Make labs, not war: Rethinking library creative technology services through a critical making lens

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ABSTRACT
Libraries are increasingly building makerspaces and technology labs which are aimed at portraying them as innovative, progressive, and future-oriented to meet the changing need of a technology-centered society. The Auraria Library designed several spaces with these ideals in mind, yet after running them for several years, the authors have redesigned and re-prioritized its services, staffing, and values. Using critical making as a framework, the authors interrogate some of the implicit logic of library makerspaces that contributes to sexism and ableism and outline how libraries can create inclusive creative technology spaces and services that center people over technology.

KEYWORDS
Critical making; creative technology; libraries; makerspaces

Introduction
The library resides within an uncommon institutional context. Located in downtown Denver, Colorado, the Auraria Campus is home to three institutions of higher education: The Metropolitan State University of Denver, the Community College of Denver, and the University of Colorado Denver. The Auraria Library serves the campus’s over 45,000 students, including many first-generation, underrepresented, and nontraditional students, and sees over 750,000 visits a year. Students here are highly motivated, many have children and full-time jobs, and for some, having access to a laptop or even Wi-Fi is considered a luxury. The library provides a physical and figurative space for students to access tools to help them complete their assignments and provides them with resources they may not have elsewhere.

The Auraria Library offers two creative technology labs in the library: The Innovation Garage and the Digital Media Studio. The Innovation Garage is a drop-in space dedicated to 3D and large-format printing, multimedia creation, and digitization. It was designed as part of a larger library renovation (Auraria Library 2020) that took place between 2010 and...
2016 in consultation with faculty, students, staff, and an architecture firm. The Digital Media Studio is a bookable space dedicated to portfolio photography, video production, and audio recording. It was a space the library inherited in 2016 from an external organization that provided digitization services for faculty on campus. The labs are run by two full-time staff members who supervise around eight part-time student assistants. They interact with about two thousand patrons a year which amounts to about ten percent of all patron interactions in the library.

**Background: Libraries and technology**

To understand some of the issues that the staff experience in these spaces and services, it is helpful to first contextualize them in a broader setting. What happens in any library technology spaces is connected to larger systems and structures of the technology industry. When libraries integrate technology into spaces or services, they are not just importing hardware and software, they are also implicitly importing ideas about who and what a technology is for (Noble 2018). Each phase of a technology’s development, including its initial startup, funding source, product design, workforce demographics, development process, user testing, material sourcing, supply chain, branding, and advertising have their own impact on the broader adoption, use, and public perception of that technology (Nakamura 2014; O’Neil 2016; Watters 2017). These forces shape how a library uses technology, and in turn, how patrons interact with them.

If the technology industry’s cultural values were in-line with the stated values of librarianship as a profession (American Library Association 2019) the transfer of implicit values from the technology industry to librarianship would not be a problem. However, the technology industry has a long history of oppressing and excluding marginalized people including women, people of color, people with disabilities, Indigenous peoples, and the LGBTQ community, among others (Fung 2008; Adam and Kreps 2009; Nakamura 2014; Keyes 2018; Benjamin 2019). This exclusion is especially felt by people who experience intersectional oppression such as being a Black woman or being disabled and trans (Crenshaw 1989). Technology culture has communicated that the type of person technology was built by and for is white, male, cisgender, heterosexual, able-bodied, and neurotypical (Benjamin 2019). While there are several initiatives that are trying to make technology more inclusive, usually led by the people it normally excludes (Women Who Code 2020; Black Girls Code 2020; Lesbians Who Tech & Allies 2020; Black Men Code Inc 2020), the technology industry is far from equitable in terms of recruitment, hiring, promotion, and
retention, equal wages by demographics, or creating products designed for diverse audiences (Guynn 2017; Kolhatkar 2019).

A second complicating factor in this broader context is that libraries and higher education tends to believe that if they want to remain relevant and in less danger of budget cuts, they need to uncritically adopt new technology (Hendrix 2010; Oakleaf 2010). The Horizon Report (Alexander et. al. 2019), an annual publication put out by the now defunct New Media Consortium and EDUCAUSE predicting up and coming technology trends, as well as the subsequent library editions, are prime examples of the kind of professional investment in technology adoption that creates a pipeline between Silicon Valley to public and academic libraries (Watters 2018). This process is also bolstered by people who believe libraries must always demonstrate their value usually through methods that involve adopting surveillance technology or violating patron privacy (Oakleaf 2018). The fact that libraries adopt technology is not necessarily good or bad in itself, assuming the adopted technology does not harm anyone, but there are enormous financial and cultural pressures upon libraries to adopt technologies without considering equity and accessibility issues they might create for patrons. This is the environment the authors found themselves in when they were designing and implementing new spaces and services for the library.

Defining critical making

Matt Ratto discusses the concept of critical making as one where the creation of a particular object is not the end goal, but rather it is how ideas are exchanged, understanding is shared, and it is that communal act which is more important than the final result (Ratto 2011). In other words, critical making “focuses on the process and act of making rather than the physical object itself” (Nizami 2018). Just as code and algorithms are biased and political, so are the objects that are created and it is these relationships—individual to object, and individual to individual—that shape the overall experience of making that occurs. The objects made from a creative process are remnants, but not the actual focus, of critical making.

There is something unique about the physicality of making which allows these elements to emerge. Perhaps it is the idea that creators develop something from nothing which brings out these existential connotations. Perhaps it is a creator’s sense of ownership over that object which is imbued with much more than filament or wires, but with their dreams and aspirations and the feeling of what the object represents as much as what it actually is. Ratto (2011) notes that these physical entities reflect the views of certain voices which have the ability and the privilege to be heard, so to
enable the rest to become a part of the conversation takes a deliberate approach toward inclusion and a way to equalize the power structures and formal hierarchies that can accompany technology-forward spaces.

Critical making also means putting the human experience above the technological one, and making a conscious effort to make space for thoughts, emotions, and feelings to permeate and parallel whatever hardware and software is also present. This can manifest itself in how support is provided for those who might be feeling lost especially as they are learning something new, such as:

- Scaffolding learning so that there are progressive levels of accomplishment without feeling like failure in one step immediately represents failure in all aspects
- Allowing for time to understand complex or abstract concepts and not assuming they are impossible to grasp or vice versa, that they are already mastered upon entry into a tech-forward space
- Demystifying language surrounding technology and minimizing the use of jargon, acronyms, or industry-specific terminology
- Allowing for all possible uses of a technology and not making assumptions about the “correct” or “proper” way
- Integrating reflection opportunities and providing a way for expression if that is desired-like leaving comments or personalizing something that was created

**Reflection as a service design methodology**

When thinking about how to design for these elements, libraries can use a reflective design approach to ensure that user needs are an integral part of these processes and not simply an afterthought. This entails questioning for whom these tools/services were created and with which rights and restrictions they are made accessible. Technology itself is not neutral and is imbued with certain assumptions and predispositions based on those of its creators. For example, having a 3D printer is great if you can physically handle moving the printing plate up and down, turning the printer on and off, and using a mouse to build the file. But what happens if you have a vision impairment or cannot manipulate the printer? The authors will also explore in more detail how access to the spaces and resources themselves needs to be made as open and available as possible, so that anyone can see themselves in that space, being able to use it, and to feel welcome within it.

Sengers et al. identify several ways this can happen with the goal of reflective design as allowing “users to maintain control of and responsibility for the meaning-making process” (2005, 8):
- Focus on personal experiences. What it means for that person at that moment and understanding will vary from individual to individual. As a way to scale some of this, it would be good to think about what baseline activities will work for anyone who uses the service or program, and then tailoring anything beyond that to allow for variation. In order to achieve this type of specialized approach, it will be imperative to understand user needs, which echoes this idea that users are as much a part of the process as the service providers and they help shape and guide how their needs are met. There is no one way to approach this, but here too, allowing for different modalities (such as surveys, focus groups, user experience studies) will help define what works best depending on the experience in question, the type of learning, and the overall context in which all of this is occurring. There will also be a natural ebb and flow to this process, and it may be that you find yourself trying out different methods and seeing what works best before you land on something more finalized which can then be shaped as the service progresses.

- Give users license to fully participate—that means breaking things, trying stuff out, and not being too concerned with chaos as part of these processes.

- Inspire meaningful feedback from users. An evaluation method should dictate the form of the design it is evaluating rather than designing something to elicit a particular response. For instance, instead of simply asking if someone was able to turn the printer on, you could also integrate an observation method where users are actually turning the printer on and commenting on what they are thinking during that part of the task.

- Approach technology as a probe where the technology itself is used as a tool toward a broader learning-inspired end. This also gets back to the ideas that Ratto (2011) espouses, where learning is more important than deliverables.

- Ensure that reflection is not a separate activity from action but is folded into it as an integral part of experience and that it is folded back into people’s experiences, actions, identities, and practice as soon as possible after the activity.

The work of Sengers et al. (2005) emphasize the importance of integrating all these elements as part of the overall user experience and as a way to integrate user autonomy and authenticity within service limits and institutional capacity. But these concepts still feel a little too abstract, so the next section will address what this might look like in practice, and more importantly, how to approach services and spaces with this lens in mind. This will
allow libraries to be intentional about the ways in which technology is offered, accessed, and implemented and make changes accordingly.

**Practical approaches for integrating critical making into library spaces and resources**

In addition, there are some very practical things that libraries can do in order to make these elements come to life. Boehner et al. (2005) discuss this notion that while the technology itself remains relatively stable; it is the iterations of the technology made by the people who use it that makes a difference. The same can be argued about technology-rich spaces. While it may be important to construct them in a way that facilitates the types of learning and interaction opportunities that have been discussed, it is what happens inside these spaces that really matters. Boehner et al. also argue that taking on a critical lens should provide opportunities for both those providing the spaces and their users to document who else used this tool and record what they did. Doing this can provide novices an example for how they can use the technology or inspire them to adapt it. Also, it is important to think about who is already using the space and feeling comfortable and welcome, and who is being excluded and why. Finding people who are both avid users and those that are not might make for a strong contrast and give you some different perspectives to ensure the space is as open, flexible, and as useful as possible. Furniture arrangement, the type of technology, lighting, and signage can all have a powerful signaling effect that works even at a subconscious level and may mean the difference between someone feeling like they can walk in and get what they need or not.

Finally, libraries may not be able to control how a tool is made, but they can control how it is implemented. Thinking about the experience surrounding a particular technology takes time and effort and must be approached from as many perspectives as possible. Do everything you can to reduce barriers to use. This can range from how something is physically presented, to how much supporting material you have available to lessen the learning curve. Libraries should provide scaffolded supports for beginners as well as opportunities for more advanced users. Perhaps offer some examples or ways to work through sample projects. Make sure you have enough of each type of tool so that you are not unintentionally creating a sense of competition for in demand resources where someone will invariably not have access to what they need. If you do not have the ability to provide a single use tool for every person, think about what guidelines may help you ensure equitable access—such as time limits, booking options, and scheduling opportunities.
Provide a rotation of different tools to highlight different types and levels of skills and learning, and not favor one over the other. You can also engage users in determining what tools might be of interest to them so that you are not only keeping things fresh, but you are actually meeting needs and providing yet another opportunity for stakeholder involvement and feedback. For staff who are there to help, create a mentorship and coaching model, rather one of expertise.

**Using critical making to address issues in the library**

As a busy customer service point in an academic library, the Innovation Garage and Digital Media Studio staff experience many of the same challenges common to library staff anywhere: answering nebulous questions, deescalating upset patrons, or connecting people with the appropriate resources. However, some consistent challenges that have arisen due to the spaces’ technological emphasis include staffing, sexism, and ableism.

**Staffing**

A key feature of critical making is paying attention to factors that might unintentionally exclude people from participating in making, and the demographics of who staffs technology services are important to create an inclusive space. Librarianship as a profession is disproportionately white (American Library Association 2017) and the library generally reflects this fact. While the demographics of maker culture is difficult to estimate, one survey had it at 80% men, a median annual income of $106,000, and 80% with a post graduate education (Alper 2013). Fortunately for the Auraria Library, the student population it serves is incredibly diverse, with high levels of first-generation students and people of color, which translates to the student employee workforce. Having a diverse group of student staff encourages a more diverse group of potential patrons.

The authors also created policies and practices that attempt to support students and make the job feel more inclusive. For example, everybody cleans the labs, including full-time permanent staff. Dr. Max Liboiron gave a presentation at What is a Feminist Lab? Symposium where they talked about how cleaning is one of the most valuable forms of labor (Liboiron 2019) which influenced some of the library’s practices. The authors see cooperative cleaning as not only a feminist act but a way to combat classism developing between student workers and permanent staff. A critical making approach should value both cleaning and maintenance. The authors think it is important to create professional growth opportunities for student employees. This looks like bringing them to library staff meetings and
having them participate in library functions and decision-making processes such as budgetary meetings and strategic planning sessions. As most student workers are actively looking for professional jobs while they work at the library, the staff spend a lot of time going over their resumes and cover letters, sending job postings around, preparing them for interviews, and providing references.

**Sexism**

Critical making interrogates the values that are built into technology, which in most cases, will include sexism. Sexism in the technology industry is pervasive and systemic (Mitchell 2015; Hennessey 2018; Dunlevy 2019; Mundy 2019), and while about 81% of librarians identify as women (American Library Association 2019), having a technology lab in a library does not offer protection from the manifestations of sexism associated with the technology industry. Unless the library has a special event or display, most people that come into the Innovation Garage for the first time appear to be white men. This is unsurprising given that white men are more represented in, marketed to, and generally supported in STEM and technology fields (Devlin and Hern 2017; Metz 2019). They likely feel more comfortable approaching a new space they have never been in before if it houses things they associate with their interests or capabilities. A subset of this demographic, sometimes referred to Tech Bros or Brogrammers (Chang 2019), often demonstrate a value system that does not align with the library and can make the space hostile for other patrons. Over the course of several years running creative technology services, the staff who runs them have noticed the following trends: Patrons who appear to be white men usually value the mastery of technology over curiosity or introducing people who are new to it. In practice, this looks like them challenging staff or other patrons about their knowledge or skill level with software or technology to determine who knows more and they can be condescending in tone toward the person who knows less. Additionally, these patrons frequently will address their questions to a male staff member first, or if they do not like the answer a female staff member has given them, will seek out a male staff member to ask again. In retrospect, the fact that the space is named the ‘Innovation Garage’ plays into those same sexist stereotypes that exist in technology. ‘Innovation’ is practically a religion in technology and the Silicon Valley culture that enables it (Morozov 2013), and ‘Garage’ is a gendered, typically masculine-associated space (Moisio and Beruchashvili 2016). Though the name was intended to represent a place for experimenting, being messy, and trying something new, it connotes one of the power dynamics that the library is trying to avoid.
The Digital Media Studio is in a part of the building far from any exit, has no windows, and only one main entrance. This configuration created some safety concerns as there were patrons who became fixated on female staff members and would spend several hours in the space multiple times a week. The authors addressed this by transitioning it from a drop-in support space to a reservation-only service. This requires patrons to go to the website, enter in their student information, and select a service in advance. While this achieved the main goal of increasing staff safety, it unintentionally benefited the lab in other ways. The use of the space actually increased after it became bookable, and the library was able to provide better service to patrons because it could prepare in advance what equipment and support they needed.

When providing media support to patrons, there is a lot of close physical proximity between the staff and the patron, often sitting side by side. Establishing personal space can be difficult as it depends on the preference of the staff and the patron and can be culturally informed. The library tells students that if at any point they feel uncomfortable with a patron, they can stop helping them, tell a supervisor, and go to a staff-only space. There have been multiple instances of patrons flirting with staff, asking them out on dates, or inappropriate touching (the supervisors track these events through two separate systems). Like most college campuses, the library lacks sufficient supports and protections from the institutional units responsible for investigating sexual harassment and assault. The authors’ first priority is staff safety, and openly talking about consent, sexual harassment, codes of conduct, campus resources, and communication has been essential to make sure the staff, and especially the student workers, feel safe.

**Ableism**

In the authors’ experience, disability is not something generally considered in creative technology spaces. Most of the software and hardware that creative technology companies produce have very few accommodations for people with disabilities. Adobe Creative Suite is one of the main products that the library supports through drop-in service. However, if a patron has visual impairment or cannot use a mouse, there is little the staff can do to make it accessible. The same goes for most of the 3D modeling software available including Blender and Maya. For 3D printing, the library has a service model where only staff operate the 3D printers if a patron can provide a 3D printable file. However, many labs allow patrons to directly operate 3D printers, and if a patron had visual or motor impairment, it would be next to impossible to provide adequate accommodations due to
the design of most 3D printing hardware. While the library has flatbed scanners that are wheelchair accessible, the rest of the computers in that space are higher up and not accessible. The library also carries a vinyl plotter and large-format printer that patrons can print on, but again, only if they can navigate software that is not accessible or have someone else appropriately size and prepare files for them. Right now, most software and hardware vendors in the creative technology space make products that are inaccessible to people with disabilities. Unless the market or legal regulations change, the authors do not foresee any significant progress in providing more accessible and inclusive creative technology software or hardware for patrons with disabilities. This amounts to ableism that the technology industry, librarianship, and maker culture have not addressed, and from the authors’ perspective, they have not signaled that it is a priority for them anytime soon. Critical making, however, demands that people with disabilities be considered and invited into making and creative technology. Librarianship’s job now is to redress this ableism and center people with disabilities in future design.

**Meeting and breaking expectations**

For some patrons, their only previous access to the technology that the library offers comes from their departmental labs, often from engineering, industrial design, or architecture. While this prior exposure can make them feel more comfortable using the technology, it can also predispose them toward a limited set of potential applications. For example, with 3D printers, students in architecture may be more inclined to find, design, and print models of buildings and perhaps less inclined to explore artistic applications. Critical making encourages exploring unconventional applications of technology and creating spaces where everyone is welcome. One way that the authors have tried to show the range of applications for 3D printing is by displaying dozens of different prints, from highly technical to aesthetic. For example, in the main window display, there are a series of succulents in multicolored 3D-printed pots arranged in the form of a rainbow. The plants and rainbows are meant to be a counterpoint to the typical messages about how to use 3D printers, i.e., rapid prototyping or futuristic technology. These kinds of displays are intended to be playful and inclusive for people not typically enrolled in highly technical majors.

While the goal is to treat every patron the same, sometimes the staff code-switch between students in different disciplines. Patrons come in with a variety of skill levels and the staff aim to match the support with their level of familiarity with the technology and experience. At times, the staff conform to disciplinary language and dispositions as a way to effectively
communicate with patrons and make them feel welcome, while at other times, the staff intentionally make the space unexpected—like with the rainbow planters—as a way to encourage new applications and invite patrons who would not normally feel welcome in it.

**Future directions**

The authors may explore four methods that could improve the library’s creative technology services: increasing accessibility and sustainability, a peer coaching program, hackathon-style events, and self-guided learning pathways.

First, the authors are actively looking into how to make the creative technology services more accessible for people with disabilities. While there does not seem to be much interest from the software and hardware manufacturers in making their products more accessible, it is possible that by collaborating with campus partners such as support offices that focus on disability, the library might be able to come up with some solutions. The staff have also reached out to 3D printing companies about how best to recycle the plastic products they produce as well as explored more recyclable paper options for the large-format printers. Sustainability is a priority for the campus and, if possible, the library wants to avoid mass producing objects that cannot be recycled. Drawing from critical making encourages the library to be thoughtful about the issue of sustainability with the process being as important as the product.

Peer coaches—having students informally instruct other students—might offer a good model for ensuring that users, especially if they are new to the space or the institution, feel at ease in asking questions and interacting with employees. Peer coaching helps build rapport and trust with students, creates a shared goal and a sense of collaborating to achieve that goal, allowing for reflection surrounding the experience, and developing a deep understanding of the concepts and tools encountered (Barron, Dawson, and Yendol-Hoppey 2009). A peer coaching program should have all the necessary components for success, including developing a clear set of recruitment and expectation processes and criteria for peers, learning outcomes for participants, compensation, training, and evaluation. While the intent behind a peer coaching program is to emphasize informal learning, the program itself would need to have a strong structure in place to succeed.

Creating opportunities for those with more experience to help guide learning in the form of coaching sessions or more collaborative hackathons and camp-like programming, might help more people feel welcome. Typically, hackathons are multi-day events where groups tackle the
development of a specific prototype. But in this context, they could take on the form of a community-based learning experience (Lara and Lockwood 2016). The concept of teamwork is central to the hackathon model as is the idea of having mentors to assist along the way. Bringing together groups of users to work collaboratively on a problem can unlock tremendous learning potential, help build relationships, and provide a fun atmosphere that is different from a traditional environment. This model allows for flexibility both in terms of the content, but also the structure, where virtual options to widen access to mentors and allow participants from remote locations to engage in this experience.

Last, “trails” and self-guided learning pathways are something the authors may explore. The idea of a trail is defined by Walker (2010) as a conceptual structure that aids in the construction of knowledge “by helping to chunk information into meaningful units and link discrete chunks together, possibly in a linear form, in order to facilitate personal or collective interpretations” (47). Although he discusses this concept within the context of how visitors find their way around a museum, this idea can have wider applicability. This builds on another idea, that no matter how well thought-out a technology space might be in its intent to guide the user toward specific tools or activities, they will invariably choose to do what they want—especially if they have more experience with these tools. On the other hand, those with less experience may need more hands-on guidance, so the space needs to accommodate all these different levels of usage. Examples of this might entail creating a brief map for users that points out the technology and other areas of interest, how-to guides, and other similar documentation. While a full-blown tour may not be necessary, thinking about the pathways that are possible depending on the space will help to center the notion that users will create meaning out of whichever options they choose. This scenario can also play out if the space features work or exhibits which have a much more museum-like quality, thus enabling what Walker (2010) discusses as the centrality of narrative—the usage stories that emerge as a result of these experiences as a key element of how trails are created and shared by the individuals who are not only sharing the space at the same time, but with those that came before and will come after. The centrality of narrative can manifest in the story that the technology tells through its arrangement and description, but also with the narrative that the user brings into the space through their experiences and prior knowledge.

**Conclusion**

Critical making is a framework that examines the processes, value systems, and social meaning of creation which libraries can use to design, assess, and improve creative technology spaces. While the technology industry and maker
culture have sexism and ableism embedded in them, using a critical and reflective approach in how libraries implement technology can help avoid reproducing sexism and ableism. By centering people over technology, libraries can offer inclusive and thoughtful creative technology spaces that are consistent with the profession’s values which will better serve patrons.

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