

Digital Preservation c. 02012: Goals, Challenges, and Future Focus Areas

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### Abstract

This paper provides an overview of the goals, challenges, and promising focus areas for the future of digital preservation as well as the role of cultural heritage institutions in this endeavor. Digital preservation maintains cultural heritage and makes it widely accessible for the entertainment, education, and research needs of current and future audiences. Efforts to include users in the decisions about what to preserve amongst the vast array of analogue and born digital materials are particularly important. Unresolved issues with the fragility of storage media, file format and software obsolescence, and the mutability of the web and other born digital materials have necessitated that digital preservation be an ongoing process. Approaches that seem promising for the future of digital preservation include: increased collaboration; the creation of a single online portal or access point for digital collections; marketing of the digital identity of cultural heritage institutions; education on the need for personal archiving; the realization of the value of long-term preservation; and ways to improve usability of digital collections.

*Keywords:* digital preservation, role of libraries, archives, and museums in digital age, cultural heritage institutions as virtual destinations, born digital material, collaboration, preservation decisions, digital preservation challenges, format obsolescence, software obsolescence, storage degradation, preservation process, long-term preservation, single search, single point of access, marketing of libraries and archives, popular archiving, archive usability, augmented reality, internet of things, gesture-based computing, touch tables, 3D scanning, Digital Public Library of America, World Digital Library, Internet Archive, Long Now Foundation, CyArk, SixthSense

## Digital Preservation c. 02012: Goals, Challenges, and Future Focus Areas<sup>1</sup>

This paper provides an overview of the goals, challenges, and several promising focus areas of digital preservation. With such an expansive topic, the scope is limited to points which the author feels are particularly formative, compelling, or helpful for the future of digital preservation. The first part includes a review of the goals and value of digital preservation, the difficulties of making preservation decisions, the challenges of digital media, and the preservation process that addresses these challenges. The second part reviews approaches which are promising for the future of digital preservation including: increased collaboration; the creation of a single online portal for access to digital collections; marketing the digital identity of cultural heritage institutions; educating the public on the need for personal archiving; the realization of the value of long-term preservation; and ways to improve usability of digital collections. Ultimately, both sections lead to the conclusion that digital collections are vital to establishing a stable and productive role for cultural heritage institutions in the present and the future.

### **An Overview of Goals and Challenges**

#### **Digital Preservation: Familiar Goals**

The goal of preservation is to ensure that our cultural heritage is secured for the use of future generations. Ideally, *digital* preservation not only safely stores this heritage it also ensures it is remotely accessible to a global audience. In this light, digital preservation furthers the traditional goals of archives by increasing the size and breadth of the audience that can easily and freely access the archived materials. For analogue materials, “digitizing provides broad access to

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<sup>1</sup> The five-digit year format (02012) pays homage to The Long Now Foundation’s date format, which includes an additional digit in recognition of the future milestone of the year 10,000. Their goal is to increase awareness of very long-term thinking by pointing out where the present fits into the timeline of the far future.

materials, as well as providing an additional layer of preservation” (Breeding, 2012, p. 24). For born digital materials, there is an urgent need for preservation due to the fragility of the medium and the lack of awareness of the need to preserve digital information by content creators. As Lasfargues, Martin and Medjkoune (2012) state, “like any other medium, the Web deserves a memory and it is essential to preserve what has a cultural, heritage and historical value” (p. 118). For the archive’s value is realized not only in the content preserved but also in the use of that content (Rieger, 2010; Smith, 2007). Use can be many things, from entertainment for interested members of the public, to the educational goals of teachers, to the research of historians. The end result of this use is vital as Craig (2011) adroitly conveys, “historical study develops practical and political skills needed to assess what is going on today and to prepare for the future: it builds immunity to the destabilizing effects of future hype and current happenstance” (p. 212). Digitally preserved materials stored with comprehensive metadata in searchable databases enable multivariate connections across a multitude of thoughts, ideas, and data “that [would] be impossible to reproduce in book form” (Bee, 2008, p. 191). Digital preservation facilitates access to a plethora of archived materials for worldwide audiences in a way that allows for unique and intimate interactions with those materials.

### **The Preservation Decision: Postmodern Inclusion**

It is easy to find examples of the value of digital preservation but the question of how to preserve digital material is much harder to answer. This is an area in which analogue and born digital materials differ. Analogue items are typically selected for preservation based on their uniqueness and scarcity (Asogwa & Ezema, 2012). “A thing that is scarce [is determined] to be valuable simply because it is scarce” (Smith, 2007, p. 10). With born digital materials, the opposite problem exists: immense quantities of digital materials are created every minute. The

vast majority of Facebook posts can hardly be categorized as scarce or unique. However, the consequence of vast quantities of information is not always information overload. In fact, the vast amount of digital information created on today's social networking sites may actually provide a better history of a broader range of society than analogue archives have by "capturing the lives of ordinary people" (Roland & Bawden, 2012, p. 225). As Grotke (2011) explains, "one of the biggest challenges is determining exactly what to collect . . . There are basically a few distinct approaches to web archiving: bulk or domain harvesting and selective, thematic, or event-based harvesting" (p. 17).

Ultimately, it is up to the institution that holds the materials to formulate a policy for digitization of analogue materials, preservation of born digital materials, and ongoing digital preservation of both. This policy should be crafted with input from users of the collection whether they are professional scholars or laypeople. Again, preservation is worthwhile in its own right, but significant value is created when preserved materials are utilized in entertainment, education, or research. With scholars in particular, Roland & Bawden (2012) point out that "there is some active collaboration between the history profession and library and archive practice. . . . However, matters could be further improved, by greater dialogue between all concerned" (p. 227). Cook (2009) goes further to call for a transition in archives "from modernist to postmodernist, from passive custodial to active interventionist, from hierarchical and exclusionary to networked and inclusive, from inward-looking and secretive to openly transparent and interactive" (p. 530). The need to hear many perspectives and voices in the appraisal of materials will help to ensure more comprehensive and inclusive archives.

However, even with the best intentions for preservation decisions, "gaps in the historical record" (Roland & Bawden, 2012, p. 231) must be expected. Those gaps appear whether the

historical record is digital or analogue. Equally, that which is seen as a gaping hole by present day participants may not be recognized as such by future historians—“it is impossible to know what will be of value to future historians” (Roland & Bawden, 2012, p. 227). Smith expounds an additional caution:

Perception of value is subjective and is conditional by time and place. Some things that are currently prized by researchers and collectors will be neglected inside of a decade or two. The instances of collections languishing in book stacks untouched for decades and then coming into demand are legion. (Smith, 2007, p. 11)

Only “about 1 to 5 percent of the total available documentation of major institutions is preserved and an even smaller percentage from the totality of records of all private citizens, groups and organizations” (Cook, 2009, p. 504-505). Though this seems a hopeless and bleak situation, it does not negate the importance of preservation and decisions about what to preserve; it, in fact, makes both the endeavor and the decisions all the more vital.

### **Digital Preservation: Fragility and Process**

Digital preservation comes with a set of many, well-documented challenges (Asogwa & Ezema, 2012; Bee, 2008; Brand, 1999; Breeding, 2012; Conway, 2010; Evens & Hauttekeete, 2011; Smith, 2003; Smith, 2007; Steenbakkens, 2005). These challenges are particularly vexing because the motivations for technology companies that could help alleviate them often run counter to the motivations of preservation-minded cultural heritage institutions. “The fragility of digital content can not be understated” (Breeding, 2012, p. 22). And it is not simply storage devices that will be obsolete in the near future; it is also an issue of file format and software obsolescence. If the file can no longer be accessed physically or rendered comprehensibly in software, then preservation *for access* has not occurred. With web pages, the additional problem

of link degradation is encountered, especially when those links pull video and other multi-media files whose original source files can't be accessed by web crawlers to be archived. “‘The real problem,’ says computer designer Hillis, ‘is not technological. We have the technical understanding to solve problems such as digital degradation. What we don’t have yet in our digital culture is the habit of long-term thinking that supports preservation’” (Brand, 1999, p. 48). A similar thought is echoed by Smith in 2007, “Its sheer abundance and ubiquity makes digital content appear perdurable” (p. 7).

Given the challenges described above and to maintain access to materials over time, digital preservation cannot be a single occurrence; it must be an ongoing process (Evens & Hautekeete, 2011, p. 158). This process is well defined and includes “refreshing, migration, replication, and emulation” (Asogwa & Ezema, 2012, p. 118). If one final, universally and continuously accessible archives format existed, would it be beneficial? Does the idea of such a format preclude (or ignore) future technological innovations that might have other currently unforeseen and positive consequences? Say such a universal format was created tomorrow, but in five years an entirely new concept of data storage and access was developed. Wouldn’t archives be updated accordingly? Would this be very different from the past migrations from stone tablets to scrolls to books to microfiche to compact discs? Granted the pace is quickening, but the change is similar in nature. Digital preservation *must* be understood as an ongoing process, at least for now. Further development of that process is required to increase the ease and quality of migration to new formats, new storage media, and new software emulation programs.

### **Promising Areas of Focus for the Future of Digital Preservation**

This section will highlight important areas of focus for continuing digital preservation efforts.

Moving collaboration beyond a sharing of best practices into true partnerships with other cultural

heritage institutions and the development of a single portal or access point through which consolidated archive collections can be accessed seem logical places to start. The need to establish truly long-term preservation is necessitated by the fragility of digitally preserved materials as discussed above. Increasing awareness of digital collections and reclaiming the perception of libraries and archives as sources of information equivalent, at least, to Google and other search engines is discussed as a marketing need. Educating digital content creators as to their role in preserving their creations for posterity is discussed. This section ends with a review of methods for enhancing the usability of digital collections in light of expected technological innovations.

### **Collaboration: Beyond Best Practices**

The need for collaboration amongst cultural heritage institutions is well understood. Sharing knowledge and banding together to create leverage with vendors are fundamental to sustaining and advancing digital preservation in institutions with limited funding and influence. While national and international cooperation has resulted in widely accepted standards for digital preservation, like the Open Archival Information System (OAIS) model, more extensive efforts are required that may blur the boundaries between institutions. Collaboration between cultural heritage institutions must proceed beyond the creation and sharing of best practices or the “exchange of experience and results” (Steenbakkers, 2005, p. 37) to a true partnership approach. Rieger recognizes this need:

We can learn from the institutional repository initiatives of the last ten years in which thousands of isolated systems were created to archive and make accessible locally produced scholarship. There is now strong recognition that this is not a sustainable model, from both technical and service perspectives. (Rieger, 2010, p. 10)



Collaboration at the collection level (both for creating the digital collection and for sharing that collection with users) will not only result in efficient use of institutions' resources but will benefit researchers. Combining multiple collections into one virtual archive serves to increase the size, breadth, and depth of all collections and allows users to make connections that would have been difficult or impossible with unconnected collections (Rieger, 2010).

This partnership should also include forming a united front when negotiating with technology companies and service vendors. This is already occurring as evidenced by the Center for Research Libraries efforts to negotiate with serial publishers on behalf of several libraries. "These libraries believed that by acting together, they could exert a stronger hand in dealing with the aggregators, and that the benefits of the undertaking might also accrue to the broader library community" (Reilly & Simon, 2010, p. 272). As Brand proclaimed in 1999, "it will take insistent, knowledgeable, unrelenting demand from libraries and archivists for long-lived digital media, or the engineers will never take the problem seriously enough" (p. 48). While such a solution is still wanting today, one must be cognizant of the fact that it doesn't jibe with the profit motive of most for-profit, technology companies. "The profits of the software and computer industry are partly based on its manufacture of products that become obsolete every few years" (Bee, 2008, p. 191). It is termed 'designed obsolescence'. Manufacturers *want* consumers to replace devices. They want to produce new and better storage formats because they are driven to innovate to stay competitive, sell product and remain profitably in business. Certainly some sort of partnership with technology companies to develop lasting data storage and universal emulators must be possible, but the nature of that partnership would likely need to be charitable (i.e., tax deductible) or philanthropic (i.e., reputation building) to be successful.

To alleviate some of the need to rely on for-profit companies, cultural heritage institutions can and do look instead to partner with computer science departments at universities. Collaboration between preservation-minded departments and computer science departments makes sense because the need for technological solutions to digital preservation problems often exceeds the knowledge of those trained in library science and archival studies. There is a “critical need for institutions to work in concert to preserve digital scholarship and heritage information” (Cruse & Sandore, 2009, p. 302). This requires moving beyond a simple sharing of best practices to an intertwined and commingled effort to achieve shared goals.

### **Single Portal: A Google of Libraries and Archives**

The idea of collection collaboration, the goals and value of digital preservation, and user behavior call for the creation of some type of single source or aggregator for digital archives. When institution specific barriers between collections are removed, users benefit from increased efficiency of search and far greater exposure to potentially relevant materials. If one of the benefits of digital preservation is instant and global access to information, then it behooves cultural heritage institutions to enable users to easily and efficiently search this information. Users want “an interface as seemingly easy to use as an Internet search engine” (Koh, 2003, p. 185). Tonta (2008) confirms by saying, “[library and museum] repositories are no longer the first stops of users when searching for information, even though they may still offer the best and most authoritative resources and services. Almost 90% of users consult search engines first” (p. 8). While Koh and Tonta are speaking specifically of a single library or museum’s website, the idea can and should be expanded to aggregating the collections of many individual institutions under the auspices of a single search-engine-like application or portal. For, as Rieger (2010) says, such an “aggregation in a virtual space of disparate and geographically distributed collections allows

scholars to study social and national identities without being bound by nationality, race, ethnicity or class” (p. 12). One of the reasons why Google is so successful is because it is a single destination for information on the Internet. It’s easy and reliable and makes the work of searching the web simple. Though speaking from the perspective of another discipline, the words of Jared Diamond are instructive here. He explains food-seeking behavior in early human societies, but the same psychology applies to the information seeking behavior of today. “All other things being equal, people seek to maximize their return of calories, protein or other specific food categories by foraging in a way that yields the most return with the greatest certainty in the least time for the least effort” (Diamond, 1999, p. 108). This is the principle of Least-Effort from information seeking theory (Bernier, 2010). Searchers desire to expend the least amount of effort to achieve their tasks. Cultural institutions have to take this behavior into account to be successful today because “we are in a user-centered rather than collection-centered world, and the library’s [or archive’s] mission is to customize information for its users” (Bodi & Maier-O’Shea, 2005, p. 145).

Several efforts towards consolidation of collections are under way. Amongst them are the Digital Public Library of America (DPLA), The Internet Archive, and the World Digital Library (WDL). Each has taken a slightly different tack, but each aspires to enable global access to digital or digitized materials through a single portal.

The DPLA is one of the most recent endeavors from the United States to create “a national digital library that would serve as an electronic repository for the nation’s cultural heritage” (Singer, 2011, para. 4). The DPLA’s Concept Note describes the library’s goal as “[making] the cultural and scientific heritage of humanity available, free of charge, to all. . . . By adhering to the fundamental principle of free and universal access to knowledge, it will promote

education in the broadest sense of the term” (Digital Public Library of America [DPLA], 2012, p. 1). Importantly, at least in its initial efforts, the DPLA will focus on access, not preservation, though the necessity for “[building] out the nation’s existing preservation architecture” (DPLA, 2012, p. 5) is recognized. The DPLA does not constrain itself to the U.S. only, but allows for coordinating activities with the digital libraries of other countries as well. The DPLA is a portal in the sense that it is not a digital repository for materials; it will link to collections that other cultural heritage institutions have digitized and/or stored and designated to be included.

The Internet Archive is probably one of the oldest, global, digital preservation efforts. Its focus is preservation and access (or preservation as access), and “its purposes include offering permanent access for researchers, historians, scholars, people with disabilities, and the general public to historical collections that exist in digital format” (Internet Archive, 2012, para. 1). Its collections include not only web sites but also books, texts, movies, audio, television news, software, video, and music. The Internet Archive also manages information archiving for several individual institutions and projects, like The Rosetta Project of The Long Now Foundation. Recognizing the fragility of born-digital materials, the non-profit is collaborating with other institutions, like the Library of Congress, to create a single portal from which preserved cultural heritage is accessible to people today and in future generations (Internet Archive, 2012).

“The World Digital Library makes it possible to discover, study, and enjoy cultural treasures from around the world on one site” (World Digital Library [WDL], para. 1). It is an excellent example of a global special collection. To create the site the WDL partnered with many global institutions including the Library of Congress and the United Nations Education, Scientific, and Cultural Organization. The WDL overcame technological issues, developed a new metadata standard, installed digitization centers in areas in need, and developed an intuitive and

beautiful interface that allows users to browse or search for information in a variety of visual and textual ways.

The above efforts towards single access points are exemplary, but, by their plurality, they embody an obvious flaw—there isn't *one* unified effort. And perhaps a truly worldwide, unified effort would be too unwieldy an enterprise what with legal, political, personnel, technological, and administrative differences. Perhaps the solution is rather that multiple institutions collaborate by providing or sharing materials with a central hub, like so many spokes of a wheel. Certainly the examples included above provide case studies for different ways to accomplish this. The next step is what is needed now. If libraries and archives want to maintain their place in society, they need a strong digital presence, ideally to a point where the idea of the library or archive (and here the reference is to libraries and archives in the aggregate, not individual institutions) is considered equally with Google in education, information, and entertainment searches. The benefit of creating such a portal separately from a general search engine is that the information accessible through the portal will have been reviewed and vetted by individuals at libraries and archives who are trained in collection building. Such a portal would not replace current search engines, but it would be an alternative to them.

### **Promotion: Increase Awareness and Shift Perception**

If researches, scholars, and the general public are not aware that they can access digital collections, then archivists and librarians have done themselves and their users a disservice. The need to re-brand libraries, archives, and museums as functioning both in physical and virtual spaces is required. As mentioned above, the first place users predominantly turn to for information is a search engine, not their local library. The perception of libraries and archives must be shifted such that they are considered a source of digital information. As discussed

earlier, the creation of single portal for digital collections would provide a new identity for libraries and archives to utilize in a re-branding effort. Establishing the brand will take much consolidated and consistent effort, expertise, and, certainly, funding. A digitally-based national awareness campaign to shift users' perceptions is one way to bring libraries and archives back into the public's consciousness as a source of knowledge—one that's accessible through the web. The consequences of not doing so are dire as Meglio (2012) states, "a special library may house a wealth of invaluable information that patrons cannot find anywhere else, but if nobody knows about it, the library's customer base will begin to erode" (p. 16).

### **Popular Archiving: Education for Public and Scholarly Audiences**

Part of increasing awareness is to educate the public and scholars about the necessity of archiving individuals' own materials, especially born-digital materials. The American Library Association (ALA) and the Association for Library Collections & Technical Services (ALCTS) created Preservation Week toward this end (Association for Library Collections & Technical Services [ALCTS], 2012). It's a weeklong, awareness-building campaign with customizable materials for local libraries and national public service announcements. This type of effort is an absolute necessity to ensure that our present is captured and that the archives of tomorrow will be full. And, thankfully, as Grotke (2011) says, it is a growing trend: "Non-specialists are learning how to archive their own digital output—websites, blogs, photos, and more—as a digital legacy of their own family history for future generations" (p. 19). On the scholarly side, and specifically with scientific data, digital archiving requirements are being built into the process from the inception of a project. "Federal funding agencies [require] researchers to submit data management plans with their proposals for grants" (Witt, 2012, p. 173). Education of scholarly

audiences outside of the sciences who do not yet have a mandate for archiving their own digital creations would be beneficial both for those scholars and for posterity.

### **Long-term Preservation: An Analogue Solution to a Digital Problem**

The longevity issues of digital preservation combined with the rush towards digitizing as a means to increase access have left archives and special collections in a precarious position. Errors in digitization of analogue materials, especially pre-1850 historical materials where Optical Character Recognition (OCR) was used, are common (Balk, 2009). Also, much context may also be lost in the digitization effort. For instance, when historical newspapers are scanned are their ads included? This context is vital to scholarly research (Bee, 2008). Continual migration equally runs the risk of data loss, and emulation may not always create an iteration as completely functional as the original. Digitization increases access and can provide a new avenue to a type of preservation, but it doesn't ensure long-term preservation—certainly not in the timeframe that archivists, scholars, and the general public expect. Accustomed to stone and clay tablets that last for thousands of years and books that last for hundreds, the fact that digital materials (digitized or born digital) may only last for a few years or a few decades is not widely understood. The Long Now Foundation was established to increase awareness of longevity issues:

The Long Now Foundation was established . . . to become the seed of a very long-term cultural institution. The Long Now Foundation hopes to provide a counterpoint to today's accelerating culture and help make long-term thinking more common. We hope to creatively foster responsibility in the framework of the next 10,000 years. (Long Now Foundation, 2012, para. 1)

To ensure long-term preservation another storage method is needed. One way to alleviate the risk of loss for digitized analogue materials is to keep the originals. “Material culture artifacts will serve as the ultimate backups for their digital surrogate” (Conway, 2010, p. 75). Artifacts should be physically as well as digitally preserved. Granted, limited budget and limited storage space (both physical and digital) are constraints that must be considered. Physical artifacts will become more valuable as we proceed into the digital age, both for their uniqueness as well as for their physical connection to the past. Saving such artifacts for posterity is exactly what archiving is about. The knowledge that those archives represent must be maintained for a “durable civilization” (Charlotte, 2012, para. 1).

Another option for long-term preservation is the creation of new, and very durable, analogue backups. “Several organizations and companies around the world have re-embraced the long-term durability of hard natural substances. The Long [Now Foundation’s] Rosetta disk . . . is made of nickel. Arnano, a French technology start-up, has developed a disk of sapphire . . . and most recently, Japanese electronics giant, Hitachi announced a new data storage technology that uses quartz glass” (Charlotte, 2012, para. 2). These methods can preserve many types of information like text, images, records, source code, and binary code. Most are created to be read by physical means like a microscope or magnifying glass and therefore do not fall subject to “platform or format [dependencies]” (The Rosetta Project, 2012, para. 3).

Yet another option to create long-term preservation is to look at ways of increasing the longevity of digital formats, and here too, The Long Now Foundation has initiatives in place. With the Longer Server and The Format Exchange projects, the organization is addressing “digital continuity” (Long Now Foundation, 2012, para. 1). They have also partnered with the Internet Archive to digitally archive their project work.



Budget, time, and resource constraints aside, it seems that adding a long-term preservation element to the preservation package is a right and responsible action. Initial digital preservation is undertaken with vigor, but it's predicated on the need to migrate data to a new format at some future point that can't necessarily be predicted, let alone funded. Budget changes, project re-prioritization, economic disturbances, and political shifts may all lead to a loss of information and materials despite the altruistic first intentions of digital preservation. Including an instance of a more durable storage format in the preservation package would work as a safety net. Such a package would then include the analogue original (where applicable), the bit stream, rendered content, scanned image, metadata (structural, content, and emulation elements), and a suitable long-term archive format.

### **Beyond Access: Enhancing Usability**

To this point in time, digital preservation has typically been valued in terms of the increased access it provides. Are there additional benefits to be garnered from the innovative technology that makes digital preservation possible? If we consider usability in addition to access, there are ways in which both physical and digital collections can be enhanced.

Augmented Reality (AR), smart objects and the Internet of Things are ways to enrich the experience of physical archives. AR is a computer-created overlay of information on top of an image or video of the real world. Besides the basics of directional navigation through the collection to the location of a particular artifact, augmented reality can provide instant access to the metadata related to a given item. Smart objects have been tagged with a small device that stores some data about that object and then communicates that data. The Internet of things enables real-time access to the smart object data from anywhere. Smart objects linked through the Internet of Things could also carry metadata as well as other environmental factors related to

the object itself (Johnson, Adams, and Cummins, 2012). Details of that metadata would then be instantly available to researchers who could in turn electronically transfer the information to their email accounts, save it on their portable devices, or share it through social media. Many museums are making use of AR in particular by blending in video overlays to create compelling and educational displays (Johnson, Smith, Willis, Levine, and Haywood, 2011):

London's Natural History Museum is . . . using AR with a recent project called Who Do You Think You Really Are? that gives museum visitors handheld screens featuring an interactive video that allows users to learn about the evolution of dinosaurs, which are seen in the video moving around the actual space of the museum. Embedding AR within video and merging these two media forms is a novel use of this technology. (Johnson, Smith, Willis, Levine, and Haywood, 2011, p. 17)

Certainly archives and special collections could also benefit from adding AR elements or smart objects to their public exhibitions in addition to providing less interpreted structural and descriptive metadata for researchers' use.

Gesture-based computing and 3D scanning have the potential to enrich the usability of digital archives. "Gesture-based computing allows users to engage in virtual activities with motions and movements similar to what they would use in the real world, manipulating content intuitively" (Johnson, Adams, and Cummins, 2012, p. 26). Rieger (2010) explains that re-installing some semblance of the physical archive would allow the context of the artifacts to be maintained in the virtual archive. "Many humanists are accustomed to working in physical archives with boxes of photos, old manuscripts, diaries and other materials . . . . The physical world assists them in their conceptual thinking" (Rieger, 2010, p. 20). A combination of high

quality 3D scanning with gesture-based interfaces would create a virtual environment that allows researchers of all kinds to intuitively interact with digital collections.

The CyArk initiative makes very detailed 3D scans of global cultural heritage sites and renders that information into virtual reality through a combination of data points and high-resolution photography (Kacyra, 2011). What CyArk accomplishes on a macro level with historic cities and monuments can also be applied to a micro level of individual texts and artifacts. Users interacting with these 3D scans and virtual renderings will be able to examine an object in great detail, much as they would if holding it in their hands.

Gesture-based interaction with digital collections would require the software to virtually organize information as well as the hardware to accept input. Software harkening back to a real desktop would be helpful. Something that, as Rieger (2010) said, allows researchers to lay their digital artifacts out on the table and organize those items as intuitively as they would physical books or boxes of photos with the added benefit that born-digital materials, like web sites, video, and audio files, could also be included in the array. Organization and conceptualization can be expanded beyond what would be allowed on a physical desktop. One could zoom into a specific piece for a closer look, and copy and paste its metadata to a word processing document or note-taking tool. One could add the digital object itself as an element or figure in an iBook or other multi-media book. One could create timelines or mind maps with the digital objects themselves. A host of other interactions could be possible. There are some very interesting and exciting devices that allow for gesture-based interaction. Touch tables would certainly be intuitive and mimic reality at a human scale. While it would be wonderful to think that every researcher would have a touch table in his or her office to access digital collections, smaller tablet or mobile device interactions are probably more financially realistic at this point in

time. However, the near future might find any surface acting as an interaction device. With the SixthSense prototype, Patti Maes and Pranav Mistry are developing an affordable, wearable device that enables one to “walk up to any surface and start using [one’s] hands to interact with information that is projected in front of [one]” (Maes, 2009). This is an entirely mobile, connected device that would allow for interaction with both digitized analogue and born-digital material anywhere, anytime. Gesture-based computing and high-resolution 3D scanning and rendering would help digital archives move beyond increased access to enhanced usability.

### **Concluding Thoughts**

This paper has intended to provide an overview of the goals, challenges, and promising areas of consideration for the future of digital preservation. Digital preservation maintains cultural heritage and makes it widely accessible for the entertainment, education, and research needs of current and future audiences. While there are challenges in determining what to preserve amongst the vast array of analogue and born digital materials, efforts to include users in the decisions are particularly relevant in our postmodern and participatory society. The “user unquestionably has emerged from his or her conceptual pigeonhole to become a recognized and valued player in archives work at all levels” (Craig, 2011, p. 215). Archivists must also understand that, despite their best efforts, there will be gaps in the historical record, and many materials will fall in and out of fashion as research subjects. Issues with the fragility of storage media, file format and software obsolescence, and the mutability of the web and other born digital materials have resulted in the realization that digital preservation is an ongoing process. There may never be a single, universal, and perpetually accessible archive format, hence perseverance in the face of constant change is necessary. “Many of the larger questions raised by computers underscore our need to understand the history of communication practices and the

experience of earlier generations in dealing with similar revolutionary challenges” (Craig, 2011, p. 212). It’s easy to consider current digital problems as unique and overwhelming when one is struggling in the midst of them. Having the presence of mind to view the situation objectively and search for help from those who have come before seems a reasoned and responsible act for archivists who preserve what has come before for exactly this purpose.

Approaches that seem promising for the future of digital preservation include: increased collaboration; the creation of a single access point for digital collections; marketing the digital identity of cultural heritage institutions; education on the need for personal archiving; the realization of the value of long-term preservation, especially in the digital age; and ways to improve usability of digital collections. Collaboration must move beyond a sharing of best practices to a level of fundamental partnerships. It is “essential in the development of preservation repositories, which should not depend for their existence on resources allocated by any single organization” (Conway, 2010, p. 76). And again from Grant (2012), “collaboration isn’t just the way to get to the future; it is the essential foundation strategy of successful library work in the future . . . . we will see end users not defined by a campus or the board of a library district, but by our globe” (p. 40). The ideological consolidation of libraries and archives made possible by partnerships would include the consolidation of their digital collections as well. Here some sort of single point of access is required, especially if libraries and archives want to reclaim their place as a source of information equivalent to Google and other search engines. Promoting the new digital identity of libraries and archives is vital to continued relevance in the present and the future. Doing so means that the collections will have broader access thus helping to fulfill the institutions’ missions. Without this increased awareness and access, special collections run the risk of being “underused and neglected” (Rieger, 2010, p. 12). Educating the public and

scholarly audiences about the need to archive their own personal creations, especially those that are born digital, is of paramount importance to ensure the digital archives of the future are not empty. Another way to ensure that future archives' collections will be abundant is to add long-term preservation to the preservation process. Often this means including analogue materials, e.g. the originals or newly created copies saved to very durable materials, along with digital representations. Including a durable back-up copy only makes sense. Long-term preservation also necessitates continued research into ways to perpetuate digital materials in digital formats for the long-term. "The creation of new digital collections that have long-term value is a new and truly appropriate business function that creates immediate value for users and long-term value for the organization" (Conway, 2010, p. 74). Finally, enhancing the usability of archives can be accomplished by applying the latest technologies, including Augmented Reality, the Internet of Things, and gesture-based computing to allow users to organize and conceptualize information in more intuitive ways.

There is still a role for libraries and archives in the digital age. Cultural heritage institutions can reclaim their position as information sources that complement the likes of Google—not as competitors, not as poor alternatives. The digital collections and the digital preservation that creates them are vital in this role because these institutions are transitioning to a service model that is "dominated by, perhaps even determined by, digital information technologies" (Conway, 2010, p. 67). Much has been accomplished in the years since the inception of digital preservation and much continued effort is needed. Cultural heritage institutions do have significant opportunities to remain relevant and contribute to the good of society by preserving and providing access to both analogue and digital information in a virtual realm. The goal for these institutions is the same—it's the new medium that presents

challenges—challenges that have already been accepted with enthusiasm, intelligent consideration, and practical effort towards resolution. Breeding (2012) encapsulates the mission of archivists, librarians, and curators succinctly, “[they] owe future generations of scholars [their] best efforts in passing along the cumulative body of knowledge entrusted to [them], even as it takes form in fragile and ephemeral digital media.” (p. 24).

## References

- Asogwa, B. & Ezema, J. (2012) The challenges of preservation of archives and records in the electronic age. *PNLA Quarterly*, 76(3), 115-125. Retrieved from <http://pnla.org/quarterly/index.htm>
- Association for Library Collections & Technical Services. Preservation week. Retrieved from <http://www.ala.org/alcts/confevents/preswk>
- Balk, H. Ploeger, L. (2009). IMPACT: Working together to address the challenges involving mass digitization of historical printed text. *OC LC Systems & Services*, 25(4), 233-248. doi:10.1108/10650750911001824
- Bee, R. (2008). The importance of preserving paper-based artifacts in a digital age. *Library Quarterly*, 78(2), 179-194. Retrieved from <http://www.jstor.org/action/showPublication?journalCode=libraryq&>
- Bernier, A. (2010). Information Seeking Theory and Practice. Unpublished lecture. School of Library & Information Science, San Jose State University, San Jose, California, United States.
- Bodi, S & Maier-O'Shea, K. (2005). The library of Babel: Making sense of collection management in a postmodern world. *The Journal of Academic Librarianship*, 31(2), 143-150. Retrieved from <http://www.journals.elsevier.com/the-journal-of-academic-librarianship/>
- Brand, S. (1999, February). Escaping the digital dark age. *Library Journal*, 46-48.
- Breeding, M. (2012, May). From disaster recovery to digital preservation. *Computers in Libraries*, 32(4), 22-25. Retrieved from <http://www.infotoday.com/cilmag/default.shtml>



Charlotte. (2012, October 12). Decoding long-term data storage [Web log post]. Retrieved from

<http://blog.longnow.org/02012/10/12/decoding-long-term-data-storage/>

Conway, P. (2010). Preservation in the age of Google: Digitization, digital preservation, and dilemmas. *Library Quarterly*, 80(1), 61-79. Retrieved from

<http://www.jstor.org/action/showPublication?journalCode=libraryq>

Cook, T. (2009). The archive(s) is a foreign country: Historians, archivists, and the changing archival landscape. *The Canadian Historical Review*, 90(3), 497-534.

Doi:10.1353/can.0.0194

Craig, B. L. (2011). The past may be the prologue: History's place in the future of the information professions. *Libraries & the Cultural Record*, 46(2), 206-219.

doi:10.1353/lac.2011.0009

Cruse, P. & Sandore, B. (2009). Introduction: The Library of Congress National Digital Information Infrastructure and Preservation Program. *Library Trends*, 57(3), 301-314.

doi:10.1353/lib.0.0055

Diamond, J. (1997). *Guns, germs, and steel: The fates of human societies*. New York, New York: W. W. Norton & Company, Inc.

Digital Public Library of America. (2012, November 15). Concept note. Retrieved from

<http://dp.la/about/>

Evans, T. & Hauttekeete, L. (2011). Challenges of digital preservation for cultural heritage institutions. *Journal of Librarianship and Information Science*, 43(3), 157-165.

doi:10.1177/0961000611410585

Grant, C. (2012). Construction zones on the library road to the future. *Public Library Quarterly*, 31(1), 21-47. doi:10.1080/01616846.2012.654734

Grotke, A. (2011, December). Web archiving at the Library of Congress. *Computers in*

*Libraries*, 31(10), 15-19. Retrieved from <http://www.infotoday.com/cilmag/default.shtml>

Internet Archive. (November 15, 2012). About. Retrieved from <http://archive.org/about/>

Johnson, L., Smith, R. Willis, H., Levine, A., & Haywood, K. (2011). *The 2011 Horizon Report*

(2011 Higher Education Edition). Austin, Texas: The New Media Consortium. Retrieved from <http://www.nmc.org>

Johnson, L., Adams, S., & Cummins, M. (2012). *The NMC Horizon Report* (2012 Higher

Education Edition). Austin, Texas: The New Media Consortium. Retrieved from <http://www.nmc.org>

Kacyra, B. (2011, July). *Ben Kacyra: Ancient wonders captured in 3D*. Presentation made at

TEDGlobal 2011, Dublin, Ireland. Retrieved from

[http://www.ted.com/talks/ben\\_kacyra\\_ancient\\_wonders\\_captured\\_in\\_3d.html](http://www.ted.com/talks/ben_kacyra_ancient_wonders_captured_in_3d.html)

Koh, C. ( ). Reconsidering services for the postmodern student. *Australian Academic & Research*

*Libraries*, 34, 184-193. Retrieved from <http://www.alia.org.au/publishing/aarl/>

Lasfargues, F., Martin, C., & Medjkoune, L. (2012). Archiving before loosing [sic] valuable

data? Development of web archiving in Europe. *Bibliothek Forschung und Praxis*, 36, 118-125. doi:10.1515/bfp-2012-0014

Long Now Foundation. (2012, November 15). About. Retrieved from <http://longnow.org/about/>

Long Now Foundation. (2012, November 15). Long server. Retrieved from <http://longserver.org/>

Maes, P. (2009, February). Pattie Mae and Pranav Mistry demo SixthSense. Presentation made at

TED2009, Long Beach, CA. Retrieved from

[http://www.ted.com/talks/pattie\\_maes\\_demos\\_the\\_sixth\\_sense.html](http://www.ted.com/talks/pattie_maes_demos_the_sixth_sense.html)

Meglio, D. (2012, July/August). Staying relevant in the digital age. *Information Outlook*, 16(4).

Retrieved from <http://www.sla.org/io/>

Reilly, B., & Simon, J. (2010). Shared digital access and preservation strategies for serials at the Center for Research Libraries. *The Serials Librarian*, 59, 271-280.

doi:10.1080/03615261003619060

Rieger, O. Y. (2010). Enduring access to special collections: Challenges and opportunities for large-scale digitization initiatives. *RBM: A Journal of Rare Books, Manuscripts, and Cultural Heritage*, 11(1), 11-22. Retrieved from <http://rbm.acrl.org/>

Roland, L., & Bawden, D. (2012). The future of history: Investigating the preservation of information in the digital age. *Library & Information History*, 28(3), 220-236. Retrieved from <http://maneypublishing.com/index.php/journals/lbh/>

The Rosetta Project. (2012, November 15). Disk. Retrieved from <http://rosettaproject.org/disk/concept/>

Singer, N. (2011, January 8). Playing catch-up in a digital library race. *The New York Times*. Retrieved from <http://www.nytimes.com>

Smith, A. (2003, May/June). Digital preservation: An individual responsibility for communal scholarship. *Educause Review*, 10-11. Retrieve from <http://www.educause.edu/ero>

Smith, A. (2007). Valuing preservation. *Library Trends*, 56(1), 4-25. doi:10.1353/lib.2007.0059

Steenbakkers, J. (2005). Digital archiving in the twenty-first century: Practice at the National Library of the Netherlands. *Library Trends*, 54(1), 33-56. Retrieved from [http://www.press.jhu.edu/journals/library\\_trends/](http://www.press.jhu.edu/journals/library_trends/)

Tonta, Y. (2008). Libraries and museums: Are they becoming virtual destinations? *Library Collections, Acquisitions, & Technical Services*, 32, 1-9. Retrieved from

<http://www.journals.elsevier.com>

Waibel, G. (2010). Collaboration contexts: Framing local, group, and global solutions. Retrieved from OCLC Research website <http://www.oclc.org/content/research/publications.html>

Witt, M. (2012). Co-designing, co-developing, and co-implementing an institutional data repository service. *Journal of Library Administration*, 52:2, 172-188. doi: 10.1080.01930826.2012.655607

World Digital Library. (2012, November 15). About. Retrieved from <http://www.wdl.org/en/about/>