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Researcher Access to Born-Digital Collections: an Exploratory Study

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RESEARCHER ACCESS TO BORN-DIGITAL COLLECTIONS: AN EXPLORATORY STUDY

In the fall of 2014, the staff at New York University's Fales Library and Special Collections began processing the Jeremy Blake Papers and the Exit Art Archive. Both collections are prime examples of the special challenges posed in processing large quantities of born-digital files created on now-obsolete computing systems. As such, these collections became test cases for staff piloting new workflows as they preserved the material for the long term and made it accessible for patrons. As born-digital artwork and art documentation, these collections entailed migrated and emulated forms of access to files. While more and more archives are making born-digital collections accessible to patrons, there is scant documentation on the end-user's experience of access. How do patrons use these collections? How do they understand emulation? How do they value practices like emulation and migration within the scope of their own research agenda?

In this working paper I share the results of an exploratory study in which five researchers consulted the Jeremy Blake Papers and Exit Art Archive using different types of emulated, migrated, and "as-is" access on both contemporary and obsolete computers. In both emulation and migration, it may not always be clear which is the more authentic and trustworthy form of access. That is, both involve degrees of fidelity to the original environment and experience of the born-digital files. Nor is there much research on the potential use and access by end-users. By documenting uses of these collections, we will have a better basis for understanding the risks and rewards of born-digital access. This study reveals some of the gaps between invisible archival work and the researchers who use them.[1]

Literature Review

Margaret Hedstrom has been a pioneer in the area of born-digital access, but there are few other published studies from which to draw. She has come to striking preliminary conclusions in her work with end-user studies evaluating comparable migration against an emulation of an interactive video game. While users noticed minute differences between the two experiences, Hedstrom and her coauthor conclude that "there may be a tension between preserving authentic digital objects and their usability. In some cases, users may prefer versions of digital objects that have been converted to run in a current operating environment even though they deviate considerably in their look and feel and behavior from the original object."[2] Cornell University's Preservation and Access Frameworks for Digital Art Objects project (2013–15) documents its investigation and approach to large-scale preservation and access to interactive born-digital art. In their initial survey to potential end-user groups, such as researchers, curators, and artists, the project researchers found not only that many were unable to access interactive born-digital

[1] Julia Kim,"Out of the Frying Pan and into the Reading Room," presentation at the Society of American Archivists Annual Meeting, Cleveland, Ohio, August 16–22, 2015. A small portion of this work was previously presented at SAA 2015.

[2] Margaret Hedstrom and Clifford Lampe, "Emulation vs. Migration: Do Users Care?" *RLG Diginews* 5 (2001): 7, https://www.researchgate.net/publication/228737832_Emulation_vs_Migration_Do_Users_Care; Margaret Hedstrom et al., "The Old Version Flickers More: Digital Preservation from the User's Perspective," *American Archivist* 69, no. 1 (Spring/Summer 2006): 159–87, https://doi.org/10.17723/aarc.69.1.1765364485n41800.

collections because of the lack of institutional resources and support but also that controversy and division exists over the very use of emulation due to its ability to hide technical context.[3] The survey conclusions emphasize potential end-users as well as creators of complex media as subjects for further study themselves; both populations require archivists to consider the initial contextual documentation as well as future avenues of possible research. A digital object's "significant properties" must then be expanded beyond the technical to better include artistic intents, variability, and spontaneity in interactions.[4]

Exit Art

For thirty years, the iconic gallery and nonprofit Manhattan art space Exit Art was a fixture in the contemporary art world where it was known for its innovative curation of interdisciplinary, multimedia artworks. By the time it closed in 2012, Exit Art had organized more than 200 exhibitions featuring over 2,500 artists.[5]

The analog portions of the Exit Art collection (234.68 linear feet, 468 containers) were processed by a full-time, dedicated project archivist over the course of two years (2012–14). Fales Library also acquired the institution's 2TB RAID drive, a data-storage device (noted in series XII: Data Storage of the finding aid).[6] With only this single piece of physical media, this collection is immense in size, content, and file types (e.g., e-mail, images, word processing, spreadsheets) including obsolete Microsoft Word for DOS word-processing files from the 1980s.

Jeremy Blake Papers

Jeremy Aaron Blake (1971–2007) was an American digital artist known for his digital Chromogenic color prints ("digital C prints") and animated sequences, or what he called his "time-based paintings." That is, while Blake had trained as a painter, he helped pioneer New Media art with creating digital video projections. His fine artwork was exhibited in three consecutive Whitney Biennials from 2000 to 2004.

The Jeremy Blake Papers includes approximately four hundred pieces on optical media, digital linear tape, and Jaz drives.[7] The papers also include external hard drives and files copied from

[3] Oya Rieger et al., "Preserving and Emulating Digital Art Objects," report submitted to the National Endowment for the Humanities, Cornell University, 2015.
[4] Oya Rieger and Madeleine Casad, "Interactive Digital Media Art Survey: Key Findings and Observations," Digital Scholarship and Preservation Services, Cornell University, July 30, 2014, https://blogs.cornell.edu/dsps/2014/07/30/interactive-digital-media-art-survey-key-findings-and-observations/; Edward M. Corrado and Heather Moulaison, *Digital Preservation for Libraries, Archives, and Museums*, 2nd ed. (Lanham, Md.: Rowman and Littlefield, 2017), 228–29. These "significant properties" are not yet conclusively defined.
[5] Exit Art Archive, MSS 343, Fales Library and Special Collections, New York University Libraries.
[6] RAID stands for "redundant array of independent disks." RAIDs use striping and redundancy to preserve and backup digital files.
[7] Jaz drives were a short lived (1990s–2000s) hard-disk storage type.

Blake's laptop and a hard drive at the donor's residence.[8] His work spans a number of operating system types and software versions.[9]

Preparation for the Exit Art Archive was relatively uncomplicated; this was not true for the Jeremy Blake Papers. But the papers' complications are also what make them so interesting and valuable: a glimpse of Blake's working process in Adobe Photoshop files created from the late 1990s through the mid-2000s. Photoshop working files far outnumber any other type of digital format. Since Blake ultimately exhibited moving-image files, it was a surprise to learn that he worked in Photoshop, a static image software program. The Photoshop files were robust in their longevity; they were backward- and forward-compatible, and rendered across different periods of Photoshop software and operating systems. It was insufficient, however, to simply access the files. From the position of archival science and the ethics of art conservation, it became necessary to experiment with emulators and period-specific hardware and software in order to give *authentic* access to the files. This meant, in practice, balancing factors like artistic intent and technical feasibility.[10] What did the artist expect with regards to future preservation and access?[11] I worked closely with the digital archivist and experimented with many iterations of emulation installations to support viewing a representative sample of Blake's Adobe Photoshop files.[12] When the selected researchers handled the Jeremy Blake Papers, they primarily focused on evaluation of these emulations.

Study Methodology

Preparation for these experiments included (1) written researcher guidelines, (2) researcher comfort with technologies, and (3) researcher interest and experience with these forms of access including emulated access of complex media artwork.[13] An underlying question throughout the project was whether researchers appreciated (in the full sense of the word) the emulation. Did they recognize the value and understand the implications of emulated access? Did researchers perceive any particular value in the experience of emulated access? Did researchers need an archival hand to arrange the files in order to conduct research? Was researching a completely arranged collection worth a five-year wait?

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[8] My work on the collection is built on previous work by Lisa Darms, Brian Hoffman, and Joseph Gallucci.

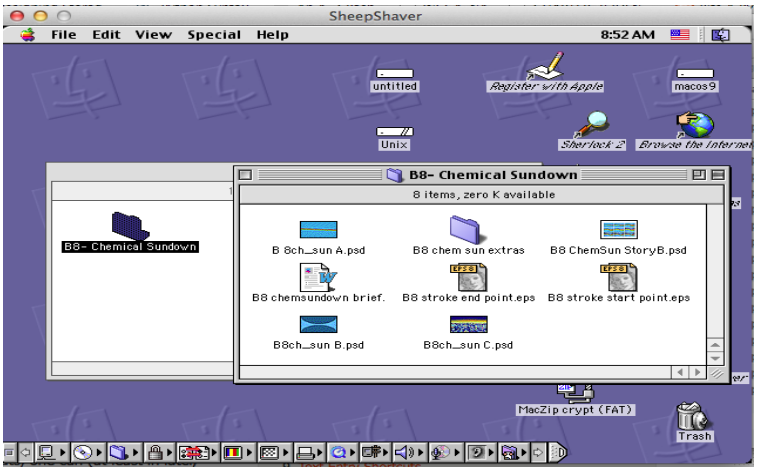
[9] More information on the Blake processing can be found at Julia Kim, "Creating Workflows for Born-Digital Collections: An NDSR Project Update," *The Signal*, March 13, 2015, http://blogs.loc.gov/digitalpreservation/2015/03/creating-workflows-for-born-digital-collections-an-ndsr-project-update/.

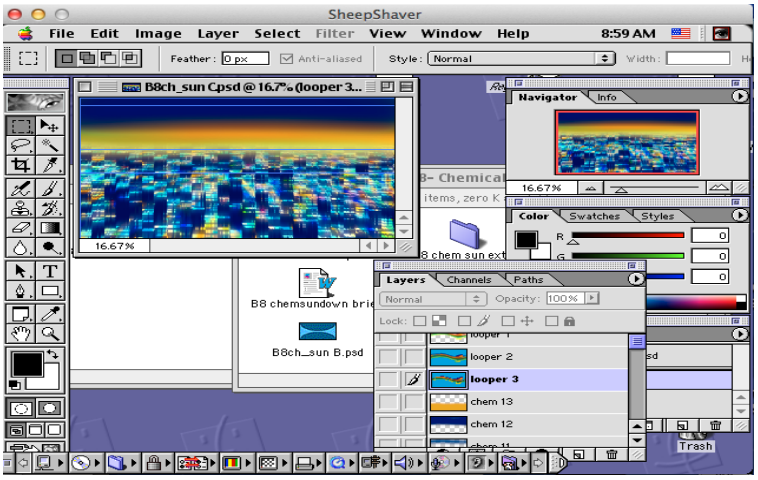
[10] Gaby Wijers, "Ethics and Practices of Media Art Conservation, a Work-in-Progress (Version 0.5)," SCART: A Website on Audiovisual Heritage by PACKED (blog), August 2010, https://www.scart.be/?q=en/content/ethics-and-practices-media-art-conservation-work-progress-version05.

[11] Sonja Teine, *Jeremy Blake's Time-Based Paintings: Sodium Fox: Fragmented Crypto Self-Portrait* (N.p.: Lambert Academic Publishing, 2012), 130**.** Blake expressed unconcern for the problems with preserving his work: "The digital file theoretically can stay new if you keep copying it, although I don't know if that is true. But what do I care? It is the museum's job to catch up and I am not worried about the museums. It is not what I can do for the museums, it is more what can the museums do for me. But a lot of artists might have forgotten that at this point, too. Why not make something that could survive a nuclear war at that point or the flood in New Orleans? It is just ridiculous. You do what you want to do."

[12] Dragan Espenschied et al., "Large-Scale Curation and Presentation of CD-ROM Art," presentation at the International Conference on Digital Preservation, Lisbon, Portugal, September 2–6, 2013.

[13] Complex media is defined here as media that is reliant on a number of technical layers, hardware, and software in order to function.





Figures 1 and 2. Screenshots of emulated access to Blake Papers

Five seasoned Fales researchers evaluated digital access through an onsite visit to NYU's Digital Forensics Lab for a period of one to two hours. Researchers were selected on the basis of two criteria: (1) each had conducted extensive archival research (defined as a book-length work), and (2) each was eager to collaborate on this project. While some were familiar with the artistic content, their disciplinary focuses extended beyond contemporary art history to include eighteenth-century literature, digital humanities, platform studies, computer science, and archival studies. Many researchers had multiple disciplinary competencies. This content-specific knowledge was a third but lesser criteria. That is to say, we sought researchers representative of a wide range of practical understandings of "content," and we specifically invited two academic researchers with backgrounds in digital humanities (e.g., media studies, image technologies, and/or platforms studies).

This selected group accessed a sliver of the total Exit Art born-digital collections files: the so-called Alternative Histories directory folders and digital files (47.6 GB, 18642 files, and 1132 folders), which represents about 4 percent of the total collection. "Alternative Histories" names one of Exit Art's major survey exhibitions of New York City's artist-run, nonprofit,

experimental spaces since the 1960s; the exhibition ran from October to November 2010. The Alternative Histories folders include administrative files, photographs, promotional materials, published works, and digital scans from primary sources taken from NYU Library's own Fales Downtown Collection, a research collection documenting New York City's downtown arts scene (1970s–1990s).[14] In total it includes contributions by and about approximately 130 different art organizations.

We selected Alternative Histories out of the many files and directories in the Exit Art server for several reasons. First, the analog Alternative Histories is arranged at the series level (series VI) in the published finding aid. Second, the born-digital files are complementary, not duplicative, of the analog collection content. And finally, these files were in high demand by researchers. Similarly, access to the Jeremy Blake Papers was limited to files from a selection of approximately six optical media from a range of Blake's work, such as *Sodium Fox* (2005), *Punch Drunk Love* (2002), and *Liquid Villa* (2001).

It is important to note that for the sake of completing this study on time, Alternative Histories files were not presented or arranged in any way. Instead, the folders were copied to a locked, non-networked laptop computer and accessed with Quick View Plus software supplemented by Adobe Acrobat software. Quick View Plus was created with the intention of supporting legal forensic workflows by offering renderings of a wide array of born-digital file types. Rather than purchasing and using the original software of the files, researchers could use this single piece of software to access and view the majority of them. This was a straightforward process that took negligible staff time.[15]

Each researcher agreed to be recorded in audio and video and to use Think Out Loud Protocol for verbalizing their thought processes and handling of the material. Afterward, the interviews were transcribed and the recordings deleted to ensure anonymity.

While we required a minimum of an hour, most researchers stayed longer to explore and discuss. After an initial study overview, they were shown the existing Alternative Histories portion of the Exit Art finding aid. They were introduced to Quick View Plus software and the Alternative Histories files on our designated laptop. After approximately thirty minutes, researchers switched their attention to the born-digital files of the Jeremy Blake Papers, which were accessible in emulation, on period computers, and on contemporary computers with Adobe Photoshop software and the Forensic Toolkit suite.[16]

As researchers accessed the files, initial interview questions framed their mock "research" including, What was the time span and date range of the items in this collection? What are some of the organizations that took part in the exhibition? Can you locate where the image files are? The sessions were punctuated with reminders to the researchers to continue to verbalize what they were doing, seeing, and noticing as they navigated the collection. We also discussed their

[14] NYU Libraries Downtown Collection at the Fales Library, https://guides.nyu.edu/downtown-collection.
[15] "Quick View," https://en.wikipedia.org/wiki/QuickView.
[16] The Forensic Toolkit has been adopted as the de facto gold standard software for archival programs to assess complex born-digital collections. Like Quick View Plus, it supports rendering of many files but also allows for robust filtering across large digital corpuses, supporting archival functions such as intellectual arrangement for large, multiformat digital collections.

expectations for a born-digital finding aid, their expectations for file types and quality, and their ability to understand and make sense of the collection without the benefit of an arrangement from a trained archivist.

The emulation portion of the interview used an Ubuntu 10.0 laptop installed with a SheepShaver emulation of Mac 9.0 and preloaded with several versions of Adobe Photoshop among other programs. As in the first half of the interviews, researchers primarily guided themselves based on their own interests but with suggestions and framing questions. Due to the instability of the emulation, this half was more flexible and adaptable.[17] While initially files were saved into the emulator, this increased the instability of the environment. To adapt, researchers also loaded files directly into the emulation during their sessions using optical media from the collection. If there were significant failures or lag times, they could also watch a short screen-capture moving-image file of someone else's navigation of Blake's emulated files. Likewise, they were given the opportunity to watch portions of Blake's completed works to better understand how the component working files were later pieced together into a long, finished artwork. Besides using the emulator, researchers explored the contemporary windows PC and contemporary Photoshop program, and the Forensic Toolkit program, as well as obsolete computers such as the Power Mac G3 and G5. Questions poised included, What are the differences in experiencing the work in this emulator versus in this contemporary PC? What does this show you about Blake's working method? What do you think are the advantages in conducting research in one environment versus the other?

The Blake Papers afforded an interesting opportunity for exploring collection material in ways ranging beyond what was originally possible or planned by the institution. In future work with researchers, the responsibilities of the reference archivist and digital archiving staff will be limited necessarily.

Methodology Limitations

This study was a pilot. The sample size was small and not random. This was based in part on the lack of clear demand for studying emulation and on our decision to purposely seek a broad cross-section of researchers. Variables were not fully controlled. Rather than follow a script throughout the process, each session was unstructured enough to allow for spontaneity and conversation; each researcher raised different issues. The digital archivist and I were then engaged as co-participants as well.

Results

Instead of synthesizing the small sample of participant remarks, individual responses are kept separate due to the methodology restrictions discussed.

[17] See Diane Dietrich et al., "How to Party Like It's 1999: Emulation for Everyone," *Code4Lib Journal* 32 (April 2016), http://journal.code4lib.org/articles/11386. See also David S. H. Rosenthal, *Emulation and Virtualization as Preservation Strategies*, a report commissioned by the Andrew W. Mellon Foundation, New York, October 2015, https://mellon.org/Rosenthal-Emulation-2015.

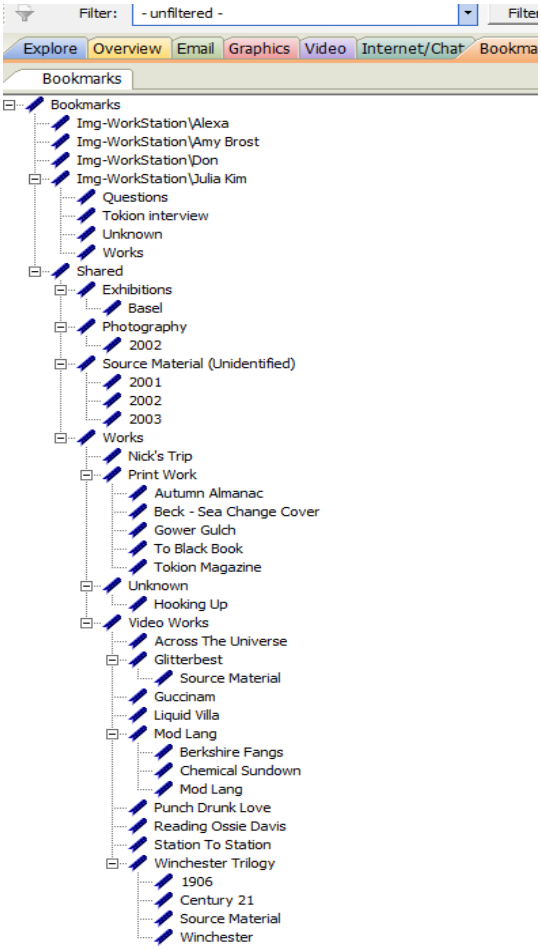


Figure 3. Screenshot of Forensic Toolkit's Bookmarks used to arrange the Blake Papers' files

"This is a complete portrait of organizational record-keeping" (Researcher C).

While many of the researchers could easily navigate the Exit Art files, some noted that future interest in the records could be within a different disciplinary context. Future researchers in the realm of organizational management and administrative studies could find the institutional records interesting in themselves. If an archivist arranged the digital files, however, this picture of recordkeeping practices in a small arts organization from 2010 could be obscured.

One researcher's content is another's context and vice versa. As archivists we owe as much responsibility to the tools, methods, and interests of future researchers as to the ones prevailing now. For example, digital humanities strategies in data mining and statistical analysis will likely be more prevalent across research disciplines in the future, and so researchers may want to look at metadata previously assumed to be private, unavailable or unknown. Underlying assumptions such as the possible value of the "original order" of unprocessed administrative files found in Exit Art, as noted by Researcher C, are more reason to embrace multiple, interactive, and flexible arrangements. Multiple arrangements would also make archival arrangement transparent

to researchers, underscoring our role as interpreters.[18] It could lessen the burden of arrangement, even when using powerful digital forensics software like the Forensic Toolkit.[19] This could in fact be a new era of foundational "respect des fonds."[20] Minimally processed disk images are increasingly possible alternatives to arrangement. Under special circumstances, some archives have allowed researchers access to collections through the Forensic Toolkit.[21] Projects like BitCurator Access, a project that created web-based tools that allow accessing disk images, make this increasingly possible.[22] Led by the University of North Carolina and the BitCurator Consortium, this grant-funded project was just one of many BitCurator contributions to making digital forensics workflows available to archivists. BitCurator Access allows for unmediated and browser-based access to disk images at the file-level while preserving original order.

In contrast to this viewpoint, Researcher D, the sole researcher with extensive archival processing experience, was opposed to unprocessed collections: "It's kind of interesting to see it as a snapshot of that person's computer life, I suppose, but that doesn't make it easy for searching. In fact, I think most people are poor at organizing on their computer or they are only meaningful to themselves." Researcher D did not agree that the born-digital "as-is" files represented a possible savings in research time. Researcher D's approach for both analog and digital processing would be the same—to methodically go through every box and folder. In the case of the Exit Art's Alternative Histories folders, however, the lack of arrangement meant that Researcher D would have to go through every folder scrupulously to account for the whimsy and inconsistencies of the organization.

"If I made an appointment I would learn Photoshop in advance" (Researcher A).

Emulation and new forms of access are not only technically challenging for the archivists preparing them. The reference archivists and tested researchers noted in conversation that they were concerned about the greater demands for their own technical responsibilities. They themselves lack expertise in obsolete technologies or specific software programs, but they would have to support future researchers accessing these types of collections. Similarly, some of the researchers expressed dismay at their unfamiliarity with navigating files in Photoshop software. However, when the digital archivist and I cited expectations for researchers to have a foreign language competency when the collection is in another language, all researchers were comfortable with this delineation of responsibility. One researcher noted, "But then again, if you are a researcher, you have to know something about what you are researching." In this case, we were able to reframe the "what" by uncovering the many ways in which the same digital files appear and render differently with different effects. All researchers were interested in the implied

[18] Leigh Rosin, "Applying Theoretical Archival Principles and Policies to Actual Born-Digital Collections," *Archive Journal* 4 (Spring 2014), http://www.archivejournal.net/issue/4/notes-queries/applying-theoretical-archival-principles-and-policies-to-actual-born-digital-collections/.

[19] Laura Wilsey and Rebecca Skirvin, "Capturing and Processing Born-Digital Files in the STOP AIDS Project Records: A Case Study," *Journal of Western Archives* 4, no. 1 (2013): 18–19, 20–22.

[20] Jefferson Bailey, "Disrespect des Fonds: Rethinking Arrangement and Description in Born-Digital Archives," *Archive Journal* 3 (Summer 2013), http://dev.archivejournal.net/issue/3/archives-remixed/disrespect-des-fonds-rethinking-arrangement-and-description-in-born-digital-archives/.

[21] Stanford and New York University.

[22] BitCurator Access, http://www.bitcurator.net/bitcurator-access/.

technical responsibilities, and they agreed with the notion that technical competency of some kind was no different from any other type of "content" competency in a field.

"It's like visiting his studio—except on virtual terms" (Researcher B).

Without prompting, all researchers commented on the tangible, even visceral experience of the emulation and its departure from contemporary computing. The immediacy of the emulation brought them a step closer to otherwise obscured aspects of the artist's workspace and methods. The look and feel of the Mac Classic screen made several researchers nostalgic for their own past experiences with early personal computing. Similarly, seeing alternate arrangements of the digital files, such as the files from different optical media, made for a more intuitive experience. The impact of alternate arrangements was understood more easily. Researchers were not just able to view rendered files and compare them across the emulator, older computer, and contemporary computer; researchers were able to manipulate Blake's Photoshop files. Researchers moved and manipulated the many layers that composed a single file using the same tools that Blake had used to modify images. Blake's Photoshop files were not simply a static image; they were many images stacked within a single file.[23] The layers could be minutely edited and modified for a subtle transition in the final moving image. With these experiences, researchers better understood Blake's time-consuming process, almost inconceivable today, for creating static images as the source material for three- to twenty-minute moving images.[24] Researchers could directly mimic his artistic process and interact with the files. If the Photoshop files had been normalized and flattened to TIF files, researchers would get a very incomplete understanding of Blake's process.

"Given the choice . . . I would use contemporary . . . unless I was doing a book-length study" (Researcher A).

Emulation reproduces original environments necessary for a work by recreating another computer environment on top of a hosting computer environment. Emulation can be done through a software application or embedded in hardware. Emulation, then, can work at many levels, starting from the hardware, working up through the operating system, and then the software. Emulations of operating environment for personal archival collections potentially give researchers unique access to the entirety of the personal computer environment.[25] This is especially useful for artistic works or interactive pieces. Key issues with emulation as well as migration for evaluation include "look and feel" and "significant properties."

It was with these concerns that the time-intensive and experimental work was done. Researchers enjoyed the novelty and sensory experience of navigating the emulation. But many expressed repeatedly the common desire for "greater ease of manipulation and faster speed."[26] As another archivist said anecdotally in describing her experiences in this area, "Authenticity is not a

[23] Adobe Photoshop Layers, https://helpx.adobe.com/photoshop/using/layer-basics.html.
[24] Dan Levin, "After Death, Unfinished Artwork Gets a Life," *New York Times*, November 29, 2007, http://www.nytimes.com/2007/11/29/arts/design/29blak.html?mcubz=0.
[25] See Salman Rushdie Papers, Stuart A. Rose Manuscript, Archives, and Rare Book Library, Emory University, Atlanta, http://pid.emory.edu/ark:/25593/8zv36.
[26] Hedstrom et al., "The Old Version Flickers More," 159–87.

researcher concern. Authenticity is an archivist concern."[27] While this does not negate professional responsibilities, it is worth further investigation. Although the Blake emulations and files as displayed in contemporary software and hardware were similar to the eye and retained essential characteristics (the number of layers, for example), it is possible that, like Researcher A, researchers and archivists may diverge on authenticity and its overall value in providing access to complex born-digital collections. One researcher jokingly suggested that perhaps we should just display an old Photoshop skin on top of a contemporary machine as a compromise. Given the many other possible ways in which context can be reconstructed, from computer monitor types and resolution to response rates, there is an argument to be made for "good enough" strategies to allow for greater access to collections.[28]

"This type of art—born-digital—is not taught. . . . I might have changed my course of study" (Researcher B).

Most researchers were unfamiliar with Jeremy Blake and his work, despite the prominence of his work during his short career. Researcher B's career was based on media art; therefore, she was particularly thrilled to access born-digital artwork through emulation of original hardware and software. If given the opportunity, she would have studied more art "after the 1990s" rather than her own areas of research, which were limited not only by lack of technical means but because of their typical exclusion from the traditional curriculum. Researchers and scholars cannot evaluate only years-old work retrospectively due to rapid obsolescence cycles.[29] This researcher's enthusiasm was both a validation and a call for further collaboration with other researchers to study born-digital collections.

Preliminary Conclusions

Since this study was conducted, the archives and library communities have benefited from major innovations in emulation and software preservation. Continued improvements with the Baden-Wurttemberg Functional Long-Term Archiving and Access's (bwFLA) "Emulation as a service" have changed the emulation game, while technical and administrative barriers continue to fall.[30] Archivists no longer need to build emulators themselves, and the steps taken in this experimented no longer need to be repeated. In fact, during the course of the study, I used bwFLA's browser-based demo service to test the emulation. Now bwFLA is accessible to all users. It supports all major operating and desktop systems, and much of the work in determining platform requirements can be made almost invisible to end-users. The Software Preservation Network is another major effort systematically investigating solutions for not only emulation but also legal issues, metadata, and other impediments to the preservation of software necessary for rendering digital files, whether emulated, migrated, or as-is.[31] Building on these efforts, Yale University Library and the Software Preservation Network launched "EaaSY—Scaling Emulation and Software Preservation Infrastructure," a multiyear, grant-funded research project

[27] Gabrielle Redwine, "The Challenges of Access Demands for an Established Accessioning Workflow," presentation at Born-Digital CurateCamp, Brooklyn, New York, April 15, 2015.
[28] See Espenschied et al., "Large-Scale Curation," 3.
[29] The resultant risks to social memory is a major premise in Richard Rinehart and Jon Ippolito, *Re-Collection: Art, New Media, and Social Memory* (Cambridge, Mass.: MIT Press, 2014).
[30] BwFLA, http://emulation.solutions/, http://eaas.uni-freiburg.de/eaas.html.
[31] Software Preservation Network, http://www.softwarepreservationnetwork.org/.

to build a shareable emulation infrastructure while creating emulated access to over three thousand computer applications.[32]

While researcher access to complex born-digital environments has been a field-wide effort, there are few studies of how born-digital collections are used and received by researchers. Part of this is simply because there are few demonstrable and publicized born-digital collections with complex, interactive archival access available. Only a handful of institutions provide emulated access to such collections. This will soon change, both because of rapid progress in the library, archive, and museum world and because of the limited timeline available for preservation and access of these at-risk collections. This essay then is an attempt to "look ahead" and explore how born-digital processing decisions are received and understood by our designated user communities. This project is an introductory study of researchers, but more research should be done. Even with field-wide improvements, born-digital access has high barriers. While many leading institutions are making tremendous progress, countless other institutions must always weigh and strategize how best to apportion limited resources. Given the tremendous resources expended on possible solutions, it is surprising that there are no comparable investigative studies on the researchers whom these collections are meant to serve. This paper only scratches the surface.

By all means let us continue to preserve files as we create solutions, guidelines, and best practices for difficult materials and processes. In the meantime, archivists must preserve bit-exact disk images of collections, software, and documentation of dependencies, behavior, and donor intent in order to secure the potential for emulation for access and preservation. While archivists fulfill these already steep prerequisites to emulation, instead of adopting a "wait-and-see" assumption of future use, they should also invite and solicit feedback from researchers and donors. The "build it and they will come" approach commonly cited in digitization initiatives makes even less sense today with born-digital collections.[33]

As in the case of the Jeremy Blake emulations, our need to rely on older host operating systems made the emulation itself an only semi-permanent solution requiring ongoing maintenance and preservation, like any other digital collection. No computing systems will remain contemporary. Given the often innate variability in complex digital art, archivists with limited resources must make difficult processing decisions. Let us then collaborate with researchers in more complex born-digital access studies as we consider new materials and methods, expansive notions of context and "content," and a fresh sense of how we can make the most of our resources and resourcefulness.

[32] Mike Cummings, "Project Revives Old Software, Preserves 'Born-Digital' Data," *Yale News*, February 13, 2018, https://news.yale.edu/2018/02/13/project-revives-old-software-preserves-born-digital-data; Software Preservation Network, EaaSY, http://www.softwarepreservationnetwork.org/eaasy/.

[33] Abby Smith, "Strategies for Building Digitized Collections," Council on Library and Information Resources, Washington, D.C., 2001, https://www.clir.org/pubs/reports/pub101/pub101.pdf. This "build it and they will come" approach common to digitizing collection is much more problematic with born-digital collections, in which there are no analog fallbacks (10).