MAKER: Identifying Practices of Inclusion in Maker and Hacker Spaces with Diverse Participation

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Abstract

Some have hailed the emergence of maker spaces as an opportunity to broaden participation of underrepresented groups in science, technology, engineering, and math (STEM) education, engaging participants in open, creative, and supportive spaces for learning and applying practical STEM knowledge. Others have questioned the potential of these spaces, as many maker and hacker spaces seem to be enacting norms that are more conducive to participation of white, male, middle-class, able-bodied hobbyists. So while there are maker spaces noted for their engagement of homeless makers, women, people of color, veterans, LGBTQ+ folks and people with disabilities, there are many more maker spaces that intentionally or unintentionally exclude these populations. This project considers how diverse maker spaces are conceived, constructed and operated to actively involve groups traditionally underrepresented in STEM, and collectively identify practices that can inform the design and operation of campus and community maker or hacker spaces that presently struggle to achieve diversity.

In 2018, we report an update on the project's data collection and the June 2018 unconference where we will bring all our partners together.

Introduction

This Participatory Action Research (PAR) employs ethnographic methods and Critical Discourse Analysis (CDA) to characterize spaces in terms of their physical and linguistic artifacts. Here we report an update on our preliminary results shared last year, including information related to our direct observation and participation in events held at diverse makerspaces across the U.S.

Research questions explored through this project include:
(1) What practices and artifacts do participants in diverse maker and hacker spaces employ to establish and maintain environments that are diverse and inclusive?
(2) What does the discourse in diverse maker and hacker spaces reveal about how meaning and value are co-constructed around identity, creativity, and the culture of production / the production of culture in engineering?
(3) What best practices emerge from diverse maker and hacker spaces, and how can these translate to design or transformation of existing maker spaces on campuses and in communities?

In 2017, we reported on preliminary content analysis of websites of six diverse maker spaces summarizing best practices of inclusion (Riley, McNair, & Masters, 2017). In Summer 2017, we began visiting our partner sites as participant-observers; these visits are ongoing through Summer 2018.

Partner Maker and Hacker Spaces

In seeking sites of study that are not only diverse and inclusionary but also liberatory, we were guided by literature on engineering and social justice (Riley, 2008), citizen science and democratizing technology (Sclove, 1995), and the Highlander strain of deeply community-based PAR (Merrifield, 1989). In all of these traditions, communities must drive the work at every phase. If campus maker spaces are to be developed in ways that are truly inclusive, diverse, and liberatory, they must begin with community leadership and support community goals and priorities; it will not do to build spaces according to university priorities and invite communities after the fact.

Thus, we intentionally selected spaces rooted in communities defined by identities underrepresented in engineering: poor people, women, racial and ethnic minorities, veterans, people with disabilities, and lesbian, gay, bisexual, and transgender people. Some sites do not explicitly identify as maker or hacker spaces. Some do not have permanent physical spaces, but exist as virtual, mobile, or temporary spaces. Sites selected represent sustainable examples of the values embedded in maker space missions: to promote shared space (physical or virtual; temporary or permanent), materials and knowledge for the purpose of putting production back in the hands of the people. Making is a form of citizen engineering.

Sites we are partnering with in this project include the following:

- **Liberating Ourselves Locally** (Oakland, CA) https://oaklandmakerspace.wordpress.com "Founded and led by people of color...works for a future where members of our community can be involved in all aspects of creating things that sustain us, such as food, clothing, energy, technology, shelter, and art. We are a local movement whose primary purpose is to serve our communities: people of color, immigrants, poor folks, trans folks, queers, women, youth."
- **Community Science Workshops** (Central Valley, Bay Area, and Central Coastal California) http://www.cswnetwork.org/ Multiple CSW sites "provide opportunities for youth to tinker, make, and explore their world through science in under-served communities across California."
- **MergeSort** (New York, NY) http://www.meetup.com/mergesort/ "New York City's first feminist hackerspace... where women and non-binary people can make things, learn, and work on projects without fear or intimidation."
- **Floyd Center for the Arts** (Floyd, VA) http://jacksonvillecenter.org/ connects making, technology and artisan entrepreneurship in rural Appalachia. In 2003 it opened Virginia's first Cultural Business Incubator and the state's first Residential Crafts School in 2005. "It continues to be widely known for its collaborative approach to creating win/win situations, its inclusiveness, its energy, its support for the creation of quality art and artisan businesses, and its influence on the economies of the region."
- **Hacksburg** (Blacksburg, VA) http://hacksburg.org/ is an inclusive hackerspace outfitted with traditional making tools such as 3-D printers, Arduino and Adafruit, wood and metal shops, as well as traditionally feminine equipment such as sewing machines. They host everything from high altitude ballooning activities to workshops on alternative sexualities, drawing membership from the local Blacksburg community that includes

Virginia Tech and residents from surrounding communities in rural Southwest Virginia.
- **Philadelphia Center for Adaptive Sports** (Philadelphia, PA)
  http://www.centeronline.com/ is "a community for all" focused on providing sporting opportunities for people with disabilities, including veterans. PCAS programs including rowing, cycling, skiing, kayaking, sailing and climbing. PCAS adapts equipment to their athletes' needs and uses technology to empower their participants.

Methods

We use CDA methods to uphold our PAR approach. The strengths of CDA are its combination of critical theory and discourse analysis to challenge assumptions of the social world. Still, limitations have been noted across 25 years of application of CDA, along with strategies for minimizing them:

1. To avoid an imbalance between linguistic and social theory, members of our research team are experts in linguistics and in social theory. Our complementary perspectives, especially when vetted through a thorough reflexivity process, help to ensure that linguistic detail is central to analysis and that the data collection and analysis are embedded in context through anthropological methods and social theory.
2. To ensure that this research is contextualized in ways that promote social action, the research will be conducted in a participatory mode, in which people who are engaged in maker spaces will always be involved in the collection, analysis and propagation of data. In addition, maker space participants will play a central role in constructing the problem space and dialogue processes, through a meeting hosted using OST (as described below).

The team is in the process of visiting our six partner sites; each site seeks to provide inclusive environments for community members to use materials and technologies for a purpose. The length of each of our visit varies due to geographic constraints; sites local to researchers have been visited multiple times over a period of months whereas other sites will be visited for 1-2 intensive days. During each visit the researchers conduct participant observation that includes participating in the operations of each space as a community member, conducting conversations with directors and members, and documenting examples of texts in use, which may include conversations, written materials, and creative products.

Specifically, when visiting a maker space site, researchers utilize the following observation protocol:

- When observing, note:
  - Setting (ie: furniture, restroom access, accessibility)
  - Safety procedures / precautions
  - Reoccurring language / "power words"
  - Interactions between people and people
  - Interactions between people and artifacts
  - Practices of welcome
  - How are opinions/critiques shared?
  - How is assistance given and/or received?

- o   Availability of training, materials, tools
- o   What impression do we get? What informs that impression?
- o   Process or product?
- o   Is this fun? Discovery? Work?
- Sketch setting, occurrences, etc
- Photograph, video and/or audio record artifacts, settings, etc. as allowed

At the time of publishing, data collection is ongoing and analysis is not complete. We will share available findings from our data collection on the poster.

Unconference on Making Liberatory Spaces

As a major component of our project, we are hosting an Unconference in June 2018. Representatives from our partner maker space sites, our advisory board and research team will be present. A delegation of one to two leaders from each of our partner maker space sites will be supported by the grant to meet for a three-day workshop in Santa Fe in June 2018. Leaders from diverse maker spaces will share their artifacts, practices, and knowledge that make their spaces not only inclusive but also liberatory. The goals of the workshop are to:

- Build and strengthen a network of diverse maker spaces who can share information and practices, build relationships, and serve as a resource to others seeking to form maker spaces that are liberatory.
- Identify practices and artifacts that can be adopted by both community and campus spaces in order to ensure broader participation among members from underrepresented groups.

Open Space Technology Workshop

Using the open space technology (OST) model, the unconference will self-organize its questions and activities around these goals. OST is a self-organizing practice of collective activity that is in keeping with maker culture.

In order to work well, an unconference or OST workshop requires:

- A powerful *theme,*
- Interested and committed *group,*
- *Space* to meet with full group and for break-outs,
- *Time* to achieve desired results (Owen, n.d.).

The creativity and leadership of participants emerge as they initiate sessions on topics that matter to them, engage in inquiry, reflection, and learning, and develop plans, recommendations, and a record of the proceedings as the process unfolds. These types of meetings bring people together about a specific issue, but are begun without a predetermined agenda. Therefore, unlike traditional meetings, the precise outcomes cannot be known; however, there are some outcomes that can be guaranteed. The OST website outlines the following:

1. All issues most important to those attending will be raised and included in the agenda.
2. All issues raised will be addressed by participants best capable of doing so.
3. Key ideas, recommendations, discussions, and next steps will be documented in a report.
4. The group can prioritize the issues addressed in the report.
5. The group can draft action plans for the highest priority issues.

In addition to the meeting report and the responses to the report, data collected from these conversations will also be analyzed using Gee's critical discourse analysis model (Gee, 2004), and the researchers will have the additional advantage of selecting tools of inquiry not only from their own expertise, but also from the perspectives offered by the workshop participants.

Outcomes from this meeting will include both the critical discourse analysis, and a new body of knowledge cooperatively built by the participants and documented in a report created following a process designed to foreground participation with idea generation as it is occurring. Available findings will be shared on our poster.

Partnership with Nation of Makers

With the help of Dorothy Jones-Davis, Nation of Makers Executive Director and grant advisory board member, we've planned our Unconference in conjunction with the Nation of Makers Conference (NOMCON). NOMCON will be:

> "a national gathering of leaders representing the breadth of the maker movement. NOMCON aims to spark and increase connections across sectors, generate robust collaborations, and promote the growth of an inclusive Nation of Makers. A central goal of the event is the promotion of relationship-building across lines of regular conversation, generating an increased sense of connected community throughout the entire ecosystem of maker-supporting entities" (Nation of Makers, n.d.).

Our Unconference event will occur on Friday, June 8, NOMCON will take place at the same location on Saturday, June 9 and Sunday, June 10.

Representatives from our partner maker/hacker spaces will not only attend our Unconference but will also be invited to NOMCON. This will be an opportunity for our partners to share their work with and connect with an audience of other maker space coordinators. Our partners' excellence in inclusion will be highlighted at NOMCON.

Broader Impacts

Publications

Through this grant, a literature review has been conducted and was also published in 2018. The literature review was presented at the Collaborative Network for Engineering and Computing Diversity (CoNECD) Conference in April 2018 and investigates the following questions: (1) Historically, what goals were set or promises made about the Maker Movement's ability to

contribute to diversity and inclusion efforts in STEM? (2) In what ways are making communities addressing or attaining the goal of increasing access to the STEM fields? (Masters, 2018).

Partnership

Additionally, our research team has developed a synergetic relationship with Nation of Makers Executive Director, Dorothy Jones-Davis, and Nation of Makers Conference (NOMCON) Coordinator, Andrew Coy.

Conclusion: Looking Ahead

Information presented in this paper are preliminary; data collection is ongoing and analysis is not yet complete. Findings, as available, will be presented on the poster. Additionally, our Unconference, to be held in June, will facilitate collaboration of Maker partners in further identifying and sharing diversity practices.

Researchers and members of diverse maker and hacker spaces will use the findings from this project to co-construct strategies for (1) stimulating innovative design thinking in experiential curricula; (2) embedding inclusive practices that increase retention and broaden participation in STEM; (3) empowering citizen engineers through local and national networks of makers, students, and faculty; and (4) enabling new STEM and design pedagogies in progressive undergraduate learning environments that will enrich the U.S. innovation ecosystem (Riley et al., 2017).

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