

The Inclusivity of MakerSpaces

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The emergence of creative technological spaces coined MakerSpaces in everyday society brings immense opportunity for greater inclusivity in the STEM field. MakerSpaces, Fab Labs, TechShops, and the like offer an array of machinery and materials for users to harness their creativity in a limitless environment. These spaces also attempt to promote innovation and further technological advancement. A user of the space has endless potential projects ranging from building a table to designing a part to programming an app. There are also numerous types of spaces—some exist at company work sites, universities and schools, public libraries while others operate like a business or a nonprofit. Theoretically, in these business-type makerspaces, anyone can go and use the resources available through a membership program or can take a class at the space. Nonprofit makerspaces utilize volunteers to help with projects or teach courses to the community. This growing availability allows for the potential for more groups to be involved in this Maker Movement, expanding the types of people who have access to technology they might have not usually had access to. While the idea of expanding the realm of technology to more groups is promising, many makerspaces still contain elements of exclusion that continue to bar groups from participating in the movement and the educational and professional benefits it can lead to. The form of exclusion can be broken into two sectors: economic and social. Economic exclusion bars those of low-income, and social exclusions bars those not associated with the demographic of the movement founders and dominated demographic of the tech industry, the white male. Both topics of exclusion can be explored by understanding the network of relations between the various actors in makerspaces, along with real examples of spaces and their operations.

The Emergence of the Maker Movement

MakerSpace is a broad term covering the network of creative and innovative spaces that carry the tools to work on projects in a collaborative environment. Some spaces have specific types of projects available or draw in certain interests in users based on the goals of those who created and currently operate the space. This demonstrates the importance of the role of the actors involved in creating a space as they can have a substantial impact on who participates. Some spaces are designed for youth education and focus on projects for kids, offering free classes and workshops. Other spaces emphasize the collaboration aspect. The Men's Shed, an organization that uses the MakerSpace design to create a community that promotes mental health and encourages men to openly talk about emotions (Men's Shed Association, n.d.). Others simply operate as a space that brings in people who are passionate about technology, and may specialize in certain areas from graphic design to woodshop to computer science. FabLab and TechShop are two trademarked MakerSpaces that operate as franchises, with specific requirements needed in the space in order to use the title. For example, FabLabs requires tools such as a laser cutter, CNC router, CNC milling machine, and relevant software, along with specified physical space requirements. They also must be open to the public and teach classes to children (Make, n.d.). TechShop focuses on offering access, with membership fees, to high-end manufacturing equipment. Private MakerSpaces tend to be nonprofit organizations, or 501(c) corporations, which grants them tax exemptions for operating as a charity.

The Maker Movement originated out of the infamous Silicon Valley tech scene. It officially started in 2006 with Dale Dougherty's first ever Maker Faire, an event that brought together all types of inventors, hobbyists, educators, students, and the like to showcase things they've made or to teach something they've learned (Fernández, 2015). Dougherty describes the modern maker as having a greater advantage due to "a level of interconnectedness that has

helped to build a movement out of what in the past would have been simply a series of micro-communities defined by a particular hobby or activity” (Dougherty, 2012). The event was very popular and showcased how invention is no longer limited to a select few, allowing for more actors to be involved in this network of society and technology. Much of this is also due to major developments in technology, such as the 3D printer, which made challenging design and creation tasks simpler.

Actor-Network Theory and MakerSpaces

An interesting and considerate framework to approach the inclusivity of MakerSpaces is through the use of the Actor-Network Theory. This theory aims to reflect on the interactions between various actors, both human and non-human, in a technical society (Sismondo, 2010). In terms of the Maker Movement as a network, many actors are working together in unique relationships to form this relatively new sector of society. To start, there are the spaces themselves—whether that be a MakerSpace, Fab Lab, TechShop, etc. The way in which the spaces are operated and physically laid out affects the people it brings in. A simple example is a space with mostly woodshop tools; this space would draw those interested in wood-based projects such as making a tree house or a chair. Inversely, the design of a space could be based on the type of people it needs to bring or the demand in the community where it is established. An example of this could be a community that is full of professionals employed in software may be more inclined to go to a MakerSpace with software items vs hardware. Within the spaces are people who operate them, and depending on the size there could be a group of people running the space. This group would affect how the space is portrayed, what materials and products are inside, and the type of people that are brought in and included in the space. It can be an

interesting relationship as some spaces develop hierarchies which could lead to conflicts of interest.

The machines and materials included in the space are non-human actors in this network; the decisions on what machines to have in the space could affect the other actors. Including machines that are difficult to use without any class or instructions to beginners has the potential to intimidate those new to the machines from learning how to use them. Additionally, including machines that are expensive to operate without providing some method of subsidizing the cost, such as through donations or sponsorships, could drive up the cost of membership and exclude people who have minimal funds to spend on extracurriculars. The last, and arguably most important, actor to consider is the general outside community in which the space operates. The community provides multiple actors to the space: the members, the leadership, the beneficiaries, the suppliers of machinery and materials, and the sponsors/donors of the space. However, to analyze how the space approaches inclusivity, it's necessary to understand what the space provides for the community. One of the actors listed previously was the beneficiaries. These are defined as those not directly associated with the space, but gain from its operation; they are not members, but still participate. With an inclusive space, this could be seen as workshops and classes in machine operation or learning technical concepts for those in the community; hosting an elementary school class field trip; or training teachers at local schools to include lessons on topics and themes featured in the space. Circling back to the design of the space and the members that develop it, some spaces could only have a certain type of beneficiary if others are excluded or feel unwelcomed. These spaces are intertwined in a whole network of actors, both human and non-human, that constantly interact and affect each other; the way in which they interact has a direct effect on the level of inclusivity.

Economic Exclusion in MakerSpaces

One obstacle blocking people from participating in the Maker Movement is the financial structure of the spaces. Many MakerSpaces are in urban areas where there are endless people who would participate and utilize the space, as well as cities tend to be hubs for technology. While the ability to draw in users to the space may be relatively easy, the cost to open and maintain the space is not. One MakerSpace called Artisan's Asylum is located in Somerville, MA and operates its own MakerSpace while also helping other entrepreneurs start their own space. Their guide to opening a MakerSpace includes layers of the business model and additional tasks if the space is a franchise like FabLabs and TechShop. The space itself is a major cost as real estate in urban areas can be costly and heavily dependent on member dues, donations, or both. Additionally, bigger MakerSpace usually needs staff to manage and maintain the space due to the high volume of members and size of the space; this cost can be as high as \$65 per square foot per year depending on the location (Make, n.d.) There are then costs of the materials and machines included in the space and the utilities to operate, which Artisan's Asylum estimates to range from \$5,000 to \$7,500 per month. Artisan's Asylum costs around \$80,000 per month to operate as a nonprofit. In order to cover their costs, they rely on a combination of income streams including memberships, rentals, providing classes at a cost, and donations. It is understandable to charge a membership fee to offset costs and to utilize the most out of donations and grants, however this fee could serve as a roadblock for people who may be interested, but are not able to pay. Some MakerSpaces like the Baltimore Hacker Space in Baltimore, MD have various levels of membership depending on how much a member is willing to pay (Baltimore Hackerspace, n.d.). Logically, higher paying members have greater access to what is available in the space such as premium licenses to software, expensive packages, and

storage space. This could potentially limit the project decisions of a maker if they cannot pay enough to access the more expensive and usually more advanced technology available.

Additionally, some spaces grant higher paying members voting rights into the decisions made about and for the space. Even if lower level members utilize the space more and understand what it needs, members paying more have a voice in the major choices and decisions. This is most likely an attempt to encourage members to give more so that the space has more operating money, but it creates an advantage based on wealth as a result. Another pillar to the financial barrier is that many low-income jobs are hourly, so the privilege of having free time to spend at the space is minimal and much more of a sacrifice. As mentioned earlier, many of the spaces are located in urban areas, which may be hard to access for those in more rural areas. For low-income in rural areas, this may mean spending more money to travel to the location on top of any membership fees or sacrificed time working. To them, it is much more of a burden to join this network of makers.

There are spaces that do, however, aim to limit the financial barriers that may exist at other spaces. The Baltimore Node in Baltimore, MD, has a flat rate of \$50 per month for all members, but states that “reduced rates can be arranged based on need” (Baltimore Node, n.d.). HAC DC in Washington, DC offers a lower membership fee specifically for students or “starving members” with approval by their leadership (HacDC, 2008). The reduced member fee still guarantees the member access to everything in the space and voting privileges. This membership organization structure is beneficial to the Maker Movement’s goal of expanding access to more communities and groups. Through offering separate payment plans for those in need, it not only allows more people to join financially and not being able to join because of the

cost, but also establishes an environment of inclusivity by respecting and acknowledging the need for this option.

Social Exclusion in MakerSpaces

Another obstacle that can prevent people from participating in MakerSpaces is the way in which the technology sector of society was built and structured. As discussed previously, the Maker Movement stemmed from the Silicon Valley area with the Maker Fair in San Mateo, CA started by Dale Dougherty. Silicon Valley, however, is known for its lack of diversity and toxic culture. In a 2019 study by Wired, Black, Hispanic, and Indigenous workers make up a combination of 5% of the total work population in Silicon Valley firms (Gruman, 2020). In a 2020 study, results found that of Silicon Valley startups, only 12% of engineers are women, and “only 11% of executive positions in Silicon Valley companies are held by women” (Bailey, 2020). This can be compared to the statistics from the 2012 Maker Faire, where 66% of attendees were white males. It is also important to note that the median income was \$117,000 and almost all had a college degree (Make, 2012). Despite being an event for all, there is definitely an unequal distribution of participants from various backgrounds, limiting the types of actors involved. Dougherty states that “[he’d] like to see makerspaces reach new audiences — it’s not just a “guy thing” or a “geek thing”. We need more women and people of diverse cultural and ethnic backgrounds to participate” (Dougherty, 2013). However, this statement assumes that these groups outside of the white male demographic actively choose not to participate and are not normally associated with the technology movement. He also implies that these groups need an invitation to join. This mindset creates an unwelcoming environment as people of diverse backgrounds feel as though they weren’t considered in the original space, but rather as an add on. In a series of blog posts by Lauren Britton, PhD from Syracuse University in Information

Science and Technology, called “Power, Access, Status: The Discourse of Race, Gender, and Class in the Maker Movement,” Britton explains how this exclusion partially stems from the idea that the Maker Movement is more of a brand rather than a social movement. One of the movement’s leaders is Make Magazine, so they represent the goals and intentions of the Maker Movements and are a major actor in this network of people interacting with MakerSpaces. However, Britton states that “a company’s goal, at a foundational level, is to generate profit. Social movements on the other hand aim to challenge authority and push for social change” (Britton, 2015). This discrepancy can lead to business strategy overriding initiatives to engage more diverse communities in MakerSpaces. Make Magazine also faced criticism for their magazine covers which mainly featured white males. As self-described on their website, “The launch of MAKE Magazine in 2005, followed by Maker Faire in 2006, jumpstarted a worldwide Maker Movement, which is transforming innovation, culture and education,” which means they are especially looked to by people intending to participate in the movement (Make Media, 2012). Their image and social media presence are important in the move to include other groups and should showcase more diverse groups as an effort to stimulate the social change as described by the Maker Movement.

Additionally, MakerSpaces may be created in a way that fosters a competitive environment similar to many professional settings in the technology industry. In an open lecture called “Maker Cultures: Dominant discourse and the possibility of heterogeneous practices” by Ellen Foster, PhD in Science and Technology studies from Rensselaer Polytechnic Institute, Foster discusses how the culture of Silicon Valley bled into MakerSpaces, causing people to eventually create their own spaces such as feminist hackerspaces. Foster states that this culture “made it easy for dominant narratives and biases regarding gender, race, and class from masculinist

technology cultures to become normalized in a way within hackerspaces and the MakerSpaces scene” and that the “power issues have never really been fully addressed” (Foster, 2018). Because Makerspaces were first created by the same groups in the male-dominated tech culture, the same malpractices bled into the Maker Movement. Many of the founders already had immense knowledge of how to use the space and advanced machines, which could intimidate others from joining if they felt they didn’t have enough knowledge. Without introductory courses or sample projects for beginners to try, people new to technology might not feel comfortable jumping into a MakerSpace with little prior knowledge. This structure places a higher level of value on actors with prior knowledge versus those without who may have equal or better potential for maximizing use of the space. Additionally, Foster stated there were also no systems of accountability. When people of different gender, race, and culture tried to participate and were faced with implicit or explicit biases or general unfriendliness, they had no process of reporting or addressing the situation. Many claimed that the spaces encouraged a competitive atmosphere as projects were more focused on competition rather than the process of solving the problem at hand. The feminist hackerspace studied by Foster, Hacking with Care, emphasized the idea of slowing down the project and taking time not only to learn how to complete it, but also various methods of completing. MakerSpaces outside of feminist hackerspaces also focus more on collaboration as well, there is just a history of this competitive culture due to the foundation of the Maker Movement.

Socio-Economic Results and Possible Solutions

While MakerSpaces are striving to include a wider range of people into creative spaces to explore STEM world and expand the network of actors, there are still ways socially and economically, as described earlier, that certain groups are excluded. There is plenty of crossover

between the social and economic structures of MakerSpaces that put people in a place of discomfort about participating in the Maker Movement. Many MakerSpaces exist in large cities due to potential for high participation and number of donors. This also means real estate is expensive, driving up costs of operation, which can hinder low-income from joining due to membership dues. Additionally, the spaces tend to be in the more expensive areas of the city closer to company offices where they expect their members to come from. This leads to citizens of low-income areas of the city to have to travel further to use the space and potentially having to pay more just in travel expenses. There is also a discrepancy with people who live in rural areas, which usually tend to lack resources in general. With the majority of spaces in cities, the spaces are less accessible to those outside, and they may not feel as encouraged to travel into the city to participate in a space, especially if they have not been as exposed to technology. The Rural Technology Fund is an organization aimed to bring MakerSpaces to rural public schools, some of which barely have enough resources in a general classroom. It can be difficult for students and professionals to engage in the tech field since often there is little industry near them to support a passion or desire to learn (RTF, 2015). By bringing a MakerSpace to an existing community, students are able to expose themselves to technology they may not have been able to use before and without having to travel far or spend money to do so.

Social barriers exist as well, as low-income demographics contain a disproportionate amount of people of color and may feel uncomfortable being in an area as the minority. This can be magnified by the toxic culture relating to Silicon Valley and now MakerSpaces where implicit practices of exclusion exist. There are, however, MakerSpaces that aim to bring in minorities and low-income to the spaces. Computers 4 Kids is a nonprofit organization in Charlottesville, VA that operates a MakerSpace for low-income students in the community and sets up a mentorship

program to guide them through utilizing and learning from the technologies available (C4K, n.d.). More and more public libraries are also starting to build their own MakerSpaces to provide free access to anyone in the community. This can also help to expose people to “maker” technologies earlier in life which may encourage them to join makerspaces since they have prior knowledge and experience. The DC public library has a creative space called the Studio Lab that allows users to explore photography, videography, and music at no cost (DCPL, n.d.) The one consequence is that public libraries typically have a specific budget set by the city, so they could potentially be limited in what they have in their MakerSpace or if they have a space at all.

Conclusion

Maker Spaces offer tremendous opportunity for a greater number of people to be involved in the Maker Movement – a movement to bring creative workspaces to explore technology to the everyday person. These spaces offer endless materials and machinery to indulge in the newest technological advancements and bring new participants and actors into the STEM field network. Many of these technologies were only available to professionals in the industry or university professors and relevant students. With MakerSpaces, anyone can theoretically utilize “maker” technologies for their own personal projects, activities, or to learn something new. However, within the Maker Movement there are economic and social barriers that could potentially hinder someone from participating in a MakerSpace. These barriers are fairly intertwined and are due to a variety of reasons ranging from the operating cost of a space, the location of a space, the foundation and social structure of a space, and the culture surrounding STEM. However, many spaces do strive to be as inclusive as they can, offering scholarship opportunities, reduced membership prices, and free classes and sessions with members of the community. Also, many spaces are nonprofits and receive grants and donations in order to offset the cost for members

and be able to provide more advanced technologies at little to no cost. Ultimately, there are solutions available to have a more inclusive Maker Movement, but many of exclusive practices are deeply rooted into American society. The move to make MakerSpaces more accessible relies on individuals, communities, and organizations to promote and develop cultural change.

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