In Cypher Writ, or New Made Idioms: Sustaining Digital Scholarship as Cooperative Digital Preservation

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Abstract

Digital Scholarship is a method of scholarly communication, research, and exchange of ideas that employs modern forms of technology, in particular, those forms of technology maintained within an institution's cyberinfrastructure. Digital scholarship then is often, in equal parts, the intellectual content *and* the manner in which it is created and presented. That is what sets it apart from, for example, humanities scholarship as it has been historically undertaken in its published form. Thus it would follow that the sustaining of digital scholarship goes far beyond what is commonly known as digital preservation. In other words, sustaining digital scholarship is not just the difficult task of preserving the atomized digital objects (or even bits and bytes) but also the relationships among them. These relationships represent the digital world of authorial aggregation and distribution that also needs to be preserved. This is not a task that any one unit within a university can possibly undertake. This article provides an outline of activities that are taking place at the University of Virginia and provides some outlines and strategies for approaching such a complex problem set.

What is Digital Scholarship?

This book, as long-lived as the elements
  Or as the world's form, this all-gravèd tome
  In cypher writ, or new made idiom;
We for Love's clergy are only instruments;
  When this book is made thus,
  Should again the ravenous
  Vandals and the Goths invade us,
Learning were safe; in this our universe,
Schools might learn sciences, spheres music, angels verse.
    John Donne " Valediction to his Book"

Centuries after Donne, we are less confident than ever before that "Learning were safe." Libraries continue to struggle to preserve the bulk of materials that are familiar to most: books and paper. Some would argue that this front, at least, has been contained. What does digital preservation mean with respect to today's digital technology? How are scholars taking advantage of new methodologies for doing what has always been the major product of higher education—research? With new trends and even newer avenues of technology to explore, the pressure mounts on academic infrastructure to continue to preserve the scholarly output of its faculty and students. Recent trends point to an understanding that a broader audience is needed to tease out the full implications of digital preservation. The Digital Preservation Coalition's report, *Mind the Gap: Assessing Digital Preservation Needs in the UK* undertaken in 2006, reiterates that it is critical that we broadcast this message to as wide an audience as possible.[1] Any complex set of preservation activities is rendered far more difficult in the wake of the digital revolution and for academics in particular, digital scholarship. It is clear that no one unit, or even no single institution can achieve this in a feat of individual prowess—the resources needed are too great and the scope too vast. Cooperative practices, ingrained and entrenched, are our only hope to succeed to preserve digital scholarship.

Digital Scholarship is the "new made idiom" for how many scholars now undertake and present their research. It is a

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[1] The report highlights the following key elements which are worth reiterating here:

• Organisations should continue to raise awareness of the impact of digital preservation beyond the current core of informed individuals and institutions.

• Training in digital preservation should be encouraged and programmes should be integrated into the training of professionals such as conservators, librarians and archivists.

• Awareness of digital preservation issues should be raised at government level, both nationally and internationally, in order to influence relevant policy making.

An international collaborative 'market' for digital preservation tools should be created. Such a market should encourage the use of open file formats and standards and consider the long-term preservation needs of digital information.
<http://www.dpconline.org/graphics/reports/mindthegap.html>

relatively recent trend that has many libraries—in particular academic libraries—scrambling to develop the requisite service models to both support and sustain it. Digital Scholarship incorporates more and more digital media for research and classroom-based projects. It goes beyond the relatively straightforward landscape of electronic journals that originally were considered to be prototypical digital scholarship examples. I see digital scholarship as a method of scholarly communication, research, and exchange of ideas that employs modern forms of technology, in particular, those forms of technology maintained within an institution's cyberinfrastructure. The American Council of Learned Society's report on cyberinfrastructure entitled, *Our Cultural Heritage*, boldly indicates that the authors believe this form of scholarship is the future of *all* scholarship (ACLS 2006). In this essay I will be specifically addressing how digital scholarship taxes our notions of appropriate curation and digital preservation. In particular, I will be looking at practical approaches to developing services, infrastructure, and policy related to these activities.

How is Digital Scholarship Different?

In what manner is digital scholarship different from "traditional" scholarship? Donne's poem referenced above celebrates the book as a stable vehicle for the dissemination of "learning" in an age that witnessed the harbinger that was to become print culture as we know it. The transition from an oral to written culture and then from manuscript circulation to print production marked a shift in technology. The hegemony of the codex format is still very much with us for many good reasons that I need not detail. However, today, new forms of scholarship are available through the ubiquitous use of technology. Data can be mined, texts can be structured, images can be delivered and manipulated—all with some very basic tools. This is where the simple comparisons end. Digital Scholarship embarks into highly esoteric realms—realms that few may even know existed. New advances in computational science, data set manipulation, aggregation of digital objects all take on increased magnitudes of complexity.

These new planes of existence require ever changing and flexible architectures to manage and deliver this content. This takes us far beyond the realm of Donne's book and closer the digitally metaphysical. Digital scholarship then is often, in equal parts, the intellectual content *and* the manner in which it is created and presented. That is what sets it apart from, for example, humanities scholarship as it has been historically undertaken in its published form. Thus it would follow that the sustaining of digital scholarship goes far beyond what I would normally classify as the (already not so straightforward) preservation of digital objects. In other words, sustaining digital scholarship is not just the difficult task of preserving the atomized digital objects (or even bits and bytes) but also the relationships among them. These relationships represent the digital world of authorial aggregation and distribution that also needs to be preserved. This is not a task that any one unit within a university can possibly undertake.

Core institutional services need to be developed in order to support and sustain digital scholarship in a manner that is appropriate to the institution's mission. These can be collecting strategies, organizational models, outreach services, as well as developing new tools for managing this scholarship. That said, digital scholarship requires a new form of library environment—one that is adaptable and extensible, one that properly adjusts to changing technologies. For most institutions this requires strategic partnerships both within and beyond what are often defined as traditional institutional relationships. I will later discuss what types of collaborative policies need be crafted. This will range from signed license agreements (SLAs) to collection or deposit agreements that cover the range of intellectual property and copyright issues. These policies should also detail how the work will actually be undertaken as it is a cooperative agreement between the author(s) and, in this case, the library as the future steward of the collection.

Goths and Vandals Invade?

When this book is made thus,
  Should again the ravenous
  Vandals and the Goths invade us,
Learning were safe

Like so many academic institutions, UVa Library struggles with the workload of managing and migrating legacy content along with the ubiquitous creation of new content. Digitizing activities are integrated in almost every facet of the higher education institutional framework both physically and philosophically. These voluminous activities threaten to strain the already tenuous hold libraries maintain over their digital services and support. One of the most important questions concerning the preservation of digital scholarship is: "How do scholars and librarians work together to ensure that resources created today will be available in the future?" (Marcum 2002). As we look at strategies for sustaining digital scholarship we are developing a framework for how all materials—old and new—can be properly stewarded. This has been a process I have been involved in here at UVa for several years. I hope to illustrate how we have begun to articulate the life cycle of digital objects (including their aggregate relationships) and how the sustaining of digital

scholarship is for us, the next generation of digital preservation.

What is a definition of Digital Preservation in this context?

Digital preservation is the managed activities for the long-term maintenance of a digital object and the continued accessibility of these objects. The Research Library Group defines digital preservation "as the managed activities necessary: 1) For the long-term maintenance of a byte stream (including metadata) sufficient to reproduce a suitable facsimile of the original document and 2) For the continued accessibility of the document contents through time and changing technology" (RLG 2002). It is also a practice that can simulate the original experience of digital scholarship (as I have defined it) whether that experience be approximated or emulated. No one would see digital preservation as a set of isolated activities in this context. It needs to form the core of any suite of services that are established in support of faculty and student research. We have demonstrated that we can easily create digital materials; we have yet to demonstrate that we can fully manage them. Digital preservation activities should move us "toward the realization that perpetuating digital materials over the long-term involves the observance of careful digital asset management practices diffused throughout the information life cycle. This in turn requires us to look at digital preservation not just as a mechanism for ensuring bit sequences created today can be rendered tomorrow, but as a process operating in concert with the full range of services supporting digital information environments, as well as the overarching economic, legal, and social contexts" (Lavoie and Dempsey 2004). Digital preservation requires and understanding of who own or is responsible for the scholarship.

At UVa we have adopted a managerial distinction to assist us in differentiating among all the possible players and preservation options. We have virtually (as opposed to physically) partitioned our service landscape according to who owns and/or manages the content that has been / will be created. We started with two main areas of content that allows us to build a structure that is both flexible and extensible. This content is defined as *scholar managed* or *library managed*. There are certainly more options but for our initial planning and development of a dependable cyberinfrastructure we began with these two categories. The scholar managed content environment is the product of supporting digital scholarship. It should be able to provide a faculty member with a stable suite of tools and services that will meet almost any need that arises through the creation of digital scholarship. Library managed content forms the core of the library's digital collections and repository environment and includes content from our websites, databases, and OPAC. The library managed environment is our digital preservation infrastructure.

The purpose for virtually partitioning these two management spheres is that we wanted to create an integrated environment that allows users to crosswalk their content from scholar to library managed content arenas. In other words, the two partitions are based on very similar software platforms and identical hardware platforms. This way scholarship that a faculty member develops in the scholar-managed content environment already shares many of the basic hardware and software requirements for transitioning into the library managed area. If the scholar wants the library to preserve her digital scholarship we have a strategic *a priori* starting point.[2] By integrating these environments "behind the scenes" we hope to have much of the raw material that faculty need (and created by the library for faculty) managed in our environment and the researcher can draw up it in from the faculty environment. That way at least, the raw content has a preservation strategy (based on file types etc.) and the faculty member's development is more related to the application and software functionality. This is our model for current and future scholarship. However, given the huge amount of legacy data the library manages, we have had to formulate a strategy for cross-walking much of the older material into the library managed content environment.

The Lay of the Service Landscape

In order to articulate the myriad of activities that comprise a strategy for digital preservation of this magnitude, we have broken out the entire process into several stages. What follows is a general overview of how we at the UVa Library approach this problem set. It is specific to our institutional landscape but by no means completely bounded by it. The goal in outlining the work plan is to allow others to adopt pieces or the entire process as a potential model for their home institutions.

We have two different vectors of approach for preserving digital scholarship. I classify them as *supporting* digital scholarship and *sustaining* digital scholarship. The former bespeaks of a highly collaborative, participatory role that librarians / technologists should have with faculty; the latter a set of transformative and migration activities with materials that have already been created and formed. Both

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[2] This environment for faculty is meant to provide the "carrot" for using the system that the library has established in cooperation with several other university units. Faculty members can self-deposit in this environment but we make it clear that the faculty member manages the scholarship at this initial stage. For a good discussion of faculty self-deposit in IRs see Marshall's article on the scholarly perspective, Section 4.

require a great deal of resources and planning and both are critical to the success of any institution's digital preservation strategy.

Supporting Digital Scholarship: Enhancing our Ability to Digitally Preserve

Activities that fall under this rubric can be categorized in many ways but most fall under support-service activities which can take the form of digital labs, digitization services, grant writing, and intellectual copyright consultation to name a few. Every institution has varying levels of infrastructure in place to support the teaching and research of faculty and students. These examples certainly represent an excellent beginning to a full suite of services for supporting scholarship. They enable the creation of new materials, their description, organization, and dissemination at a minimum. The services that are based on such activities draw heavily upon the expertise and abilities of both librarians and technologists (often in the form of blended professionals). In many cases, however, these services exist almost entirely independent of the second layer of support that is required—a complex institutional repository and web services environment. The maintenance of this framework often goes beyond a single department or unit's ability to support on its own. More and more, institutions are adopting the strategy of the institutional repository to administer faculty and student output. Foster and Gibbons see these types of systems as a form of digital preservation: "In the long run, we envision a system that, first and foremost, supports our faculty members' efforts to 'do their own work'" (Foster 2005). A recent survey of repository services demonstrates that very few (none with a Preserv[3] profile) had a formal preservation policy (Hitchcock *et al*. 2007). Certainly, this is an important first step and the need to integrate the above-mentioned services with these repository environments is critical for truly supporting digital scholarship. It is a major part of the necessary cyberinfrastructure for faculty and student research. However, without the complete integration of services and repository environments it could still fall far short of a solid digital preservation solution. Too much of today's digital scholarship is taking place and exists only on faculty members' local machines which are managed informally and not part of an institution's infrastructure. This puts much of that work in peril for both the researcher and the institution: lose the scholar-lose the scholarship is not a sound institutional strategy. The organization of the repository landscape should represent the commitment of the library to preserve scholarly research as well as a concomitant assurance from the institution through its

support. If not, the result can be a series of one-off pseudo-solutions. Single solutions often address the preservation of files in isolation and are much less adaptable to aggregations of content. Integration of services and repository environments becomes part of what Lavoie calls an institution's promise to its scholars: "Fulfilling this promise requires the cultivation of stakeholder communities that, through their working and learning experiences, meaningfully engage with digital information environments" (Lavoie 2008). Cultivating these communities can occur in many ways—some overt and some that are covert. For example, most practitioners understand that in order to approach a solid preservation strategy one needs to "catch" faculty and students early on in the planning stages of their projects. At the very least, catching them at the point of production will minimize the efforts that may have to happen downstream whether they be reformatting, re-digitization, etc. These follow up activities can often derail future preservation strategies and damage relationships between the researcher and the institution.

Covert methods are often equally successful to those of a services lab or production environment. Creating an integrated environment that contains scholarship and projects is a key component. Ensuring that the faculty and students have a development environment that is built on similar standards (if not duplicative) that can be found in the institution's production and management environment will allow for smoother transitions between what I referred to as library managed content versus scholar managed content. There is of course the inevitable trade-off between standardization, which is essential for long-term preservation, and flexibility, which allows for a researcher's versatility in discovery and application. At UVa we have been collaborating for years with our central technology group, ITC (Information, Technology and Communications) to provide an appropriate technology environment that supports research. To create an environment such as the one needed to handle faculty scholarship the library could not do it alone.[4] Instead, we built upon a relationship that centers on different spheres of management. In this scenario, the library is responsible for the content, ITC for the hardware. The software layer becomes the shared interface where a baseline platform is vetted and agreed upon. Producing a development environment that approximates the production environment is one way of approaching this problem. How would one

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[3] Preserv project <http://preserv.eprints.org/>.

[4] This is a clustered server environment that provides three tiers of service: a development environment that individual faculty members can use to incubate their research and test out new technologies; a test environment that is a clone of the final production environment where changes and load testing occurs; and finally, the production environment which is meant to deliver and manage only fully tested and "mature" digital scholarship.

decide what new technology might need to be integrated into the production environment? Creating a feedback loop of testing and production can allow for greater flexibility. If a faculty member considers a new piece of software integral to her research then the library and other support structures have a review process to analyze and test the claim. If it is determined that the new technology provides new and improved functionality then the library can integrate the new technology into its environment along with the research. This provides the greatest balance between flexibility and stability. This is an ongoing cooperative approach to maintain a service environment that faculty use and trust. Beyond simply defining the environment (as if it were simple) the expectations that are required for the environment need to be clearly delineated. It took several months to establish service level agreements between the library and ITC in order that we could communicate those levels of service to faculty. For example, materials that are served from our production environment could have a 24 by 7 guaranteed "up-time" with a definable problem response time, the test environment might be 24 by 5, and then the development environment weekdays, 9 to 5. Establishing and publishing these parameters with faculty greatly increases the trust in the integrated environment and serves as an incentive for faculty to use our services to do their research rather than going it alone. Like Entlich and Buckley, we see it as our mission to create and "establish institutional repositories in which faculty are encouraged to deposit their work" (Entlich and Buckley 2006). If we do this, then preserving the materials becomes a slightly less difficult task since the cyberinfrastructure closely mirrors the library managed content environment.

Sustaining Digital Scholarship as the Next Level of Digital Preservation

Supporting and sustaining are not mutually exclusive activities. For larger institutions that were early adopters of digital technology, the support structures have changed dramatically over time. UVa is once such institution. Early activities originating from the mid 1990s to today mean that we have a vast amount of legacy data—none of which conforms to any one standard. Images, text, data sets, early faculty forays into digital scholarship, all sit on servers and laptops and any number of portable media devices. Enter the sustaining portion of digital scholarship. This is where I believe we push the limits of digital preservation. It often involves materials that used technology that has become obsolete or outdated file formats. The library is confronted with a series of challenges with this material. No single unit can make the decision to keep or weed the materials. Nadal speaks of a need of the need for the "human element" in digital preservation (Nadal 2007) and this

certainly comes into play in making these decisions. This is where the library needs to draw upon its collection development strategy for digital materials.[5] At the very least this should provide some guidelines for prioritizing materials to be preserved. In all the most significant ways, digital preservation of this level most closely mirrors the preservation of physical materials. The digital scholarship most at risk (decaying hardware or software environment, formats approaching obsolescence, etc.) is prioritized above other materials that have a perceived longer life potential.

If preserving the bits and bytes is the default activity for sustaining digital scholarship, the next step is where things get messy. Deciding to "collect"[6] a piece of digital scholarship goes far beyond just format preservation. Replicating the functionality of the files will largely depend on what one's integrated support environment can handle. Parameter must be in place to provide the necessary context for collecting since the re-factoring of content may be involved. UVa library partnered with the Institute for Advanced Technology in the Humanities (IATH) in 2000 in the Mellon sponsored Supporting Digital Scholarship (SDS) grant. The goals for this project were to "propose guidelines and document methods for libraries and related technology centers to support the creation and long-term maintenance of digital scholarly projects."[7] The original SDS grant forms much of the underpinnings of this current approach. It analyzed digital scholarship from both a technical and a policy perspective. Sustaining digital scholarship can be stated as follows: an attempt to develop a socially and technologically sustainable and scalable model for support and preservation of digital scholarship. The operative words in the statement are *sustainable* and *scalable*. Sustainable gestures to the "trustworthy" nature of the institution (both technologically and conceptually) to continue to support faculty research and scalable to grow those research support models as needed. In order to fully understand the implications of preserving digital scholarship the grant established "levels" of collecting. These break down as follows:

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[5] Some scholars have argued that we need to justify digitizing books based solely on preservation needs. This strategy often leaves the library stuck choosing between preservation and access. Mass digitization is a sound strategy for maintaining access but should only play a part in the overall preservation strategy of an institution. See Hahn's 2008 article on mass digitization.

[6] "Collect" in this sense means to migrate the materials into the library managed content environment. Many of these early examples of digital scholarship exist on different servers--not all of which the library manages. Therefore a formal collection strategy needs to be employed.

[7] SDS Mellon Final Annual Report, 2003.

Level 1: Collecting metadata only – At this level the project would be represented as a single object in the digital library which records that the project exists or existed in the past, and includes some descriptive metadata about the content of the project, people who were associated with it, etc.

Level 2: Saving the project as a set of binary files and metadata only – Only the most basic preservation would be attained at this level. Content files and possibly all the files associated with any custom software would be collected as standard binary files only. The same descriptive metadata would be collected as for level 1, along with technical metadata about the original formats of the files and any software that was necessary to use them. At this level, the assumption is that anyone interested in using the project would be on his or her own in trying to reconstruct it.

Level 3: The content can still be delivered as in the original – At this level, relationships among the content are preserved but no attempt is made to capture the exact action of the project or its look and feel. The user's experience may be different but the ability to navigate the connections that the author provided is preserved.

Level 4: Look and feel intact – The project operates and appears exactly as it was originally intended. The software may not be identical but every effort is made to recreate the user's experience as completely as possible.

Level 5: The project is completely documented – The project is preserved as a complete artifact, documenting its development and history. This could include ephemera such as e-mail archives from a project development team, reviews or citations of the project from other sources, documentation associated with grant proposals, etc.

These levels all map to functionality provided by the integrated repository environment—depending on what level of complexity it can handle. This model is based on the symptomatic reading of the components (derived from a complete technology assessment—see below) and can be adapted to almost any institution's cyberinfrastructure. These can also be thought of as levels of service following recent trends in repository management. William LeFurgy's article "Levels of Service for Digital Repositories" states: "Levels of service can best be thought of as a matrix with one set of values determined by the available technology and the other set determined by the degree to which digital materials have persistent qualities. The first set depends on incremental development of new and improved tools. The second set of values is tied to the degree to which digital materials are persistent (based on

consistent and transparent rules for description and structure, standardized file formats, and so forth)." Embarking on a digital preservation assessment of digital scholarship requires clear guidelines to manage expectations as closely as possible. To outline these activities, it helps to have a formal work plan that can be mapped to a level of collecting.

First order: Do a technical assessment of the digital scholarship. This will also include a census of all the scholarship as defined by the faculty member or as defined by the "collection" or corpus of materials. It is imperative that one undertakes a technical assessment of the scholarship prior to any other activity. This can be broken down into different areas of assessment: technology required, file format, functionality, and intellectual property, digital rights management, to name a few. The assessment should also take into account mappings from current hardware and software environments to the integrated environment that the institution supports. Granted, as with all similar types of activities it can only ever be an approximation but it most certainly can be used to map the project to a level of service (and hopefully, faculty expectations). The first part of any migration (or re-factoring as the case may be) is to understand the scope of the scholarship (collection, project) itself. This is a surprisingly difficult process and is often taken for granted that everyone understands the extent of the digital scholarship. In fact, this is seldom the case. This stage is integral to formulating a roadmap of work that will be necessary to digitally preserve the materials for inclusion into the library managed content environment.

Second order: Once the census and assessment is completed you can map the functionality to an appropriate level of service. This should be an agreed upon level between the original manager of the content and the future managers (e.g. faculty member and those responsible for the library managed content environment). If the two parties agree then the next step is to develop and formalize agreements between parties. This could take the form of a collection or deposit agreement and should provide several key components at a minimum:

1. An overview of the intellectual property components of the collection (including copyright and access issues).
2. A formal work plan that maps out each stage of work that will need to be done. This should include shared staff time and server access.
3. Document all decisions and factors related to preserving the digital scholarship so that future managers can understand why certain decisions were made.

Final order: Implement service and procedural methods to formally ingest the digital scholarship into the integrated repository environment. This is also known as the final "publishing" of the digital scholarship. This final stage "freezes" the digital scholarship not allowing any new changes to take place unless governed by the collection agreement. The content is then managed by the library and is digitally preserved to the best of the institution's ability. This overview is meant to be a conceptual framework that could be adapted to most institution's missions and infrastructure. It does not do justice to the many complexities and challenges that go into preserving digital scholarship. This process should be mutable and adapted to changing technology and scholars' needs and is never meant to become a monolithic structure. Digital preservation is still a moving target and we need to be ready to change with it.

Conclusion

When one steps back and surveys the vast complexities involved in the preservation of digital scholarship it becomes painfully clear that unless units across the institution cooperate, we will all fail. The first step is to create a suite of services that can meet our researchers' needs for supporting and sustaining digital scholarship. Developing a network of cooperative elements to support these services needs to be part of the initial planning. The library, technology units, faculty, provosts, academic departments, all need to have a shared understanding of what the goal for digital preservation should be. The library cannot establish seemingly arbitrary requirements for faculty to manage the scholarly output of the institution, unless the scholars understand what is at stake. University administrators (chancellors, presidents, provosts, deans) all need to agree that the preservation of the scholarly record in a digital world is a complex set of cooperative communication, management, and administration. If the funding is not available for digital preservation then we will fail before we begin. Therefore it is incumbent upon all levels of higher education to understand the implications of a true digital preservation strategy: one that is not bounded by a single department, library, or school; one that is not entirely dependent upon commercial organizations to do it for us; and one that combines all the strengths of librarianship, technology, innovation, and faculty participation. No one can do it alone. Establishing as sound strategy for one's own institution is only the beginning—partnering with other institutions means that we can begin to develop some digital preservation synergy. We have only just started down this path and there is more to do so that we preserve our scholarly record. Sustaining digital scholarship is the next phase of approaching collecting faculty output into our cultural heritage. It remains to be seen whether or not we will fully succeed in this endeavor. If we do not, then in Donne's words, "posterity shall know it too."

References

ACLS. 2006 "Our Cultural Commonwealth: Report of the American Council of Learned Societies Commission on Cyberinfrastructure for the Humanities and Social Sciences." <http://www.acls.org/cyberinfrastructure/cyber.htm >.

Entlich, Richard and Ellie Buckley (2006) Digging Up Bits of the Past: Hands-on With Obsolescence, *RLG DigiNews*, Vol. 10, No. 5, 15 October 2006 http://www.rlg.org/en/page.php?Page_ID=20987#article1.

Foster, N. F., & Gibbons, S. (2005). Understanding faculty to improve content recruitment for institutional repositories. *D-Lib Magazine*, *11*(1). http://www.dlib.org/dlib/january05/foster/01foster.html.

Hahn, T. B. (2008). Mass digitization: Implications for preserving the scholarly record. *Library Resources & Technical Services*, *52*(1), 18-26.

Hitchcock, Steve, Tim Brody, Jessie M.N. Hey and Leslie Carr (2007) Survey of repository preservation policy and activity. Preserv project, January 2007 <http://preserv.eprints.org/papers/survey/survey-results.html>.

Horrell, J. L. (2008). Converting and preserving the scholarly record: An overview. *Library Resources & Technical Services*, *52*(1), 27-32.

Jantz, R., & Giarlo, M. J. (2005). Digital preservation: Architecture and technology for trusted digital repositories. *D-Lib Magazine*, *11*(6). http://www.dlib.org/dlib/june05/jantz/06jantz.html.

Lavoie, B., & Dempsey, L. (2004). Thirteen ways of looking at...digital preservation. *D-Lib Magazine*, *10*(7/8). http://www.dlib.org/dlib/july04/lavoie/07lavoie.html.

LeFurgy, W. G. (2002). Levels of Service for Digital Repositories. *D-Lib Magazine*, *8*(5). Retrieved from http://www.dlib.org/dlib/may02/lefurgy/05lefurgy.html.

Marcum, Deanna B. (2002). "Preservation of Scholarship: The Digital Dilemma" in *The Internet and the University*

Forum,   2002.
<http://www.educause.edu/forum/ffpiu02w.asp>

Marshall, C. C. (2008). From writing and analysis to the repository: Taking the scholars' perspective on scholarly archiving. *Proceedings of the 8th ACM/IEEE-CS Joint Conference on Digital Libraries*, 251-260.

Nadal, J. (2007). The human element in digital preservation. *Collection Management*, *32*(3/4), 289-303.

Research Libraries Group. (2002). *Trusted digital repositories: Attributes and responsibilities*. An RLG-OCLC Report. Available at: <http://www.rlg.org/longterm/repositories.pdf>

Smith, A. (2007). Valuing preservation. *Library Trends*, *56*(1), 4-25.