

9-12-2018

## History in the Making: Outreach and Collaboration between Special Collections and Makerspaces

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### Recommended Citation

Passehl-Stoddart, Erin; Velte, Ashlyn; Henrich, Kristin J.; and Gaines, Annie M. MLIS (2018) "History in the Making: Outreach and Collaboration between Special Collections and Makerspaces," *Collaborative Librarianship*: Vol. 10: Iss. 2, Article 8.

Available at: <https://digitalcommons.du.edu/collaborativelibrarianship/vol10/iss2/8>

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makerspace, special collections, archives, outreach, 3D, academic libraries, collaboration, technology, innovation

*Peer Reviewed Article*

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### Abstract

Makerspaces present unique possibilities for creative partnerships within libraries, including the opportunity for interdisciplinary use of emerging technologies with archival objects and primary sources. One example of this type of interdisciplinary collaboration is the fabrication of cultural heritage replicas via 3D scanning and printing of historical university objects in academic libraries. Two departments in the University of Idaho Library, Special Collections and Archives (SPEC) and the Making, Innovating, and Learning Laboratory (MILL), partnered on such a project as a way to broaden maker competencies across library departments, leverage interdisciplinary connections between emerging technologies and historic archives, and create innovative outreach opportunities. Since many academic libraries house both special collections and makerspaces, this article outlines a path towards creative collaboration while creating an in-library maker community of practice and suggests opportunities for outreach and engagement that are widely applicable to library professionals.

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### Introduction

In the past ten years, the presence of makerspaces in academic libraries has grown significantly.<sup>1</sup> In a 2013 survey, half of the respondents indicated that their makerspaces were less than a year old.<sup>2</sup> Inherently interdisciplinary, makerspaces present intriguing opportunities for

collaboration and creative partnerships on campus and beyond. While research about many aspects of library makerspaces abounds, there has been less focus on collaborations between library makerspaces and other library departments, such as archives and special collections. These internal partnerships can yield unexpected and positive results, including the development of a maker community of practice and



creative outreach opportunities such as 3D scanning and printing of cultural heritage objects.

Common technology found in many makerspaces are 3D printers and 3D scanners of varying size and scale. While makerspaces with 3D printers serve as a prototyping space for students, some museums and cultural institutions use 3D scanning and printing to replicate cultural heritage objects for both preservation and access. In 2014, the British Museum uploaded 3D scans of museum objects and made the files available for users to download from their website. By scanning historical artifacts, the British Museum was able to “expose more of its archive without damaging any artifacts.”<sup>3</sup>

Many colleges and universities have archives and special collections departments that hold unique artifacts and objects that are culturally significant to the school, community, and region. One such example is the history of school mascots and other cultural artifacts used to unite and rally academic communities and their alumni. At the University of Idaho (UI), the school mascot, *Joe Vandal*, has a history that is mostly unknown to faculty, students, staff, and alumni.

Two departments in the University of Idaho Library, Special Collections and Archives (SPEC) and the Making, Innovating, and Learning Laboratory (MILL), collaborated to 3D scan and print a historically significant university artifact as a way to provide outreach to new audiences, develop skills and workflows related to maker technology, and promote maker culture on campus. These two departments also collaborated on outreach activities to promote each department’s unique assets and services, including a float in the homecoming parade and an open house event. Many academic libraries house both special collections and makerspaces; this collaboration models a path towards creative collaboration and suggests opportunities for

outreach and promotion that are widely applicable to library professionals.

## Literature Review

Makerspaces are unique places where patrons come to learn and experiment with new technologies. Makerspaces are collaborative learning environments where people share materials and learn new skills and can include anything from electronics, woodworking, sewing, programming, to other making tools.<sup>4</sup> While makerspaces are a growing service area for school, public, and academic libraries, this literature review will focus on the implementation and use of makerspaces in academic libraries, with a specific focus on applications for interdepartmental library collaboration with archives and special collections.

University libraries are in a unique position to create makerspaces, as it leverages the wealth of learning opportunities for knowledge creation that access to such technology provides, and easily connects those services to larger institutional goals.<sup>5</sup> Younghee Noh describes Library 4.0 as an ‘infinite creative space,’ a concept meant to facilitate creation using technology but not restricted to STEM activities.<sup>6</sup> The library is often viewed as a non-disciplinary or cross-disciplinary space on campus, where access to the materials and services is available to all users.<sup>7</sup> This discipline-neutral space academic libraries provide on a university campus makes an ideal location for a makerspace, because while some departments may provide their students access to 3D printers, locating a 3D printer in the university’s library ensures that all students have access to the technology regardless of their major.<sup>8</sup> Equitable access to technology has long been a professional value, and “by offering these spaces, support, tools, and culture in a library, those usually without the means or access to such resources now have a free place to create and learn.”<sup>9</sup>

While makerspaces support institutional goals centered on interdisciplinary collaboration, transformational learning, and creative activity, they require marketing and outreach to make these connections explicit to both internal and external stakeholders. New and non-traditional library resources, such as those commonly found in a makerspace, can seem abstract, intimidating, or even unrelated to the library mission.<sup>10</sup> Campus community members may not be familiar with the concept of makerspaces, how they relate to university teaching and learning, or may be interested in the concept but unsure how emerging technologies found in the makerspace impacts their own research and scholarship. Outreach helps patrons draw connections between the tools and their curriculum, facilitating creative and interdisciplinary exploration. Outreach is also a useful tool in the 'soft open' phase of makerspace implementation; as Beth Filar Williams and Michelle Folkman noted, "while exploration and self-discovery are hallmarks of a successful makerspace, the deadlines imposed on librarians to manage such a space do not often allow the time necessary for these methods of learning."<sup>11</sup> In cases such as these, makerspace librarians can shorten the learning curve with intentional and proactive collaboration with other departments within the library to accomplish specific goals, such as building maker competencies across library units. In these instances, the potential benefits of meaningful collaboration and developing a maker cohort outweigh the possible challenges.

A successful makerspace emphasizes cross-disciplinary collaboration and outreach.<sup>12</sup> For example, Kevin R. Messner describes a collaboration between the campus makerspace and an archaeology professor who 3D scanned archaeological artifacts, highlighting both an opportunity to learn from colleagues with diverse skill sets as well as potential for broad media exposure.<sup>13</sup> Sarah Younan and Cathy Treadaway expand on the use of 3D printing museum artifacts

with examples from the National Museum in Cardiff,<sup>14</sup> and Daniel B. Short discusses how natural history museums are using 3D printing technology to replicate and restore artifacts while supporting the educational mission of the institution.<sup>15</sup> These examples of 3D printing artifacts are similar to the collaboration and outreach in this case study, which centered on 3D scanning and 3D printing a university historical mascot.

Innovative programs can also help attract new audiences to unique materials found in archives and special collections. Ruth C. Carter and Thomas J. Frusciano state, "as a profession, we can agree that new activities have emerged, driven by technological advances that help us reach a larger and more diverse audience, with the simple goal of informing the public about our historical gems and how they can be used in a wide range of inquiries."<sup>16</sup> 3D printing is a great example of taking advantage of new technologies to connect with current and potential users in archives. To date, archival literature has barely touched on using 3D modeling and printing of archival materials for outreach. Carol F. Street provides a case study on producing 3D prints of architectural drawings, including an analysis of building 3D models and its positive effects on archival outreach. Specifically she mentioned, "The novelty of the 3D printing elicits an enthusiasm not typically seen for archival materials."<sup>17</sup> While not explicitly using archival material, an English class at Purdue University fabricated and 3D printed a Purdue Pere PEZ candy dispenser based on the university's mascot.<sup>18</sup>

Collaborative outreach projects usually result in successful promotion of library resources. For example, Erin E. Meyer found that short-term collaborative project-based outreach requires less formality and fewer shared goals which makes them "low-hanging fruit" and more likely to succeed than long-term collaborative projects.<sup>19</sup> Others indicate that collaboration is

more successful when long-term relationships are built and contact between parties is high, as is the case with partnerships within the library.<sup>20</sup> Kathryn M. Crowe explains that collaborative outreach encourages “staff interaction among departments and offers the chance for a great deal of creativity, innovation, and fun.”<sup>21</sup>

Collaborative projects between library departments and special collections result in benefits for both departments. For example, Karen E. Viars and Amanda G. Pellerin collaborated to provide information and archival literacy instruction at their academic library. They explain that, for archives, collaborating within the library results in access to a wider audience, better understanding of the value of archives, and recognition as a resource on par with other library services. For librarians, collaborating with archivists provides specific resources to apply information literacy skills and relationships that are more productive with faculty members.<sup>22</sup>

Other collaborations with libraries and cultural heritage institutions can model the Salzburg Curriculum to build communities of practice. At a summit of library and museum professionals co-sponsored by the Institute of Museum and Library Services in 2011, the Salzburg Curriculum included values such as continuous learning, creativity, and imagination, as well as core skills such as *knowledge, learning, and innovation*.<sup>23</sup> The curriculum highlights the importance of library and museum professionals being always open to learning new things, and also stresses five key areas: the construction of knowledge; improvisation or innovation; interpretation; dissemination; and information seeking.<sup>24</sup> One way librarians can build their capacity for these skills is by participating in a maker community of practice (CoP), where they can learn and create with colleagues and peers. In their influential article “Librarians as Makers,” Beth Filar Williams and Michelle Folkman highlight the importance and benefits of creating a maker community of practice, noting, “Making

is about individual action but as part of a larger community of learning, with active participation by a group.”<sup>25</sup>

Building on these case studies of academic library makerspaces and outreach projects, maker librarians and special collections archivists at the University of Idaho collaborated to explore outreach opportunities around homecoming to promote and market both the Special Collections and Archives and the recently formed Making, Innovating, and Learning Laboratory.

### Partnership between the MILL and SPEC

For over fifty years, UI Library Special Collections and Archives has collected, preserved, and curated unique materials that document the history of the University of Idaho, the State of Idaho, and the Intermountain West. As the second largest archival repository in Idaho, SPEC is open to the public and provides access to university artifacts (such as the campus mascot), historical photographs, manuscripts, rare books, maps, oral histories, and other related materials. Researchers may use archival materials in the department’s reading room. Collecting areas correspond with major areas of study at the university: agriculture, natural resources, mining, political papers, literature, and other economic and cultural strengths of the state and greater Pacific Northwest and Intermountain region.

The Making, Innovating, and Learning Laboratory (MILL) is the University of Idaho Library’s makerspace, which opened as a pilot space in August 2016 to extend the library’s mission of providing collaborative, interdisciplinary teaching and learning spaces. Created with the goal of providing centralized open access to innovative technology across disciplines, the MILL is available to all university affiliated students, staff, and faculty. While other spaces existed on campus that provided 3D printing, 3D scanning, and emerging technologies to students, those spaces were restricted for use by students in a

specific class or major such as architecture or engineering. Additionally, students often faced barriers to use that prevented hands-on learning, primarily the ‘print on demand’ or staff-mediated models that many such spaces feature, as well as the supervision requirement that many spaces mandate of students using emerging technology. In contrast, the MILL promotes an environment of inclusive peer learning, provides open and equitable access to technology, and facilitates a low-risk creative space where students can explore and learn together. Conceived in 2015 during planning for a first floor renovation, library administration supported the makerspace pilot, and agreed to provide one-time funding for equipment and temporary space that could be repurposed if the project failed. The space was managed by existing librarians and staff for the first year of the pilot. Initial equipment included a 3D printer, a 3D scanner, and various analog and digital maker tools such as a button maker, sewing machine, Arduino, Raspberry Pi, and more.

At the beginning of the fall 2016 semester, both SPEC and the MILL were looking for outreach opportunities. Maker librarians wanted a project-based experience to build their 3D printing and 3D scanning capacity in anticipation of future workshops and classes, and hoped to promote the recently opened MILL to the campus community and outside stakeholders. SPEC archivists sought innovative promotion strategies that would highlight the relevance of its collections to current students and the community. The University of Idaho Homecoming Week occurred during National Archives Month in October and presented the opportunity to capitalize on a wide audience that shares an enthusiasm for school spirit. The two departments met to discuss potential projects and brainstormed several ideas for outreach that promoted the general concept of making and involved 3D scanning and printing. Archivists and maker librarians decided to focus on one of SPEC’s favorite

items to pull for display during public events and instruction sessions, a statue named *The Vandal* created by student Peter Paul Drus in 1924 (Image 1). Painted a matte gold, the statue stands approximately one foot tall and was the first embodiment of the University of Idaho mascot.<sup>26</sup> Librarians and archivists chose this cultural object as the outreach focus due to its public interest as well as its quirky appearance that would allow maker librarians to experiment with 3D scanning such an object.

MILL and SPEC saw the opportunity to 3D print *The Vandal* statue as an outreach case study that would benefit numerous promotional events and activities: maker librarians could explore curricular applications in 3D scanning and printing a cultural artifact; archivists could be connected to emerging technologies; and the statue itself could serve as inspiration for a float in the Homecoming Parade. The collaboration benefited each department's outreach efforts, as collaborating provided an opportunity to test new 3D scanning and 3D printing capabilities in the MILL, highlight SPEC material that celebrates university history, and demonstrate the educational value of both the technology in the MILL and the resources in Special Collections. One of the oldest departments in the library could collaborate with the newest department to promote numerous outreach activities to both new and current audiences.

### Outreach Activities

#### 3D Printing a Cultural Object

Although the initial goal was to hand out tiny 3D printed versions of *The Vandal* at the Homecoming Parade to mirror the librarian-made life size statue, the file cleanup and production process proved to be impossible to complete and deploy at a large scale in time for the parade and Archives Month. Maker librarians had learned 3D scanning and 3D printing quickly, but they still lacked the 3D modeling skills necessary to

clean and patch the existing scans into a 3D printable file. Recently hired student assistants with advanced modeling skills could not complete the file cleanup and processing before the parade deadline. Maker librarians searched for easily modified 3D files that could be mass-produced as giveaways during outreach events, including the Homecoming Parade. After finding a 'Viking Helmet' on the 3D printing community website Thingiverse (similar to the one worn by *The Vandal*), student assistants modified the file to include an 'I' to represent Idaho and added a small ring at the top of the helmet to connect to a keychain (Image 2). Maker librarians and student assistants completed this modification process in Tinkercad, an open-source 3D modeling program, and printed several prototypes before finalizing the design and mass printing.<sup>27</sup>

#### Homecoming Parade

For the first time, the UI Library entered a float in the annual Homecoming Parade, an annual Vandal tradition on the Moscow campus that draws thousands of people. Spectators of the parade include future, current, and past library users: community members, families, university students, faculty, and thousands of alumni who return to Moscow for the event. Since there was not enough time to reproduce *The Vandal* before the event, librarians wanted to include the historical aspect of the statue in the parade. Motivated by the DIY maker environment found in the MILL, the two departments decided to create a life-size replica of *The Vandal* (Image 3).

Librarians thought the impact of a life-size statue mounted on the float would generate interest in the mascot's history and wanted to demonstrate the generalized concept of 'making' that is a central value of the MILL. Building a life-size statue also gave librarians an opportunity to creatively problem-solve and collaboratively prototype; these skills are foundational to making and encouraged a spirit of innovation

throughout the collaboration. Constructed out of packing tape, newspaper, spray paint, PVC pipe, and a laundry detergent bottle, staff created the sculpture using online instructions for packing tape ghost sculptures<sup>28</sup> and came in under the allocated budget of \$100. The cart featured a five-foot tall replica statue and posters promoting the newly published photographic history of the university.<sup>29</sup> MILL and SPEC faculty and staff pulled the cart in the parade route to a crowd of thousands (Image 4). Archivists also used *The Vandal* float at a book-signing event with the authors later that day at the Idaho Fan Zone, where people could take their photograph with the original Vandal and SPEC could promote the book and university history to an audience of UI athletic fans.

Librarians provided a description of the historic mascot, as well as publicity statements for both SPEC and the MILL, to the parade announcers to advertise the departments and their services. Supplementing the visual outreach provided by the parade float, librarians handed out promotional items advertising both departments. These items included 3D printed Vandal helmet keychains from the MILL, pinback buttons featuring historic images from SPEC created with the MILL button maker, and candy.

#### Open House and Celebration of Archives Month

SPEC and the MILL hosted a joint open house during National Archives Month in October following the homecoming events. SPEC received \$100 towards the open house through an archives month award available through the Northwest Archivists professional organization. Light appetizers and drinks were available throughout the three-hour event to attract attendees. The open house highlighted SPEC materials in the newly renovated reading room from different collecting areas, including university and local history. Archivists chose a variety of material to communicate the extent and value



**Image 1.** *The Vandal* by Peter Paul Drus, 1924.



**Image 2.** Viking helmet keychains 3D printed with University of Idaho "I".



Image 3. *The Vandal*, life-size replica.



Image 4. *The Vandal* float at the University of Idaho Homecoming Parade.



of the collection that would also interest the local community.

During the open house, the MILL and SPEC each gave a half-hour workshop based on their collaboration. SPEC presented on the history of the university's mascot, Joe Vandal, which included the origin of *The Vandal* statue. The MILL's workshop demonstrated how they 3D scanned and 3D printed a replica of the historic statue. In addition to recounting the process and tools used to scan *The Vandal*, maker librarians

facilitated a hands-on 3D scanning activity with attendees, and discussed the lessons learned during the process. The MILL provided technology for attendees to test and use throughout the open house, including a banana piano built using a Makey Makey, Arduinos and Raspberry Pis, virtual reality equipment, button maker, and vinyl cutter. The 3D scanner and 3D printer were also used throughout the event to demonstrate their capabilities. Attendees of the MILL workshop had very limited experience with

maker technology, but were interested and engaged participants with many good questions about the 3D scanning and printing process. The MILL 3D printed additional batches of *The Vandal* helmet keychains and created more 2.25" pinback buttons advertising each department's services, while SPEC created bookmarks featuring an illustration of *The Vandal* by UI student Peter Paul Drus using the MILL's laminator; both departments provided handouts detailing their workshop content to attendees.

### Outcomes

Maker librarians and archivists benchmarked the outreach activities against predetermined goals to determine success. The outreach activities considered included 3D scanning and printing of the modified helmet, the float and giveaways at the Homecoming Parade, and the joint open house event open to the public. All events stayed under the budget of \$200 (\$100 for parade, \$100 for open house), and the filament costs for prototyping *The Vandal* and mass producing helmets were estimated between \$25-\$50 (one to two reels of filament).

The five goals outlined by maker librarians and archivists included: (1) introduce new audiences to MILL and SPEC; (2) introduce the history of the institution; (3) communicate the value of MILL and SPEC; (4) develop skills of 3D scanning and printing for the MILL staff; and (5) increase communication and collaboration between MILL and SPEC. All outreach activities met the expected goals and led to unexpected opportunities. Maker librarians and MILL student employees developed their 3D scanning and printing skills and learned 3D modeling skills, including file cleanup. By playing a role in the highly popular UI Homecoming Parade, SPEC and the MILL connected with thousands more people than would have been reached by an event inside the library. The parade was an effective outreach tool because it advertised

lesser-known library services such as the makerspace and historical archives to alumni, community, and children. The goal was to interact with a new audience while promoting a sense of playfulness and demonstrating different types of learning.

Approximately 20 people attended the open house. Attendees represented all the user groups targeted by the event (students, faculty, community members, and alumni). A joint open house introduced new user groups to the services provided by both departments and illustrated the interdisciplinary nature of the collaboration. Attendees interested in science and technology available in the MILL learned about archival materials, while students interested in the humanities learned how science and technology applied to their interests. The open house also helped communicate innovative research uses for SPEC materials. Collaborating with the MILL demonstrated creative ways to use archival material and its relevance to contemporary research.

Both the MILL and SPEC developed new collaborations with other groups on campus following the outreach events. One example included an English instructor who attended the open house event and contacted SPEC in spring 2017 to incorporate archival instruction into both sections of her creative writing class. SPEC added a new class to its instruction roster and connected with 50 new undergraduate students. The increase in visibility of the MILL also encouraged new users of the space, especially faculty and staff who were excited by the co-curricular technology opportunities available to them in the new space.

*The Vandal*, successfully finished after Homecoming and printed in a variety of sizes, provided a conversation piece for MILL visitors and sparked creative discussions about other potential projects involving 3D scanning and 3D printing cultural heritage objects (Image 5). One

example is a replica of a historic gargoyle, represented by a football player in helmet and pads holding a football; this stonework is an iconic feature of the university's historic Memorial Gym.<sup>1</sup> University employees in Facilities brought a cast of the gargoyle to the MILL, where maker librarians 3D scanned the model and were able to use their improved 3D modeling skills to clean up the file and successfully print a miniature version (Image 6). While not curricular in scope, this activity allowed the MILL and SPEC to create and preserve a 3D file of a unique and iconic university artifact, and increased collaboration and visibility with an often-overlooked unit on campus.

The most recent example of collaboration to recreate cultural heritage objects is a project with the international studies department, in which maker librarians helped students in a co-curricular group 3D scan and 3D print a historic bust of Idaho Senator William E. Borah (Image 7). The Borah bust acted as a nice counterpart to the previous year's activity; both the Borah bust and *The Vandal* were used in homecoming activities, and maker librarians were able to apply their improved skills to streamline the process for scanning, modeling, and 3D printing university artifacts.

The products developed in the MILL for Homecoming proved to be useful items for subsequent outreach and promotional events. The helmet keychains remain a popular promotional item used by the library at many functions throughout the year, including at student welcome

events and informational fairs, and the MILL collaborates with other library departments to develop customized 3D printed takeaways for unique outreach events. The library gives away 3D printed items at promotional tables, new and prospective student events, and in celebrating other events on campus. For example, during another major campus event, the Lionel Hampton Jazz Festival, the MILL 3D printed musical instruments. The 3D printed replica of *The Vandal* is now an essential component of an Arduino-based motion sensor, where the statue moves in response to light sensors with the help of a servo motor.

The skills that maker librarians and MILL student employees learned during the project directly contributed to the launch of a very successful MILL workshop series in spring of 2017. Topics covered during the series included 3D modeling, 3D printing, post-print techniques, programming with Raspberry Pi, and deconstructing a laptop. The pilot proved successful enough to become a permanent library space and additional funding for a staff position and increased student staffing was secured. 3D printing demand by students necessitated the purchase of a second printer, and student demand informed subsequent equipment purchases. Student assistants have been invaluable to the success of the space; by staffing the space with student workers in disciplines such as design and engineering, encouraging an 'okay to fail' culture, and providing peer-learning opportunities, the MILL has created a community of makers that help each other learn, problem-

Image 5. 3D-scanned and printed replica of *The Vandal*.



**Image 6. Miniature, 3D printed football player gargoyle replica, complete with helmet, pads, and football.**



**Image 7. A historic bust of Idaho Senator William E. Borah, 3D printed.**





solve, troubleshoot, iterate, and execute across a variety of resources and tools.

In addition to observable outcomes, this outreach project resulted in additional outcomes not directly measured in this case study. For example, it is possible that alumni excitement and engagement about university collections could increase donations to Special Collections and Archives, or that the student assistants who designed the keychains and replicas may have an improved understanding of the relationship between technology and the humanities. These types of unanticipated outcomes provide a fertile area for future research on collaborations with makerspaces.

### Conclusion

The MILL and Special Collections and Archives deemed this series of collaborative outreach activities a success. One major accomplishment that occurred throughout this partnership was the vast amount of learning that took place among maker librarians as they navigated through 3D scanning and printing a cultural object for the first time. For the MILL, this collaboration went a long way toward developing an in-library maker community of practice. Partnering with trusted library colleagues to explore innovative technologies, brainstorm creative approaches to outreach, and collaboratively problem-solve in a low-stakes environment strengthened existing relationships, provided a blueprint for future interdepartmental library collaborations, and added capacity for maker literacies to librarians outside of the MILL. With the development of new staff skills and familiarity with 3D scanning and printing, both the MILL and SPEC intend to continue their new partnership and explore new relationships with faculty and students on campus.

This series of collaborative outreach activities also allowed archivists and maker librarians to

take advantage of an opportunity for interdisciplinary collaboration that allowed for crossover between the humanities and science and technology throughout these outreach activities. Other academic library makerspaces, archives, and other library departments may find similar benefits to pursuing collaborative outreach. Much like the lesson learned by Street, SPEC found that it was possible to approach 3D printing on a modest budget and garner results.<sup>1</sup> Through the partnership with the MILL, SPEC not only learned about the challenges of 3D scanning cultural objects, but also found the collaboration creatively freeing; it helped inspire new ideas about the use and value of special collections materials for outreach, education, and research. It also brought forward ideas about how archivists encourage active and creative uses of unique materials found in archives and special collections.

The collaboration between the MILL and SPEC resulted in innovative outreach programming that demonstrated new ideas for library resources and the transformative power of ideas, and excited users to pursue their interests in a creative way. By building on technical skills and academic interest in the MILL, and making use of campus historical information located in SPEC, the UI Library continues to uncover how it can add value to the teaching and learning experience of the campus community while working within a library community that encourages creativity and continuous learning.

*Authors' Note: At the time of writing, the authors were at University of Idaho: Erin Passehl-Stoddart, Head, Special Collections and Archives & Associate Professor and Annie M. Gaines, Scholarly Communications Librarian & Assistant Professor.*



<sup>1</sup> ACRL Tech Connect, "Makerspaces Move into Academic Libraries," Association of College and Research Libraries, <https://acrl.ala.org/tech-connect/post/makerspaces-move-into-academic-libraries/>.

<sup>2</sup> John Burke, "Making Sense: Can Makerspaces Work in Academic Libraries?" (paper presented at the ACRL Meeting, Portland, OR, March 25-28, 2015), <http://www.ala.org/acrl/sites/ala.org/acrl/files/content/conferences/confsandpreconfs/2015/Burke.pdf>.

<sup>3</sup> Emma Bryce, "The British Museum Uses 3D Scanning to Bring Artefacts to Life," *Wired Magazine*, February 5, 2015, <http://www.wired.co.uk/article/reprinting-history>.

<sup>4</sup> Samantha Roslund and Emily Puckett Rodgers, *Makerspaces (21st Century Skills Innovation Library: Makers as Innovators)* (Ann Arbor, MI: Cherry Lake Publishing, 2013): 9.

<sup>5</sup> Lisa Kurt and Tod Colegrove, "3D Printers in the Library: Toward a FabLab in the Academic Library," *ACRL TechConnect Blog*, July 7, 2012, <http://acrl.ala.org/techconnect/post/3d-printers-in-the-library-toward-a-fablab-in-the-academic-library>.

<sup>6</sup> Younghee Noh, "Imagining Library 4.0: Creating a Model for Future Libraries," *The Journal of Academic Librarianship* 41, no. 6 (2015): 794. <http://doi.org/10.1016/j.acalib.2015.08.020>.

<sup>7</sup> Amy Van Epps, Davin Huston, John Sherrill, Ann Alvar, and Anna Bowen, "How 3D Printers Support Teaching in Engineering, Technology, and Beyond," *Bulletin of the Association for Information Science and Technology* 42, no. 1 (2015): 17.

<sup>8</sup> Samantha Rich, "A Survey of Makerspaces in Academic Libraries" (Master's thesis, University of North Carolina, 2014), 7,

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<sup>9</sup> Beth Filar Williams and Michelle Folkman, "Librarians as Makers," *Journal of Library Administration* 57, no. 1 (2016): 24.

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