Museums and 3D Printing: More Than a Workshop Novelty, Connecting to Collections and the Classroom

by Megan Hancock

3D Printing and Digital Fabrication Technologies in Libraries and Museums

EDITOR'S SUMMARY

A typical museum visitor views an artwork for about half a minute, but 3D scanning and printing technology can help provide a more meaningful experience. Several museums have invited audiences to hands-on 3D scanning and printing events, encouraging them to engage with museum pieces more deeply, creating 3D photo files and ultimately constructing 3D printed models of the pieces that can be manipulated and interacted with in new ways. The ARTLAB+ program in Washington, D.C., and the Parachute Factory in New Mexico are examples of makerspaces focusing on hands-on activities with cutting edge technologies including 3D printers for a variety of users. A special exhibit on 3D technology at the British Museum and Samsung Digital Discovery Center enabled visitors to recreate museum pieces with computer-aided design technology, 3D pens and 3D printing. A resource list describes additional projects and information sources.

KEYWORDS

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As a museum professional and personal art lover, I find the art I encounter has so much to say. My idea of fun is discovering a work of art and then researching every little detail I can find. Not everyone finds art or cultural material as interesting or engaging as I do, so perhaps this is why I became a museum professional. Working in higher education, I am constantly looking for new and innovative ways to connect objects to courses across the curriculum. Did you know that the average museum visitors only look at artwork between 15 to 32 seconds? [1]. That time includes looking at the work and reading the label, which doesn't really allow for a particularly meaningful experience. The development of affordable 3D printing may be starting to change that span, providing myriad possibilities to increase engagement by taking works that you couldn't touch and putting them right into visitor's hands. Although I do not consider myself an expert, I am very interested in 3D printing and scanning and have been following its progress over the last few years, attending workshops and developing experimental programming at my institution.

This rest of this article is a quick overview of what's happening right now with 3D printing and scanning technologies at museums around the world. Much of what you see on Google and social media amounts to buzzwords and baubles, but I'm much more interested in exploring education and programming opportunities that take 3D printing beyond a novelty and leverage it to create engaging, transformative experiences.

Many museums are already using 3D technologies, and with each passing year I have seen the list grow. Here are just a few to get you started: Intrepid Sea, Air & Space Museum, American Museum of Natural History, Smithsonian, Metropolitan Museum of Art (MET), Florida Science Museum, Museum of Arts and Design, The Field Museum, Philadelphia

Museum of Art, Art Institute of Chicago, Hirshhorn Museum and Sculpture Garden, and abroad we have The British Museum, London Science Museum, Dorset County Museum, Hunt Museum and the Tokyo Printing Museum.

The simple act of looking, of passively seeing, is the way most of us commonly experience art, be it through books or screens. But what if you could engage your audience actively with an object for a prolonged and more in-depth experience? Through photography, 3D scanning and printing, we can. Perhaps you've seen the numerous makerspaces or fab-labs in your own hometown, where young and old together experiment with math, science, technology and art. Simply check your local libraries or museums and look for workshops or special events experimenting with 3D, and you will be pleasantly surprised by just how abundantly this technology has spread. Why? Just attend one of these events and you can see how spaces can now extend the time visitors engage with artwork or objects. In addition to traditional tours, audio guides and labels, visitor engagement with 3D printing and scanning increases the depth of connections by the additional time spent with objects.

Through the use of these technologies, we can also provide kinetic, sensory and object-based learning through touch: we can feel and look at objects previously only viewed under glass. Not only do these reproduced objects allow the original object to be preserved and safe from close contact, but they also enable visitors to be more active and engaged participants. This enhanced participation is partly because visitors can handle the reproductions, which provides sensory information and allows people to experience or understand the object in new and direct ways. It is also easy to create programming that is about more than just the final product, also involving participants in photographing, scanning and printing objects.

Although the technology continues to get better, cheaper and faster, the biggest issue that museums and libraries still face with 3D technology is copyright. The Smithsonian Institution is leading the way for major museums going digital with the Smithsonian X 3D archive (http://3D.si.edu/) launched on November 13, 2013, where historic artifacts from their collections are available for viewing and printing.

Such a major institution providing access to their collections has helped set the tone for how other museums view this issue. The MET, the Science Museum (UK), and the Museum of Science and Industry (Chicago) all offer workshops, hack-a-thons or other special events and share 3D files on Thingiverse (www.thingiverse.com) or their own platforms like X3D. However, most of these opportunities are summer workshops aimed at very specific audiences, like students and hacker-hobbyists. The Art Institute of Chicago (AIC) is reaching beyond those groups, offering 3D workshops for museum professionals, and more recently, a residency and workshop program. Another great example was the 3D printing and scanning workshop for the 2013 Museums and the Web conference (presented by Elizabeth Neely, museum digital experience professional and formerly the director of digital information and access at the AIC; Miriam Langer, professor of media arts and cultural technology, New Mexico Highlands University; and Mike Murawski, director of education and public programs, Portland Art Museum). You can read both Neely and Langer's papers on the conference website.

At the workshop participants used a combination of technology to engage with works typically glossed over by visitors in that typical 30-second window. Using 123D Catch (a free photo app for smartphones), visitors can take pictures of objects in the gallery that automatically stitch together and create a 3D file. These files can be loaded into basic editing software and, using the scan as a base, create a physical, 3D printed model. This process truly moves museum galleries from quiet chambers to exciting and innovative makerspaces. It became clear to me after participating in a one-day workshop how these technologies could engage, educate and empower visitors to foster in-depth and prolonged learning. From 30 seconds to three hours, a visitor can look at a work of art carefully, take pictures, assist in checking the scan of the work before printing for accuracy and eventually have a final printed work that can be held, examined and even taken home.

As much fun as it is to read about these things, sometimes the best way to learn is by diving right in. I've recently had good luck replicating these experiences at my own institution. During our Fall 2014 *Curiosity* exhibition, Christian Faur, director of collaborative technology and fine arts, used 123D Catch to photograph and create a 3D scan of an object from our permanent

FIGURE 1. Garuda, Enemy of Serpents, 20th century painted wood Indonesian sculpture, DU2010.5.145, Gift of Selena Large.
Image courtesy of Denison Museum

collection (Figure 1) and then print copies on our 3D campus printer. The 3D model of a Garuda sculpture was used in numerous class visits, where it was passed around as a way to connect students to the work on display (Figure 2). Even though I couldn't offer the full 3D scanning and printing for all students yet, even this small event sparked conversation and interest.

To jumpstart project ideas for your own institution, there are two current programs, one museum-based and one community-based, that are showing great results. The ARTLAB+ program at the Hirshhorn Museum and Sculpture Garden in Washington, D.C., is a free after school program for teens that allows them to explore digital media and technical tools. Mentors encourage teens to explore their own interests, create their own learning trajectories and foster their own values. The overarching pedagogy used in programming is HOMAGO, which stands for hang out, mess around and geek out [2]. Although it's not solely about 3D printing and scanning, you can find some amazing projects, now published, available to download and use.

The Parachute Factory (http://parachutefactory.org/) is a community makerspace in New Mexico that works in partnership with the media arts department at New Mexico Highlands University, the New Mexico Department of Cultural Affairs and the New Mexico State Library. Parachute Factory builds opportunities for residents of northern New Mexico to explore technology, art and culture through hands-on workshops and making. Founder and director Mariano Ulibarri and local programming coordinator Rowyn Alarid created the Hacker Scouts group for kids aged 8-14. The scouts work to gain skills in cutting-edge technologies like 3D printing, electronic textiles,

programming and other new media arts. Since that time they have been offering opportunities for young and old in libraries, community centers and even farmers' markets (where the hacker scouts show community members how to use 3D printing) to engage and empower youth with technology. They even created a storefront where high school students can sell their creations, taking the students from passive learners to creators and entrepreneurs.

The British Museum and the Samsung Digital Discovery Center (SDDC) moved beyond novelty with their *Ancient lives, new discoveries* exhibition (May 2014), with a series of activities for families and teenagers. This exhibition showcases some of the innovative ways in which technology can be used to engage young audiences with a museum [3]. One activity offered was a 3D printing weekend. Inspired by the exhibition's amulets, visitors could recreate a choice of three amulets using computer-aided design (CAD) technology, handling examples from the collection and discovering the different spells associated with each. The amulets were then printed in the Great Court, where visitors could also learn about 3D printing and how it is used within different parts of the museum. To complement this activity, children were then able to design their own amulets, brought to life using 3Doodler pens, which create 3D shapes from plastic filament as you draw. A second day of 3D activities was aimed at 13-18-year-old visitors. Working with a professional 3D artist, participants animated an Egyptian river scene, using techniques and CAD software commonly used by the games industry. They also had the chance to 3D-print their models.

Ready to get started? Here are a few resources about the latest and greatest developments:

FIGURE 2. 3D printed version of the Garuda sculpture.
Image courtesy of Denison Museum
An interactive 3D model of the Garuda sculpture is available online at http://personal.denison.edu/~fulekia/museum/garuda.html

- Check out the 3D printing industry website and twitter feed to keep you updated in all things 3D (http://3Dprintingindustry.com).

- 3D Systems is another great resource and can get you on your way with The MakerLab Club (http://www.3Dsystems.com/zh/education/partnersandresources/makerlab-club) – a group that aspires to be a community of libraries and museums all across the United States, chartered to advance 3D digital literacy with dedicated equipment, staff for workshops and public access. Sign up for donated printers and discounts, workshop curricula and context, access to 3DU for 3D printing and design opportunities for your community.

- The aforementioned Hirshhorn Artlab + (https://artsy.net/hirshhorn) is a great source, and the artsy link has full lesson plans ready for your community, school group or family.

- Former MET intern Decho Pitukcharoen produced a great downloadable 3D printing booklet for beginners that walks you step-by-step through using 123D catch, editing your scan and printing (www.metmuseum.org/about-the-museum/museum-departments/office-of-the-director/digital-media-department/digital-underground/2014/3D-printing-booklet)

- Smithsonian: The Mind Behind the Mask: 3D Technology and the Portrayal of Abraham Lincoln (http://3D.si.edu) gives everything from an interactive pdf with lesson plans and 3D scans so that you can print your own Lincoln death mask for your students.

- Higher education is not left out either. 3DPetrie located at the University College London has a research program looking into the viability of using high-quality 3D images of museum collections to engage a range of audiences through the production of 3D models of Petrie Museum artifacts and the development of end-user digital 3D applications. They even recently offered a course on technology in the arts and cultural heritage. (www.ucl.ac.uk/museums/petrie/research/research-projects/3Dpetrie)

As technology improves and costs decrease, the possibilities for development and integration will explode. Everyday libraries and museums around the world are coming up with new and exciting ways to leverage 3D technologies to create deeper, more engaging and transformative experiences for their patrons. ■

Resources Mentioned in the Article

[1] Smith, J.K., and Smith, L. F. (2001). Spending time on art. *Empirical Studies of the Arts, 19*(2), 229-236.

[2] Ito, M. (2009). *Hanging out, messing around, and geeking out: Kids living and learning with new media.* Cambridge, MA: The MIT Press.

[3] Biggs, K. (May 30, 2014) Mummies, mobiles and 3D printing [blog post]. *British Museum Blog.* Retrieved from http://blog.britishmuseum.org/2014/05/30/mummies-mobiles-and-3D-printing/