GOING FROM CURIOUS TO MAKER: NEW USER EXPERIENCES IN A UNIVERSITY MAKERSPACE

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Abstract

In the summer of 2014, Tufts University's Center for Engineering Education and Outreach and Tisch Library teamed up and, with support from VentureWell (formerly NCIIA), converted a library conference room into a makerspace called Jumbo's Maker Studio. This pilot makerspace was to examine the effectiveness of opening up a makerspace in a centralized location on Tufts University's Medford campus and to examine how a makerspace designed to appeal to the larger university community would be accepted and used. This case study examines the effectiveness of that endeavor through the experiences of several users who had never previously entered a makerspace and had not considered themselves makers. This new user case study follows a cataloging and metadata services librarian, a member of the library's administrative staff, a research librarian, a biomedical engineering grad student, and a software engineer from Tufts technology services, who all came in with an interest in finding out what the makerspace could offer. They left understanding the tools available and having completed several projects at Jumbo's Maker Studio. Their feedback provided insight to the value of a centralized campus makerspace designed for wide appeal.

Introduction

The maker movement is a thriving community formed around do-it-yourself values and a desire to innovate and create, as well as an open-source mentality of enabling others to do the same. This community comes together through "making," a term which has been kept deliberately vague by the movement so as to encompass as many creative endeavors as possible. Whether their favorite medium is electronics, fabrics, wood, code, metals, or anything else they use in their projects, the community welcomes them as "makers." The physical embodiments of this movement, makerspaces, have been increasing in popularity as well. They serve as spaces where many makers of varied interests and backgrounds can come together to help and teach one another skills and collaborate on personal projects. The mentality of this movement is general acceptance of any who wish to make, which leads to availability of people from a wide range of backgrounds. Combined with the compilation of advanced resources within makerspaces, there are significant opportunities for meaningful interdisciplinary collaborations among makers. This leads to individual and group achievements, technological advancements, and business opportunities (Anderson 2012; Foersch 2013).

These outcomes pique a particular interest in the maker movement and makerspaces at colleges and universities due to their productive economical effects. Institutions of higher education historically act as significant sources of innovation and incubation centers for the future of our economy, producing the technologies of tomorrow and the individuals who create and improve upon them. In recent years, makers were on the leading edge of a proliferation of new manufacturing technologies, new innovations, and solutions for a quickly changing world in the

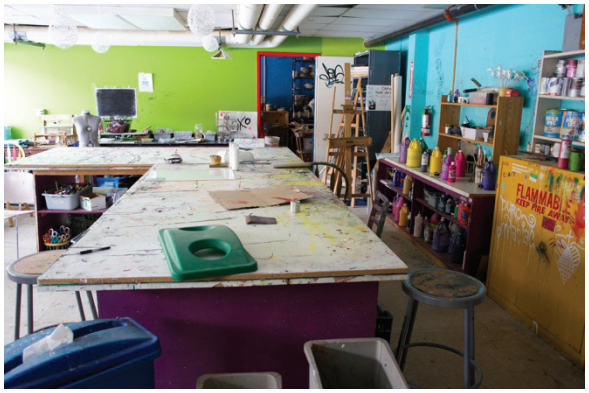

Figure 1. Soldering section of Tufts Bot Lab (left) and central work table of Tufts Crafts Center (right)

Figure 2: Jumbo's Maker Studio at Tisch Library

Figure 3: Jumbo's Maker Studio Grand Opening, June 2014

Figure 4. Calvin and Hobbes charm designed and prototyped in Jumbo's Maker Studio. (Left) 14k white gold charm in nylon case, both printed at shapeways.com. (Right) From right to left: PLA and ABS prototype printed at Jumbo's Maker Studio, brass and white gold versions printed at shapeways.com

midst of a change in economy that allows for successful small-scale production and open-source business practices. The two environments provide similar opportunities for collaboration, and academics and makers share an enthusiasm for understanding and advancing new technologies (Dougherty 2013; Foersch 2013; Open Source Hardware Association 2015; Anderson 2012).

Making at Tufts University

The value of the maker movement and makerspace*s* as something that reflects the values of institutions of higher education has not gone unnoticed by Tufts University. Campus involvement in this movement, both intentionally and unintentionally, existed for many years now through several student groups focused on making as well as various spaces on campus created for that purpose. Before the summer of 2014, two major locations on the Medford, MA campus self-identified as makerspaces: the Bot Lab and the Crafts Center. In 2008, a group of students created the Bot Lab with faculty support from the department of mechanical engineering. This student makerspace is exclusively approved for use by members of the Tufts Robotics Club and is located on the outskirts of the main campus. The space is equipped with equipment and supplies for building robots: electronics, hand power tools, 3D printers, and similar small-scale manufacturing equipment (Tufts Robotics Club 2014). The Crafts Center, an arts and crafts-focused space, started long before the term makerspace was coined. Students outfitted it with materials like paints, fabrics, clay, wood, glass, and their associated tools. They have also recently acquired a 3D printer for their space. The Crafts Center is located in the basement of one of the student dorms and is open to the entire Tufts Community (Tufts Crafts Center 2014).

Although these excellent spaces operate well within the values of the maker movement, some issues exist with their availability and general presence on campus. The Bot Lab's designation as a Robotics Club resource makes it unavailable to the general Tufts population. It is also physically located at the bottom of a large hill in a mechanical engineering building on the edge of campus, so students tend not to be aware of it unless they are mechanical engineering majors or are specifically interested in robotics and seek it out. If you happen to enter, electronics, metal and plastic parts, and robots in various states of completion clutter the workspace—an unappealing and sometimes intimidating sight for people unfamiliar or not as interested in electromechanical projects (see Figure 1).

Similarly the Crafts Center's out of the way location in a dorm basement, with only an external access door on the opposite side

of the building's main doorway, makes approaching it randomly unlikely. Although they recently added more electronics and advanced equipment, the space's equipment and public perception creates a niche appeal for those primarily interested in arts and crafts activities. Paint spatters much of the workspace, and the space predominantly displays supplies all highly associated with artistic endeavors, which can be unappealing and sometimes intimidating for people who believe they lack an artist's touch (see Figure 1). Tufts lacked a space both centralized and designed to appeal to a wide breadth of the university community.

Jumbo's Maker Studio

Tufts University's Center for Engineering Education and Outreach partnered with Tisch Library to address this shortcoming by creating Jumbo's Maker Studio. In the summer of 2014, with financial support from a National Collegiate Inventors and Innovators Alliance (now VentureWell) grant, they set up a pilot makerspace in the library of Tufts University's main campus from mid June until late August. The team repurposed a conference room to become a temporary makerspace designed to appeal to the library's wide range of attendees (see Figure 2). The 26' by 14' space went from a room dominated by a long table and chairs to a space with three 3D printers; a dozen LEGO® Mindstorms kits; a soldering station with available equipment and supplies; stop-action motion cameras and software available to document work or create movies; various craft materials and electronic components; and other items to enable making. The team designed the layout to encourage interaction and collaboration between users, so that you could easily see what others are working on. To encourage people to enter, they utilized the curiosity 3D printers tend to invoke by locating them near the entrance, visible to passers-by. The team even designed the name to be welcoming, naming the space after the school's mascot and using the term studio to be more reminiscent of an artist space rather than a space for engineers.

Over 75 members of the Tufts community visited during its grand opening and a few hundred more throughout the summer (see Figure 3). Visitors included members of the Tufts administrative staff, faculty from various departments, and both undergraduate and graduate students on campus for the summer. Members of the Tufts community even brought their children in as well. Having a makerspace in a centralized, high traffic area of the Tufts campus served as an way for many more individuals to organically discover this opportunity to design and create on campus (Vavra 2014).

Maker Studio Makers

Some makers took to the space far more than most and agreed to be interviewed about their experiences. They provided some interesting feedback that helped us evaluate the success of the pilot makerspace. This group consisted of a cataloging and metadata services librarian, a member of the library's administrative staff, a research librarian, a biomedical engineering student, and a software engineer from Tufts technology services. None of these individuals had previously frequented a makerspace or considered themselves makers before their experiences in Jumbo's Maker Studio. They spent the most time in the space, immersing themselves in the design process and the creation of things with their own hands; some were making for the first time, while others were simply eager to be involved and take on new challenges.

They all attended our initial open house but returned for various reasons. Unsurprisingly, 3D printing provided an attraction for many of our return users, including some of this case group.

> The chance to get experience with 3D printing, which I've been wanting to learn about for years.
>
> —Software Engineer

> I wanted to learn about 3D printing/ modeling.
>
> —Library administration staff member

There were those that had other projects already in mind and professional reasons for their attendance.

> I needed to quickly create a portable book cradle that would allow for the both the displaying of rare materials while protecting the integrity of the binding.
>
> —Metadata Services Librarian

> My work at the library is focused on helping Tufts freshmen develop their research skills, so I also wanted to see what types of opportunities students have for non-coursework self-motivated learning.
>
> —Research Librarian

> I was looking for a soldering iron to help me make a mold for one of my projects and was told that the makerspace had soldering irons that anyone could use.
>
> —Biomedical Engineering Student

Returning and actively taking part in making led to discovery and changes for each of them. Some simply surprised themselves at how easy it was to design and create, given the opportunity. People commonly associate functional design with engineering, a concept that scares off many people. Many, including some of these users, found it surprising that they could engineer solutions given the opportunity and support to do so.

> I was surprised at how easy making an object is with the right support and equipment.
>
> —Metadata Services Librarian

> I also learned that I find engineering so interesting, that if there was an engineering class for non-engineers, I'd sign up if my schedule allowed.
>
> —Library administration staff member

> I brought my kids in to see a 3D printer and we ended up learning about LEDs and making light-up pictures...Having the freedom to be supported while working on any project I could dream up was fantastic, and very different from taking a structured class
>
> —Research Librarian

The availability of this open-design space helped to showcase engineering and design for these makers in an approachable way. The things they did in the summer of 2014 all could have been done on their own but simply weren't, due to lack of availability of materials, equipment, and encouragement. Jumbo's Maker Studio and the community that formed around it provided these necessities for creation. This accessibility led to some changes in perception for participants with regard to making in general and seeing themselves as makers.

> None of the things I learned were actually all that difficult to pick up, and having the printers and people who knew how to run them removed the last barrier to giving it a try.
>
> --Software Engineer

> Prior to entering the studio, I thought there would be a steep learning-curve. Needless to say I was a bit intimidated. The staff provided the support and set-me up with the basics that empowered me as a maker...I went from someone who had real doubts about my own

ability to create objects to someone who would like to create more.

—Metadata Services Librarian

Through this use of the makerspace, important aspects of the design process became apparent simply through the encouragement and ability to iterate on designs. This allowance to learn from mistakes and redo tasks led to a greater appreciation of the general process, as well as further understanding of the specific methods.

My daughter had requested a printed cat, and seeing how it was structured/printed made me think differently about how and what would be a good use of the 3D printer. I was really grateful that I was able to re-print a job gone wrong to learn more about the nitty gritty of printing

—Research Librarian

Over the course of the summer, my perception of "making" changed in that there are always a lot more factors and pieces that need to be considered while I was making.

—Biomedical Engineering Student

These new makers showed an appreciation for the value of Jumbo's Maker Studio by returning on several occasions. Their statements speak of its value to the larger Tufts community as well:

This is an important incubator space that provides the raw material and personal connections necessary for creatively thinking about new solutions to common, and not so common, problems. In short, it has an entrepreneurial energy that is contagious because new ideas can be tried without the fear of failure. I can easily see this space growing into a place of discovery where students and staff can take ownership of their own ideas, while contributing to the success of others.... It was a positive experience from the moment I walked into the room.

—Metadata Services Librarian

Having the tools and removing the barriers to using them is powerful. That makes it easy for people to get started with something new.

—Software Engineer

I see tremendous value for students in being able to find and explore ways they can create/solve problems using technologies that have a learning curve and may not seem immediately accessible. The makerspace ended up being a creative outlet for me this summer and provided some opportunities for co-worker bonding and art therapy-esque times.... It was inspiring to see the types of projects that other people were working on. I enjoy learning from others and especially appreciated being able to learn and problem-solve with students.

—Research Librarian

I feel the value of the makerspace is that it provides materials and devices that might not be available to people elsewhere. For example, if I hadn't found the maker space, I wouldn't have been able to expand one part of my project because I wouldn't have been able to make the molds I wanted to make. The makerspace is a space where anyone who wants to try something new but might not have the materials or ability can go. Honestly, the makerspace is a great resource for the engineering community and Tufts community in general.

—Biomedical Engineering Student

Figure 5: Jumbo's Maker Studio at Tufts Univrsity Center for Engineering Education and Outreach

Conclusion

Many individuals came across Jumbo's Maker Studio in the summer of 2014 and took advantage of the opportunity to develop their own projects and *make* in an accessible free design space on campus. A catalog and metadata services librarian created his own hardware to protect and display rare and valuable books in the library collection. A biomedical engineering student took her summer project to another level by having the tools and support to iterate and improve upon her testing apparatus without having to settle for available items from her lab's shelf. A member of the library's administrative staff and a research librarian collaborated on designing and creating their own jewelry, learning from one another while doing so. A software engineer took an interest in geometric figures and created many physical representations through 3D printing, as well as designing and crafting a custom charm as a gift for his wife (see Figure 4). For a room previously used mainly for meetings, a fair amount of *making* took place within its walls and many resulting physical creations went out its doors. Each served as a source of pride and a representation of the challenges each *maker* undertook and the learning they achieved.

A few hundred individual visitors came to Jumbo's Maker Studio in its temporary location throughout Tufts University's summer session of 2014. Afterward, it moved to a more permanent location at Tufts University Center for Engineering Education and Outreach, where students and staff continue to take advantage of the opportunities that it provides (see Figure 5). For a makerspace, having makers come through its door and utilize the tools and community within is a measure of success. The continued ability to exist and function as a lab on a university campus while serving as a research space, as well as serving the student body, also has great value. Overall, the team considered this pilot makerspace

a successful endeavor due to consistent attendance throughout the summer and the many and varied works produced by its users. Feedback from this group of makers reinforce that view, allowing us to see how individuals viewed Jumbo's Maker Studio and the value of having a centralized makerspace for the Tufts university community.

> A makerspace at my workplace gave me opportunities to learn, explore, craft, tinker, refine, dream and create something awesome
>
> —Research Librarian

> The Jumbo Maker Studio was probably one of the highlights of working at Tufts this summer. Having access to all the amazing equipment and tools was vital to my project this summer.
>
> —Biomedical Engineering Student

> I think that if it can be as successful as it was during the summer it will be even more used and enjoyed when more people are back on campus.
>
> —Software Engineer

> Collaborative and empowering!
>
> —Metadata Services Librarian

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