital collections and acquiring online resources. Given that the library constitutes the historic infrastructure of scholarship, it is entirely appropriate that librarians have sought to re-ignite scholarly engagement with infrastructural issues. Nevertheless, others now need to take up the cause and shoulder their leadership responsibilities. As the task force of the American Association of Universities indicated in its 2004 report Reinvigorating the Humanities, "[u]niversity presidents, provosts and humanities deans" must "support the development and use of digital information and technology in the humanities." [11]

Leadership requires structure. Humanities organizations, in particular, should develop new means of sharing information and setting agendas. Again, the example of the library community is instructive. The Association of Research Libraries (ARL); Council on Library and Information Resources (CLIR); and Online Computer Library Center (OCLC), which is about to absorb the Research Libraries Group, have made technological transformation central to their missions and programming. They have, in turn, created vehicles—the Coalition for Networked Information, the Digital Library Federation, the Scholarly Publishing and Academic Resources Coalition—dedicated entirely to providing leadership on these issues. Very few cognate efforts exist in the humanities and social sciences. The Alliance of Digital Humanities Organizations (ADHO), H-Net, and the Humanities, Arts, Science, and Technology Advanced Collaboratory (HASTAC) are three examples, but these have not enjoyed the kind of financial support from the humanities and social sciences communities that ARL, CLIR, OCLC, or RLG have received from the research library community.

[10]National Science Foundation http://www.nsf.gov/pubs/2004/nsf04605/nsf04605.htm (<http://www.nsf.gov/pubs/2004/nsf04605/nsf04605.htm

[11]American Association of Universities, Reinvigorating the Humanities: Enhancing Research and Education on Campus and Beyond (Washington, DC: American Association of Universities, 2004), IV 59-69 http://www.aau.edu/issues/HumRpt.pdf (<http://www.aau.edu/issues/HumRpt.pdf>).

Scholarly societies have a special role to play in providing—and funding—similar leadership for scholars in the humanities and social sciences.

At the campus level, university administrators should go out of their way to ensure that representatives from the social sciences and humanities are at the planning table alongside librarians, scientists, and engineers when issues of cyberinfrastructure are being decided. All too often, humanists and social scientists learn about policy and funding decisions after they are made. By the same token, scholars in the humanities and social sciences must not hesitate to insist on being included in these discussions and decisions.

22.1.5 5.Encourage digital scholarship.

Addressed to: Universities; research libraries; the National Endowment for the Humanities (NEH); the National Endowment for the Arts (NEA); the Institute of Museum and Library Services (IMLS); the National Academies; the National Archives; major private foundations; major scholarly societies; individual leaders in the humanities and social sciences

Implementation: Federal funding agencies and private foundations should establish programs that address workforce issues in digital humanities and social sciences, from short-term workshops to postdoctoral and research fellowships to the cultivation of appropriately trained computer professionals. The ACLS should lead its member organizations in developing uniform policies with respect to digital scholarship in tenure and promotion.

The Commission believes that digital scholarship is the inevitable future of the humanities and social sciences, and that digital literacy is a matter of national competitiveness and a mission that needs to be embraced by universities, libraries, museums, and archives. In order to foster digital research, teaching, and publishing, we recommend specifically that there be

- fellowship and research leave for digital scholarship and for collaborative research projects in laboratories that take full advantage of cyberinfrastructure;
- policies for tenure and promotion that recognize and reward digital scholarship and scholarly communication; recognition should be given not only to scholarship that uses the humanities and social science cyberinfrastructure but also to scholarship that contributes to its design, construction, and growth;
- workshops aimed at introducing scholars and teachers to the methods and possibilities of digital scholarship and giving them the opportunity to develop their own creative ideas in the context of cyberinfrastructure; [12]
- workshops that bring scholars and technologists together around a set of goals and that forge working partnerships with computer scientists and engineers;
- university support for software, data storage, and technical support for librarians and computer professionals.

We might expect younger colleagues to use new technologies with greater fluency and ease, but with tenure at stake, they will also be more risk- averse. There is a widely shared perception that academic departments in the humanities and social sciences do not adequately reward innovative work in digital form. A handful of recent examples provide exceptions to the norm, but in the most elite universities, traditional scholarly work, in the form of a single-authored, printed book or article published by a university press or scholarly society, is the currency of tenure and promotion; work online or in new media—especially work involving collaboration—is not encouraged. Senior scholars now have both the opportunity and the responsibility to take certain risks, first among which is to condone risk taking in their junior colleagues and their graduate students, making sure that such endeavors are appropriately rewarded.

How will younger scholars in the humanities and social sciences engage these new technologies and methods? Experience demonstrates that some will find a way of their own, but it also suggests that if more than a few are to pioneer new digital pathways, more formal venues and opportunities for training and encouragement are needed. The Commission recommends the creation of brief (one- to three-week) workshops for younger scholars—perhaps located at some of the existing centers in the digital humanities

[12] See, e.g., http://flatiron.sdsc.edu/projects/ci-hass/main.php (<http://flatiron.sdsc.edu/projects/ci-hass/main.php>).

and social sciences and organized in conjunction with scholarly societies—focusing on how to do research, how to present the products of scholarship, and how to teach in the digital era. One model could be the Canadian Social Sciences and Humanities Research Council's Image, Sound, Text and Technology Institute Program, which provides grants for such workshops. [13]A recent workshop on digital scholarship offered only to younger scholars in one very specific domain—the history of science and technology—found itself vastly oversubscribed. [14]But we should not neglect training opportunities for midcareer scholars who wish to learn about new tools, resources, and approaches.

It is also important to remember that students, and often their teachers, need help in making sense of what they find. For example, a 1930s photograph of sharecroppers, with the imprimatur of the Library of Congress's American Memory site, may seem to be a transparent reflection of social and historical reality rather than a created and composed artifact with a larger political message. We recommend that resources be devoted to making students (and citizens) into sophisticated and critical consumers of the vast cultural heritage that has been placed at their fingertips. Some of this can be done electronically, but workshops for K–12 teachers who use the Web in their classrooms are badly needed as well.

22.1.6 6.Establish national centers to support scholarship that contributes to and exploits cyberinfrastructure.

Addressed to: Universities; Congress; state legislatures; public funding agencies; private foundations

Implementation: Universities should develop national and international fellowships at existing humanities and social science computing centers, and develop new centers with such programs, with a combination of university, federal, and private funding.

A robust cyberinfrastructure should include centers that support collaborative work with specialized methods. When human, institutional, or technical resources become too expensive to replicate at every institution, it makes sense to provide those resources through a more limited number of national centers. This is what has already been done in the sciences, and it is what should also be done in the humanities and social sciences. Public funds should be at the forefront of support to such national centers of excellence in digital humanities and social science, as crucial seedbeds of further innovation.

The humanities and social science cyberinfrastructure should include a network of such centers distributed around the country. Centers might focus on particular methods or tools—for example, the application of Geographic Information Systems or data-mining or visualization to humanities and social science research problems. Centers might also, in some cases, be devoted to research involving copyrighted digital materials or research involving confidential social science data. The Inter-University Consortium for Political and Social Research (ICPSR) is one such national center in the social sciences; the Vanderbilt Television News Archive might be taken as an example or a starting point with respect to copyrighted material. The Library of Congress's NDIIPP (National Digital Information Infrastructure Preservation Program) partnerships are exploring the creation of data centers to serve other communities, using a range of business models.

Universities should foster interdisciplinary laboratories and research groups that include both technical and subject expertise. "Once humanities faculty began using the laboratory in their research," Stanford University computer scientist Marc Levoy told the Commission, "they would also find creative ways to fold its technology into their teaching—for example, through project-based assignments in upper-level courses. This would bring humanities students into the lab, some of whom have dual backgrounds, and so could help run the lab." Provost James O'Donnell of Georgetown University, speaking to the Commission, advocated "zones of experimentation and innovation for humanists." O'Donnell added that those zones should be "part and parcel of the formal academic structure. Ghettos are not the answer. We need instead the creation of privileged but open communities, where the very best young people are challenged to invent, experiment, break things, and succeed." Exemplary models of such centers include the American Social History Project/Center for Media and Learning at the City University of New York; the Center for History

[13]Canadian Social Sciences and Humanities Research Council http://www.sshrc.ca/web/apply/program_descriptions/itst/workshops_e.asp (<http://www.sshrc.ca/web/apply/program_descriptions/itst/workshops_e.asp>).

[14]The workshop, offered by the Center for History and New Media at George Mason University with funding from the Sloan Foundation, had 75 applicants for 15 slots.

and New Media at George Mason University; MATRIX, the Center for Humane Arts Letters and Social Sciences at Michigan State University; and the Institute for Advanced Technology in the Humanities at the University of Virginia. The National Center for Supercomputing Applications at the University of Illinois has recently shown interest in arts, humanities, and social sciences, and its involvement in this effort would be most welcome. [15]

22.1.7 7.Develop and maintain open standards and robust tools.

Addressed to: Funding agencies, public and private; scholars; librarians; curators; publishers; technologists

Implementation: University consortia such as the Committee on Institutional Cooperation should license the SourceForge software and make it available to open-source developers in academic institutions. The National Endowment for the Humanities (NEH), National Archives and Records Administration (NARA), and Institute of Museum and Library Services (IMLS) should support the development, maintenance, and coordination of community-based standards such as the Text Encoding Initiative, Encoded Archival Description, Metadata Encoding and Transmission Standard, and Visual Resources Data Standards. The National Science Foundation (NSF), the Andrew W. Mellon Foundation, IMLS, and other funding agencies should support the development of tools for the analysis of digital content.

Scholars in the humanities and social sciences should work with librarians, curators, publishers, and technologists to develop tools for producing, searching, analyzing, vetting, and representing knowledge, as well as standards for documenting data of all kinds. For hundreds of years, the most important tools of humanists and social scientists were pen or brush and paper. Today, scholars require a range of digital tools for research, teaching, and writing, including tools for finding, filtering and reviewing, processing and organizing, annotating, analyzing, and visualizing digital information. Even though we can point to current efforts in many of these areas, lack of coordination among them is a problem: a great deal of tool building is done on a local scale, and this results in unnecessary redundancy of effort. [16]

In part, this is because academic software developers may be prohibited by their university counsels from participating in open-source communities such as SourceForge (not because of any university opposition to open-source but, instead, because of statutory prohibitions against accepting the terms of use that these communities impose, especially regarding issues such as indemnification and governing law in the resolution of disputes). In that case, it is incumbent on the university community to provide and encourage the use of a parallel community infrastructure for open-source software development, in order to avoid duplication of effort and ensure that tool builders in academic settings are not specially disadvantaged compared with tool builders outside universities. Such an effort could begin with a consortium of major universities (for example, the Committee on Institutional Cooperation) licensing the SourceForge software and then making it available for use by academic open-source software developers on acceptable terms.

Tools developed in one discipline may frequently be transferable or adaptable to other disciplines, but scholars may be unaware of tools developed outside their own discipline. Libraries, archives, and museums are positioned to serve as bridges among the sciences, humanities, social sciences, and arts in integrating widely disparate information and building new interdisciplinary relationships. The library of the University of California, Riverside, for example, is conducting research aimed at producing better machine-based, automatically generated metadata to improve the search and retrieval of multidisciplinary online content. [17]The Museums and Online Archives Collaboration Community Toolbox, developed by the California Digital Library, will enable museums and libraries to produce standards-based data for broad content sharing. [18]

[15]The American Social History Project/Center for Media and Learning http://www.ashp.cuny.edu/ (<http://www.ashp.cuny.edu/>); Center for History and New Media http://chnm.gmu.edu/ (<http://chnm.gmu.edu/>); Institute for Advanced Technology in the Humanities http://jefferson.village.virginia.edu/ (<http://jefferson.village.virginia.edu/>); National Center for Supercomputing Applications http://www.ncsa.uiuc.edu/ (<http://www.ncsa.uiuc.edu/>).

[16]For examples, see http://echo.gmu.edu/toolcenter-wiki/index.php?title=Main_Page (<http://echo.gmu.edu/toolcenter-wiki/index.php?title=Main_Page>).

[17]University of California, Riverside http://infomine.ucr.edu/ (<http://infomine.ucr.edu/>).

[18]California Digital Library http://www.cdlib.org/inside/news/building_collections.ppt (<http://www.cdlib.org/inside/news/building_collectio

With respect to open standards, commercial entities that create significant digital collections (such as Google with its digitization of collections from five major U.S. research libraries) should produce at least one version of the resource in a nonproprietary format, if only for deposit with and local use by the institution that holds the originals being digitized—and universities should speak with a stronger voice on that point. Funding agencies—including the NSF, NEH, NARA, NDIIPP, and IMLS—and academic leaders should support the development and maintenance of digital tools and increase direct funding for the development and documentation of standards that improve the preservation and interoperability of digital content in the humanities and social sciences. Such support should include the development of opportunities for collaboration among tool builders and between tool builders and standards organizations, as well as scholarly validation of the tools and standards they use. The NEH, NARA, and IMLS should coordinate support for standards activity and should harmonize these efforts with the parallel tool- and resource-building activities of organizations such as the Digital Library Federation.

New approaches are necessary to capture and integrate digital resources from different kinds of cultural heritage organizations, which have followed very different practices in describing and organizing their collections, and to maintain the intellectual context of collections when they are digitized. A research project at the University of Illinois, Urbana-Champaign, has created a collection-level registry and item-level repository, based on the Open Archives Initiative Metadata Harvesting Protocol, that allows browsing of collection descriptions as well as content searching within and across collections. The project also serves as a testbed for research to improve the development of integrated, large-scale multidisciplinary digital libraries. [19]When best practices are identified, projects of this type can be scaled up to contribute to the "Global Digital Library." Interoperability in software and in data is never perfect, but, in both cases, it has a better chance of emerging when information about those resources is open, easy to find, and readily reusable. Interoperability across the humanities and social science cyberinfrastructure therefore requires the continued development and promotion of vendor-independent, open standards for document modeling and data documentation as well as open-source methods for software development.

Humanists and social scientists and their organizations must build the tools and standards they need: others will not do it for them. The summit on Digital Tools for the Humanities, supported by the NSF and held at the University of Virginia in September 2005, is a promising first step toward improving coordination in developing tools. The Andrew W. Mellon Foundation has also been funding the development of open-source tools. The Text Encoding Initiative Consortium is a long-standing and exemplary community-based standards organization focused on literary and linguistic texts, their uses, and their users.

22.1.8 8.Create extensive and reusable digital collections.

Addressed to: TheNational Endowment for the Arts (NEA), the National Endowment for the Humanities (NEH), the Institute of Museum and Library Services (IMLS), the National Archives and Records Administration (NARA), and other funding agencies, both public and private; scholars; research libraries and librarians; university presses; commercial publishers

Implementation: National centers with a focus on particular methods or disciplines can organize a certain amount of scholar-driven digitization. Library organizations and libraries should sponsor discipline-based focus groups to discuss priorities with respect to digitization. When priorities are established, these should be relayed to the organizers of annual meetings on commercial and nonprofit partnerships, and they should be considered in the distribution of grant funds by federal agencies and private foundations. Funding to support the maintenance and coordination of standards will improve the reusability of digital collections. The NEA, NEH, and IMLS should work together to promote collaboration and skills development—through conferences, workshops, and/or grant programs—for the creation, management, preservation, and presentation of reusable digital collections, objects, and products.

The extensive digitization of cultural heritage materials is one of the most exciting developments in the humanities and social sciences in the past century, and it should be continued and expanded through a

[19]University of Illinois, Urbana-Champaign, Digital Collections and Content http://imlsdcc.grainger.uiuc.edu/ (<http://imlsdcc.grainger.uiuc.edu/>).

thoughtful combination of institutional, public, and private support. The Commission believes that scholars have an important role to play in the development of commercial and nonprofit digital archives alike, and neither research libraries nor companies such as Google have yet gone far enough to encourage dialogue with the scholarly community on such questions as the selection of materials for digitization, decisions about what to omit from the digitized representation, or the design of descriptive metadata.

We support efforts such as the Million Book Project, Project Gutenberg, the Open Content Alliance, and other noncommercial digitization projects. These might include efforts to digitize the archives of public broadcasting (the Public Broadcasting System [PBS] and others in the United States; the British Broadcasting Corporation [BBC] in the United Kingdom). More broadly, the Commission recognizes the importance of the cultural institutions whose collections are being digitized in these alliances and projects: scholarship and public understanding of the cultural record rely on museums, libraries, archives, and cultural institutions in general. The record that they preserve is the fundamental dataset for cultural research and education, and it is critical that they be engaged with scholars and educators in all disciplines, not only in creating interoperable and reusable digital content, but also to ensure that scholarly work in digital formats being produced today remains accessible in the future. The Walt Whitman Archive, spearheaded by the University of Nebraska, Lincoln, libraries, is creating a model metadata- encoding-and-transmission-standard (METS) profile for digital thematic research collections, integrating high-quality data and metadata, in-depth description, high-resolution files, and encoded texts. Created by scholars in collaboration with librarians and archivists, this model project enables creators of digital thematic research collections to make their work more sustainable and universally usable. [20]The Institute of Museum and Library Services has supported the development of A Framework of Guidance for Building Good Digital Collections, [21]which establishes principles for the creation, preservation, and management of digital collections and objects and is now maintained by the National Information Standards Organization. Likewise, Cataloging Cultural Objects, [22]a tool developed by the Visual Resources Association with input from the library, archives, and museum communities, promotes good descriptive practices across disciplines. These kinds of tools should be continued and expanded.

The Commission endorses efforts such as the Digital Promise Project (www.digitalpromise.org), which aims to provide public support for the digitization of collections unlikely to attract commercial investment. Ambitious projects such as those undertaken by Google should not allow us to forget about the continued need for investment from the public and nonprofit sector. One recent and carefully reasoned estimate suggests that Google Book Search represents only about a third of the books held in research libraries—and there are many forms other than books in which the cultural record is purveyed, and many books not held by research libraries. [23]In public and nonprofit digitization efforts, priority must be placed on those collections that commerce is unlikely to fund. They will probably be collections held by institutions that are content-rich and technology-poor, such as historically black colleges and universities, which are custodians of vast and important collections documenting the lives and heritage of African Americans.

The Commission also encourages continued investment in this area by the National Endowment for the Humanities, the Institute of Museum and Library Services, the National Archives, the Andrew W. Mellon Foundation, and other funding agencies, both public and private. In addition, we recommend that scholars and university presses cooperate with commercial digitization efforts with the goal of ensuring that they are as well designed and widely accessible as possible. Scholars should participate in institutional repository programs, and universities should develop programs at the national level to share digital content for teaching and research and to coordinate and share successful practices for working with digital resources. Institutional repositories should plan and be funded for the long-term preservation and migration of data.

The general public, students, teachers, and scholars want to have online access to the full range of primary source materials housed in repositories such as museums, historical societies, local libraries and research

[20]The Walt Whitman Archive http://www.whitmanarchive.org/ (<http://www.whitmanarchive.org/>).

[21]http://www.niso.org/framework/Framework2.html (<http://www.niso.org/framework/Framework2.html>).

[22]http://www.vraweb.org/ccoweb/index.html (<http://www.vraweb.org/ccoweb/index.html>).

[23]Brian Lavoie et al., "Anatomy of Aggregate Collections: The Example of Google Print for Libraries," D-Lib Magazine 11:9 (September 2005) http://www.dlib.org/dlib/september05/lavoie/09lavoie.html (<http://www.dlib.org/dlib/september05/lavoie/09lavoie.html>).

libraries, special collections, archives, and privately held collections. This includes books and journals, newspapers and magazines, government documents, manuscripts, maps, photographs, satellite images, census data, recorded sound, film, broadcast television, and Web content. Information technology offers ways to reunite dispersed collections, as in the International Dunhuang Project, [24]which makes information and images of more than a hundred thousand manuscripts, paintings, textiles, and other artifacts from Dunhuang and other Silk Road sites freely available on the Internet; to compare exemplars (for example, the Shakespeare quartos [25]or the many variants of the Roman de la Rose [26]); to assemble the works of single creators, such as the photographs of Mathew Brady; [27]or to aggregate disparate examples pertaining to a single theme, such as the University of Nebraska Press's Gallery of the Open Frontier, with 23 thousand images of the American West. [28]We have only begun to realize the potential of networked cultural heritage information.

[24]British Library, International Dunhuang Project (2006) http://idp.bl.uk/ (<http://idp.bl.uk/>).

[25]British Library, Treasure in Full: Shakespeare in Quarto http://www.bl.uk/treasures/shakespeare/homepage.html (<http://www.bl.uk/treasures/shakespeare/homepage.html>).

[26]Johns Hopkins University and the Pierpont Morgan Library, Roman de la Rose http://rose.mse.jhu.edu/ (<http://rose.mse.jhu.edu/>).

[27]Library of Congress, Selected Civil War Photographs (2000) http://memory.loc.gov/ammem/cwphtml/cwphome.html (<http://memory.loc.gov/ammem/cwphtml/cwphome.html>).

[28]http://gallery.unl.edu/index.html (<http://gallery.unl.edu/index.html>).

Chapter 23

Conclusion[1]

23.1 Conclusion

We should place the world's cultural heritage—its historical documentation, its literary and artistic achievements, its languages, beliefs, and practices—within the reach of every citizen. The value of building an infrastructure that gives all citizens access to the human record and the opportunity to participate in its creation and use is enormous, exceeding even the significant investment that will be required to build that infrastructure. The Commission is also keenly aware that in order for the future to have a record of the present, we need legal and viable strategies for digital preservation; considerable investment is now required on that front as well. Investments need to be made on the basis of research, and, in this case, a good deal more research is needed on digital preservation, tools, and uses and users of digital collections, in academic settings and beyond. [2]

But this is only part of the realization that the Commission hopes to leave with readers of this report. In a recent public presentation of the draft findings of this report, the Commission's chair was asked, "If your report were a complete success, what would be the result, five or six years from now?" The answer is two-fold. First, if this report's recommendations are implemented, then in five or six years, there will be a significantly expanded audience for humanities and social science research among the general public. A relatively small audience on the open Web will still be a far larger audience than scholars in these disciplines have been able to find up to now in academic bookstores, research libraries, and print journals. Second, if the recommendations of this report are implemented, humanities and social science researchers five or six years from now will be answering questions that today they might not even consider asking.

The Commission understands that increasing access to scholarly research and experimenting with new research methods both entail some risk, but it firmly and collectively believes that the risk of not doing both is far greater, in terms of the ultimate sustainability of the disciplines in question. Senior scholars in the humanities and social sciences and senior administrators in research universities must lead the way to a new, more open, and more productive relationship with the public, and to new ways of doing scholarship.

[1] This content is available online at <http://cnx.org/content/m14144/1.2/>.

[2] Some research is already being done. At the University of California, Berkeley, e.g., a two-year "Digital Resource Study" is looking at the "use of digital resources in undergraduate education in the humanities and social sciences" See http://digitalresourcestudy.berkeley.edu/ (<http://digitalresourcestudy.berkeley.edu/>).

Appendix I: The Charge to the Commission[1]

24.1 Appendix I: The Charge to the Commission

As scholars in the humanities and social sciences use digital tools and technologies with increasing sophistication and innovation, they are transforming their practices of collaboration and communication. New forms of scholarship, criticism, and creativity proliferate in arts and letters and in the social sciences, resulting in significant new works accessible and meaningful only in digital form. Many technology-driven projects in these areas have become enormously complex and, at the same time, indispensable for teaching and research.

For their part, scientists and engineers no longer see digital technologies merely as tools enhancing established research methodologies but as forces creating environments that enable the creation of new knowledge. The recent National Science Foundation report "Revolutionizing Science and Engineering through Cyberinfrastructure" argues for large-scale investments across all disciplines to develop a shared technology infrastructure that will support ever-greater capacities. Those capacities would include the development and deployment of new tools; the rapid adoption of best practices; interoperability; the ability to invoke services over the network; secure sharing of facilities; long-term storage of, and access to, important data; and ready availability of expertise and assistance.

The needs of humanists and scientists converge in this emerging cyberinfrastructure. As the importance of technology-enabled innovation grows across all fields, scholars are increasingly dependent on sophisticated systems for the creation, curation, and preservation of information. They are also dependent on a policy, economic, and legal environment that encourages appropriate and unimpeded access to both digital information and digital tools. It is crucial for the humanities and the social sciences to join scientists and engineers in defining and building this infrastructure so that it meets the needs and incorporates the contributions of humanists and social scientists.

ACLS is sponsoring a national commission to investigate and report on these issues. The Commission will operate throughout 2004 and is charged to

- describe and analyze the current state of humanities and social science cyberinfrastructure;
- articulate the requirements and potential contributions of the humanities and the social sciences in developing a cyberinfrastructure for information, teaching, and research;
- recommend areas of emphasis and coordination for the various agencies and institutions, public and private, that contribute to the development of this cyberinfrastructure.

Among the questions to be explored in pursuing these three goals are:

Describe and analyze the current state of humanities and social science cyberinfrastructure.

1. What can be generalized from the already significant digital projects in the humanities and social sciences? Which humanities and social science communities are most active, and why? Of those that are not, which might soon, easily and/or profitably, engage more deeply with digital technology? How

[1] This content is available online at <http://cnx.org/content/m14142/1.4/>.

have scholars developed computing applications to accomplish their scholarly and expressive goals? Where have they failed to do so, and what can be learned from those failures?
2. What new intellectual strategies, critical methods, and creative practices are emerging in response to technical applications in the humanities? To what extent are disciplines in the humanities transforming themselves through the use of computing and networking technologies? What are the implications of those transformations?
3. What organizations and structures have empowered or impeded the digital humanities? What are examples of successful and durable collaboration between technologists and humanities scholars? Where and how are people being trained to support and engage in such collaborations? What has been the role of libraries, archives, and publishers in these projects?

Articulate the requirements and the potential contributions of the humanities and the social sciences in developing a national cyberinfrastructure for information, teaching, and research.

1. What are the "grand challenge" problems for the humanities and social sciences in the coming decade? Are they tractable to computation? Do they require cyberinfrastructure in some other way?
2. What technological developments can we predict that will have special impact in the humanities and social sciences in the near future?
3. Which are the most important functionalities necessary for new research and development in cyberinfrastructure generally? What kinds of humanities or social science problems are theoretically difficult or expressively complex, or challenge our ability to formulate a computable problem in some other way? What kinds of humanities or social science problems are computationally intensive, require especially high bandwidth, or present resource challenges in other ways?
4. What are the barriers that confront humanities and social science users who wish to take advantage of state-of-the-art computational, storage, networking, and visualization resources in their research? What can be done to remove these barriers?
5. What impact will the availability of high-performance infrastructure have on enabling cross-disciplinary research? What will high-performance infrastructure mean for the broader social impact of humanities and social sciences?
6. What can be done to improve education and outreach activities in the computer-science and engineering community to broaden access to high-end computing? How can computing expertise in the humanities and social sciences themselves be increased?

Recommend areas of emphasis and coordination for the various agencies and institutions, public and private, that contribute to the development of humanities cyberinfrastructure.

1. What investments in cyberinfrastructure are likely to have the greatest impact on scholarship in the humanities and social sciences?
2. What research infrastructure should be coupled with cyberinfrastructure?
3. How can private and public funding agencies coordinate their efforts and cooperate with universities, research libraries, disciplinary organizations, and others to maximize the benefits of cyberinfrastructure for the humanities and social sciences?
4. How should new investments in infrastructure and technologies be administered so as to include the humanities?

Appendix II: Public Information-Gathering Sessions[1]

25.1 Appendix II: Public Information-Gathering Sessions

The ACLS Commission on Cyberinfrastructure for the Humanities and Social Sciences convened seven public information-gathering sessions to hear from those interested in contributing to the work of the Commission. Below is a record of those who testified at these public sessions, held throughout the country on the following dates. Transcripts of these testimonies are available on the ACLS Web site at: http://www.acls.org/cyberinfrastructure/cyber_public_sessions.htm[2]

25.1.1 Tuesday, April 27th, 2004 – Washington, DC

- Michael Jensen, National Academies Press
- Joyce Ray, Institute of Museum and Library Services
- Max Evans, National Historical Publications and Records Commission

25.1.2 Saturday, May 22nd, 2004 – Chicago

- William Barnett, Field Museum
- James Grossman, Newberry Library
- Myron P. Gutmann, University of Michigan, Ann Arbor
- James Hilton, University of Michigan, Ann Arbor
- Lorna Hughes, New York University
- Martin Mueller, Northwestern University
- Bill Regier, University of Illinois Press

25.1.3 Saturday, June 19th, 2004 – New York

- Stephen Brier, New Media Lab, CUNY Graduate Center
- Diana Taylor, New York University
- Kevin Guthrie, Ithaka Harbors
- Kate Wittenberg, Columbia University
- Robert Darnton, Princeton University
- Stanley N. Katz, Princeton University

[1] This content is available online at <http://cnx.org/content/m14167/1.1/>.
[2] http://www.acls.org/cyberinfrastructure/cyber_public_sessions.htm

25.1.4 Saturday, August 21st, 2004 – Berkeley

- Suzanne Calpestri, University of California, Berkeley
- Henry Brady, University of California, Berkeley
- Michael Buckland, Electronic Cultural Atlas Initiative (ECAI)
- Richard Rinehart, University of California, Berkeley
- Geoffrey Nunberg, Stanford University
- Gregory Niemeyer, University of California, Berkeley
- John Ober, University of California, Berkeley
- Marc Levoy, Stanford University

25.1.5 Saturday, September 18th, 2004 – Los Angeles

- Janice Reiff, University of California, Los Angeles
- Kenneth Hamma, J. Paul Getty Trust
- Jerry D. Campbell, University of Southern California
- Douglas Greenberg, Survivors of the Shoah Visual History Foundation
- David Theo Goldberg, University of California Humanities Research Institute
- Zoe Borofsky, University of California, Los Angeles

25.1.6 Tuesday, October 26th, 2004 – Baltimore

- James J. O'Donnell, Georgetown University
- David Greenbaum, The Interactive University Project, University of California, Berkeley
- Fred Heath, University of Texas, Austin
- Patricia Kosco Cossard, Medieval Academy of America, University of Maryland
- Bernard Frischer, Institute for Advanced Technology in the Humanities, University of Virginia

Attributions

Collection: *"Our Cultural Commonwealth" The Report of the American Council of Learned Societies Commission on Cyberinfrastructure for the Humanities and Social Sciences*
Edited by: American Council of Learned Societies Commission on Cyberinfrastructure for the Humanities & Social Sciences
URL: http://cnx.org/content/col10391/1.2/
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Module: "Commission Members"
By: American Council of Learned Societies Commission on Cyberinfrastructure for the Humanities & Social Sciences
URL: http://cnx.org/content/m14143/1.2/
Pages: 1-2
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Module: "Foreword"
By: American Council of Learned Societies Commission on Cyberinfrastructure for the Humanities & Social Sciences
URL: http://cnx.org/content/m14151/1.2/
Pages: 3-4
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Module: "Preface: Who Is the Intended Audience for This Report?"
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URL: http://cnx.org/content/m14154/1.1/
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Module: "Executive Summary"
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URL: http://cnx.org/content/m14150/1.2/
Pages: 7-11
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Module: "What Is Cyberinfrastructure?"
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Module: "What Are the Humanities and Social Sciences?"
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