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Moving the Archivist Closer to the Creator: Implementing Integrated Archival Policies for Born Digital Photography at Colleges and Universities

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This article discusses integrated approaches to the management and preservation of born digital photography. It examines the changing practices among photographers, and the needed relationships between the photographers using digital technology and the archivists responsible for acquiring their born digital images. Special consideration is given to technical issues surrounding preservation and access of image formats. It explores how integrated policies can enhance the success of managing born digital photographs in an academic setting and illustrates the benefits and challenges to acquisition, description, and dissemination of born digital photographs. It advocates for the archivist's active involvement in the photographer's image management practices to improve the acquisition and preservation of images.

KEYWORDS *digital photography, born digital records, raw image format, academic archives*

INTRODUCTION

College and university archives have historically played a crucial role in preserving the photographic records of their institutions. Analog film negatives, contact sheets, and prints were created for administrative and publicity purposes, and then were traditionally transferred by campus photographers to the archives. The role of the archivist in collecting and preserving campus photography was well established and understood in our profession.

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However, as photographers transition from analog film to digital formats, college and university photographs from the 1990s may paradoxically be in greater danger than photographs from the 1890s.

The shift from analog to digital has been a disruptive force that puts digital assets at risk. The ease in shooting images that digital photography affords has dramatically increased the number of images of enduring value. Growing file sizes, as well as the numerous proprietary formats created by digital cameras, render old print-based management practices an impractical option. The recent announcement that the Eastman Kodak Company has filed for bankruptcy rings the death knell for the era of print photography and film and should be a clear indication to archivists that preserving digital photography is now our central concern.[1]

Although current practices of campus photographers work relatively smoothly for meeting their business needs, access and preservation are becoming increasingly unmanageable activities. Photographers are required to devote more time, in addition to their core business duties, to the tasks of managing their digital images. Archivists' inability to acquire images in a timely manner contributes to bulging storage servers and difficult-to-manage optical disk collections in photography departments. Digital photography requires an unprecedented level of engagement by the archivist throughout the entire lifecycle of the records, but given the size of the problem where does the archivist begin?

Archivists can take small steps to develop tools appropriate to their setting that can lead toward long-term solutions. The wide implementation of Institutional Repository (IR) software and Digital Asset Management Systems (DAMS) for digitized collections may be potential test beds for implementing practical methods to provide access for born digital images. The relative ease with which institutions adopt standards and practices for digitization is reflected in the large number of well-documented case studies. The issues surrounding born digital collections are well known, and standards and practices are being developed to solve these problems. However, there remain too few examples documented by repositories that demonstrate practical methods and tools for providing access and preservation for born digital images, and such practical approaches deserve more attention.

This article explores the policies and technical issues related to born digital images that influence their preservation in the college and university archives context. It discusses how the University at Albany's Special Collections and Archives Department began acquiring born digital images. It suggests practical approaches and methods to meet the challenges of digital photography with special consideration given to possible staffing and financial constraints, and it advocates greater collaboration between university archives and campus photography departments.

LITERATURE REVIEW

The Archivist and Photographer Relationship

The digital age requires more involvement, not less, by the archivist for institutions that hope to preserve their cultural legacies. Elizabeth Yakel and William Brown, as early as 1996, examined the effect of digital technology on records creators and archivists. They argued that in the digital age there is a need for an "active archivist who serves as part of the administrative team, both culling and packaging information as well as working with administrative colleagues in the evaluation and interpretation of the data."[2] However, the close relationships that institutional archivists once enjoyed with paper records creators faded with the advent of digital technology. Many archivists, contrary to professional best practice, are excluded or not able to get involved in the policy decisions about records creators.[3]

Lisl Zach and Marcia Frank Peri suggested that there has been relatively little development of campus electronic records programs between 2005 and 2009 and concluded that the acquisition and management of institutional digital records is comparatively neglected.[4] Until recently, digital records that arrived on magnetic and optical media typically played an ancillary role to the paper records contained in the collection. Whereas floppy disks and other aging media pose problems, they are only the tip of the iceberg. Increasingly, repositories are being tasked with acquiring digital collections with no paper counterpart, putting archivists in the uncomfortable position of not being able to provide access to the materials they own.

A recent Online Computer Library Center (OCLC) report noted alarming findings among Association of Research Libraries affiliated special collections departments. The report recognizes a "widespread lack of basic infrastructure for collecting and managing born-digital materials: more than two thirds [of the collections studied] cited lack of funding as an impediment, while more than half noted lack of both expertise and time for planning."[5] Indeed, the report summarized that special collections departments state born digital materials as their second biggest challenge. Yet, these findings are a striking contrast to the amount of investment institutions have made in their technological infrastructure. The OCLC report also found that 69% of the respondents are using an IR, suggesting that lack of technology might be a smaller obstacle to acquiring and preserving born digital records than conventional wisdom would suggest.[6]

The failed attempts to successfully deploy IR software for the digital scholarship community have met obstacles similar to those encountered by archivists working with electronic records. As IR deployments proliferated, libraries floundered to acquire faculty research due in part to a faulty assumption that faculty (the records creators) would self-archive their materials. Even relatively simple digital assets, such as preprints in PDF format, are difficult to acquire because in many cases faculty are left to their own devices to manage their own records.[7]

The "build it and they will come" approach has largely failed because of the lack of staffing and administration of the repository software and programs.[8] The poor levels of participation in IRs may be owed in part to the emergent role of the repository librarian, who has suddenly assumed many of the responsibilities traditionally fulfilled by an archivist. The findings of the MIRACLE (Making Institutional Repositories A Collaborative Learning Environment) project suggest that the "type of one-on-one collection development and content recruitment now being carried out by librarians to populate IRs is exactly the type of field work that archivists have done for decades."[9] Archivists are professionally trained in collection building, especially the heterogeneous content and mixed format typically found in archival and manuscript collections. Archivists are accustomed to networking with creators to ensure that custody is taken of those collections, and yet archivists have not played a significant role, especially when the IR is deemed the place to deposit electronic records. Although it is important to understand this historical distinction between the role of archivists and IR librarians, merely shifting the responsibility of collecting digital scholarship to the archivist will not solve the problem. Similarly, archivists have struggled to acquire born digital material from campus administrative offices. Unless archivists redouble their engagement with campus records creators, digital scholarship and administrative records will most likely remain in separate silos.

Absent the involvement of an archivist, the contemporary campus photographer devotes a surprisingly large amount of time to access and preservation issues. Professional photography literature devotes significantly more effort to these issues than the museum and archival community. This development is a logical one especially for commercial photographers who may have no dedicated managers or archivists to care for their legacy collections. Jessica Bushey says that "it is necessary to rearticulate the role of the photographer as both creator and preserver," yet she hastens to add that photographers still must obtain "input from those entrusted with preserving digital materials, such as archivists."[10]

Born Digital Photography

To improve this situation, it is incumbent upon archivists to develop a greater understanding of digital photographic practices. The photographer's technical environment has changed dramatically and generated a new and complex set of terminology and techniques. Rules of thumb developed for digital image scanning operations may not be enough for the archivist to fully understand the problem space of born digital photography. Patricia Russotti and Richard Anderson include over 150 new, digitally specific terms in their recent review of best practices for digital photography.[11] As with other types of digital materials, such as audio and video, the digital imaging literature and terminology runs deep and wide and can be daunting to the novice. In particular, archivists need to develop a better understanding of digital photography file formats and metadata practices if they aim to engage photographers effectively.

Born digital "originals" bring different kinds of responsibility to planning and decisions not found in scanning operations and introduce a new level of complexity and cost. The archivists' commitment to authenticity may lead them toward wanting to preserve the "camera raw" (Raw)[12] format as the "negative," but this commitment may come into conflict with the realities of resource and staffing constraints because of its complexity and additional file storage. The emphasis put on authenticity, reliability, and accuracy of electronic records can be daunting, and it can even lead to further inaction by the archivist.[13] The proprietary nature of the Raw format, as adopted among the most popular camera manufacturers, has become a serious concern among photographers who worry that they may not be able to access their files in the future.[14]

Raw Image Format

The importance of the Raw file format to the photographer cannot be understated, and archivists must learn about it to meet the needs of the photographer and to preserve the format effectively. Photographers work in the Raw format because it affords the highest quality in resolution and color range, and it allows the photographer to non-destructively adjust properties of the image. Many photographers consider the Raw image file generated by a digital camera as the "digital negative," and *image developing* refers to the process of color selection and conversion of the Raw file into a JPEG or TIFF format.[15] The Raw file stores the information gathered from the camera's sensor in an unprocessed format.

Michael K. Bennett and F. Barry Wheeler explored the barriers and benefits to archivists who want to preserve an image in Raw format, which they consider the true camera "negative" versus typical practices of preserving an image "positive" in TIFF format.[16] Until the advent of Raw, pictures shot using the JPEG and TIFF formats were typically rendered inside the camera. Raw, however, defers processing of the image until the image is transferred to a desktop computer, and rendered inside of Adobe Camera Raw software or a comparable program. Managing this format is complicated by the fact that there are dozens of proprietary formats in use by different camera brands, sometimes differing with each successive mode. This increased functionality of cameras consequently increases the burden of the archivist.

Currently, Adobe's Digital Negative (DNG) is the only standardized, openly documented Raw format,[17] and the Library of Congress supports it as the most sustainable format for long-term storage of images.[18] If Adobe successfully makes DNG a widely accepted standard among camera manufacturers, then archivists may reap the same benefits for photographs as they have with documents reformatted to PDF. Adobe should be commended for the degree of openness it has brought to these formats, but archivists should be wary of becoming too reliant on one software manufacturer to manage their collections. By converting to DNG, photographers have the option of storing the parametric image edits made to the Raw image in a “side car” file.[19] Parametric image editing allows for cropping and rotating the image, as well as adjusting the color and contrast non-destructively, but the same edits made to a TIFF are irreversible.[20]

Adobe’s Camera Raw software affords the user the ability to adjust dozens of settings, and then records them in an Extensible Metadata Platform (XMP) file or side car file, which resides separate from the Raw file; thus the digital negative is never tampered with. The encoded information in the XMP file can be inspected by viewing the tagged information about the edits and color settings made to the image in a text editor, which is easily read by a human. Adobe’s DNG negative convertor is a free converter that allows the archivist to preserve the original proprietary Raw file, as created by the camera, inside the DNG file. The DNG negative convertor can also extract the proprietary files, such as the Nikon Electronic Format (NEF) format, if needed. Additionally, with the conversion to DNG, the convertor creates and stores an MD5 hash code within the file, which is useful for documenting a file’s accuracy and authenticity.[21]

The file size of a Raw image can vary depending on the megapixel and the bit depth of the camera and settings selected by the photographer. A Nikon D7000 camera with image sensor sized at 4928 × 3264 pixels (16.1 megapixels) that shoots a 12 bit, lossless image will produce a 15.5 MB file size, which makes the Raw format in this same model roughly twice the size of a high quality, rendered JPEG format.[22] Archivists have relied heavily on the TIFF format as an archival master for use in repositories because of its ability to preserve lossless images. Although the TIFF format has been phased out as an option in professional cameras, it is still a common rendering option in computer software and scanners. Because TIFF is a fully rendered file format, the settings of a camera or scanner are encoded permanently into the image thereby increasing the size (especially using 16-bit settings) and preventing any future re-renderings by the photographer or archivist.[23] However, if an archivist chooses DNG as a master format, other options are available that can actually surpass the storage footprint of TIFF. Archivists may choose to embed the proprietary Raw image inside of the DNG Raw file. Although allowing the records creator to retain their original proprietary format, migrating to the open DNG format will double the storage requirements for the repository.

Embedded Metadata and Image Handling Software

The sheer volume of born digital images requires archivists to economize their efforts, and capturing metadata can be one of the most costly aspects of acquiring a born digital collection. Whereas creating a descriptive metadata record about the image is important, photographers and archivists need to understand and use embedded metadata, which is critical to ensuring the preservation of digital assets. Preservation file formats allow self-describing information to be embedded into the "header" of the image itself. Embedded metadata ensures against loss if the file is separated from its descriptive database record. The TIFF, Raw (most proprietary versions), and JPEG formats store the three following units of metadata in the file: Exchangeable Image File (EXIF) format, International Press Telecommunications Council (IPTC), and XMP; the DNG format includes even more.[24]

The IPTC standard was merged with XMP, and now users can extend XMP to adopt the IPTC Core metadata standard. XMP is an Adobe created, XML-based formatting standard, which is primarily used for images and PDF files. The EXIF metadata is the information generated automatically by the camera; this includes such information as the f-stop setting, flash, focal length of the lens, and more. The IPTC metadata contains the description information about the content of the image, creator, date, and other descriptive information. IPTC can be extended by the Dublin Core standard as well, which allows for time saving processes through automation. Previously we discussed XMP in the context of side car files and the information they store from the parametric image editing. The DNG format stores descriptive information in the XMP-formatted IPTC "chunk" inside the DNG file, whereas edits made to the image (cropping, color correction) are stored in a separate file, known as the side car file that is formatted in XMP as well.

The simple act of viewing an image, and the slightly more difficult act of reading and writing embedded metadata, is a common barrier to managing the Raw format in a repository. Raw images often do not display the same user-friendly image information in the form of thumbnail images as with JPEG and TIFF, making it impractical to conduct search and management actions through Windows Explorer and Finder programs. Further, there are known issues with handling and interacting with the embedded data in files through some default file managers, and especially with older generations of applications,[25] yet this should not be an issue if the proper software is used. Adobe Bridge can help photographers and archivists safely automate some of the processes of adding metadata to the image file header. Other software dedicated to preparing images for ingestion include Adobe Lightroom, Apple's Aperture, and Photo Mechanic. This additional image "collection processing" also known as "PIEware"[26] software may be a small cost in comparison to the added control it gives and the time it saves.

As part of the Preserving Digital Images project, ARTstor developed new practices and tools for photographers so that they could create archive ready born digital images. The project developed best practices that advise photographers to only embed metadata into the image using Adobe Bridge or its equivalent without having to rely on cumbersome Excel spreadsheets. Archivists can instead use ARTstor's recently developed Embedded Metadata Extraction Tool tool to extract metadata from digital assets and export them as spreadsheets.[27]

The archivist must have a firm understanding of the technical complexities of the contemporary photographer's work, but technical knowledge alone will not guide archivists through the steps of implementing the processes for acquiring and preserving digital images. Research projects, conferences, and standards groups have developed an overwhelming number and array of technical guidelines, best practices, frameworks, and models to manage and preserve electronic records. In light of these theoretical inroads in research, Christopher Prom posed the question, "Have libraries and archives made adequate progress in implementing the procedures, tools and services to actually preserve digital records?"[28] The number of demonstrated implementations pale in comparison to our plethora of theory and standards, but this is slowly beginning to change.[29] The gap between theory and practice has proven to be much wider than initially thought. Although repositories hold out for a comprehensive electronic records solution, Ben Goldman wisely recommended "moving forward with practical and achievable steps" toward that goal "responsibly."[30] With this in mind, what are the short-term measures archivists can take to acquire and extend the life of their digital images?

UNIVERSITY AT ALBANY'S BORN DIGITAL IMAGES

This section depicts the University at Albany's experience in formulating practical methods for acquiring and providing access to born digital images. It will discuss how the University Archives dealt with the backlog of born digital images, and then describe how it wrote integrated image management policies with the photographer to improve the University Archives' ability to acquire images. We believe these short-term, practical steps will help us build toward our long-term goal of the archives becoming a "systematic institutional function" within the university.[31]

Background

Since the early 1970s, the University Archives has regularly acquired photographic prints and negatives from the campus Photography Department. The photographer typically transferred the images seven to ten years after their initial use, even earlier in some cases when the photographer ran out of cabinet storage. Archivists transferred prints and negatives into the archives, re-housed them in acid-free boxes and folders, and placed them in the repository's processing backlog. The collections typically required little processing because they were well organized and easily accessible. Currently, there are more than 50,000 prints and negatives that are used frequently by the University community in exhibits and promotional material, and by off-campus researchers.

Analog to Digital

Campus photographers began gradually converting to digital photography in 1997. During the course of ten years, campus photographers routinely used up their allowed data storage and would rely on optical media as an "archiving" solution. As the digital camera industry evolved, the photographers did too by adopting new file formats to meet their needs and to stay current with industry standards. Over time, the Photography Department confronted image management issues, such as redundancy and proprietary formats that made search and retrieval of their own files difficult. In addition to the Photography Department, many departments across the University began struggling to manage their digital assets, and the campus implemented a collaborative project to plan and purchase a DAMS.

The project charter sought to solve "a broad-based need, expressed by several University constituencies, for an enterprise-wide service focused on the management, curation and accessibility of digital media and related assets."[32] The project deemed it important that the DAMS feature superior image functionality because images were a priority for nearly all of the project participants. The project chose Luna Insight as its DAMS, and the system was adopted by various departments, including the University Archives.

Originally, it was intended that each department would upload and manage its own digital collections. It quickly became clear, however, that the other departments lacked the qualified staff and time required to upload their images into the DAMS. The University Art Museum was the lone exception, and that was because they already had an employee tasked with managing their digital images on a legacy system. As with many implementations of IR software, the "build it and they will come approach" was not working. It was clear that the University Archives needed to play a leadership role for campus departments using the Luna Insight system. As the University Archives began using the DAMS for their digitized collections, it also began exploring how the archivists could get directly involved with acquiring born digital records across the campus.

1997 to 2007

Realizing that access to proprietary formats was problematic, archivists dealt with the images taken between 1997 and 2007 first to address three major challenges: the lack of image descriptions; the lack of tools to facilitate the transfer of images and database records from the photographer to the University Archives; and the lack of a centralized portal to access digital images. To address these challenges, we first needed a better understanding of how the campus photographer worked.

Our first step in understanding the photographer's practice was to capture, organize, and retain information about his workflow. We had previously created some common ground between the University Archives and the photographer, having already had conversations about the planning and implementation of Luna Insight. We met with the campus photographer to learn what information he obtained during his work, and we discussed with him what information the archives lacked. We learned that when the photographer shot pictures for a particular job, he entered information about the event into a Microsoft Access database including the date, unique job number, brief description, and name of the person or department who made the request. After completing the job, the photographer loaded the Raw files onto a local hard drive, created a folder for each event that contained the unique job number as the folder name, and placed all of the images created from the job in that folder. The photographer typically burned the job's images to a CD and gave it to the customer. The images are used for the marketing of a particular event, and they are then repurposed for a multitude of uses in a semi-active manner by other departments on campus and in official university publications and alumni literature. For this purpose, the photographer created JPEG derivatives from the Raw files (NEF), which were edited for color correction and selected for publication or distribution; these might be comparable to the "print positive" in the analog photography. Until 2008, unfortunately, the photographer deleted 90% of the JPEG derivatives to save storage space.

Transfer to Archives

In 2007, the campus photographer transferred to the University Archives 150,000 Raw files (with connected XMP files) stored on optical discs totaling close to two terabytes. One of the first steps was to transfer the files from the optical media onto a shared network drive while maintaining the original order and unique job numbers. Graduate students appraise these images based on retention guidelines developed by the archivist. Students work primarily in Adobe Bridge and Photoshop to view, describe, rename, and to do batch conversions. Before we obtained Bridge, the student had to go through the cumbersome task of renaming files using Windows Explorer. If the image must be opened up, the student must use the Adobe Camera Raw program that runs inside of Photoshop. A batch file conversion is conducted on the images, converting them from proprietary Raw files (NEF) to TIFF using Adobe Bridge and Photoshop's Image Processor tool.

It is important to adopt self-describing file naming conventions as well as embedding metadata into the header file of the image. Adobe Bridge is used to normalize all the file names using a consistent and planned file naming and identifier convention. File names should consist of lowercase characters from the Latin alphabet and Arabic numeral set; they should not consist of special characters or punctuation except for the use of the underscore character to designate meaningful spaces in a file name.[33] These practices help to identify files in the case of disaster where the files are separated from their descriptive metadata records. Graduate students create a first draft of a Dublin Core descriptive metadata record for each image that is later reviewed and enhanced by an archivist before being uploaded with the affiliated images to the University's Luna Insight system.[34]

Improve Workflow for Current Images

The nature of the campus photographer's work aids in the development of descriptive metadata and master file formats for access and preservation. After analyzing the photographer's work process, we altered it so that he now creates a TIFF derivative of all Raw files when he completes a job and enhances the event description. Instead of transferring images to the University Archives on optical media, the photographer transfers images directly onto a dedicated share on the University Libraries' server, which is restricted to the University Archives staff and the photographer. The TIFFs are loaded into the DAMS by the University Archives and the Raw files are stored offline on servers. We currently describe the images in such a way that the crucial job numbers used to identify the photographer's work are preserved. The photographer can use old job numbers to search for images in Luna Insight. To ensure that each image is assigned a unique file name by the camera, we recommended to the photographer that he change the file numbering setting on his camera to "continuous" and to avoid using "auto reset." If the incorrect setting is selected, the photographer may risk overwriting older files. Digital image collections that have not been set to "continuous" may also complicate the important task of appending identifier information to the image.

Findings

It has become abundantly clear that archivists can no longer passively wait for the transferal of born digital collections to our repositories. The archivist must become involved in the work of the creator to ensure that valuable digital information is not lost. Archivists must leverage their traditional relationships to the departments outside of the library while at the same time acquiring the proper skills and methods to enable them to properly take custody when the time comes. The archivist must strike a balance between complete inaction and waiting for the perfect solution. Numerous colleges and universities are exploring alternatives to conventional acquisition practices, such as using online vendors to host their images off site, and this is especially true for recent born digital images.[35] However, other institutions are already fully involved in the act of acquiring born digital images into the archives and are administering the software and technology locally using their campus IT infrastructure.[36] Although the OCLC report points to the lack of IT support as being a large barrier to acquisition, our experiences show that archivists can surmount this barrier by taking small incremental steps.

Some of the most important decisions are made at the moment of acquisition—these decisions may have lasting, irreversible effects on the sustainability of the collection. All attempts must be made to "do no harm" to the digital assets. Does the repository consider the images used for a particular event the most important thing worth documenting or do they want all of the images? Furthermore, the archivists' commitment to authenticity may lead them toward wanting to preserve the Raw format as the "negative," but this commitment may come into conflict with the realities of resource and staffing constraints.

Archivists who aim to preserve the digital masters may want to consider migrating their image collections out of the proprietary Raw file created by the camera to a more stable Raw format such as DNG. DNG will preserve all of the settings of the proprietary format and the metadata. DNG also has a built-in data validation mechanism that keeps "hash" file information to prevent against the possibility of data corruption. Hash files or checksums are unique pieces of data that get assigned to each image; they serve as a guarantee to the user that the file has not been digitally altered or corrupted. Each time the file is handled by the computer there is always a small risk of data corruption. Thus, the checksum that resides within the DNG file can allow the archivist to periodically check all of the files to make sure they have not become corrupted.

Archivists can assume that as image processing software improves, older DNG files can be reprocessed into even more faithful reproductions of the original. Once the image has been converted to TIFF, the archivist permanently loses future capabilities to eliminate noise and to recover colors lost from the original image.[37] The University Archives is considering the costs and benefits of moving to DNG. Most DAMS require users to upload surrogate copies of their images because Raw formats are not provided with the same functionality in DAMS as found with JPEG and TIFF. The ingest engines do not currently handle Raw, but this is likely to change as Raw becomes a more accepted preservation format. Even though Raw provides unlimited options to archivists and photographers, choosing these options for long-term preservation should be considered carefully because storage requirements can become overly costly. If storage costs are not a concern, the justified belief that technology will improve over time suggests that archivists should attempt to preserve the Raw format, DNG preferably, when possible.

The archivist and the photographer will have to come to agreement on what they want to preserve. Although migrating the images out of a proprietary Raw format to one such as DNG may meet the photographer's needs, it does bring additional costs in management and storage to the repository. Michael J. Bennett and F. Barry Wheeler stated that, "as a baseline, familiarity with the concepts of parametric editing is necessary to confidently sustain DNG files while the format and its tools continue to mature."[38] The archivist and photographer may have to make a compelling case to their managers as to why preserving multiple formats is needed. Access copies must be created in place of the Raw files because most DAMS and IR software do not display Raw files natively. Once you dispose of the Raw files however, something is lost, and the repository will not be able to turn back.

Archivists need to consider the benefits of embedding metadata into their image files. The University Archives has not begun enhancing the embedded metadata in its images beyond what is already there, though this is something it is considering for future integrated workflow improvements. The work of the ARTstor project holds great promise for not only making it easier for the photographers to embed information into image files, but also for making it easier for archivists to get that information back out of the file and into their conventional metadata records. Because records creators are typically not concerned with extensive metadata, the ARTstor project might be a way forward that lightens the costly burden of creating metadata for the creator and the archivist.

Our profession must continue building better tools to preserve and provide access to our digital heritage, but we must remember that, when possible, making relationships with our creators is an integral first step to making effective use of these tools. With this in mind, Lisl Zach and Marcia Frank Peri suggested that archivists must find a "champion with influence within their institutions. . .forming strategic alliances with key players outside of the library."[39] The photographer's mindset and work environment may lend itself to repositories looking for a willing collaborator to begin an electronic records management program. It has become clear that without the archivist's pre-custodial intervention early in the lifecycle of born digital images, their long-term preservation may be at risk. The records creator must not only have a desire to transfer his or her records, but also see a legitimate reason to do so. Whether in print or digital formats, photographers are accustomed to keeping pace with technical innovation in their field. Thus, photographers' technical understanding of their own work environment, and their keen awareness of the problems that long-term access and preservation pose, can make them willing partners for archivists who plan to acquire born digital records.

NOTES

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9. Karen Markey, Soo Young Rieh, Beth St. Jean, Jihyuun Kim, and Elizabeth Yakel, *Census of Institutional Repositories in the United States: MIRACLE Project Research Findings,* (Washington, DC: Council on Library and Information Resources, 2007), 79.

10. Jessica Bushey, “He Shoots, He Stores: New Photographic Practice in the Digital Age,” *Archivaria* 65 (2008): 127.

11. Patricia Russotti and Richard Anderson, *Digital Photography Best Practices and Workflow Handbook,* (Burlington, MA: Focal Press, 2010), 8–27.

12. Camera raw is also conventionally referred to as Raw or RAW, but it is not an acronym.

13. Jessica Elaine Bushey, “Born Digital Images as Reliable as Authentic Records” (master’s thesis, University of British Columbia, 2005), accessed March 15, 2012), http://www.interpares.org/display_file.cfm?doc = ip1-2_dissemination_thes_bushey_ubc-slais_2005.pdf.

14. Michael Reichmann and Juergen Specht, “The Raw Flaw,” accessed March15, 2012, http://www.luminous-landscape.com/essays/raw-flaw.shtml.

15. Philip Andrews, Yvonne Butler, and Joe Farace, *Raw Workflow from Capture to Archives: A Complete Digital Photographer’s Guide to Raw Imaging* (Oxford, UK: Focal Press, 2006), 6.

16. Michael J. Bennett and F. Barry Wheeler, “Raw as Archival Still Images Format: A Consideration,” UConn Libraries Published Works Paper 23, accessed March 15, 2012, http://digitalcommons.uconn.edu/libr_pubs/23/.

17. The OpenRAW working group has been advocating for a Raw format that is even more open and comprehensive than the current DNG format. It does not feel DNG is a fully open and documented format as Adobe purports. See http://www.openraw.org/about/index.html (accessed March 15, 2012).

18. See http://en.wikipedia.org/wiki/Digital_Negative (accessed March 15, 2012).

19. These are sometimes referred to as “buddy” files.

20. Bennett and Wheeler, “Raw as Archival Still Images Format,” 7.

21. Richard Anderson, “Should I Convert to DNG?” *DPBestFlow.org*, accessed March 15, 2012, http://dpbestflow.org/NODE/570.

22. Memory card capacity for a Nikon D7000 camera, accessed March 15, 2012, http://imaging.nikon.com/lineup/dslr/d7000/features03.htm.

23. “Raw vs. Rendered,” accessed March 15, 2012, http://dpbestflow.org/camera/raw-vs-rendered#tiff.

24. Russotti and Anderson, *Digital Photography Best Practices,* 46–49.

25. It has been reported that rotating some image formats, and even checking the properties of an image, can permanently change or destroy the EXIF data. See: “Nikon Also Warn About Windows XP,” *dpreview.com*, accessed March 15, 2012, http://www.dpreview.com/news/2001/12/14/nikonxpwarnings. See also, Peter Krogh, “Metadata Handling,” *DPBestFlow.org*, accessed Mar 15, 2012, http://dpbestflow.org/metadata/metadata-handling#durability.

26. See http://dpbestflow.org/image-editing/catalog-pieware.

27. “Final Report on Activities Related to ARTstor’s NDIPP Grant: Preserving Digital Still Images,” Available at http://www.digitalpreservation.gov/partners/documents/ARTstor_FinalReport020311.pdf

28. Chris Prom, “Making Digital Curation a Systematic Institutional Function,” *The International Journal of Digital Curation* 6, no. 1 (2011): 139–152, accessed March 15, 2012, http://ijdc.net/index.php/ijdc/article/viewFile/169/237.

29. For example, Michael Forstrom’s “Managing Electronic Records in Manuscript Collections: A Case Study from the Beinecke Rare Book and Manuscript Library,” *American Archivist* 72 (2009), 460–477, is an excellent case study on managing born digital collections, and he reviews literature of other prominent case studies.

30. Ben Goldman, “Bridging the Gap: Taking Practical Steps Toward Managing Born-Digital Collections in Manuscript Repositories,” *RBM: A Journal of Rare Books, Manuscripts, and Cultural Heritage* 12 (2011): 16.

31. Prom, “Making Digital Curation,” 142–143.

32. ”University at Albany University Digital Image Database Proof-of-Concept Project Charter,” November 16, 2007.

33. Jeffrey Warda, *The AIC Guide to Digital Photography and Conservation Documentation* (Washington, DC: American Institute for Conservation, 2011), 85.

34. The Dublin Core standard is widely used by libraries and archives, and provides for easier interoperability and flexibility.

35. For example, the Web site SmugMug.com contains the born digital images of numerous colleges and universities. In an e-mail from John Edens, January 17, 2012, he explains that University at Buffalo’s Creative Services are housing current photos as well as some historic photos online through SmugMug.com, and the UB University Archives are looking at solutions to preserve the images once they are no longer needed for their current uses online.

36. The Tufts University Archives contain born digital photos from 2005 to 2010. See, http://dl.tufts.edu/view_collection.jsp?pid=tufts:UA069.006.DO.UA206 (accessed March 15, 2012)

37. Bennett and Wheeler, “Raw as Archival.”

38. Ibid.

39. Zach and Peri, “Practices for College,” 122.