The Future of Preservation:

Combining Digitization and Automated Storage / Retrieval Systems

in Research Libraries

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Abstract

This paper explores the future of preservation in research libraries looking at digitization of intellectual content, incorporating ideas on archival microfilming, and preserving the original artifact through the use of automated storage and retrieval systems (ASRS). Issues to be discussed include access and space. Is the information within the text more important than the artifact itself? Or must we consider original materials as master copy artifacts that must be conserved do to unforeseen events? One possibility is an amalgamation of access via digitization and preservation of the source item via ASRS. A two pronged effort such as this will serve to satisfy all those in the expanding field of preservation while allowing research libraries to develop their collections.

The Future of Preservation: Combining Digitization and Automated Storage / Retrieval Systems in Research Libraries

Libraries across the world have always had one thing in common, besides books on the shelves. And that is the issue of providing space for books. Research libraries can be hardest hit by the circumstance of space. Information old or new is always necessary whether it be in the form of books, journals, and various print and non-print materials it increases yearly. While some research institutions have currently turned to digital preservation or digitization in an effort to save the intellectual content of materials others are creating more shelf space by building automated storage and retrieval systems (ASRS). Both concepts have individual merit, but an amalgamation of a digitization program and an ASRS would benefit libraries with increased floor space and access to materials.

It must be noted that although the term digital preservation is used quite frequently it in itself is a misnomer. The concept of digital preservation, stemming from the age of microfilming and, according to Higgenbotham (1990, p. 170-171), even dating back to the turn of the twentieth century in the form of photographic facsimiles, is more related to access of information. Smith (1999, p.342) stated, "digital resources are at their best when facilitating access to information and weakest when assigned the traditional library responsibility of preservation." However, for this paper the terms digitization and digital preservation will be used as they apply to intellectual content preservation while noting the benefits of access to said content. For the purposes of this paper the term digital preservation will only refer to the conversion of original material into digital content versus born digital items.

Advancement of microfilm technology between the First and Second World Wars lead the Library of Congress to begin a rigorous program of microfilming their entire newspaper collection. The Library of Congress was not alone in the endeavors as other research libraries enacted similar programs. Literally microfilm technology would allow copies of newspapers and journals to be accessible to the public while freeing up the necessary shelf space for ever expanding book collections. Some books, Petroski (2000, p. 212-213) noted, were microfilmed during this period for the purpose of projecting onto walls as a form of entertainment for recovering Second World War veterans. Although this was an advancement in intellectual preservation, film quality, mistakes in focusing, and everything from lost pages to complete editions have left marked gaps in the very information research libraries, such as the Library of Congress were trying to preserve. Still, smaller research and general public libraries were confident that the newspapers and journals had been accurately preserved on film, so much so, many institutions threw out entire original runs in favor of purchasing microfilmed editions.

The National Endowment for the Humanities (NEH) through grants to the non-profit group Commission on Preservation and Access (CPA) formed in 1986, now reformatted into the Council on Library and Information Resources (CLIR), continued the mission of preserving intellectual content by means of microfilming what they determined were brittle books. Though some books, deemed brittle, had been microfilmed in the past this program became a concentrated campaign by the CPA to save the human record from literally turning into dust on the shelves according to the Terry Sanders (1987) documentary, *Slow Fires*. Brittleness, as it relates to books, continues to be at the forefront of efforts to continue with digitization and/or microfilming programs.

The definition of brittleness is in itself highly subjective having no quantitative value system. A broad definition of brittleness presented by Lambert, Atkins, Litts, Petty and Olley (2002, p. 35) concerns the acidity of the paper and whether it breaks when a page is turned. Nicholson Baker explained one highly subjective test known as the double fold in his book of the same name. Baker (2001, p. 155-157) noted that a random page corner is tested for strength by folding it back and forth making one double-fold until and repeating until the corner tears off. The number of times this could be done determined brittleness, while some institutions even included a slight tug of the paper into the folding process. Because there was no set canon to follow in the double fold test the number of folds varied from library to library. Yet, books were indeed brittle and something had to be done.

Accordingly the NEH and CPA concluded that the solution to the problem of brittle books at that time was to microfilm the content of as many books as possible before they literally fell apart. The microfilming was conducted by research libraries throughout the country including academic libraries, large public libraries and the Library of Congress. However, many books were not in as bad circumstances as to be falling apart in ones hands, but instead found to be taking up space on the shelves. The preservation methods used, according to both Baker (2001, p. 216-221) and Tanselle (1998, p.89-90), did little to save viable books sending rarely used, as opposed to rare books, into the discard pile after summarily guillotining the spine from the pages and microfilming said pages. Copies of item, can be made, but should never be done at the expense of the artifact.

Less than a decade later the newest innovation to come out of library preservation, with the success of world wide access due to the Internet, was digitization and the ability to put information on computer screens everywhere. It was believed that the process of digitization

would be easy with microfilm needing only to be scanned it into a computer. The process has proved to be a little more complex. Digitization becomes complicated when microfilm is found to be unreadable due to a variety of reasons, poor focus being the likely culprit. And, as stated previously, when text is missing due to human error in the original microfilming stage. Artifacts, having been discarded or sold, are difficult, if not impossible, to find making some digitizing programs challenging to say the least. Still, it must be considered that even if the microfilm is of a suitable quality digitization is the equivalent of making a copy of a copy.

Readability of digitized copy can be further complicated by software that is supposed to aid researchers. Optical character recognition (OCR) software transfers the scanned data into a digital system allowing the item to be searchable by specific words or phrases. One of the top uses of this software currently is for digital newspaper projects and academic journals available through Internet databases. While experimenting with the technology Online it appears that it does have its flaws. A specific search for the word "brothel," in early editions of the *Deseret Evening News,* on the Library of Congress' digital newspaper site brought up several newspaper articles with the word "brother" highlighted. Utah Digital Newspapers fairs better in finding articles with the same word search of early editions of the *Deseret Evening News*. However, the newsprint is extremely difficult to read on the computer screen, due to using original microfilm copy. Utah Digital Newspapers does provide an OCR text option which in turn makes the article look like a complicated mass of typographical errors. Baker (2001, p. 71) purports similar findings with his research on Journal STORage (JSTOR). Even with these flaws digitization is giving individuals access to historical documents they would otherwise not have the opportunity to read.

While some have whole heartedly taken to digitization as a method of preservation others, such as Smith (1999, p. 342-345) have not. Digitization is an unstable medium that has to be constantly monitored, migrated and authenticated. A book can be left on the shelf for many years and even if it is in a delicate state can be taken off the shelf and read. Digital materials are the complete opposite to this. A floppy disk containing information a mere decade old is absolutely useless today due to both obsolete hardware and software. In turn databases are subject to storage conditions, data backups and electrical failure. Some efforts have been made towards digital storage management by means of multiple copies referred to as "Lots of Copies Keeps Stuff Safe" (LOCKSS), but this, according to Van Der Werf (2002, p.63), does little to archive the information which would be true digital preservation.

It has been suggested by Chapman, Conway and Kenney (n.d., p. 2) that a hybrid of microfilming and digitization be established for the preservation of brittle books. Microfilm can be archived while digitized copies can be used for information access. Weber and Dörr (1997 para. 3) noted that microfilming does have a place in digital media because it can be stored for long periods and be processed at any point into a digital format. This can be a viable solution to intellectual content preservation however concerns are presented again about making a digital copy from a microfilm copy.

Microfilming and digitization have cost considerations. These would include initial rendering for both with long term climate controlled storage and copying for microfilm. While a digitization program should include costs for file storage and migration. It must be further understood that any copying of materials must be thoroughly checked against any and all copyright laws to prevent any unwanted legal problems which may also incur fees.

Although digitization is nowhere near any kind of traditional definition of archival preservation it does have its merits. Some books that are rare, or very delicate, truly would benefit from having the intellectual content preserved in one format or another. According to Lambert et al., the limitations of intellectual content are addressed noting that, "Although his does not preserve the complete physical evidence of production and use, preserving the intellectual content still conveys the author's or artist's message to a wide range of users now and in the future" (2002, p. 13). Advances in technology are happening every day, which at times can be the demise of digitization, but may at some point be what makes it a worthwhile preservation tool.

Books as artifacts will always be a crucial component of libraries. William F. Poole (1876, p. 511) stated, ". . . it is quite as impossible to predict the future demand for a book. It may stand on the shelves a decade untouched, and then, by some event in the literary or scientific world, be called forth and wanted by everybody." Some individuals defer to the fact that information is outdated in determining whether artifacts are worth keeping. If this standard was kept many rare historical works would have been on the discard pile long ago. Truth be told many great works have probably been lost for a variety of reasons too many to enumerate at this time. Of course there is by no means going to be an instance when an institution will never discard or sell an item due to age, damage or obsolescence.

The concept of a "last, best copy," mentioned by Nichols and Smith (2001, p. vii), is routinely floated around as a means of retaining one copy of an artifact in designated archival repositories that are supported by institutional networks sharing responsibility and cost of storage, maintenance, and digitization. A danger with the notion of discarding duplicate copies makes the last, best copy all the more important to preserve. This theory has gained little ground due to

lack of appropriate funding and individual libraries' anxiety over sharing and/or disposing of artifacts.

Intellectual content of a book provided by digital access is not always what researchers are interested in. An artist who is concerned about a particular illustrator might prefer to see the original printing versus a digitized copy. This is also applicable to persons researching book bindings, end papers, typeface and diversity of various publications. The Modern Language Association of America (MLA) voiced their concerns about this particular subject in their "Statement on the Significance of Primary Documents" (1995, p. 27-28). While Rieger (2008, p. 31) came to a similar conclusion stating that, "the future of the book as an artifact and its contributions to the intellectual value that are difficult to capture through digital reformatting such as the historical context provided by binding, watermarks and chemical composition of inks." An artifact cannot truly be examined unless one can use all the senses. Yet, these very same books may be rarely used if not exactly rare. And books that are rarely used are subject to weeding.

Space is essential in maintaining viable research libraries intent in offering patrons access to artifacts. More and more academic institutions are turning to high volume on site storage. Such concepts of high volume storage systems are not new. In fact the Randtriever, described by Ellsworth (1969, p. 50-57), appears to be an early, although small scale, concept of today's ASRS. ASRS incorporated by libraries today resemble a warehouse set-up with industrial racks and bins. The racks can be built as part of a building or as a stand-alone offsite structure with the ability to add to the storage as needed.

ASRS uses an arrangement of racks that can hold multiple bins or shelves in stacks several stories high. Books are digitally encoded and placed into bins that are tracked by the software provided by the particular instillation company. When a patron requests an item that request goes to the ASRS room where an automated mechanism selects the correct bin and moves it to a technician. The technician then looks at a monitor to determine where in the bin the item is located. Accuracy of the pick is confirmed by book title and/or barcode via the computer. The item is then delivered to a retrieval area, usually a circulation desk, where the patron can check out their selection. An in house system can have a book in the requester's hands within minutes versus waiting up to 24 hours for retrieval from offsite storage.

An ASRS is a closed stack system which does not allow for browsability. This according to, Haslam, Kwon, Pearson, Vent and White (2002, p. 72) was what made many library administrators hesitant in implementing such a system in the past. In contrast Kountz (1987, p. 67) notes that the closed stack system complements an open stack system. For this reason the ASRS is excellent for rarely used items, older journals, government documents and even archival materials. Software that is used to track items in the bins can also be used to track usage or non-usage as the case may be. If an item is used significantly then it can be considered for a return to normal shelving according to library policy.

ASRS as a closed stack system does have its advantages for preservation. Items are kept in a controlled environment that is accessible only by specific personnel. The security of the ASRS area virtually guarantees that theft will not occur to the most important items. Loss due to incorrect shelving or patrons hiding materials is also eliminated. Temperature and humidity levels can be monitored and adjusted to keep items under optimal conditions. Where common areas in the library are maintained for human comfort the ASRS area can be kept at a cooler

temperature with lower humidity in order to keep items at preservation quality levels. The ASRS even protects materials from seismic activities. California State University at Northridge ("Automated", n.d., para.7) notes on their library website that after the 1994 Northridge Earthquake most of the "open shelf collection was dumped on the floor," while, "not one book in the ASRS was damaged."

However, this is not the greatest advantage of ASRS. What research libraries crave is shelf space and that is exactly what ASRS delivers. One of the top companies in the United States that implements ASRS in libraries is HK Systems. HK Systems refers to its library ASRS as Automated Library Systems (ALS). According to HK Systems' (2008) promotional video their high density storage provides seven times that of traditional shelving, storing up 250 books per square foot. In an interview the Facilities Manager of the J. Willard Marriott Library, Ian Godfrey (HK Systems, 2008), stated that amount of storage was one of the reasons why the University of Utah looked into an ASRS within the original footprint of the library as compared to building an extension with cantilever shelving. One of the largest ALS in the country, the University of Utah's Automated Retrieval Center (ARC) has the capacity for two million books and is currently only half full.

The main focus of building the ARC was to create more book storage and allow for greater library space for students while freeing up shelving for additional books. While the current trend is to implement increasing amounts digital sources in research libraries, at the University of Utah there is an effort to keep collections safe and available for researchers as well as continue an ongoing patronage with donors. Joyce Ogburn ("U of U's", 2008, para. 5), University Librarian and Director of the Marriott Library noted that the, "Use of electronic

journals and e-books is certainly on the rise, but we will always have demand for our traditional collections and will continue to acquire more, especially unique and rare collections." According to recent article on the reopening of the library it is mentioned by Lindbert (2009, para. 21) that storage of one million items in the ARC opened up 20,000 square feet of floor space. This space, although currently used for student computers, study areas and classrooms, can be available in the future for more shelving units allowing the library to expand within its current walls.

ASRS can be adapted for various different formats. The Utah State Archives implemented an ASRS that handles shelving units with boxes of archival materials. Because of the modular storied design of the ASRS the state archive was able to keep the collection in a smaller square foot imprint than traditional storage. Benefits, according to Utah State Archivist, Brandon Metcalf (HK Systems, 2008), are security and on site storage allowing them to deliver materials to researchers in optimal time.

A non-automated system has been adopted by the Library of Congress at its offsite Fort Meade storage facility. The Fort Meade site will eventually consist of 13 storage modules on a 100 acre site according to Enos, Donato and Strong (2005, para. 4). Currently the Harvard model of high-bay shelving with items sorted by size and retrieved with forklifts was confirmed by Steve Herman, Chief Collections Access, Loan and Management Division Library of Congress (personal communication, December 5, 2009). Although the site is not fully automated it may be possible at a later date to install components into the established system depending on current configurations. Due to the location materials are prevented from getting to researchers in as quick as a few minutes, two service times daily noted on the official website ("Library", 2002, para. 21), it does allow for the Library of Congress to amalgamate several storage units into one high density unit.

One issue of concern that some institutions may have in setting up an ASRS is that of cost. However, many have concluded after initial costs the system saves money in the long run. Richard Boss (2008, para. 16) concluded that an ASRS built to hold a minimum of 400,000 volumes would be the most cost effective at $4.00 per volume versus $20 per volume for traditional library shelving. The ASRS area is also cheaper to maintain than the larger open stack area due to less need of electrical lighting, variances in heating and custodial duties that needing to be performed. Costs for an ASRS area would include standard computer and mechanical maintenance and operating personnel. Overall an ASRS is a good investment in storage, preservation and creation of space in libraries now and in the future.

Research libraries now have a tool for storing books, instead of possessing the unnecessary desire to discard them while at the same time creating space for more materials in their open stacks. If digitization is a priority high density storage should be an equal endeavor. During an interview for his book, *Double Fold,* Baker was asked by Jeffrey R. Young (2001) about the role of research libraries in the current age of digitization. Baker answered that,

> The job of the research library is to keep the stuff that people read. And that's a very simple task, and it allows for any sort of revolution in publishing that might or might not happen.
>
> If next Tuesday everything was published electronically, the research library would have the job of keeping the stuff that people read, because people are always going to read. And it contains in it the corollary obligation to keep the stuff that people have read. (para. 16-17)

The ability to store books and allow access to those books should be the goal of research libraries everywhere. Digitization will assist with access and intellectual content preservation while an ASRS will help in keeping the original artifacts around as long as possible.

An advantage of an ASRS is that it can store many types of research library materials. Some digital preservations programs will have microfilm copies for backup which can be stored along with the original artifact in an ASRS. Access is not a necessity, but storage has always been a priority with research libraries. The best way to preserve materials is to keep them in controlled environments. Such environments can be established within an ASRS or as an independent unit within an established facility, as in the case of cold storage for archival film.

The artifact is just as important as the information contained inside and deserves to be preserved. Digitization will allow access, but it will not replace the artifact. However, it is a given that the books currently sitting on the shelves in research libraries will not last forever. Digital preservation of intellectual content of an artifact and an ASRS to store the original is the best way to approach preservation in the future. Individually these systems have their own merit. Nonetheless combining them makes an institution strong in its purpose of serving the research community. The future of preservation can be realized in coalescing digitization and ASRS technologies.

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