Technology Transforming Preservation
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VOL. 32, NO. 1

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Cover: A user navigating within a virtual reality environment displaying a model of Frank Lloyd Wright’s Taliesin.
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Forum Journal, a publication of the National Trust for Historic Preservation (ISSN 1536-1012), is published quarterly by the Preservation Resources Department at the National Trust for Historic Preservation, 2600 Virginia Avenue, NW, Suite 1100, Washington, DC 20037 as a benefit of National Trust Forum membership. Forum members also receive four issues of Preservation magazine. Annual dues are $195. Send email address changes to members@savingplaces.org. Copyright ©2018 National Trust for Historic Preservation in the United States. Of the total amount of base dues, $6.00 is for a subscription for Preservation magazine for one year. Support for the National Trust is provided by membership dues; endowment funds; individual, corporate and foundation contributions; and grants from state and federal agencies. The National Trust Forum Journal is a channel for expressing opinions, encouraging debate, and conveying information of importance and of general interest to Forum members of the National Trust. Inclusion of material or product references does not constitute an endorsement by the National Trust for Historic Preservation.
Preservation Technology: Opening the Field to New Possibilities

PRIYA CHHAYA AND REINA MURRAY

In less than half a lifetime, significant portions of the world have undergone a digital transformation—one that experts believe is just beginning. Odds are that you would have read this article from a desktop computer a mere 10 years ago; today you are likely to be reading it from a device that fits into the palm of your hand. But while such impacts on our daily lives are ubiquitous and self-evident, technology’s role in protecting old and historic places may be less obvious.

A little more than a year ago, the two of us were tasked with surveying the role technology plays in historic preservation. Over the course of many subsequent hours of planning—and cups of coffee—we realized that tech has at least two distinct roles in preservation. The first is documenting historic places for their protection. Technology has transformed the methods and tools used for survey as well as the subsequent management, evaluation, and integration of survey data with other information. From mobile applications to drones, the tools we use to measure and analyze the essential details of a resource are changing, opening the field to new possibilities.
Technology is also transforming the ways preservationists tell the stories of old and historic places; increasingly, they use innovations like social media and virtual reality. Evolving technologies present new options for telling the full American story—but with these new opportunities come new challenges.

As we pulled together materials on this subject—for a conference track supported by the Richard H. Driehaus Foundation, blog stories, webinars, and this *Forum Journal* issue—certain fundamental questions about the role technology plays in preservation emerged. When should we adopt new technologies in an ever-changing world? Is new always better? Or does sustainable innovation require embracing new tools in tandem with existing methods of saving places? In short, how can technology best help us do our work? Tom Schienfeldt’s article contemplates these questions—as well as how professionals and organizations can do this work while facing funding, time, and capacity challenges.

We also want to take this opportunity to underscore how Forum is leveraging technology to engage our members. Early last fall we launched Forum Connect, an online community to replace the Forum-L listserv. Discussion boards have become an integral part of digital discourse, and this community is giving Forum members a dynamic new space in which to network, engage, and discuss the issues that are most important to preservation professionals. If you haven’t joined yet, sign up today.

Technology can support the work that we do to save places. While we recognize that new methods and tools do not come without challenges, we believe, as the artist and futurist Zenka said in her PastForward 2017 TrustLive, that “if we can bring [technological experts and preservationists] to the table, we can really make magic happen and give this technology a purpose and a path forward.” FJ

PRIYA CHHAYA is a public historian and the associate director of publications and programs at the National Trust for Historic Preservation. REINA MURRAY is the GIS project manager for the National Trust.
Making Sustainable Technology Choices

WHETHER IT’S IMPLEMENTING A NEW CONTENT MANAGEMENT SYSTEM FOR YOUR WEBSITE, USING A NEW PROJECT MANAGEMENT PLATFORM TO PLAN AN UPCOMING EXHIBITION, OR ROLLING OUT A NEW CUSTOMER RELATIONSHIP MANAGEMENT PACKAGE, MAKING TECHNOLOGY CHANGES REQUIRES MEANINGFUL INSTITUTIONAL INVESTMENTS. BECAUSE NEW TECHNOLOGIES HAVE SIGNIFICANT COSTS—SOMETIMES IN LICENSE FEES, BUT ALWAYS IN STAFF TIME AND TRAINING—CULTURAL HERITAGE ORGANIZATIONS ARE UNDERSTANDABLY RELUCTANT TO ADOPT THEM TOO OFTEN. MOREOVER, WHEN IT DOES BECOME NECESSARY TO MAKE A CHANGE, ORGANIZATIONS WANT TO MAKE VERY SURE THAT THE NEW TECHNOLOGIES THEY CHOOSE WILL HAVE STAYING POWER—THAT THEY WON’T INCUR ONGOING MAINTENANCE COSTS OR BECOME OBSOLETE IN A FEW SHORT YEARS.

AS SOMEONE WHO BOTH ADMINISTERS A PUBLIC HUMANITIES ORGANIZATION AND HAS BUILT SOFTWARE PACKAGES FOR CULTURAL HERITAGE ORGANIZATIONS, I AM OFTEN ASKED HOW TO PICK A NEW TECHNOLOGY PLATFORM. IMPLEMENTING NEW TECHNOLOGY ALWAYS REQUIRES EXPERIMENTATION, SO THERE ARE NO HARD-AND-FAST RULES. THERE ARE, HOWEVER, CERTAIN GUIDELINES THAT CAN MAKE THE PROCESS MORE PRODUCTIVE AND SUSTAINABLE.

MANAGE EXPECTATIONS

WHEN PICKING A NEW SOFTWARE PLATFORM, IT IS VITAL TO START WITH CLEAR-EYED EXPECTATIONS FOR WHAT AND HOW MUCH THE ORGANIZATION WILL GET OUT OF THE SOFTWARE, IN TERMS OF BOTH INCREASED CAPACITY AND LONGEVITY.

MOST NEW TECHNOLOGIES ARE INITIALLY SOLD AS TIME SAVERS, BUT RARELY DO THEY END UP SAVING US TIME. IT IS IMPORTANT TO UNDERSTAND THAT A NEW PIECE OF TECHNOLOGY WILL GENERALLY NOT HELP AN ORGANIZATION SAVE STAFF TIME, EVEN AFTER ITS INITIAL INSTALLATION IS COMPLETE. INSTEAD, NEW TECHNOLOGIES INCREASE OUR PRODUCTIVITY. WE STILL HAVE AS MUCH WORK AS EVER, WE ARE JUST ABLE TO DO MORE OF IT AND DO IT MORE EFFECTIVELY.
The introduction of the washing machine in the early 20th century, for example, did not immediately allow women in the home more leisure time, though this is what its marketing promised. Instead, in many cases, women using early washing machines actually spent more time on laundry. Rather than saving women time, the washing machine allowed families to have more and cleaner clothes.

Likewise, do not expect the adoption of, for example, a new customer relationship management platform or web content management system to save you or your staff time. It follows that technology will not allow you to “downsize,” as it has in some sectors of the economy, particularly manufacturing. Instead, you should expect that new technologies will make your marketing or outreach efforts better. You may be able to keep in contact with donors and patrons more regularly, reach audiences over greater distances, distribute educational materials more widely, and tell more compelling stories. But you will still need staff to keep these systems and their contents up to date, to experiment with new methods and strategies, and to follow up with all the new people.
you’ve reached. In the essentially people-centered business of cultural heritage, technology is for enhancing the capabilities of our people, not for replacing their jobs.

Organizational decision-makers should also make technology decisions with the clear-eyed expectation that, whatever technology they choose, it will likely be obsolete in less than five years. I know this is hard to stomach, but irresistible forces are at work here.

To a great extent, obsolescence is simply a function of how digital technologies develop. Amazingly, more than 50 years after it was posited, Moore’s Law—the prediction by Intel co-founder Gordon Moore that computing power should double approximately every two years—still more or less holds. Hardware companies use this geometric increase in computing power to maintain aggressive product cycles: the computers and mobile devices on the shelves in two years will be twice as fast as the ones you buy today. And your computer is designed to be old by then.

Now maybe you don’t care about having the fastest laptop or latest smartphone. Unfortunately, it’s not just about hardware. Software developers design their products to run on the latest hardware—all the more so in these days of automatic updates via mobile app stores like the iOS App Store and Google Play and subscription software services such as Office 365. Therefore, roughly two years from now, whether or not you will want a faster device, the software delivered to it will be designed to run on something twice as powerful as the one you have today. Snapchat’s iPhone app is 51 times larger in 2017 than it was in 2013.

Alas, mobile phone operators are in on it too: this is the reason for two-year contracts and financing plans. Verizon and AT&T know that you’ll be fed up with your phone in two years when it slows to a crawl trying the run the latest update of the Facebook mobile app. The planned obsolescence perpetrated by hardware makers, software companies, and mobile operators may be lamentable, but it has been a fact of computing for more than a half century. We shouldn’t expect it change. What we should do is plan, budget, and fundraise accordingly.
START LOW TECH

When picking a new technology platform, the strong temptation is to go for the option with the most features. But choosing software is a lot like choosing a car. A Chevrolet and a Mercedes-Benz are equally capable of getting you to work. The Benz may do it in more comfort and style, and it will certainly have additional features to help you get there—a navigation system or adaptive cruise control, perhaps. But the Chevy will do the essential work just as well, and it will leave you with more resources to use elsewhere.

Likewise, when choosing a new technology for your organization, start with the lowest-tech solution possible, and only move up to a higher-tech solution when you reach the limitations of the original product. For example, in picking a collaborative project management tool for your team, don’t go straight to Microsoft Project or Jira. Start, perhaps, with a Google Doc, which offers most of the essential features of those more sophisticated platforms—collaborative authoring, checklists, revision histories, and user management and tracking—without any upfront cost or setup time and with a minimal learning curve. You could easily spend hundreds of dollars and days, if not weeks, of staff time installing and configuring something like Microsoft Project, or even a “freemium” online solution like Basecamp, and be no better placed to share task lists and milestones with your team than if you had started a Google Doc. You can always transfer the plain text of a Google Doc or the structured data of a Google Sheet or Excel spreadsheet to a more sophisticated system if you find you need the additional features. Moreover, after starting small and exhausting the capacity of a lower-tech system, you will discover what features you really need by repeatedly bumping up against their absence. For instance, maybe you’ll find that you need a more “granular” permissions structure that allows some people to view and edit some data and others to view and edit other data. Maybe you’ll need a more thorough notifications system to keep team members on task or a better calendar feature.

This rule applies across the cultural heritage technology spectrum, from project management software to web content management to collections management. Resist the temptation to
buy the Benz—start with the Chevy. The skills that you learn while driving the Chevy will be entirely transferable to the luxury car, and the experience of driving it will help you know which options you’re looking for in a Benz.

CHOOSE OPEN SOURCE AND OPEN STANDARDS

Beginning about 15 years ago, in the aftermath of the dot-com boom, digitally minded cultural heritage professionals became increasingly interested in the potential of open source software—that is, software whose code is released under open copyright terms. Although it comes in many flavors, open source software is contrasted with proprietary software, which is licensed to users, usually for payment, under terms that restrict its use and redistribution. Proprietary software is “closed” in that users cannot alter or reuse its source code. Open source software, by contrast, allows users to inspect the source code, change it to reflect their particular needs, and redistribute those changes.

Note that the terms “open source” and “proprietary” refer to how software is licensed, not to whether it has been developed by a nonprofit organization versus a corporation. Plenty of corporations build open source software: Google is probably the largest, but IBM and even big proprietary software makers like Microsoft release open source software as well. Conversely, nonprofits routinely build and sell proprietary software.

And while educational and cultural organizations’ shift toward open source in the early 2000s partly stemmed from a desire to align themselves with technology communities motivated less by the corporate excesses of Silicon Valley and venture capital and more by the shared values of knowledge creation and dissemination and public service, there were also important practical reasons for choosing open source technologies in the wake of the dot-com bust. The very present realization of the fragility of corporate technology firms drove many cultural heritage and educational organizations, for whom sustainability is a core value, toward open source as the most practical, most prudent choice. What is important for our discussion is not whether one kind of software
is made by idealists and the other by corporate villains. Instead, we should evaluate what an open source software package enables you to do and what it offers in terms of sustainability—and many factors make open source a more sustainable choice.

Users can not only view open source code and make changes to it but they are also encouraged—sometimes required—to release those changes back to fellow users and developers, who can use the altered code and develop it further. This dynamic creates a virtuous cycle of continuous improvement, particularly when it comes to squashing bugs and fixing security vulnerabilities. As programmer and open source advocate Eric Raymond famously noted, “With many eyes, all bugs are shallow.” Open source software is continuously updated by a loose community of developers, and new releases are issued when they are needed, not when a copyright holder determines it will be best for business. This means that, in theory at least, your organization can always have the most up-to-date software.

The same communities that find bugs and contribute security patches, device drivers, and maintenance updates are also available for support and training. Robust open source software projects have active user forums where questions are answered quickly by fellow users who often have faced the same real-world problems. It is in the community’s own interest to produce and make freely available good documentation, instead of keeping expertise in the domain of consultants employed by software proprietors. Most successful communities host their own conferences and workshops.

And community developers are not simply writing bug fixes and driver updates for the core software—they are extending it to do new things. Most open source software packages offer extensible architectures that allow you to “plug in” new features and functionality as you need it. In thriving open source projects, many of the features you might need will be available in the form of a plug-in developed by a fellow community member. Users of open source web browsers such as Firefox and Google Chrome (which is based on the open source Chromium project) will recognize this plug-in concept from the wide range of available “extensions” for their browsers. Of course, you are not confined to
being a passive user of the software and its plug-ins—you too can be an active developer, building plug-ins to accomplish your goals and giving them back to the community.

Finally, open source software packages typically implement open data standards, which will allow you to move your data to a new platform when necessary. It may be in a proprietary software maker’s best interest to make it hard to leave—to “lock” you in by formatting your data in a way that’s only readable by its own products. An open source community has no such incentive. It’s interest, like yours, is in data portability, and its open data standards support this.

These qualities of open source software all point in the same direction: robust open source projects have active communities behind them committed to keeping the technology alive. Like all digital technology, open source software is subject to Moore’s Law and turns over on roughly a two- to three-year cycle. You’ll have to turn over with it. Doing so will necessitate becoming a member of the open source community, and if that seems like a lot of work, it is. Although you may not have to pay a license fee, running open source software is patently not “free” of cost. Rather, advocates joke that open source software is free like a puppy: you can have it, but you’re committing to a lifetime of care and feeding. Dog owners, and open source software community members, know that it’s worth it.

**INVEST IN PEOPLE, NOT TECHNOLOGY**

By now it should be clear that sustainable technology requires the time, attention, and care of people working in community, and that brings me to the most salient advice I have to offer organizations looking for a sustainable technology strategy. When making technology choices, it is best not to invest in technologies themselves, but in the people who will use and maintain them for your organization. Laying out cash on vendors and consulting is always a short-term strategy. On the other hand, making steady, consistent investments in finding people comfortable with experimentation, and then in supporting them as they explore and adopt new technologies, will create a sustainable culture of digital know-how and innovation that will serve your organization across
the unrelenting cycles of technological change. You need not hire purebred geeks or even dedicated IT staff. Empower your existing staff, support their professional development through workshops and training, and give them time to push their limits. If you’re hiring, don’t hire for particular tech skills or knowledge of a particular software platform, but with these culture-building values in mind: a demonstrated track record of experimentation with technology, a do-it-yourself approach, and a commitment to engaging with technology communities. Let your people work through the processes of migrating data to a new platform when an old one becomes untenable, starting low tech and working up to the best-fit solution, or participating in an open source community—and they will build a technology strategy that’s right for your organization.

Investing in people is costly, no doubt, but building technology know-how—and a culture of technology know-how—is your best bet for weathering the change inherent to the technology landscape. Your technology roadmap will be more crooked, and your timeline to implementation will be longer—but so will your timeline to obsolescence. FJ

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TAKEAWAY
Read about the Greenhouse Studios design process.

TAKEAWAY
Read about the collaborative culture at Greenhouse Studios.
A Different View: Using Drones to Document Historic Places

TERRY KILBY AND BELINDA KILBY

Although drone—also known as unmanned aerial vehicle (UAV)—technology has been developing at a feverish pace, it was only recently that UAV tech matured to the point of being a consistent tool in historic site documentation. Early systems were sometimes unreliable or provided data that were difficult to incorporate into existing workflows. However, the latest UAV aircraft paired with industry-leading processing software are now proven tools for capturing highly accurate 3-D models and 2-D site documentation while saving time, effort, and money.

THE EVOLUTION OF CIVILIAN UAVS
The U.S. civilian sector started experimenting with UAVs in the mid-2000s. The first small UAVs were homemade aerial robots created by tech-savvy hobbyists who cobbled together somewhat functional units out of disparate electronic components. This high barrier to entry kept the number of drone users low.

The DJI Inspire 2 unmanned aerial vehicle is capable of autonomous flight and takes high-resolution photographs.
PHOTO BY JUAN JOSE
In January 2013 the second generation of UAVs was born with the release of the DJI Phantom line. This was the first off-the-shelf quadcopter, and it allowed users to take to the air without having to build their own drones. The user-friendly aircraft carried a GoPro camera, though not one that could be operated remotely. Before take-off, operators had to set the camera to trigger the shutter at regular intervals and hope for the best.

The next generation of small drones were ready-to-fly aircraft equipped with proprietary camera systems that could be controlled remotely through an app on a mobile device. These gave users the ability to see what the camera saw and adjust camera and drone settings in real time as the drone was flying.

The current, fourth-generation aircraft still have proprietary imaging systems, but with larger camera sensors, optimized propulsion systems to allow for flight times of 30 minutes or even longer, and advanced communications protocols that power their flight and camera control systems. Beyond that, there is also a level of intelligence built into the aircraft: “obstacle avoidance” allows them to gauge their surroundings and adjust their flight paths to avoid colliding with physical objects, and “geofencing” enables them to avoid flight-restricted areas using GPS software.

Given this list of impressive capabilities, one can imagine what a valuable tool today’s small UAVs are for efficiently capturing photographic data. Many industries and fields, including historic preservation and archaeological documentation, are increasingly adopting unmanned technologies into their workflows.

Our company, Elevated Element, has used UAVs to document several historic sites around the state of Maryland and create 3-D models of them. We were able to participate in these projects thanks to our working relationships with the Maryland State Highway Administration as well as Preservation Maryland.

**3-D DOCUMENTATION OF WHITES HALL AND COMPTON BASSETT**

Drone missions were used to document, in 3-D, two endangered historic structures in Maryland. Whites Hall, the birthplace and childhood home of 19th-century entrepreneur and philanthropist
Johns Hopkins, is threatened by local development efforts, while the plantation house at Compton Bassett is in danger of falling due to structural damage.

While drones were selected for their ability to document these sites in the least invasive way possible, they can do much more than simply take photos of structures. For example, drones can facilitate photogrammetry. In this process, a single site is photographed from all possible angles and computer software uses the vast array of resulting photos to construct a model featuring both 3-D geometry and photo-realistic textures.

While autonomous flight planning software is typically used to conduct photogrammetry missions, the Whites Hall and Compton Bassett missions were both flown manually. This approach, usually used for single structures, dig sites, and other areas where a higher level of 3-D accuracy is required, has two major benefits. First and foremost, it allows users to capture a much greater level of detail along the elevations, facades, and overhangs of the structures. Secondly, users can navigate the complex surroundings of each structure and avoid thin obstacles that the aircraft may not be able to sense, such as tree limbs and power lines.

This type of project yields web-based 3-D models that are accessible through SketchFab, 3-D computer-aided design files that are compatible with GIS software, and “fly-through” video animations. Additional processing can also prepare the model for full-color 3-D printing through services such as Shapeways.

**INSPECTION PHOTOS AND 3-D MODELS FOR HISTORIC RESTORATION OF ELICOTT CITY**

July 30, 2016, will not be forgotten around Ellicott City, Maryland, anytime soon. The city saw six inches of rainfall over two hours, which caused extreme flash floods to rip through the historic Main Street area of downtown. Once the waters receded, the damage became apparent and the long process of rebuilding began.

In Ellicott City UAV technology was used to cover a large area of land, complementing other data collection techniques. Elevated Element worked alongside terrestrial 3-D laser scanning company
Direct Dimensions to jointly document the flood damage, capturing data from the site as quickly as possible. Laser scanners on the ground and drones flying overhead in autonomous grid patterns allowed us to combine two sets of data to expand the footprint of the resulting model. In situations like this, lasers and drones complement each other very well: lasers can collect data at very high accuracy levels (up to 2 millimeters) but are limited by their line of sight from the ground, whereas drones have a higher line of sight but lack the accuracy of lasers. Combining these two tools can offer the best of both worlds for total coverage. In Ellicott City, the drone also captured a final set of additional photos for inspection and 2-D documentation. The extensive documentation generated 3-D data and animated fly-through videos.

In an ideal world, sites would proactively collect such data sets before experiencing natural disasters or other accidents for reference and comparison in the event of loss. The documentation in Ellicott City was only conducted after the flood had occurred, but it would have been that much more valuable to assess damage by comparing it to existing data.
DIGITAL RE-CREATION OF NEWLIN MILL ARCHAEOLOGICAL SITE

The Newlin Mill site in Brookeville, Maryland, once contained a grist mill, auxiliary buildings, and the miller’s house. All of these structures have been gone for many decades now, with only a small ruin and a well remaining where the miller’s home once stood. To determine what the site might have once looked like, we pulled together several sources of data, including high-level aerial scans for ground topology, low-altitude manual flights for detailed 3-D models, state archaeological surveys, written records from local historians, and 360 panoramic photography. There was also a single photo of the mill building, though it had been taken after the structure was no longer being used as a mill.

The first step in this project was to align current drone data with survey and archaeological data collected in 2002. From this, Elevated Element was able to lay out the footprint of all the structures and compare it to the actual topology of the land. This merging of data allowed historians to visualize the site in a way that had not previously been possible. Based on this new visualization tool, they were able to make critical determinations about features of the site.
property that had been missing from the written record. For example, it had always been assumed that the mill used an over-shot type of water wheel, though little had been known about its mechanics, but examining the merged data sets led the archaeologist on the project to conclude otherwise. Since overshot wheels use water from a higher elevation that strikes the wheel from above, the relatively minor degree of elevation change between the waterway and the mill wheel suggested that the mill had actually operated with a breastshot water wheel.

The project yielded a re-creation of the entire mill site, including multiple structures and covering more than four acres of land, made by a 3-D digital artist. The digital re-creation includes renderings of what the mill and miller’s house structures might have looked like, modeled by hand based on all available data. The miller’s house was re-created using highly detailed 3-D photogrammetry scans of the ruins merged with the archaeological site survey data. Surface textures were sampled from known local examples, such as wood roofing, fieldstone walls, and period windows and doors.

Exports from the re-creation include camera-ready artwork for print material and trail plaques, an animated fly-through video, a virtual reality (VR) tour of the site that can be viewed with either a VR headset or in a standard web browser, and a simplified model
of the entire site made with the open source 3-D modeling program **SketchUp**. The SketchUp model can be used to export 2-D pen-and-ink type drawings of the site, similar to the field drawings archived by the **Historic American Building Survey and the Historic American Engineering Record** (HABS/HAER).

**GETTING OFF THE GROUND**

Professional UAV services companies can capture and deliver the exact data that preservation organizations need, but there are several things to keep in mind when choosing one. A reputable operator will be able to show a remote pilot certificate, proof of insurance, and a portfolio of work—and all of these are important to review.

In August 2017 the Federal Aviation Administration (FAA) launched its current commercial remote pilot certification program, known as Part 107. Anyone operating under these guidelines will be able to produce a valid remote pilot certificate to prove that they are in good standing with the FAA and aware of the rules and laws. It is important to check a pilot’s certificate, as working with noncertificated pilots can result in FAA fines.

A professional operator will also be able to plan the flight and thoroughly vet the airspace to verify that it is not restricted. Restricted areas might include airspace around airports, which can require additional waivers; permanent no-fly zones; or temporary flight restrictions due, for example, to the movement of government leaders or environmental conditions like forest fires.

Most operators should carry a minimum of $1 million worth of liability insurance. Coverage should be constant and not “per flight,” which is a little less defined and may only cover a limited number of situations.

The portfolios created by UAV services companies speak volumes. Some operations only deliver simple aerial photos and videos, while others get involved with the data at a much deeper level, providing advanced visualizations and data extraction. A company’s portfolio should reflect the kind of work that it’s being hired to perform.
The cost associated with hiring UAV pilots will vary greatly, primarily based on the operator’s credentials and level of experience and the type of hardware needed to complete the mission. In the hands of a trained pilot, the newest UAVs can be up and flying within minutes. The images they produce are rich with metadata that help speed up processing time. One hundred acres of land can be 2-D mapped in as little as 10 minutes of flight time plus about an hour of processing. Creating a detailed 3-D re-creation of a structure can take about 20 minutes of flying time with a few extra hours of processing. Flying to gather data is usually priced at a half- or whole-day rate. Processing or other post-production may not be included, so customers should be sure to inquire about it when requesting an estimate.

As an alternative to hiring a company, it is possible to purchase one’s own UAV imaging system. Learning to safely and efficiently operate a UAV aircraft will take some time. It requires training as well as practice, since it is important to achieve a certain degree of mastery and confidence prior to trying a drone mission on a live site. Schools and classes available in most parts of the country teach people to fly UAVs safely and in compliance with FAA rules. The price of training can range widely, with online training being generally the most affordable. Baseline costs of purchasing and using a UAV will also include initial hardware packages, aviation insurance, commercial UAV certification, aircraft maintenance, and data processing.

Whether hiring a pilot or learning to operate UAVs, it is essential to keep up with ever-changing drone regulations. Complete Part 107 rules for both hobbyists and commercial remote aircraft can be found on the FAA website, and familiarity with the types of flights permitted within different classes of airspace is key to ensuring success. Knowing local regulations is also important, as they may vary from one state to the next.

**HERE TO STAY**
As with most new technologies, there are obstacles to adopting UAVs and integrating them into standardized practices.
Requirements for documenting historic places put forth by HABS/HAER and other organizations haven’t kept up with the pace of technology. Field drawings, written records, and black-and-white photo prints are still the standard. Hopefully, the organizing bodies will work toward integrating more modern documentation formats in the near future, since technology like UAVs will only become more useful, and more ubiquitous, over time. FJ

TERRY KILBY and BELINDA KILBY are co-founders of Elevated Element, an unmanned aerial vehicle imaging and visualization service company located in Owings Mills, Maryland, that has worked on many historic documentation and archaeological visualization projects. They co-authored “Drone Art: Baltimore in 2013” and “Make: Getting Started with Drones” in 2015.

TAKEAWAY
Read a Forum Blog post about the second devastating flood in historic Ellicott City.

AUDIO
Listen to an interview with Belinda Kilby on PreserveCast, Preservation Maryland’s podcast.

TAKEAWAY
See 3-D models and fly-through animations of Whites Hall, Compton Bassett, Ellicott City, and Newlin Mill.
Virtual Reality as an Agent of Preservation

ROSS TREDINNICK, ERICA GILL, DESTINEE UDELHOVEN, AND KEVIN PONTO

The spaces we inhabit evolve over time. Each building is a vessel that holds memories of celebrations, personal triumphs, hardships, and the moments of everyday life. A building reflects its period through subtle reminders of the social context, the inhabitants, and the historical events of the time. Preserving and providing access to key historic places can be challenging for many reasons. They are put at risk by competing development needs, unsustainable maintenance costs, and unsolvable operational challenges. Historic places may also be inaccessible, especially to those with special needs. Or public access may need to be restricted to avoid vandalism and the inevitable wear-and-tear of human contact.

Imagine being able to record a full physical replica of your surroundings, down to a millimeter level of detail, and then use that replica to experience that setting again. This is the methodology that researchers at the University of Wisconsin–Madison’s Living Environments Laboratory (LEL) at the Wisconsin Institute for Discovery have developed through a combination of light detection and ranging (LiDAR) scanning and virtual reality (VR) technologies. While nothing will fully replace the experience of being physically present in a space, we recently piloted the next best thing—an immersive virtual exhibit complemented by a rich narrative telling the tales of near-forgotten places.

TECHNOLOGY OVERVIEW: LIDAR AND VR

LiDAR, a laser-based technology that has been around for more than 50 years, was originally built into NASA spacecrafts to measure atmospheric gases. Later it was positioned on the bottom of aircrafts to measure geographical data such as tree canopy heights and vegetation cover. Within the last 25 years, terrestrial LiDAR scanning—using a LiDAR scanner on a tripod to rapidly
accumulate information about the surroundings—has gained popularity. The distance information that terrestrial LiDAR scanning generates can be paired with a high-resolution panoramic photograph to give color information to each distance point. The resulting data set, known as a “point cloud,” consists of millions of 3-D colored points representing the space surrounding the scanner. Users can then move the scanner to an adjacent location and operate it again, repeating this process until they have obtained a sufficient number of scans to fully depict the desired environment.

VR is a technology that places its users in an immersive simulation space. VR systems typically combine a 3-D stereo display system with a 3-D tracking system and user input devices, enabling users to feel immersed and present in a virtual space that is different from their actual physical environment.

Head-mounted displays (HMDs), which University of Utah professor Ivan Sutherland pioneered in the late 1960s, are now a common VR stereo display system. HMDs look like a pair of goggles on the user’s head. Within those goggles, two small displays show rapidly alternating images from viewpoints that attempt to match the user’s actual left and right eye positions. The brain then fuses these two images into a single 3-D image. HMDs have recently gained greater popularity with the advent of consumer-grade devices such as the Oculus Rift or HTC Vive.

The cave automatic virtual environment (CAVE), invented at the University of Illinois at Chicago in 1991, is the second primary immersive 3-D VR display system. CAVE users wear 3-D glasses—similar to those worn at 3-D movie theaters—while images are projected onto the surrounding walls. To the users, the scenes appear as a single seamless virtual environment. Unlike with HMDs, users are not tethered in a CAVE system, and they are still able see their own bodies.

Researchers at the LEL did not start out intending to put LiDAR and VR technologies to use in the historic preservation field. We originally adopted them to study the home environments of people who were managing chronic medical conditions—to better
understand how the physical context of the home shapes health care and health information management. The team wanted to study real home environments, rather than hypothetical models of home environments that could be made with traditional 3-D design programs. Understanding that measuring and hand-modeling an actual home environment would take an infeasible amount of time, the team turned to LiDAR technology to 3-D scan home interiors.

One of the challenges of using LiDAR scans is that the point cloud data sets typically acquired from an interior environment contain anywhere between 500,000 and 3 billion points and range from 10 to 50 gigabytes (GB) in size, an amount that often exceeds modern graphics processing unit (GPU) memory capacity. And early testing showed that rendering only 10–20 million points per frame quickly reduces the frame rates to numbers nowhere close to the desired rate for VR experiences, which is typically 60–90 frames per second. Through careful GPU programming and after several design iterations, the team successfully developed a VR rendering application that achieves 90 frames per second rates when navigating through and rendering the large models in HMDs. Users can also experience the models at the lab within a six-sided VR CAVE, wherein images are rear projected onto six walls.

CREATING 3-D MODELS OF TALIESIN EAST
The LEL began a collaborative project with Taliesin Preservation and the Frank Lloyd Wright Foundation in 2014. After some initial exploration, the LEL and the Frank Lloyd Wright School of Architecture, located at Taliesin East in Spring Green, Wisconsin, decided to use LiDAR scanning to capture and study home environments at Taliesin East, Wright’s primary residence and workplace from 1911 to 1959. Taliesin had never been LiDAR scanned before, though other researchers had attempted to generate 3-D models using traditional design software. However, the resulting models lacked the intricate details and objects that distinguish the space.

In May 2015 two LEL lab members scanned approximately one-third of the 40,000-square-foot estate, a feat that required
three five-hour sessions and generated 80 LiDAR scans. They scanned both outdoor spaces, such as the gardens and hillside, and interior spaces including Wright’s studio, living room, and bedroom. The scans included locations that are not available on the regularly scheduled tours of the estate due to accessibility limitations. The model created from those scans contained nearly 2 billion points in a single binary data file almost 35 GB in size. To the knowledge of Taliesin Preservation, the data set is the largest and most detailed 3-D model of Taliesin East in existence.

To broaden the impact of this work, the lab hosted several outreach events showcasing the Taliesin scan, including two at community libraries in Wisconsin. Members of the public experienced the technology, and learned about both the history of Taliesin and the research conducted at the LEL. The lab also held a public event at its facility, featuring talks by members of the LEL and Taliesin Preservation and offering attendees the chance to experience the model generated from the data set in the LEL’s CAVE system. The team plans to return to the Frank Lloyd Wright estate to scan other buildings that hold significant cultural and historical value, such as Tan-y-Deri and the Romeo and Juliet Windmill.
“KEEPING” THE NORWAY BUILDING IN WISCONSIN

Another preservation opportunity presented itself two months later, when lab members learned about a historically significant building located just west of Madison that was destined to return to Norway, where it has been built in 1892 before being shipped across the ocean for the 1893 Chicago World’s Fair. The Norway Building is a replica of a traditional “stave church,” a type of church popular between 800 and 900 years ago in medieval Norway. Revered as a form of Norwegian cultural heritage, stave churches are constructed using a unique method that allows them to be easily disassembled in one location and reassembled in another.

The Norway Building stood on the former site of “Little Norway” in the town of Blue Mounds, Wisconsin. Little Norway was a tourist attraction that celebrated Norwegian heritage and honored the many persons of Norwegian background that had settled in southwest Wisconsin. Unfortunately, Little Norway closed its doors in 2012 due to increasing costs, and its artifacts and possessions were slowly sold off or sent to museums. In summer 2015 the
owner of Little Norway agreed to sell the structure to a group of Norwegians—among them, descendants of those who had built the church in the 19th century. The building was set to be shipped back to Norway in late August 2015.

Upon hearing this story, LEL lab members decided to 3-D scan the building before it was removed, so that it could still exist in Wisconsin in digital form. They donated time and resources to scan the inside of the Norway Building as well as the surrounding outdoor location, performing 16 scans that totaled about 400 million points over a four-hour period on an August morning in 2015.

For two years, the lab showed the resulting model sparingly, mostly during occasional tours of its facility, but we always hoped to make better use of it. The opportunity came in 2017, when the Mount Horeb Area Historical Society (MHAHS) was awarded a major grant by the Raymond & Margaret Vicket Charitable Trust. MHAHS was to create the Driftless Historium, a $1.7 million renovation and expansion of a museum in downtown Mount Horeb, Wisconsin—a town immediately adjacent to Little Norway’s former location. LEL lab members met with MHAHS staff and were contracted to design an exhibit for the new museum titled “A Virtual Tour Through Mount Horeb Area History.” The interactive VR exhibit pairs an Oculus Rift HMD with the software-rendering engine that the LEL developed to display the Norway Building model, adding a track-ball for user input. The team will soon add models of two other culturally significant buildings within the Mount Horeb area to the exhibit: the “Rare Earth” barn and the Springdale Lutheran Church.

“A Virtual Tour Through Mount Horeb Area History” exhibit at the Driftless Historium in Mount Horeb, Wisconsin.

PHOTO COURTESY OF MOUNT HOREB AREA HISTORICAL SOCIETY
Virtually capturing these environments accomplished a variety of significant goals: the VR exhibit complements MHAHS’ vibrant and expansive collection of Norwegian folk art and historical artifact holdings; the exhibit enables a relatively low-staff, low-budget institution to incorporate a technological addition that will help attract younger visitors; and, perhaps most important, this vehicle for learning allows visitors to experience historic sites while sparing those sites from the threat of harm that actual human contact poses.

The exhibit was designed and programmed to support scalability and maintenance, allowing for the expansion of its content in future years. We are currently developing user experience surveys to gather data on the effectiveness of the exhibit and inform the development of new content and functionality. We hope to provide a mechanism for capturing and sharing historic places with a wider audience and to inspire deeper connections to historically significant places.

THE FUTURE OF VR AS AN AGENT OF PRESERVATION

Based on a quick survey, it appears that the application of VR technologies in museum settings is largely restricted to the re-creation and representation of long-gone historic environments, aimed at immersing visitors in a past that is no longer extant. By contrast, the use of VR to capture an existing space or structure for the purpose of permanent documentation or public accessibility appears to be rare—at least for now.

Why isn’t that happening more? To take full advantage of the possibilities, the historic preservation field will need to confront the reasons behind—and limitations of—insisting on “authenticity of place.” Would digitally capturing historic sites and environments contribute to a growing apathy toward place-based experiences? Would the presence of these data sets provide an excuse for the desecration, development, or even demolition of cultural sites?

On the other hand, preservationists should consider the potential benefits. Given the right partnerships with those who have the necessary equipment, the process can be fairly inexpensive for site owners and stewards. In fact, the use of relatively easy-to-obtain scans for hire opens many possibilities for small museums and historical societies that preserve local landmarks and historic
environments and could use this technology to, among other things, engage younger audiences.

The possibilities for applying LiDAR and VR in the fields of historic preservation and public history are not hypothetical, theoretical, or merely speculative. Right now, today, we can preserve the physical data of a cultural site or structure in perpetuity. After eight decades of residency, the Norway Building may be gone from Mount Horeb, but that doesn’t mean visitors can’t still walk through its doors, stumble across the small side bathroom, thrill at the woodwork details that were carved more than a century ago. The future is here. How can we use it to save the past? FJ

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nventories are essential for the effective management and protection of cultural resources. At a minimum, by providing authoritative information identifying cultural resources, their locations, and their conditions, inventories inform the decision-making of organizations responsible for protecting these resources and applying historic preservation–related laws and policies. At best, inventories can provide more in-depth information—such as explanations of a resource’s significance and its characteristics—that enables preservation and planning professionals to make more complex, nuanced, and proactive decisions. When such information is presented efficiently and goes beyond simple textual lists, it can make relationships and connections between resources more apparent. Also, by making inventory information available to the public, preservation organizations can engage community stakeholders and communicate the importance of both cultural resources and historic preservation practice.

Preservation organizations frequently put considerable emphasis on collecting data through surveys without adequately planning for or supporting the long-term management and searchability of those data through inventory systems. This is at least in part because preservationists can sometimes secure special funding to conduct surveys, which capture snapshots of the state of cultural resources; by contrast, maintaining and continually updating an inventory, which is an ongoing and evolving record of cultural resources, requires stable, continuous staff time and funding.

In 2012 the Getty Conservation Institute (GCI) and World Monuments Fund (WMF) began developing the Arches Heritage Inventory and Management System as a direct response to the demonstrated need for an economical and modern information system purpose-built for cultural resource inventories—one that could be customized to accommodate the different inventory
programs of preservation institutions around the world. During the initial stages of the project, the partners identified some fundamental challenges that most preservation organizations, and the preservation field as a whole, face in creating and maintaining inventory systems. These include:

- complexity of cultural resource information;
- rapid changes in information technology; and
- lack of financial and staff resources.

Arches specifically addresses these challenges to create more robust inventory systems, advance inventory practice, and ultimately help conserve cultural resources.

**CAPTURING THE COMPLEXITY OF INFORMATION**

**Significance and Relationships**

First of all, an inventory must be able to describe why a cultural resource is, in fact, significant. In the past, complex explanations were recorded in lengthy narrative texts, but, to be truly useful, these texts need to be machine searchable in a meaningful way. Often, one must be able to discern the historical relationships between places, events, and people to get a full picture of the significance of a resource. Arches is designed to enable describing and then searching for such relationships.

The default version of Arches allows organizations to record information for six different types of resources:

- **Historic Resources**: individual cultural resources such as historic buildings, structures, monuments, archaeological sites, and landscapes;
- **Historic Resource Groups**: historic districts and other groupings of historic resources;
- **People/Organizations**: significant people, architects, cultural groups, and organizations;
- **Historical Events**: historic battles, natural disasters, and cultural movements;
- **Activities**: preservation-related interventions as well as surveys; and
- **Information Resources**: photos, reports, videos, audio files, and 3-D models.
In Arches, resource records of any type can be related to each other to document and define resource relationships.

A simple example of this would be a resource record for an architect being related to the records of all the other buildings that they designed. Seeing these relationships often clarifies why a cultural resource or group of cultural resources is significant.

**Spatial Information**

To protect cultural resources, a preservation organization must not only know where a particular resource is located but should also be able to view spatial relationships between resources that are near each other and/or share common characteristics. Arches is geospatially enabled, giving organizations the ability to easily add multiple types of spatial data—such as points, lines, or polygons—for the same resource to one record by importing existing data; by entering coordinate or address information; or by drawing the location on a basemap using the Arches interface. Users can also search for information spatially by drawing search boundaries on the map and defining a buffer distance. For example, a planner can quickly search for all the cultural resources that might be affected by a planned development.

**Differences in Terminology**

The terminology used to describe cultural resources may differ based on region, culture, language, and even the person documenting the
resource. For example, a “carriage house” might also be referred to as a “chaise house,” “coach house,” or “coach barn.” All of these terms describe the same type of structure, but it might be difficult to come to a consensus about which term to use in an information system. Furthermore, even if a consensus was reached, the public could not be expected to know which term had been chosen.

The Arches platform includes the Reference Data Manager (RDM), a module that manages the terminology and values that appear in dropdown lists. Arches can store multiple terms as labels to describe the same concept, so a user can search for “carriage house,” “chaise house,” or even the Spanish “cochera,” and Arches will return all the relevant resources. The RDM helps to ensure valid and consistent data entry and enhances searching.

**Controlled Access to Information**

Cultural resource data may include sensitive information, such as the location of sacred tribal sites or fragile archaeological sites, that must be withheld from unauthorized viewers. Thus, organizations may want to control what information particular users can view and/or edit.

The administrator of an Arches system can define users and user groups and assign permissions to each at the data-field level. For example, authorized preservation professionals may be given full access to make edits to all fields, while volunteers could be allowed to edit fewer fields or none at all.

**System Customization and Arches Version 4**

Because of cultural, regional, statutory, and other differences, a one-size-fits-all approach to cultural resource inventory software is not realistic. With this in mind, Arches is designed to be as generic as possible for the preservation field while offering maximum opportunities for customization. With Arches Version 4, unveiled in 2017, an administrator can determine what data fields to include in their organization’s Arches implementation; the corresponding data entry forms and reports will be created dynamically without the need for specialized programming.
Arches Version 4 also includes a number of other substantial software features that enhance users’ ability to customize the system. The Arches Designer, for example, allows administrators to dynamically determine which data fields are included in their implementation as well as how those data are entered and displayed. The map server enables the incorporation of locally stored satellite imagery and other basemaps, such as historic maps. In 2018 the software platform will include a new integrated online-offline mobile data-collection app for field data collection, which will let survey managers customize their projects and define the scope, area, timeframe, and users for field data collection.

KEEPING UP WITH RAPID CHANGES IN TECHNOLOGY

A new generation of information technologies presents the preservation field with more effective ways of managing, enriching, and disseminating cultural resource data. However, keeping track of new technologies and applying them to preservation work can be challenging. Arches is a modern system that incorporates the latest technologies while remaining easy to use for those who are not experts in specialized software such as geographic information systems (GIS).
The move to digital documentation allows substantially more cultural resource data to be recorded, but that introduces new challenges for managing and making usable larger amounts of data over the long term. Arches addresses these challenges by adhering to internationally recognized standards that apply to both data format and modeling of cultural heritage information. For example, Arches is compliant with the standards and specifications of the Open Geospatial Consortium, which ensures compatibility with desktop GIS systems (such as ESRI ArcGIS, Google Earth, or Quantum GIS), modern web browsers, and online mapping services.

Arches also incorporates the CIDOC Conceptual Reference Model (CRM), an International Organization for Standardization (ISO) standard that facilitates the exchange of information by defining cultural heritage information entities and the relationships between them. Essentially, the CRM allows Arches to automatically encode data in the system so that the information is machine-readable regardless of the software used; that is, the data are now portable and can be migrated to new systems and formats, protecting them for the future.

**MAXIMIZING RESOURCES THROUGH AN OPEN SOURCE APPROACH**

Effective inventory programs require not only modern information systems to securely manage and provide access to cultural resource data but also the money and staff time to keep those data up to date and relevant. This can often put a strain on resource-strapped preservation organizations.

With this in mind, Arches has been developed as an open source software platform, which means that its software code can be downloaded and modified by anyone. Arches’ code is free, although preservation organizations must host the software themselves, on either a local or cloud server. Users are not subject to annual license fees and there are no limits on how many users can access any Arches implementation. And improvements to the software code must be made available to all, so they can be implemented by any institutions that find them useful; this helps prevent wasteful duplication of expensive software development.
efforts by preservation organizations working alone. The open source approach applies only to the software code; as mentioned earlier, the data managed in an organization’s Arches instance can be as open or closed as needed.

Institutions do not have to rely on proprietary software companies to release new features, but can instead develop their own. The Arches software platform is strengthened by its community of users interacting and helping each other through direct support and the development of features that benefit the entire preservation field.

ARCHES IN ACTION
Approximately 40 organizations around the world are currently using the Arches software platform to manage cultural resource inventory information.

- The City of Los Angeles is using Arches to power HistoricPlacesLA, the Los Angeles Historic Resources Inventory. The system contains cultural resource information from various sources—including the National Register of Historic Places, the California Register of Historic Resources, and the Los Angeles Historic-Cultural Monument designation program—but primarily derived from SurveyLA, which won a Richard H. Driehaus Foundation National Preservation Award in 2017. The information is open not only to city agencies but also to the public at large.
• The Cane River National Heritage Area in Louisiana implemented Arches to both manage its resources and publish information about them. The Cane River Heritage Inventory and Map include historic basemaps of the area as well as audio recordings of oral histories.

• Established in 1851 for military veterans, the Armed Forces Retirement Home customized Arches to better manage the important cultural resources on its 272-acre historic residential campus in Washington, D.C.

• Currently preparing its Arches implementation for a public launch, Queen Anne’s County, Maryland, is recording more than 300 years of its history through the people, places, and events that shaped the county, the state of Maryland, and the nation.

• Through a collaboration with the U.S. Department of State, the American Schools of Oriental Research (ASOR) is working to document damage to heritage caused by armed conflict in Syria, Islamic State–affected areas of Iraq, and Libya. This ASOR Cultural Heritage Initiatives project will use Arches to help manage and collect data, share information with other institutions working in the same region, and eventually plan for postwar conservation.

• Based at the universities of Oxford, Leicester, and Durham in England, the Endangered Archaeology in the Middle East and North Africa (EAMENA) project uses Arches to bring together data from satellite imagery and published reports. The EAMENA project compiles and shares information about threatened archaeological sites and landscapes across the Middle East and North Africa.

• A Manila-based nonprofit group, Grupo Kalinangan, has deployed Arches to create the Philippine Heritage Map, which includes survey information about cultural resources throughout the Philippines, supplied by both preservation professionals and volunteers.

  The Kingdom of Bhutan as well as St. Kitts and Nevis also use Arches as the system for their respective national inventories. Implementations are now being prepared in the United States by
the city and county of San Francisco and in the United Kingdom by Historic England for Greater London and by the city of Lincoln.

By focusing on a fundamental component of cultural resource management—inventorys—and providing a robust system to manage and access inventory data at no cost, the Arches team hopes to help preservation organizations and professionals more effectively conserve cultural resources by being more efficient—not wasting precious resources on independently creating digital inventory systems from scratch.

In short, the Arches Heritage Inventory and Management System is a freely available modern software platform that captures the complexity of cultural resource information and uses the latest technologies to facilitate informed preservation decisions in the present and future. FJ

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TAKEAWAY
Explore the Arches Version 4 demo site.

VIDEO
Watch the 2017 Richard H. Driehaus Foundation National Preservation Award video for SurveyLA.
Social Stories: Digital Storytelling and Social Media

JESSICA MARIE JOHNSON

Digital storytelling—as practice, methodology, and ethos—has been drawing increasing interest from a wide range of educational and cultural institutions. It was initially associated with Joe Lambert and the Center for Digital Storytelling, founded in the 1990s. But given the spread of broadband and the increased importance of digital media today, digital storytelling may now be synonymous with storytelling writ large. The center’s 2015 name change to simply “StoryCenter” reflects this development. However, the unique tools that digital technology offers for shaping narrative and experiencing authorship remain important to the tenets Lambert outlined in *Digital Storytelling: Capturing Lives, Creating Community*. One of the goals of digital storytelling, Lambert wrote, is to encourage every user, creator, and student to be “the author of your own life, of the way you move through the world.” Social media platforms are uniquely suited to achieving this goal—they expand the possibility of 21st-century digital storytelling. Either alone or in conjunction with the more traditional blogs and digital archives, social media can disrupt and construct inclusive narratives, highlight marginalized histories, and empower users.

TWITTER: BEYOND HASHTAG ACTIVISM

Like other forms of digital storytelling, social media offers user-creators opportunities to tell new kinds of stories, ones that express the many dimensions of everyday life. Although Facebook is often considered the progenitor of social media, Twitter has emerged as perhaps an even more effective tool for creating new narratives. Much has changed since its launch in 2006 as a social networking service that allowed users to post tweets limited to 140 characters, accessible via both text messaging and desktop devices. The platform currently allows users to share images, video,
and gifs (digital graphics formatted to permit animation), and the recent expansion from 140 to 280 characters per tweet suggests that still more innovation may be on the horizon.

As a global public platform—accessible to anyone with a cell phone—Twitter offers users across the political spectrum opportunities to raise awareness of pressing issues; turn the spotlight on social protest; and challenge the narratives presented by major media outlets, government officials, and law enforcement. Mark Anthony Neal, author and professor of black popular culture at Duke University writes that tweets about the Georgia Prison Strike, the Arab Spring, the #Occupy movement, and the execution of Troy Davis recall “the spirit of the Civil Rights Movement of the early 1960s and the role that technology played during that time.” The most well-known such use of social media in recent years is by the Black Lives Matter movement, whose eponymous slogan was launched in a 2013 Facebook exchange between Alicia Garza, Opal Tometi, and Patrisse Cullors after George Zimmerman, charged in the shooting death of 17-year-old Trayvon Martin, was acquitted. With dozens more unpunished murders of black children in the years since Trayvon Martin’s, users of platforms like Twitter have played a central role in drawing attention to events as they occurred. As researchers Sarah Jackson and Brooke Foucault Welles note, “many populations have been systematically excluded from the public sphere by historically narrow definitions of citizenship,” but social media functions as a “counterpublic”—a space for exchanging political views and opinions that exist in opposition to the norms of its cultural environment, and that “provides an alternative structure for citizen voices and minority viewpoints as well as highlights stories and sources based on relevance and credibility.”

As a counterpublic, Twitter creates space for the kinds of radical and democratic activities outlined by Lambert in his description of the possibilities of digital storytelling. For example, Tara Conley described the use of black feminist hashtags as acts of self-affirmation and consciousness-raising that shape the lives of black women and girls. Deen Freelon, Charlton D. McIlwain, and Meredith Clark have written about the impact of using hashtags
like #BlackLivesMatter and #Ferguson. As these and other researchers demonstrate, social media allows users to be the authors of their own lives; responding directly to events that impact them and their communities; and curating those events as they happen, shaping the surrounding cultural narrative in profound ways.

DIGITAL STORYTELLING AND THE SOCIAL MEDIA “BUILD”

A rigid focus on hashtag activism may obscure other ways in which social media platforms serve as novel digital storytelling tools. Twitter offers users specific opportunities to engage in rich world-building through avatar development—including selecting profile pictures and cover photos, biographies, links, and locations—creating unique identities and content. These choices, which I describe as “social media builds,” bring different aspects of a Twitter account together, so that the account itself tells a story as much as the tweets do. In some ways, however, it is the limits placed on user-creators that generate unique opportunities for narration and self-narration.

Less a sonnet and more a haiku, personalization on Twitter has remained something of an alluring challenge. Users can only send short-form messages and do not have access to the development code that might allow them to manipulate profile pages as they might have done with earlier platforms like LiveJournal or MySpace.

One example of social media build as digital storytelling practice is the Twitter account for the Isabella Gibbons, who was once enslaved at the University of Virginia, would go on to become a teacher in New England.

PHOTO COURTESY OF BOSTON PUBLIC LIBRARY
President’s Commission on Slavery at the University of Virginia (@slaveryUVA). Kirt von Daacke, dean of history at the University of Virginia (UVA) and co-chair of the commission, runs the Twitter account with help from an array of graduate students. One tweet at a time, he posts material relating to the experience of enslaved and free black men and women at the institution. Von Daacke began the account in 2015 to bring widespread attention to UVA’s history of slavery, the focus of his own archival research. As the university’s ties to slavery continued to come under scrutiny, and in the wake of the August 2017 white nationalist rally and violence in nearby Charlottesville, @slaveryUVA’s tweets shifted toward bringing attention to the rally and its aftermath as well as the history of Confederate monuments on UVA’s campus. The @slaveryUVA account does more than document a frequently underrepresented history of the university: it challenges widely held beliefs about the university’s history of slavery by acting as an archive and chronicle of pasts that have been marginalized in mainstream narratives—at UVA and in broader U.S. history. It takes the power of storytelling further by offering a public history practice of sharing information; challenging normative points of view; responding to events as they unfold through improvisation and call-and-response, more akin to oral storytelling than to written history; and engaging the highly affective and difficult questions surrounding the history of bondage.

The account’s build includes its cover image: a close-up of one of the serpentine walls that winds through the university grounds—an engineering marvel and a literal barrier between the spaces that were once worked by enslaved labor and those now walked by faculty or students.

@slaveryuva on Twitter.

IMAGE COURTESY OF NATIONAL TRUST FOR HISTORIC PRESERVATION
The cover and profile images both represent opportunities to juxtapose the university as a space of higher learning against the reality of bondage that made such a space possible. Although set against an image of red brick, the @slaveryUVA tweets break down the wall by exposing the forced labor—as well as the experiences of free black people—that were integral to creating this institution of higher learning.

While @slaveryUVA is powered by human beings—which is to say, flesh-and-blood people manually post every tweet—social media bots can also be used in digital storytelling—for example, W. Caleb McDaniel’s @Every3Minutes Twitter bot. In 1975, history of slavery researcher Herbert Gutman wrote, “If we assume that slave sales did not occur on Sundays and holidays and that such selling went on for ten hours on working days, a slave was sold on average every 3.6 minutes between 1820 and 1860.” Intrigued, Rice University professor McDaniel considered the possibilities of using Twitter’s short-form structure to express the ubiquity of the sale of enslaved people during that period. In 2014, McDaniel created a Twitter account and made it into a “bot” by writing a Python code to automate its output. Every three minutes, the account tweets a variation of the same idea: “In the antebellum United States, someone just bought a human being.” Like @slaveryUVA, @Every3Minutes tells a story of slavery within Twitter’s minimalistic format. The use of bot technology, however, has allowed McDaniel to establish a constant frequency to disrupt followers’ timelines regularly, at potentially importune moments. As McDaniel noted in a blog post on the subject, his intention had been to repeat the same phrase each time, but Twitter does not allow duplicate tweets. The code he wrote to ensure variation rotates through words like “person,” “enslaved person,” and “black person” as well as “child,” “grandparent,” and “friend.” Thus, McDaniel explains, Twitter’s rules “forced [him] to attend to ‘an enslaved person’ as someone bearing multiple relationships to other persons.” The steady, unceasing tweets combined with the variable texts center questions of narrative and underscore the objectification of enslaved persons.
TRADITIONAL BLOGS AND ARCHIVE PLATFORMS
Although social media offers unique spaces and technologies for digital storytelling, the reach of its platforms is limited and the content is usually ephemeral. Outside of hashtags, in order to engage deeply with the content of a social media account, users must follow it; and most stories will become buried beneath new updates, posts, and news items within 10 to 14 days. Another common concern, particularly poignant when discussing issues related to marginalized groups, is the growing levels of surveillance. The most populated platforms, Facebook and Twitter, have come under increased scrutiny, and the U.S. Department of Justice recently subpoenaed Facebook for information related to activists.

The public nature of social media also makes Twitter a difficult platform to use in classrooms, where students of different ages or experience levels may need a better understanding not only of the technology itself, but also of the ethics and risks of engaging in public political discourse. WordPress plugins like BuddyPress or CommentPress offer an alternative by creating opportunities to simulate the productive and improvisational space that social media provides in a smaller classroom setting.

Stand-alone and self-hosted blogs and archives continue to play an important role in digital storytelling: platforms like WordPress, Omeka, Tableau Public, and Scalar are popular across many organizations and projects. The Colored Conventions Project (CCP), for example, uses Dublin Core and Omeka to archive minutes from the 19th-century black convention movement. Beginning in the antebellum era, huge groups of free black people gathered in conventions to organize against slavery and for their human rights. These meetings occurred across the country and into the 1890s. CCP uses “exhibits”—long-form essays combined with references to and images of artifacts from its archives—to showcase the history of those meetings. New exhibits may be proposed from within the Colored Conventions cohort of faculty, archivists, librarians, and graduate students or by partner faculty and institutions. The rich exchange between CCP staff and faculty around the country has generated exhibits about the politics of food and housing, black women’s economic power, and key individuals such as Henry Highland Garnet.
STORYTELLING ACROSS DIGITAL MEDIA

Digital storytelling allows for the fusing of traditional blog spaces with social media platforms to create robust structures capable of supporting counterpublics. In 2015 scholars Amanda Figueroa and Ravon Ruffin founded the Brown Girls Museum Blog (#BGMB). They were interested in elevating the voices of marginalized and oppressed groups and highlighting those groups as worthy of study by museum professionals as well as in exploring the role of black and brown curators doing museum work. As a blog, #BGMB draws attention to events and happenings in the museum world, with a focus on narratives of African diasporic and Latinx life that are often left out of museum and gallery exhibits. But as a hashtag and in its accounts on Twitter and Instagram, #BGMB expands the conversation even further. The BGMB Instagram page is filled with high-resolution images from curated spaces around the world, screenshots of memes, portraits of museum and art world professionals, and images of Figueroa and Ruffin. It can, in and of itself, be construed as a museum, an exhibit, and a story of people of color in art and culture. Like @slaveryUVA, #BGMB also uses Instagram and Twitter to respond to recent events, from award shows to protests. Responsiveness, particularly in the context of digital media and its public audience, is imperative, and...
user-creators like Figueroa and Ruffin make a critical political impact despite their economical use of characters. With hashtags like #BGMBFindYourSpace, Figueroa and Ruffin make clear that their goal is to help black and brown museum professionals, workers, and guests create and find their space.

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Digital storytelling is happening in a wider range of forms and across a broader range of platforms than teachers, researchers, and user-creators could have imagined just a few decades ago. Today the technology not only offers potential user-creators opportunities to shape their stories and share their work in different ways but it also challenges user-creators to rethink what the story form is and whom it serves. At the same time, the original call for a democratic format that allows creators at all stages of their lives and all levels of society to craft their own narratives is even more relevant now. Social media platforms’ contributions in this arena are seldom recognized, but they are creating some of the most innovative, daring, and radical space for this kind of work. FJ

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The Challenges and Opportunities of Technology in Preservation

LUKE PECORARO

This issue of Forum Journal highlights the deployment of new technologies within historic preservation, covering a great variety of current work within the field. The articles address the use of virtual reality; the digitization of cultural resource documentation; the use of drones for heritage documentation; digital storytelling; and, crucially, the questions surrounding when to adopt new technology. Many of the ideas and questions that the authors in this issue raise are familiar to me from my work at George Washington’s Mount Vernon.

In a maturing digital age that has already transformed how documentation is undertaken within historic preservation, it remains difficult to keep up not only with the technology itself but also with how digital recording standards may change and how newly generated data will be archived for future use. If we go back...
to one of the origin points of the historic preservation movement—the passage of the National Historic Preservation Act in 1966—we see that most federal, state, and local entities have a legacy of recorded data in the form of mountains of paper records and slides, most of which probably have not yet been digitized. It takes money and time to do that, of course, but also a consensus regarding how to store information for easy and timely access. It’s harder to implement new technology if the back-of-house is not yet taken care of. As Tom Scheinfeldt states in his article, “cultural heritage organizations are understandably reluctant to adopt [new technologies] too often”—and this is just one reason why. It’s important to know where we’ve been and where we’re going before deciding what platforms to adopt, and Scheinfeldt provides excellent guidance for deciding on a path forward.

RECORDS AND DOCUMENTATION
Since the inception of a modern preservation program at Mount Vernon in 1987, a number of technologies has been integrated into the daily work of our archaeology and architecture teams. At that point, the records we kept related to work on the mansion and outbuildings, changes to the landscape through infrastructure improvements, and grounds restoration; these date back to 1858, when the Mount Vernon Ladies’ Association of the Union (MVLA) purchased 200 acres from George Washington’s heirs and made the site public. In 1987 one of the first initiatives of the program, which was then concerned only with archaeology, was an attempt to compile information from the MVLA archives by inventorying existing conditions of buildings, previous excavation work, and recovered artifacts. This work mostly involved photocopying documents, organizing a folder system, and creating collection-finding aids, but it was the first important step toward creating order; those early efforts made it much easier, years later, to scan the information and curate it in a digital system. While this is an ongoing process, it already pays dividends—we can immediately find the requisite documentation when we need to perform mitigation work.
In their article, Annabel Lee Enriquez, David Myers, and Alison Dalgity describe the new Arches Heritage Inventory Management System, which is designed to simplify the storage and management of large amounts of complex data. The open source platform provides users with a model for organizing legacy and new data and is versatile enough to suit the needs of diverse organizations. What’s more, Arches incorporates spatial information—geographic information system (GIS) data, for example—into the system, alleviating the need for those entering the data to be proficient in specialized software. At Mount Vernon, we have used ESRI ArcGIS software since 2004, but that use was initially restricted by limited employee time, software familiarity, and number of licenses. We were fortunate to get expert help from the National Park Service Cultural Resource GIS (CRGIS) facility to begin building our cultural resource basemap; still, it took years to develop the software into a robust management tool that many staff members can now use. The Arches system’s ability to bring the functions of two or more software programs together both keeps down cost and increases staff buy-in.

The articles in this issue remind us that with new technologies come learning curves—and that it is imperative to commit resources to training not only the specific staff members who will manage new systems in the short term but also institutions as a whole. In fact, one of Scheinfeldt’s key recommendations for making sustainable choices is investing in people rather than spending large sums on the latest technology.

And when should institutions hire technology specialists rather than do the work themselves? This is explored thoroughly in Terry and Belinda Kilby’s article about the use of unmanned aerial vehicles (UAVs) for taking photographs and recording digital data about buildings and archaeological sites. While the authors carefully weigh the pros and cons, based on personal experience, I would be hesitant not to use a professional operator, especially because the rules and regulations that govern drone flight vary from one location to another.

In 2015, after an attempt to begin a drone program that could document the Mount Vernon site and acquire aerial imagery for
both preservation and marketing purposes, we drew up an in-house drone policy. A number of factors limited the use of this technology on our site—most of all the restricted airspace around the nearby Reagan National Airport, as well as some airspace restrictions around Mount Vernon itself. Furthermore, there were qualms about potential damage to the mansion and associated outbuildings in the event of a crash. We ultimately obtained a waiver for flying through restricted airspace from the Federal Aviation Administration and hired a licensed pilot to fly several drone missions and shoot promotional footage.

Terry and Belinda Kilby certainly show the positive utility of recording standing structures, especially otherwise inaccessible ones, using drones. They point to Ellicott City, Maryland, where, despite limited access to unstable buildings in the aftermath of a disastrous flood that mostly affected a historic district, government and safety officials—including staff from the state historic preservation office—needed to assess the damage. Live visualization is critical in these types of disaster situations—far too often little attention is given to the cultural resources affected and hasty decisions can have lasting negative consequences.
Drones are also useful for documenting existing conditions over time—for example, when tracking the effects of climate change on cultural heritage. It seems that 2017 was a year of exceptionally devastating weather-related disasters, ranging from wildfires in the West to hurricanes impacting the Gulf Coast and Caribbean. While the extent of the heritage losses in these areas is still being calculated, triage efforts could employ drone imagery to better develop management plans for stabilization. The ability to program flight paths over places that are either unsafe or unsuitable for on-the-ground surveyors makes UAVs an important resource in a disaster toolkit.

THOUGHTFULLY EMBRACING CHANGE
This issue also calls attention to the challenges inherent in integrating technology into our field. Ross Tredinnick, Kevin Ponto, Erica Gill, and Destinee Udelhoven describe using virtual reality (VR) technology combined with light detection and ranging (LiDAR) scanning to model both extant environments and those that are no longer visible. The authors present two interesting case studies of deploying these technologies to educate and engage visitors to historic sites and museums, emphasizing that their use potentially attracts a younger demographic to the heritage sector. As people in all fields become more tech savvy, they are better able to recognize smart new trends, and preservationists need to prepare to welcome not only new audiences but also new colleagues. As the authors point out, building the right partnerships with technology specialists—and perhaps this must originate within the academy and spread—makes the implementation of technology for historic preservation uses more cost effective and sets a precedent that smaller institutions can build upon.

One of the easiest and most effective ways for any institution, large or small, to get the word out about its work and mission is through social media. In her article, Jessica Marie Johnson gives special attention to the power of social media in digital storytelling. This is a particularly dynamic realm for historic preservation, but also one that takes significant investments of time and effort. Using
Facebook and Twitter occasionally is one thing, but it’s quite another to keep a blog regular and current, continually coming up with and vetting content and presenting well-written posts. And while the format of short bursts of information and commentary is useful in the immediate term, Johnson also brings up the important question of how social media posts will be stored and curated over the long term. What happens after a week or two, when the news feed moves on? To ensure longer-term staying power when archiving is not guaranteed, other means of storing and sharing posts may be required.

The archaeology program at Mount Vernon tackles this challenge, using Facebook, Instagram, and the ESRI Story Maps platform to convey to-the-minute updates on current fieldwork. For example, for the past four years, we’ve run a public archaeology program at Mount Vernon’s slave cemetery, where little historic documentation exists to adequately interpret the space and no burial markers remain. The project is ongoing, and a full report is some years away from completion, but public interpretation on site is needed daily to inform visitors about this work. The Story Maps application has proven to be an excellent way to present site history and background as well as archaeological methods and project goals, including a regularly updated section on recovered artifacts and a brief drone flight video. By combining several platforms, we can engage on-site visitors through their smartphones and virtual visitors through our website and ESRI’s Story Maps gallery—all of which enable us to reach new audiences while simultaneously archiving the material.
The question of how to keep newly captured digital data around for the long term is of paramount concern, and I am not sure we’ve figured that out yet. I think of how we once used punch cards, 8 mm film, slides, floppy disks, and CDs for storage, and I wonder how we’re caring for the next generation of information. While this question has been asked before—and sometimes answered—it remains unresolved. I think in some ways we find it easier to curate paper and Mylar than a website or a point cloud scan of a building.

While I am hopeful and looking forward to embracing new technologies as they enter the field, we must approach their implementation with care to establish best practices and meet critical needs. New innovations move fast, and we need to be mindful of keeping a detailed institutional record of why decisions were made, what outcomes were expected and what was achieved, and how the institution or historic resource benefited—or didn’t. Institutions should then share information about their successes or failures. Crucially, we must always consider what will be most beneficial to an institution and the field over the long run, sustainable into the future. This is an exciting and dynamic time for preservation. There are limitless options, and we should be poised to take advantage of them, so long as we can keep the record straight. FJ

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**TAKEAWAY**

Read a list of technology resources on the Forum Blog.